

# Appendix C – Maryland Climate Programs

## Acronyms Used:

BGE – Baltimore Gas and Electric  
CO<sub>2</sub>-equivalent – Carbon dioxide equivalent  
DBED – Maryland Department of Budget and Economic Development  
DGS – Maryland Department of General Services  
DHCD – Maryland Department of Housing and Community Development  
DHMH – Maryland Department of Health and Mental Hygiene  
DNR – Maryland Department of Natural Resources  
DPL – Delmarva Power and Light  
EPA – U.S. Environmental Protection Agency  
GGRA – Greenhouse Gas Emissions Reductions Act of 2009  
GHG – Greenhouse gas  
LEED – Leadership in Energy and Environmental Design  
MACT – Maximum available control technology  
MARC – Maryland area regional commuter  
MDA – Maryland Department of Agriculture  
MDE – Maryland Department of the Environment  
MDOT – Maryland Department of Transportation  
MDP – Maryland Department of Planning  
MEA – Maryland Energy Administration  
MIA – Maryland Insurance Agency  
MMtCO<sub>2</sub>e – million metric tons of CO<sub>2</sub>-equivalent  
MW – Megawatt  
MWh – Megawatt-hour  
PE – Potomac Edison  
PEPCO – Potomac Electric Power Company  
PSC – Maryland Public Service Commission  
REC – Renewable energy certificate  
RGGI – Regional Greenhouse Gas Initiative  
RPS – Maryland Renewable Portfolio Standard  
SMECO – Southern Maryland Electric Cooperative  
TCI – Transportation Climate Initiative  
VMT – Vehicle miles traveled

**Figure C-1. Maryland's Climate Programs by Sector with Range of GHG Benefits**

<b>Policy I.D.</b>	<b>Policy (Program)</b>	<b>Potential GHG Reductions (MMtCO<sub>2</sub>e)</b>
<b>ENERGY</b>		
A	EmPOWER	8.42 – 10.52
A.1	EmPOWER: Energy Efficiency in the Residential Sector	Included in A
A.2	EmPOWER: Energy Efficiency in the Commercial and Industrial Sectors	Included in A
A.3	EmPOWER: Energy efficiency: appliances and other products	Included in A
A.4	EmPOWER: Utility Programs	Included in A
A.5	Combined Heat and Power	Included in A
B	Maryland Renewable Energy Portfolio Standard (RPS)	6.86 – 10.96
B.1	The Maryland Renewable Energy Portfolio Standard (RPS) Program	5.86 – 9.96
B.2	Fuel Switching	1.00 – 1.00
B.3	Incentives and Grant Programs to Support Renewable Energy	Included in B
B.4	Offshore Wind Initiatives to Support Renewable Energy	Included in B
C	Regional Greenhouse Gas Initiative	0.00 – 3.60
D	Other Energy Programs	0.13 – 0.23
D.1	GHG Power Plant Emission Reductions from Federal Programs	
D.1.A	Boiler Maximum Achievable Control Technology (MACT)	0.07 – 0.07
D.1.B	GHG New Source Performance Standards (NSPS)	Included in D
D.1.C	GHG Prevention of Significant Deterioration Permitting Program	Included in D
D.2	Main Street	0.05 – 0.14
D.3	Weatherization and energy efficiency for affordable housing	0.01– 0.02
Total		15.41 – 25.31
<b>TRANSPORTATION</b>		
E	Transportation Technologies	8.10 – 8.61
E.1	Motor Vehicle Emissions and Fuel Standards	

E.1.A	Maryland Clean Cars Program	4.33 - 4.33
E.1.B	Corporate Average Fuel Economy (CAFÉ) Standards: Model Years 2008-2011	2.27 – 2.27
E.1.C	Federal Medium and heavy Duty GHG Standards	0.88 – 0.88
E.1.D	Renewable Fuels Standard	0.24 – 0.24
E.2	On Road, Airport, Port and Freight/Freight Rail technology Initiatives	0.38 – 0.38
E.2.A	ON Road Technology	Included in E.2
E.2.B	Airport Initiatives	Included in E.2
E.2.C	Port Initiatives	Included in E.2
E.2.D	Freight and Freight Rail Strategies	Included in E.2
E.3	Electric Vehicle Initiatives	0.00 – 0.27
E.3	Low Emitting Vehicle Initiatives	Included in E.3
F	Public Transportation	2.00 - 2.89
F.1	Public Transportation Initiatives	Included in F
F.2	Intercity Transportation Initiatives	Included in F
G	Pricing Initiatives	0.41 – 2.30
H	Other Innovative Transportation Strategies/Programs	
H.1	Evaluate the GHG Emissions Impacts from Major New Projects and Plans	Included in H
H.2	Bike and Pedestrian Initiatives	Included in H
Total		10.51 – 13.80
<b>AGRICULTURE AND FORESTRY</b>		
I	Forestry and Sequestration	4.56 – 4.56
I.1	Managing Forests to Capture Carbon	1.80 – 1.80
I.2	Planting forests in Maryland	1.79 – 1.79
I.3	Creating and protecting wetlands and waterway borders to capture carbon	0.43 – 0.43
I.4	Biomass for energy production	0.33 – 0.33
I.5	Conservation of agricultural land for GHG benefits	0.18 – 0.18
I.6	Increasing urban trees to capture carbon	0.02 – 0.02
J.1	Creating ecosystems markets to encourage GHG emission reductions	0.11 - 0.11
J.2	Nutrient trading for GHG benefits	0.09 – 0.57
Total		4.76 – 5.24
<b>BUILDING</b>		

K	Building and Trade Codes	3.15 – 3.15
<b>ZERO WASTE</b>		
L	Zero Waste	2.80 – 4.80
Leadership-By-Example		
M	Leadership-By-Example	1.45 – 1.77
M.1	Leadership-By-Example: State of Maryland initiatives	0.56 – 1.77
M.2	Leadership-By-Example – Maryland Colleges and University	0.37 – 0.37
M.3	Leadership-By-Example – Federal Government	0.27 – 0.27
M.4	Leadership-By-Example – Local Government	0.25 – 0.25
N	Maryland’s Innovative Initiatives	0.21 – 0.21
N.1	Voluntary Stationary Source Reductions	0.17 – 0.17
N.2	Buy local for GHG benefits	0.02 – 0.02
N.3	Pay-As-You-Drive® Insurance in Maryland	0.02 - 0.02
N.4	Job creation and economic development initiatives related to climate change	Included in N
O	Future or Developing Programs	0.02 – 0.02
O.1	The Transportation Climate Initiative	0.01 – 0.01
O.2	Clean Fuel Standard	0.00 – 0.00
Total		1.68 – 2.00
<b>LAND USE</b>		
P	Land Use Programs	0.54 – 1.14
P.1	Reducing Emissions through Smart Growth and Land Use/Location Efficiency	Included in P
P.2	Priority Funding Area (Growth Boundary) related benefits	Included in P
Total		0.54 – 1.14
<b>OUTREACH</b>		
Q	Outreach and public education	0.03 – 0.03

Total		0.03 – 0.03
<b>TOTAL RANGE OF ESTIMATED GHG EMISSIONS REDUCTIONS</b>		
<b>Sector</b>	<b>Total Expected GHG Reductions (MMtCO<sub>2</sub>e)</b>	
Energy	15.41 – 25.31	
Transportation	10.51 – 13.80	
Agriculture and Forestry	4.76 – 5.24	
Buildings	3.15 – 3.15	
Zero Waste	2.80 – 4.80	
Leadership-By-Example	1.68 – 1.77	
Land Use	0.54 – 1.14	
Outreach and Public education	0.03 – 0.03	
<b>Total</b>	<b>38.87 – 55.47</b>	

## Sub-Appendix C-1: Energy Programs

### EmPower Maryland

#### Estimated GHG Emission Reductions in 2020

Figure C-2. Low and High GHG Benefits for Energy-6

Initial Reduction	8.42 MMtCO <sub>2</sub> e	MEA Quantification
Enhanced Reduction	10.52 MMtCO <sub>2</sub> e	MEA Quantification Below

### A.1: EmPOWER: Energy Efficiency in the Residential Sector

Lead Agency: MEA

#### Program Description

MEA’s residential programs are part of the EmPOWER Maryland suite of energy efficiency programs it administers using revenues paid into the Strategic Energy Investment Fund from the auction of RGGI allowances.<sup>1</sup> Together with utility-funded

<sup>1</sup> The SEIF fund was created by legislative act of the General Assembly, “Regional Greenhouse Gas Initiative – Maryland Strategic Energy Investment Program”, Md. Public Utility Companies Code § 7-701 et seq. (Senate Bill 268/House Bill 368, General Assembly 2008). A portion of the fund is allocated to the MEA to administer programs in the residential, commercial and industrial sectors to reduce consumer demand for electricity and natural gas through energy efficiency measures.

programs, MEA's programs in all sectors, including residential, commercial and industrial, are intended to achieve the EmPOWER Maryland goal of a 15 percent reduction in per capita energy use by 2015.<sup>2</sup> Programs funded and administered through other State agencies including DHCD also contribute to the EmPOWER goal.

Existing Programs. MEA administers a number of programs that target energy efficiency improvements in the residential sector. Many of these programs are funded with federal American Recovery and Reinvestment Act money, which are only available through early 2012.

- *EmPOWER Maryland Empowering Finance Initiative.* This initiative is targeted at helping residential consumers afford clean energy improvements. MEA made a grant to the Maryland Clean Energy Center and is working with private banks to leverage sustainable capital that will continue to serve Marylanders past the end of federal funding. MEA is also working with the EmPOWER utilities to propose program enhancements using utility funds.
- *EmPOWER Maryland Residential Incentives.* These incentives include various programs such as a grant/loan program called Multifamily Energy Efficiency and Housing Affordability which is offered in coordination with DHCD. The program conducts energy audits and energy efficiency retrofits in apartment units and common space to reduce energy bills for low and moderate income families. The program has awarded \$9.7 million that will benefit approximately 3,800 families by reducing their energy bills an estimated 20 percent, saving about \$52.8 million over the life of the investments.
- *MEA Home Performance Rebate Program.* When it was in place, this program offered homeowners rebates for home energy efficiency improvements. By combining a 35 percent rebate, and up to \$3,100 total, from MEA with a 15 percent rebate from the utility company, homeowners saved a total of 50 percent on home energy improvements. MEA encouraged homeowners to upgrade the energy efficiency of their homes to ENERGY STAR standards. This is a one-time federally-funded program and likely will not continue when the \$1.5 million in rebate funding is expended. However, learning from the success of this program, Maryland's utility companies increased rebate levels from 15% to 50% starting in early 2012.
- *DHCD Weatherization.* DHCD is awarded funding on an annual basis from the U.S. Department of Energy to improve the energy efficiency in homes owned by limited-income Marylanders. Thanks to an uptick in federal funding, DHCD has retrofitted more than 7,000 homes since 2009. When the federal funding is fully expended, DHCD is likely to revert back to its previous annual budget.
- *Clean Energy Communities Grants.* MEA has awarded over \$8.6 million to local governments and non-profit organizations in every county in Maryland for energy

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<sup>2</sup> EmPOWER Maryland Energy Efficiency Act of 2008, Md. Public Utility Companies Code § 7-211 (House Bill 374, General Assembly 2008). The law requires utilities to reduce per capita electricity consumption in Maryland by 10 percent by 2015 and peak demand by 15 percent by 2015 by implementing energy efficiency programs targeted to consumers. Working together with demand-side management programs implemented by the MEA and other state agencies, the law targets a 15 percent reduction in per capita and peak demand by 2015.

efficiency projects that benefit low-to-moderate income citizens. These awards have helped more than 9,000 Marylanders reduce their energy usage through lighting improvements, energy efficient appliances, and whole home energy retrofits *Maryland Home Energy Loan Program*. Funded by a grant from MEA, the Maryland Clean Energy Center currently manages this program to offer unsecured, low-cost loans for efficiency upgrades to primary single-family detached and townhouse residences in Maryland. The primary focus is replacing furnaces, heat pumps and air conditioners that are at least 10 years old, as well upgrading insulation, plugging air leaks and sealing ducts. The program launched in December 2010 and, by June 2011, had cleared \$400,000 in loan commitments.<sup>3</sup>

- *Energy Workforce Training*. MEA worked closely with DHCD and Maryland's community colleges to create a comprehensive training program for contractors working in the energy improvement field. The program has trained more than 1000 contractors to date, and the focus moving forward will be improving the skill sets of contractors already participating in the Maryland Home Performance program or DHCD Weatherization program. This program is now independently managed by Maryland's community colleges.
- *State Energy Efficient Appliance Rebate Program*. MEA worked with Maryland's five major utilities to enhance their existing appliance rebate programs for homeowners.<sup>4</sup> This was a one-time program, made possible by a \$5.4 million federal American Recovery and Reinvestment Act grant in 2009. This program provided additional rebates for super-efficient clothes washers and refrigerators, room air conditioners, freezers, electric heat pump water heaters, central air conditioners, and air source heat pumps, adding onto the amount offered by the utilities. More than 33,000 Marylanders participated in the enhanced program. Based on the program's popularity and success, Maryland's utilities enhanced their appliance rebate offerings in their 2012-2014 plans.

Programs Under Consideration. MEA continues to analyze new initiatives to help meet the EmPOWER Maryland goals. Some programs under consideration by MEA specifically target the residential sector; others have a broader sector-based reach.<sup>5</sup>

- MEA continues to systematically evaluate other states' best practices and lessons learned and, where appropriate, will adapt and incorporate program elements into existing programs. The American Council for an Energy-Efficient Economy has recognized the programs of several states as national models for spurring energy

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<sup>3</sup> Maryland Clean Energy Center, MHELP program, <http://MCECloans.org>. The program is funded through federal stimulus dollars. Loans are capped at \$20,000 with a 6.99 percent interest rate. Audits must be performed by certified auditors and contractor must have a MHIC license.

<sup>4</sup> Each utility offers a slightly different program. See program links at the end of this Section. The full suite of the utilities' EmPOWER Maryland programs are addressed in Sections 6.3.5 through 6.3.10.

<sup>5</sup> Maryland Climate Action Plan, August 2008, Appendix D-3, pp. 14-15, and Chapter 4, p. 79, contains the recommendations of the Maryland Commission on Climate Change for MEA-run energy efficiency programs. Appliances and lighting programs are addressed in Section 6.3.11 – "Energy Efficiency in Appliances and Other Products".

[http://www.mde.state.md.us/assets/document/Air/ClimateChange/Appendix\\_D\\_Mitigation.pdf](http://www.mde.state.md.us/assets/document/Air/ClimateChange/Appendix_D_Mitigation.pdf)

<http://www.mde.state.md.us/assets/document/Air/ClimateChange/Chapter4.pdf>

efficiency in the residential sector and these programs are summarized in its September 2010 report.<sup>6</sup>

- MEA will continue to engage in ongoing, high-level Statewide resource planning in coordination with PSC.
- MEA will continue to analyze and if appropriate pursue additional tax policies, revolving loan funds and other measures to reduce energy efficiency transaction costs for consumers/ratepayers.
- MEA will continue to analyze and if appropriate work to encourage or require Energy Star or comparable energy labeling standards for new homes and for the sale or lease of existing homes.<sup>7</sup>
- MEA proposed three residential program enhancements for the utilities to consider for their 2012-2014 EmPOWER Maryland planning periods: higher incentives for residential retrofit and energy efficient product replacement programs, a program to conduct energy efficiency retrofits in market-rate multifamily dwelling units, and an educational program for schools. The utilities will be proposing various iterations of these programs in their 2012-2014 EmPOWER Maryland plans. The utilities were approved to offer 50% rebates on residential retrofits and enhanced product replacement programs.
  - For appliances and equipment which do not have energy efficiency levels established by federal or Maryland laws, MEA will work with the Governor and the general Assembly to consider legislation establishing energy efficiency standards.<sup>8</sup>
  - MEA will continue to work with federal authorities and energy officials from other states to advocate for more stringent and comprehensive national energy efficiency appliance standards.

### **Estimated GHG Emission Reductions in 2020**

In order to account for similarities across programs, all emission benefits and costs associated with this program have been aggregated under A: EmPOWER

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<sup>6</sup> States Stepping Forward: Best Practices for State-Led Energy Efficiency Programs, Sciortino, Michael, American Council for an Energy-Efficient Economy, September 2010, Report Number E106. See, e.g.: Colorado Energy Star New Homes Program at 12-14; Alaska Home Energy Rebate Program at 26-27; Connecticut Home Energy Joint Solutions Program at 28-29; and Louisiana Home Energy Rebate Program at 30-31. <http://www.aceee.org/research-report/e106>

<sup>7</sup> The Colorado Energy Star New Homes Program presents an excellent model for promoting Energy Star certification in new residential construction. The state energy office forms regional partnerships with counties, cities, nonprofit organizations, and utilities to offer locally tailored programs. The program was recently recognized by American Council for an Energy-Efficient Economy as one of the top five state-led energy efficiency programs in the nation.

<sup>8</sup> Maryland has two laws that establish energy efficiency standards for certain appliances and equipment: Maryland Energy Efficiency Standards Act, Annotated Code of Maryland, Sec. 9-2006 (became law per Maryland Constitution, Chapter 2 of 2004 on January 20, 2004); and Maryland Energy Efficiency Standards Act of 2007, Annotated Code of Maryland, Sec. 9-2006. Maryland Efficiency Standards Act - Televisions (House Bill 349/Senate Bill 455) was introduced in the 2010 Session but did not pass. It would have added televisions to the list of regulated products.

## High Estimate – MEA Quantification

**Figure C-3. Estimated GHG Benefits from EMPOWER Maryland**

Generation	Intensity (MMt)	Emission MMt	Reduction	Overlap Adj
66,398,431	0.660	43.8	10.6	8.42

### **Implementation**

Maryland's demand-side management programs are mandated and funded by Maryland law. The utilities are responsible for at least 10 of the 15 percentage point EmPOWER goal, and MEA and other State agencies are responsible for the remaining amount. MEA tracks the savings Statewide and is responsible for reporting to the Governor and the Legislature on the progress. PSC is required by law to calculate per capita electricity consumption and peak demand each year and report the calculations to the General Assembly as part of its annual report.<sup>9</sup> In consultation with PSC, MEA is required to submit annual reports to the General Assembly on the Strategic Energy Investment Fund status, including receipts and disbursements; administrative expenses; loan and grant evaluation criteria, amounts, number, and recipients; status of outstanding loans; and plans for Strategic Energy Investment Fund resources for the current year.<sup>10</sup>

## **A.2: EMPOWER: Energy Efficiency in the Commercial and Industrial Sectors**

Lead Agency: MEA

### **Program Description**

MEA's commercial and industrial programs are part of the EmPOWER Maryland suite of energy efficiency programs it administers using revenues paid into the Strategic Energy Investment Fund from the auction of RGGI allowances.<sup>11</sup> Together with utility-funded programs, MEA's programs in all sectors, including residential, commercial and industrial, are intended to achieve the EmPOWER Maryland goal of a 15 percent reduction in per capita energy use by 2015.<sup>12</sup> Programs funded and administered through other State agencies also contribute to the EmPOWER goal.

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<sup>9</sup> EmPOWER Maryland Energy Efficiency Act of 2008, Md. Public Utility Companies Code § 7-211 (House Bill 374, General Assembly 2008).

<sup>10</sup> Regional Greenhouse Gas Initiative – Maryland Strategic Energy Investment Program, Md. Public Utility Companies Code § 7-701 et seq. (Senate Bill 268/House Bill 368, General Assembly 2008).

<sup>11</sup> The Strategic Energy Investment Fund was created by legislative act of the General Assembly, “Regional Greenhouse Gas Initiative – Maryland Strategic Energy Investment Program”, Md. Public Utility Companies Code § 7-701 et seq. (Senate Bill 268/House Bill 368, General Assembly 2008). A portion of the fund is allocated to the MEA to administer programs in the residential, commercial and industrial sectors to reduce consumer demand for electricity and natural gas through energy efficiency measures.

<sup>12</sup> EmPOWER Maryland Energy Efficiency Act of 2008, Md. Public Utility Companies Code § 7-211 (House Bill 374, General Assembly 2008). The law requires utilities to reduce per capita electricity

Existing Programs. MEA administers a number of programs that target energy efficiency improvements in the commercial and industrial sectors, which represent approximately 60 percent of electricity consumption in Maryland.<sup>13</sup> Four programs are summarized here: 1) Maryland Save Energy Now; 2) the Lawton Loan Program.; 3) the Energy Efficiency and Conservation Block Grant Program; and 4) the State Agencies Loan Program.

1. *Maryland Save Energy Now:* MEA offers assistance to the State’s industrial sector through the Maryland Save Energy Now Program. Support offered through the program includes:

- Energy Assessments for industrial facilities:<sup>14</sup> The assessments include a one-to-three-day site visit by the University of Maryland Manufacturing Assistance Program to evaluate energy use at the facility, identification of opportunities for energy efficiency improvements and combined heat and power, and a report on the assessment findings and recommendations.
- Free monthly training webinars on various industrial energy efficiency topics, including combined heat and power.
- Information on financial incentives and other helpful resources for businesses, including those offered by Maryland’s utilities, MEA and federal agencies, such as U.S. Department of Energy, and third party investors.

2. *Jane E. Lawton Conservation Loan Program:* The Jane E. Lawton Conservation Loan Program is a revolving loan fund available to local governments, non-profit organizations, and businesses seeking to reduce operating expenses by implementing energy conservation measures. Lawton Loans are structured so borrowers use the cost savings generated by the conservation improvements as the primary source of revenue for repaying the loans. Projects financed with Lawton Loans must have paybacks of 10 years or less. Lawton Loans have low interest rates (currently 2.5 percent) and fall between a minimum financed amount of \$40,000 and a maximum of \$500,000.

3. *Energy Efficiency and Conservation Block Grant Program:* The federal Energy Efficiency and Conservation Block Grant program is funded by the American Recovery and Reinvestment Act through 2012. Through this grant program, MEA is using \$9.593 million to provide approximately 130 local Maryland governments with an energy audit and a sub-grant to finance some or all of the energy projects identified in the energy audit. The energy improvements must occur on a facility that is either owned and/or

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consumption in Maryland by 10 percent by 2015 and peak demand by 15 percent by 2015 by implementing energy efficiency programs targeted to consumers. Working together with demand-side management programs implemented by MEA and other state agencies, the law targets a 15 percent reduction in per capita and peak demand by 2015.

<sup>13</sup> EmPOWERing Maryland Clean Energy Programs FY11 Draft, MEA, p. 5.

[energy.maryland.gov/documents/fy11programbook.pdf](http://energy.maryland.gov/documents/fy11programbook.pdf)

<sup>14</sup> University of Maryland Manufacturing Assistance Program conducts site visits to evaluate energy use, identify opportunities for energy efficiency and CHP improvements, and provide a report. This program then works with facility managers to identify financing tools and resources, including state and federal incentives.

operated by the local government. Both energy efficiency and renewable energy projects are eligible for funding under the federal grant program. The energy audit portion of this project identified approximately 4,200 MWh per year of electricity opportunity, 33,000 therms of natural gas opportunity, and 35,000 gallons of oil opportunity.

*4. State Agencies Loan Program:* The State Agencies Loan Program is a revolving loan program dedicated to directly assisting energy efficiency programs and improvements in Maryland State agencies so that Maryland agencies can lead by example. The bulk of the loans have been awarded to agencies in support of their energy performance contracts. Each year, about 20 percent of the loan fund is directed to support State agencies' specific energy efficiency measures such as higher efficiency lighting and HVAC systems. These loans are made at zero interest with a 1 percent administrative fee. In 2011, nearly 11,000 MWh in annual savings resulted from eight loans.

Programs under Consideration. MEA continues to create, evaluate and improve its programs. Commercial and industrial programs under consideration by MEA include the following:

- The Green Buildings Tax Credit: MEA re-opened the tax credit program through the end of 2011 to ensure developers of the green commercial and multi-family buildings will get tax credits for designing and constructing energy-efficient buildings that meet specified energy goals. The details of the program were announced by MEA in September 2011. The program closed in December 2011 and was able to issue an additional \$1 million in Maryland tax credit allotment. MEA will work with Maryland utilities and PSC in promoting new and emerging technologies. MEA has proposed that the utilities take up combined heat and power as a custom energy efficiency measure in their programs. MEA will be coordinating a pilot demonstration of the technology in the Pepco Holdings and BGE territories in 2011 in an attempt to collect quantitative information on the cost and benefits of the technology versus EmPOWER Maryland goals. An RFP has been issued with an expected program allocation of \$11 million through 2015.
- MEA will develop incentives and assistance for follow-up on audit recommendations.
- MEA will systematically evaluate other states' best practices and lessons learned and, where appropriate, will adapt and incorporate program elements into existing programs. American Council for an Energy-Efficient Economy has recognized the programs of four states – New York, Minnesota, Washington, and Texas – as national models for spurring energy efficiency in the commercial and industrial sectors. These are summarized the American Council for an Energy-Efficient Economy's September 2010 report.<sup>15</sup>

### **Estimated GHG Emission Reductions in 2020**

In order to account for similarities across programs, all emission benefits and costs associated with this program have been aggregated under A: EmPOWER.

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<sup>15</sup> For program detail, see American Council for an Energy-Efficient Economy report, supra, at 15-17 and 41-43 (New York); pp. 38-40 (Minnesota); pp. 46-48 (Texas); and pp. 49-52 (Washington).  
<http://www.aceee.org/research-report/e106>

## **Implementation**

Maryland's demand-side management programs are mandated and funded by Maryland law. The utilities are responsible for at least 10 percent of the 15 percent EmPOWER goal, and MEA and other State agencies are responsible for the remaining. MEA tracks the savings Statewide and is responsible for reporting to the Governor and the Legislature on the progress. PSC is required by law to calculate per capita electricity consumption and peak demand each year and report the calculations to the General Assembly as part of its annual report.<sup>16</sup> In consultation with PSC, MEA is required to submit annual reports to the General Assembly on the Strategic Energy Investment Fund status, including receipts and disbursements; administrative expenses; loan and grant evaluation criteria, amounts, number, and recipients; status of outstanding loans; and plans for Strategic Energy Investment Fund resources for the current year.<sup>17</sup>

## **A.3: EMPOWER: Energy Efficiency Appliances and Other Products**

Lead Agency: MEA

### **Program Description**

As indicated in A.1: Energy Efficiency in the Residential Sector, MEA's appliances, equipment and lighting programs are part of the EmPOWER Maryland suite of energy efficiency programs it administers using revenues paid into the Strategic Energy Investment Fund from the auction of RGGI allowances.<sup>18</sup> Together with utility-funded programs, MEA's programs are intended to achieve the EmPOWER Maryland goal of a 15 percent reduction in per capita energy use by 2015.<sup>19</sup>

Existing/Past Programs. MEA administered several appliance and equipment rebate programs for homeowners in the past years. It currently administers low-interest loans for residential and commercial energy efficiency improvements, which may include appliances, equipment and lighting. These programs include the State Energy Efficient

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<sup>16</sup> EmPOWER Maryland Energy Efficiency Act of 2008, Md. Public Utility Companies Code § 7-211 (House Bill 374, General Assembly 08).

<sup>17</sup> Regional Greenhouse Gas Initiative – Maryland Strategic Energy Investment Program, Md. Public Utility Companies Code § 7-701 et seq. (Senate Bill 268/House Bill 368, General Assembly 2008).

<sup>18</sup> The Strategic Energy Investment Fund was created by legislative act of the General Assembly, “Regional Greenhouse Gas Initiative – Maryland Strategic Energy Investment Program”, Md. Public Utility Companies Code § 7-701 et seq. (Senate Bill 268/House Bill 368, General Assembly 2008). A portion of the fund is allocated to the MEA to administer programs in the residential, commercial and industrial sectors to reduce consumer demand for electricity and natural gas through energy efficiency measures.

<sup>19</sup> EmPOWER Maryland Energy Efficiency Act of 2008, Md. Public Utility Companies Code § 7-211 (House Bill 374, General Assembly 2008). The law requires utilities to reduce per capita electricity consumption in Maryland by 10 percent by 2015 and peak demand by 15 percent by 2015 by implementing energy efficiency programs targeted to consumers. Working together with demand-side management programs implemented by the MEA with RGGI funds, the law targets a 15 percent reduction in per capita and peak demand by 2015.

Appliance Rebate Program, the Maryland Home Energy Loan Program, and the Jane E. Lawton Conservation Loan Program.

### Programs Under Consideration.

MEA continues to analyze new initiatives to help meet the EmPOWER Maryland goals. MEA is considering programs to support and advance existing federal and State energy efficiency standards and to establish new standards where none exist. It is also analyzing options for improving existing programs and expanding their funding and scope. These should include the following:

- The Energy Independence and Security Act of 2007 established federal energy efficiency standards for certain residential and commercial appliances and lighting.<sup>20</sup> MEA should continue analyzing opportunities to advance and exceed federal lighting standards. For example, some states are pushing to have compact fluorescent bulbs make up 95 percent of residential light bulb sales in the State by 2014. A key aspect of this would involve designing and implementing a public awareness campaign coupled with incentives to encourage residential customers to replace incandescent light bulbs with compact fluorescent bulbs or other energy efficient bulbs such as light emitting diodes. MDE continues to explore current disposal problems associated with compact fluorescent bulbs containing mercury within the bulbs, and ensure that appropriate disposal/recycling facilities are available to protect the environment from contamination.
- For appliances and equipment which do not have energy efficiency levels established by federal or Maryland laws, MEA would work with the Governor and the general Assembly to consider legislation establishing energy efficiency standards recommended by the Appliance Standard Awareness Program.<sup>21</sup>
- MEA would work to significantly ramp up its education/outreach and incentive programs to promote purchases of energy efficient appliances.
- MEA should look for opportunities to significantly ramp up its existing energy efficiency loan programs. This effort should continue to target an increase in government funding to a minimum level of \$15 million (\$10 million for the residential sector and \$5 million for the commercial sector). This funding would leverage private sector capital at the minimum level of \$60 million (\$40 million for the residential sector and \$20 million for the commercial sector).

### **Estimated GHG Emission Reductions in 2020**

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<sup>20</sup> Energy Independence and Security Act (P.L. 110-140, H.R. 6). The law requires light bulbs sold in and after to be 25 percent more efficient than current incandescent bulbs. It directs the U.S. Department of Energy to set standards that will reduce energy use to no more than about 65 percent of current lamp use by 2020. The sale of most incandescent light bulbs will be banned. Exempt from this ban are various specialty bulbs, including appliance bulbs, colored lights, and 3-way bulbs.

<sup>21</sup> Maryland has two laws that establish energy efficiency standards for certain appliances and equipment: Maryland Energy Efficiency Standards Act, Annotated Code of Maryland, Sec. 9-2006 (became law per Maryland Constitution, Chapter 2 of 2004 on January 20, 2004); and Maryland Energy Efficiency Standards Act of 2007, Annotated Code of Maryland, Sec. 9-2006. Maryland Efficiency Standards Act - Televisions (House Bill 349/Senate Bill 455) was introduced in the 2010 Session but did not pass. It would have added televisions to the list of regulated products.

In order to account for similarities across programs, all emission benefits and costs associated with these programs have been aggregated under A: EmPOWER.

#### **A.4: EMPOWER: Utility Responsibility, including:**

**A BGE**

**B Pepco**

**C SMECO**

**D Potomac Edison**

**E Delmarva Power and Light**

Lead Agency: MEA

#### **Program Description**

Enacted on April 24, 2008, EmPOWER Maryland Act calls for the State to reduce its energy consumption 15 percent by 2015, in order to reduce energy bills, protect our environment and reduce global warming pollution, while also creating new jobs and sources of clean, reliable energy. EmPOWER Maryland mandated that PSC require each utility to propose cost-effective energy efficiency and conservation programs and services designed to achieve targeted per capita energy reductions of at least five percent by the end of 2011 and ten percent by the end of 2015. Among other things, EmPOWER Maryland required the companies to consult with MEA and file proposed programs in order for PSC to approve any cost-effective programs by December 31, 2008. EmPOWER Maryland's electricity consumption goal calls for a reduction of 15 percent of the 2007 per capita electricity consumption by 2015. Together with utility-funded programs, the State's programs in all sectors, including residential, commercial and industrial, are intended to achieve the EmPOWER Maryland goal of a 15 percent reduction in per capita energy use by 2015.<sup>22</sup> Electric utilities are responsible for two thirds of the EmPOWER goal. Energy savings targets are spread amongst all customer classes, including low-to-moderate income customers. The utilities will submit program enhancements and improvements to PSC in early September 2011 for the 2012-2015 program cycle, which will help to improve current programs and add new energy efficiency measures. In 2012, MEA will begin evaluating the EmPOWER Maryland goals for beyond 2015. In the meantime, MEA assumes that programs will work to ensure the 15 percent per capita reduction is maintained after 2015.

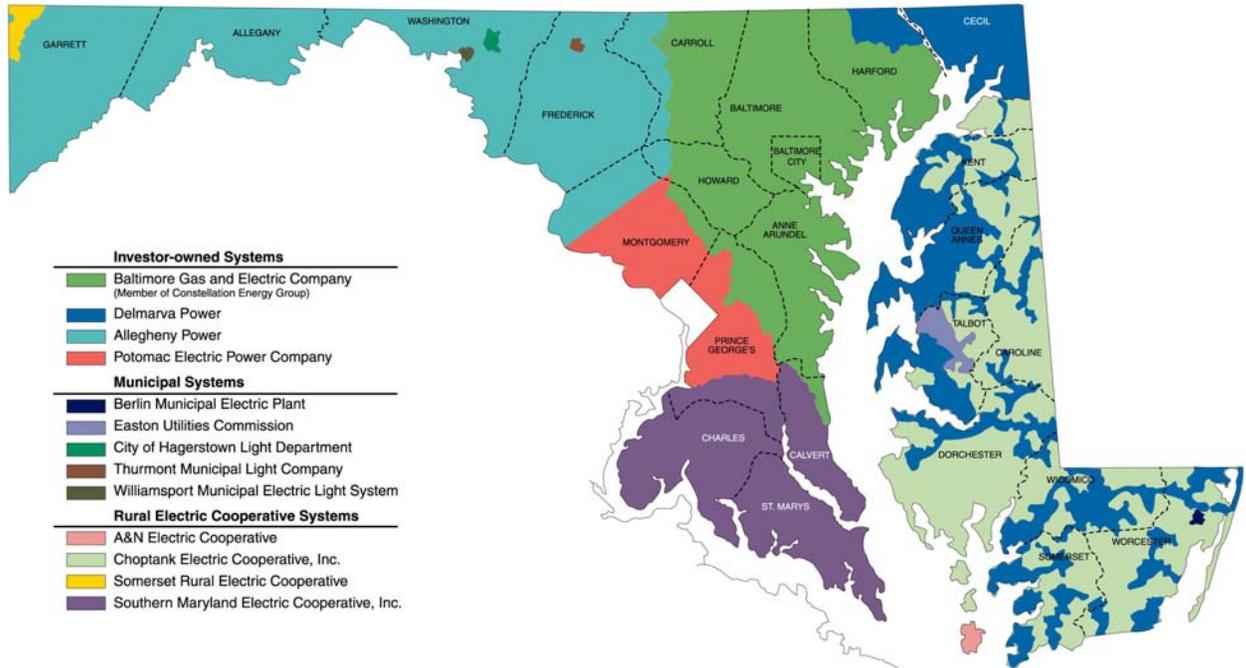
EmPOWER Maryland also requires the five utilities to implement cost-effective demand response programs designed to achieve a reduction in their per capita peak energy demand of five percent by 2011, ten percent by 2013, and 15 percent by 2015. The five

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<sup>22</sup> EmPOWER Maryland Energy Efficiency Act of 2008, Md. Public Utility Companies Code § 7-211 (House Bill 374, General Assembly 2008). The law requires utilities to reduce per capita electricity consumption in Maryland by 10 percent by 2015 and peak demand by 15 percent by 2015 by implementing energy efficiency programs targeted to consumers. Working together with demand-side management programs implemented by the MEA and other state agencies, the law targets a 15 percent reduction in per capita and peak demand by 2015.

utilities include: Potomac Edison (PE), formerly known as Allegheny Power; Baltimore Gas and Electric (BGE); Delmarva Power and Light (DPL); Potomac Electric Power Company (PEPCO); and Southern Maryland Electric Cooperative (SMECO). In instances of system reliability or high electricity prices during critical peak hours, these programs commonly use a switch or thermostat for a central air conditioning or an electric heat pump to briefly curtail usage.

Figure C-4: Service Territories of Utilities in Maryland



Source: PSC, Ten-Year Plan (2009 – 2018) of Electric Companies in Maryland (February 2010).

To generate a portion of this savings, the five utilities each developed energy efficiency and conservation portfolios, based on a three-year planning cycle beginning with the Program Planning Year 2009 – 2011. Subsequent plans are currently being developed for the 2012 – 2014 program cycle. Residential energy efficiency and conservation programs include discounted compact fluorescent light bulbs and appliances, heating ventilation and air conditioning (HVAC) rebates, home energy audits and incentives for energy efficiency upgrades, and low income programs. Commercial energy efficiency and conservation programs are designed to encourage businesses to upgrade to more efficient equipment, such as lighting, HVAC or motors, or improve their building performance through weatherization or building shell upgrades. For larger commercial buildings or industrial facilities, the utilities can customize its incentives for cost-effective improvements.

PSC expects that the utilities will continue to revise or enhance their plans to provide additional resources, especially the deficient energy savings, to meet their 2011 and 2015

goals. These additional resources may be derived from new energy efficiency and conservation programs, advanced metering initiatives, and/or increased development and use of distributed generation and demand response resources.

**Figure C-5: Number of Customers by Customer Class (As of December 31, 2008)**

Utility	Residential	Commercial	Industrial	Other	Total	Percentage of Total
AP	218,661	27,339	2,835	345	<b>249,180</b>	<b>10.6%</b>
BGE	1,108,503	117,633	5,345	0	<b>1,231,481</b>	<b>52.5%</b>
DPL	172,766	25,573	250	272	<b>198,861</b>	<b>8.5%</b>
PEPCO	472,874	46,756	11	102	<b>519,743</b>	<b>22.2%</b>
SMECO	133,560	13,204	5	267	<b>147,036</b>	<b>6.3%</b>
<b>Total</b>	<b>2,106,364</b>	<b>230,505</b>	<b>8,446</b>	<b>986</b>	<b>2,346,301</b>	<b>100.0%</b>

Source: PSC, Ten-Year Plan (2009 – 2018) of Electric Companies in Maryland (February 2010).

### **Estimated GHG Emission Reductions, by 2020, for each Utility**

In order to account for similarities across programs, all emission benefits and costs associated with this program have been aggregated under A.1: EmPOWER: Energy Efficiency in the Residential Sector.

### **Implementation:**

#### **A.4.A: Baltimore Gas and Electric**

Baltimore Gas and Electric (BGE) received its PSC Order on December 31, 2008, and began implementing six residential and three commercial energy efficiency and conservation programs throughout 2009,<sup>23</sup> which were designed to save approximately 1,105,612 MWh by 2011 and 2,778,606 MWh by 2015. Since it was the first to receive its PSC Order, BGE continues to achieve the most energy savings and demand reduction to date.

All programs were fully operational during 2010. Overall, the residential suite of programs has made progress toward goals throughout the service territory in 2010, with nearly 300,000 participants since the programs launched in 2009. Of those participants, nearly 220,000 took part in the programs in calendar year 2010. The commercial programs failed to meet annual forecasted energy savings estimates. However, the commercial programs reported fourth quarter energy savings that exceeded the reported energy savings from the prior two quarters.

<sup>23</sup> Approved residential programs include: the Lighting and Appliance Program; Energy Star for New Home; Home Performance with Energy Star; Quick Home Energy Check-up; Online Energy Calculator; Residential HVAC Rebate Program; Limited Income Energy Efficiency Program. Approved commercial programs include: Energy Solutions for Small Business; Small Business Lighting Solutions Program; Retro-commissioning Program for industrial and commercial businesses.

In 2010, BGE's energy efficiency and conservation programs achieved 274,068 MWh, of its 2011 energy efficiency and conservation electric consumption reduction target. Since the programs started in 2009, they have achieved almost 444,000 MWh of savings, about 40 percent of the 2011 estimated reduction. BGE's portfolio of programs, including demand response, achieved 47 percent, or 555 MW of its 2011 peak demand reduction target. BGE fell short of its forecasted annual energy and demand savings in order to remain on target for 2011, reaching only 80 percent and 70 percent of its 2010 forecasted benchmark for energy savings and demand reduction, respectively. Primarily, this is attributable to the commercial programs ramping up more slowly due to economic conditions. In 2010, these commercial programs have shown improved participation and savings, with this trend is expected to continue in 2011.

*Energy Efficiency and Conservation Programs:*<sup>24</sup>

*Residential Programs*

BGE's lighting and appliance rebate programs achieved more than 135,000 MWh of energy savings in 2010, accounting for more than half of the overall portfolio savings. Rebates on HVAC equipment saved another 7,600 MWh, surpassing the forecast by more than 2,000 MWh. This was largely thanks to MEA's addition of federal American Reinvestment and Recovery Act funding into the program. BGE provided rebates for 3.1 million light bulbs, 58,000 appliances (including refrigerators, clothes washers, and room air conditioners), and 15,000 HVAC units. Program participation has been strong and BGE will continue to enhance the program in coming years by adding more appliances and new lighting technologies.

Performing well was BGE's Residential Retrofit program, the Quick Home Energy Check-up Program. In calendar year 2010, the residential retrofit program (including both Quick Check-ups and Home Performance with ENERGY STAR) had forecasted 1,235 participants and 12,965 measures. The Quick Home Energy Check-up program alone reported 8,605 participants and 79,494 measures. This helped the residential retrofit program achieve an almost seven-fold increase in participants over full program expectations, and energy savings nearly on par with its annual 2010 targets. The Quick Home Energy Check-up program also met or exceeded most of its energy savings goals for 2010. The Home Performance with ENERGY STAR Program, the more comprehensive of the two residential retrofit programs, showed improvement over 2009 results, but was still trailing in its forecasted targets. BGE is working closely with MEA and the other utilities to make improvements to the Home Performance with ENERGY STAR program.

In addition to the existing home retrofit program, BGE has an ENERGY STAR for New Homes program, which works with builders on making new construction more energy efficient. The program was on target in 2010, achieving 98 percent of its participation goal and 103 percent of its energy saving goal.

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<sup>24</sup> Participant, measure, and energy savings number are taken from the January 31, 2011 Q4 2010 EmPOWER Maryland Report (Case 9154); Premise Level – Full Year 2010 Program Summary chart.

BGE's Low Income program met or exceeded forecasts in most of its metrics in 2010. There were 1,691 participants, 10 percent more than the forecast. Additionally, BGE achieved 94 percent of its annualized energy savings. BGE also improved the time it took for a customer to receive an audit, decreasing the wait time from 44 days calendar days in 2009 to 24 days in 2010. BGE's partnership with Baltimore City Weatherization for boiler, furnace, and heat pump replacement ended in April 2010 as planned after 6 months of pilot activity. Forty-eight referrals were received in 2010 with each receiving a replacement.

BGE continued marketing efforts in line with the themes developed by under its *Learning to Speak the Language of Energy Efficiency* campaign. BGE utilized television, radio, print, transit, outdoor, internet and events to market their programs. BGE also combined direct mailings and phone calls to effectively promote its Residential programs to homeowner associations reaching over 3,000 units in 2010.

BGE's OPOWER pilot was approved in July 2010 with mailings being sent to 25,000 customers in October and November. The OPOWER program aims to improve energy efficiency knowledge by providing customers with comparison charts of their energy use compared with similar BGE customers, as well as, providing energy efficiency information. Only 34 customers have opted out at this point and fewer than 50 calls have been made to the call center.

#### *Commercial and Industrial Programs*

BGE's commercial and industrial energy efficiency programs include custom, prescriptive, and direct install energy efficiency measures for large and small customers. Participants range from small businesses to large manufacturers. The Prescriptive Lighting program is the largest contributor to energy savings in the commercial & industrial program suite, representing 70 percent of commercial & industrial program savings. Overall, the commercial & industrial programs saved 106,000 MWh in 2010, about 60 percent of their 187,000 MWh annual goal.

#### *Demand Response*

Demand response is defined as the change in electricity usage by end-use customers either in response to price changes or to incentive payments designed to induce lower electricity use when demand is higher. BGE launched its demand response program, PeakRewards, in June 2008. Participants can choose to have either a thermostat or a digital switch on their air conditioner or electric heat pump installed, which gives BGE the ability to cycle electricity usage during periods of high demand. Events are usually called on the hottest summer days when electricity usage is at its peak and system reliability may be jeopardized. In 2010, PeakRewards enrolled 131,000 participants and installed a total of 159,000 air conditioning cycling devices. A total of 299,500 participants are enrolled in the program since its inception, with 326,000 installed devices (thermostats and switches). The estimated load reduction as of the end of 2010 was about 489 MW, 164 MW of which was achieved in 2010.

BGE deployed its PeakRewards water heater program in April 2010. As of December 31, 2010, there were approximately 2,850 water heater switch installations. BGE continues to seek ways to move forward in the counties where water heater switch installation permitting issues have not been resolved.

*Advance Metering Infrastructure*

Advance Metering Infrastructure or “Smart Grid” technology is generally defined as a two-way communication system and associated equipment and software, including metering equipment installed on an electric customer’s premises, that use the electric company’s distribution network to provide real-time monitoring, diagnostic, and control information and services. Advanced metering infrastructure is generally considered to be an initiative that can reduce peak demand and energy consumption beyond those reductions achieved through energy efficiency and conservation and demand response programs. Additionally, advanced metering infrastructure and Smart Grid technology will improve the efficiency and reliability of the distribution and use of electricity by reducing blackout probabilities and forced outage rates and restoring power in shorter time periods.

In 2010, PSC approved the advanced metering infrastructure initiative for BGE. Since authorization, BGE, in conjunction with Pepco Holdings, Inc., PSC Staff and other stakeholders established a Smart Grid Collaborative Work Group. The Work Group offers a venue to discuss issues such as the consumer education plan and the comprehensive set of performance metrics. BGE proposes the deployment period to take place from 2011-2014, with installation of smart meters beginning in October 2011.

**Figure C-6. BGE Energy Efficiency & Conservation and Demand Response Reported Achievements\***

	<b>2010 Reduction</b>	<b>Percentage of 2010 Interim Target**</b>	<b>Program-to-Date Reduction</b>	<b>Percentage of 2011 Target</b>
<b>BGE</b>				
Electric Consumption Reduction (MWh)	274,068	80%	443,824	44%
Demand Reduction (MW)***	214	70%	555	47%

\*Based on preliminary energy and demand savings from quarterly programmatic reports. These savings will be verified through a process currently under development.

\*\* Percentage of energy savings forecasted to be achieved in 2010 minus 2009 forecast.

\*\*\*Demand reduction is from both the Peak Rewards program and the demand savings created through energy efficiency program savings.

**A.4.B: Pepco**

Pepco received its Commission Order on August 13, 2009. Pepco’s approved plan included four residential and four non-residential energy efficiency and conservation

programs,<sup>25</sup> as well as demand response, and street lighting programs, which were designed to save 588,628 MWh by 2011 and 1.290 million MWh by 2015. Opportunities range from using the information provided through customer information and education, to incentives to purchase lighting and energy efficient HVAC and housing or building upgrades.

#### *Energy Efficiency and Conservation Programs<sup>26</sup>*

By the end of 2010, Pepco's energy efficiency and conservation programs achieved 23 percent, or 134,179 MWh, of its 2011 energy efficiency and conservation electric consumption reduction target. This number includes all programs, including those started in 2009. Pepco's portfolio of programs, including Demand Response, achieved 13 percent, or 68 MW of the company-set 2011 peak demand reduction target. The company-set demand response target was significantly higher than the 2011 EmPOWER Maryland goal; Pepco achieved 30 percent of the 230 MW EmPOWER goal. Due to the fact that Pepco was still ramping up its programs well into 2010, Pepco fell short of its rough incremental annual energy and demand savings in order to remain on target for 2011, reaching only 43 percent and 59 percent of its 2010 Interim Target for energy savings and demand reduction, respectively. Pepco does not anticipate that it will achieve its 2011 goal or target.

#### *Residential Programs*

At the conclusion of 2010, all programs in Pepco's suite were up and running. Among the residential offerings, Pepco's most successful program to date continued to be the Lighting and Appliance program. The Appliance portion of the program experienced double the number of rebated appliances during 2010 compared to 2009 due to the increased rebates available through MEA's State Energy Efficiency Appliance Replacement Program funded by the American Reinvestment and Recovery Act of 2008. This program ran from April 2010 through November 2010 and offered additional rebates on utility rebated appliances as well as new rebates not offered under the EmPOWER portfolio.

The Lighting and Appliance Program exceeded several annual forecasts for Pepco. The Lighting Program had 860,282 participants -- 88 percent more than forecasted. The resulting energy savings were 41 percent higher than forecasted. The Appliance Program rebated 159 percent more appliances than forecasted for 2010, generating a total of 762 MWh savings. Pepco plans to enhance its Appliance Program to include additional appliances and rebates to match the levels resulting from the collaborative effort with MEA.

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<sup>25</sup> Approved residential programs include: the Lighting and Appliance Program; the Home Performance with Energy Star Program which includes Quick Home Energy Check-up and the Online Audit Calculator; the a no cost appliance replacement program for Low Income; the residential HVAC Program. Approved commercial programs include: the Prescriptive Program; the Heating, Ventilation, and Air-Conditioning Program, Custom Incentive Program; the Building Commissioning and Operations & Maintenance Program.

<sup>26</sup> Participant, measure, and energy savings number are taken from the January 31, 2011 Q4 2010 EmPOWER Maryland Report (Case 9155); Premise Level – Full Year 2010 Program Summary chart.

Pepco offered HVAC rebates throughout 2010, which were not as successful as anticipated. Rather than the expected 14,067 participants, Pepco rebated just 1,176 pieces of equipment in 2010. Like in the DPL service territory, low participation was due in part to Pepco's requirements for participating contractors, which were much more stringent than other utilities. Those requirements have since been modified, and Pepco expects that contractor and customer participation will improve dramatically through 2011.

Pepco began its Income Eligible Energy Efficiency Program, a limited income energy improvement program, in March 2010, completing its first audits in the third quarter of 2010. In 2010, Pepco weatherized forty-seven homes, in which they installed a total of 554 measures, compared to their forecast of 5,174 participants. Pepco achieved just 139 MWh savings during 2010, compared to its expected 1,885 MWh savings. In late 2010, Pepco filed and was approved for an expansion of its limited income program to include electric appliance replacement. Pepco works in coordination with DHCD to provide appliance replacement for homes being retrofitted under DHCD Weatherization program, as well. Measures include air conditioning units, heat pumps, refrigerators and hot water heaters. Pepco anticipates that this portion of the program will be available through 2011. Pepco has expanded its contractor pool in 2010 as part of its execution plan to complete more audits and installations during 2011.

Throughout 2010, Pepco's campaign targeted various audiences with program specific messages, beginning with radio spots, but later expanding its campaign to include television, newspaper, cinema, billboards and direct mail. A majority of the marketing was focused on building awareness around Pepco's suite of program to improve winter energy bills. During the cooling season, Pepco heavily promoted its demand response program, Energy Wise Rewards.

In a unique approach, Pepco sponsored a Home Energy Makeover contest with a local television station. Pepco aired television advertisements to promote EmPOWER programs and did special on air spots with the news station to answer customer questions regarding energy efficiency. In addition, Pepco chose two winners from its Maryland territory to receive \$10,000 towards energy efficiency upgrades.

#### *Commercial and Industrial Programs*

Pepco offers prescriptive, custom, retrocommissioning, and HVAC programs for commercial and industrial customers. Overall, the commercial and industrial programs were well below their 2010 program targets, achieving just 28,055 MWh of the expected 114,434 MWh savings. Among its commercial and industrial programs, the Prescriptive Program contributed the most savings, and was the only commercial and industrial program to exceed its forecasted participant number, with 17 more participants than expected. This program offers rebates on standard commercial items such as overhead lighting, occupancy sensors and motors.

Pepco is proposing modifications to their commercial and industrial programs to begin in 2012. Proposed program improvements include higher incentives levels and programs

that include direct installation of measures for small businesses. The company is also proposing an updated marketing strategy that will target appropriate energy efficiency measures by sector. Program managers will expand their outreach to previously untapped markets, including small retail and convenience stores which may have significant refrigeration or HVAC needs.

For industrial customers, Pepco hopes to focus on motors, pumps, fans and compressors, a key set of measures for this sector. Pepco may be interested in doing a demonstration trial utilizing combined heat and power technology.

#### *Demand Response*

Demand response is defined as the change in electricity usage by end-use customers either in response to price changes or to incentive payments designed to induce lower electricity use when demand is higher. Pepco launched its EnergyWise Rewards program (similar in program design to BGE's PeakRewards) in June 2009. Participants can choose to have either a thermostat or a digital switch installed on their air conditioner or electric heat pump, which gives Pepco the ability to cycle electricity usage during periods of high demand. Events are usually called on the hottest summer days when electricity usage is at its peak and system reliability may be jeopardized. Pepco installed 36,057 air conditioning measures in 2010 and a total of 39,987 measures since program inception. The number of installed measures is below the estimated target levels of 60,600 measures in 2010 and 75,760 measures program to date.

One of contributing factors to this shortfall was that PSC temporarily suspended the installation of thermostats due to a potential safety hazard with the devices. On September 23, 2010, Pepco Holdings, Inc. notified PSC of a potential fire hazard associated with the model of programmable thermostats Pepco was installing as part of its EnergyWise program.<sup>27</sup> PSC issued Order No. 83588 on September 23, 2010 that directed Pepco to cease the installation of the affected thermostats immediately. On September 24, 2010, PSC issued Order No. 83592 reinforcing the decision to cease thermostat installation in Order No. 83588 and directed Pepco to notify PSC when the Consumer Protection Safety Commission issued a decision on corrective actions for the safety issue with the thermostats. Pepco has not installed any thermostat since PSC issued Order No. 83588. However, Pepco is still able to install load control devices on central air conditioners and heat pumps.

#### *Advance Metering Infrastructure*

Advance metering infrastructure or "Smart Grid" technology is generally defined as a two-way communication system and associated equipment and software, including metering equipment installed on an electric customer's premises, that use the electric company's distribution network to provide real-time monitoring, diagnostic, and control information and services. Advanced metering infrastructure is generally considered to be an initiative that can reduce peak demand and energy consumption beyond those

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<sup>27</sup> The safety issue for Model 1F88 of programmable thermostat was reported to the Consumer Protection Safety Commission by the manufacturer of the thermostat, White Rogers. The manufacturer notified Pepco Holdings Inc.'s contractor, Comverge and Comverge informed Pepco Holdings, Inc.

reductions achieved through “traditional” energy efficiency and conservation and demand response programs. Additionally, advanced metering infrastructure and Smart Grid technology will improve the efficiency and reliability of the distribution and use of electricity by reducing blackout probabilities and forced outage rates and restoring power in shorter time periods.

On September 2, 2010, PSC authorized Pepco to deploy its Advanced Metering Infrastructure Initiative. Some highlights of the approved Advanced Meter Initiative in Pepco territory are:

- Install 570,000 electric meters;
- Total benefits over the life of the project are estimated at \$311.6 million;
- 100 percent of all meters to be installed by 2011; and,
- Pepco awarded \$104.8 million in Smart Grid Investment Grant funds.

**Figure C-7. Pepco Energy Efficiency & Conservation and Demand Response Reported Achievements\***

	<b>2010 Reduction</b>	<b>Percentage of 2010 Interim Target**</b>	<b>Program-to-Date Reduction</b>	<b>Percentage of 2011 Target</b>
<b>Pepco</b>				
Electric Consumption Reduction (MWh)	68,149	42%	134,179	28%
Demand Reduction (MW)***	58	51%	68	13%

\*Based on preliminary wholesale energy and demand savings from quarterly programmatic reports. These savings will be verified through a process currently under development.

\*\* Percentage of energy savings forecasted to be achieved in 2010 minus 2009 forecast.

\*\*\*Demand reduction is from both the Peak Rewards program and the demand savings created through energy efficiency program savings.

#### **A.4.C: SMECO**

SMECO received its Commission Order on August 13, 2009. The approved plan included six residential energy efficiency and conservation programs and two non-residential energy efficiency and conservation programs.<sup>28</sup> SMECO’s programs were designed to reduce energy consumption by 68,627 MWh by the end of 2011 and 165,542 MWh by the end of 2015. SMECO’s plan consists of a traditional set of programs, such as market buy-down or other incentives for the purchase and/or installation of energy efficient products or measures.

<sup>28</sup> Approved residential programs include: Lighting Program; Appliances Program; Home Performance with Energy Star; Quick Home Energy Check-up; HVAC; Energy Star New Home Construction; Limited Income Energy Efficiency Program. Approved commercial program includes: Prescriptive/Custom Program.

SMECO's suite of programs was fully operational by the first quarter of 2010. During the year, SMECO worked to ramp up its program participation through marketing and general awareness. The residential programs have proven to be successful throughout the service territory, exceeding their forecasted annualized energy savings by 54 percent. The coincident peak demand reduction for residential programs was 25 percent better than expected, achieving 2.94 MW instead of the expected 2.35 MW. The Commercial and Industrial programs performed below expectations for 2010, achieving just 1,383 MWh of savings instead of the forecasted 10,536 MWh, which affected the overall savings reductions. However, SMECO has several projects in the pipeline for 2011 that will help to improve its Commercial and Industrial Programs.

#### *Energy Efficiency and Conservation Programs*

Just in 2010, SMECO's programs achieved 18,461 MWh of the 21,630 MWh 2010 annual goal, an 85 percent achievement. SMECO's portfolio of programs, including the Cool Sentry peak demand response program, reduced demand by 19 MW since starting in 2009. The EmPOWER Maryland peak demand goal for SMECO is 28.7 MW, and the company estimated that they could achieve 13 MW of demand reduction by 2011, so they've already exceeded their own target by 32 percent. SMECO does not anticipate that it will achieve its 2011 goal.

#### *Residential Programs*

SMECO's appliance and lighting programs achieved more than 20,000 MWh of energy savings in 2010, 81 percent more savings than the expected 11,000 MWh. Participation was also very strong. SMECO had expected to rebate about 226,000 light bulbs in 2010, but ended up providing rebates for more than 365,000 bulbs. Appliance rebates were nearly double the forecasted measure quantity, thanks in part to the MEA State Energy Efficient Appliance Rebate Program. Based on the success of the MEA program, SMECO will continue to enhance the program in coming years by adding more appliances and new lighting technologies.

SMECO's HVAC rebate program also exceeded program forecasts, rebating nearly 1,300 units instead of the expected 767. However, energy savings were only about half of what was expected, likely due to customers' choice of equipment.

SMECO's Quick Home Energy Checkup program launched in January 2010 and its Home Performance with ENERGYSTAR program launched in June 2010. Because of the late launch, this program had just two participants by the end of 2010. However, SMECO is working to market this program aggressively in its service territory, and SMECO is working closely with MEA and the other utilities to make improvements to the Home Performance with ENERGYSTAR program. Enhancements include proposed rebates of up to 40 percent. If approved by PSC, these higher rebates would begin in early 2012. The Quick Home Energy Checkup was a strong performer, with 1,071 participants in 2010 compared to an expected 767.

SMECO's New Homes Program was well-received by the construction industry despite the housing market downturn and surpassed forecasted results for both 2010 and program-to-date. The program incentivizes builders to build homes that contain measures equivalent to or greater than ENERGY STAR code. In 2010, SMECO forecasted that the program would complete 71 homes generating 155 MWh in annualized energy savings and 0.11 MW in demand reduction. At the conclusion of 2010, builders had completed 245 homes, 245 percent more than anticipated. This resulted in SMECO realizing a 273 percent increase in both annualized energy savings and coincident peak demand reduction. There were 600 homes committed to the program prior to the conclusion of 2011.

SMECO launched its Limited Income Energy Efficiency Program in February 2010. Since the program began there have only been 52 active leads. This has resulted in 42 completed audits and 17 homes have received installation of measures. As a unique approach, SMECO's low income program compliments the DHCD program by providing shell improvements to bring homes up to code to allow for weatherization to occur.

SMECO continued its "Save Energy. Save Money" campaign in 2010. Through this campaign, SMECO utilized print advertisements in local publications to promote various tips to save energy. Through online messaging, its Facebook fan base and video on demand, SMECO has been able to connect with customers. SMECO also developed and produced "Save Some Bacon" tee-shirts as promotional items to get customers excited about the initiative as well as to generate word of mouth buzz.

#### *Commercial and Industrial Programs*

SMECO's prescriptive and custom commercial and industrial programs launched in December 2009. Response to both programs was slower than expected, with the prescriptive program attracting 65 of an expected 3,400 participants and the custom program attracting 13 of an expected 385 participants. The program attracted a lot of interest from trade allies, contractors, and industry associations. Projects grew in size throughout the year, and SMECO expects programs to continue to grow in 2011, thanks largely in part to the submetering that is taking place on the Patuxent River Naval Air Station. Working with the Patuxent River Naval Air Station will allow SMECO to achieve a great deal of savings. For 2012 and beyond, SMECO will be proposing to offer a small business lighting and retrofit program, similar to what BGE and the other utilities are proposing.

Overall, SMECO faces the challenge of having very little industry in its service territory. However, the company is preparing to focus more on small business direct install measures, including lighting, refrigeration, and compressed air. Other opportunities for energy savings are available through the hotel, food chain, and small hospital sectors, where waste-heat recovery and refrigeration upgrades may be possible.

The prescriptive commercial and industrial program will be enhanced with new measures and higher incentive levels, as well as increased marketing efforts. Targeted marketing

will also help increase participation in the custom program by reaching out directly to customers rather than relying on trade allies.

*Demand Response*

Demand response is defined as the change in electricity usage by end-use customers either in response to price changes or to incentive payments designed to induce lower electricity use when demand is higher. SMECO launched its demand response program, CoolSentry, in November 2008. Participants can choose to have either a thermostat or a digital switch on their air conditioner or electric heat pump installed, which gives SMECO the ability to cycle electricity usage during periods of high demand. Events are usually called on the hottest summer days when electricity usage is at its peak and system reliability may be jeopardized. In 2010, SMECO installed 9,599 measures, which was below the 2010 target of 11,520 and also less than the number of devices installed in 2009 (9,874). Similar to Pepco, SMECO attributed this shortfall to the Commission Order that directed it to cease installations of thermostats due to the same safety issue discussed in the Pepco and DPL sections of this report.

*Advance Metering Infrastructure*

Advance metering infrastructure or “Smart Grid” technology is generally defined as a two-way communication system and associated equipment and software, including metering equipment installed on an electric customer’s premises, that use the electric company’s distribution network to provide real-time monitoring, diagnostic, and control information and services. Advanced metering infrastructure is generally considered to be an initiative that can reduce peak demand and energy consumption beyond those reductions achieved through “traditional” energy efficiency and conservation and demand response programs. Additionally, advanced metering infrastructure and Smart Grid technology will improve the efficiency and reliability of the distribution and use of electricity by reducing blackout probabilities and forced outage rates and restoring power in shorter time periods.

SMECO has a proposed a two-phase Advanced Metering Infrastructure Pilot Program to test the operational benefits of deploying this technology, such as savings from eliminating meter readings and improved outage restoration. Phase I of the pilot, approved by PSC in December of 2009, includes the installation of 1,000 meters in one section of the territory and went into effect in 2010. SMECO will attempt to quantify the level of operational benefits attainable through deployment of advanced metering infrastructure in SMECO’s service territory, and it will report the results of Phase I to PSC prior to implementing Phase II, which will be a 10,000 meter deployment across the entire service territory.

**Figure C-8. SMECO Energy Efficiency & Conservation and Demand Response Reported Achievements\***

	<b>2010 Reduction</b>	<b>Percentage of 2010 Interim Target**</b>	<b>Program-to-Date Reduction</b>	<b>Percentage of 2011 Target</b>
<b>SMECO</b>				

Electric Consumption Reduction (MWh)	18,461	73%	18,494	27%
Demand Reduction (MW)***	11	48%	19	32%

\*Based on preliminary wholesale energy and demand savings from quarterly programmatic reports. These savings will be verified through a process currently under development.

\*\* Percentage of energy savings forecasted to be achieved in 2010 minus 2009 forecast.

\*\*\*Demand reduction is from both the Cool Sentry program and the demand savings created through energy efficiency program savings.

#### **A.4.D: Potomac Edison**

Potomac Edison (PE, formerly Allegheny Power) received its PSC Order on August 6, 2009. The approved plan includes a portfolio of six residential and five commercial energy efficiency and conservation programs.<sup>29</sup> PE's programs as modified by PSC's Order, including transformer and streetlight replacement, are designed to save 109,955 MWh by the end of 2011 and 263,867 MWh by the end of 2015.

#### *Energy Efficiency and Conservation Programs*

PE's suite of programs was fully operational by the first quarter of 2010. The programs, for both residential and commercial, continued to ramp up during the year. Including the fast-track programs that began in 2009, PE's energy efficiency and conservation programs achieved 37 percent, or 40,227 MWh, of its 2011 energy efficiency and conservation electric consumption reduction target. Just in 2010, the company reported 15,068 MWh of savings toward the 38,056 MWh annual goal, or about 40 percent of this interim target. PE's portfolio of programs achieved 14 percent, or 5 MW of its 35 MW 2011 peak demand reduction target. While PE fell short of its 2010 targets, over 52 percent of PE's reported energy savings for the year occurred in the fourth quarter of 2010. The company also reports that there is an additional 12,000 MWh of electricity savings under contract which will be able to be counted in early 2011.

#### *Residential Programs*

To capture more participation, PE enhanced several of its programs. For its Lighting Program, PE altered its program approach from a mail-in rebate form to a point of purchase buy-down. After the alteration of the program method, the program experienced a 212 percent increase in participation from the previous quarter. However, the lighting program still was far from its 2010 goal, rebating just 107,000 bulbs rather than the expected 446,000.

Likewise, the PE appliance rebate program did not meet its forecasted number of participants, reporting 12,222 participants instead of the expected 20,651. Though

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<sup>29</sup>Approved residential programs: Compact Fluorescent Light Rebate Program; Energy Star Appliance Program; Home Performance Program; Low Income Program; Air Conditioner Efficiency Program; Heat Pump Efficiency Program. Approved commercial programs: Lighting Efficiency Program; Air Conditioning Efficiency Program; Heat Pump Efficiency Program; Commercial and Industrial Efficient Drives; Commercial and Industrial Custom Applications.

participation was lower, the energy savings numbers show that participants are choosing appliances with higher energy savings than expected – the company reports a savings of 4,083 MWh, while the expected savings was 4,621 MWh.

PE experienced success with its Heating Ventilation Air Conditioner Efficiency Program in 2010. The program generated 193 percent, or 1,522 MWh more in annualized energy savings than forecasted. This is largely due to the higher rebates available from MEA's program. PE doubled the number of rebates processed under this program between the third and fourth quarters. The success of this program through late 2010 may be an indicator of the results to be anticipated for the 2011 cooling season.

In addition to the Quick Home Energy Checkup and Home Performance programs, PE also offers a free online energy audit as part of its suite of residential retrofit programs. Energy savings are counted when customers accept an energy efficiency kit containing compact fluorescent light bulbs. Participation was well below the forecasts, with just 3,500 participants across all three programs instead of the expected 23,700.

PE began its Limited Income Program in November 2009. Rather than develop its own contractor base, PE developed a partnership with DHCD that utilizes local weatherization agencies in the utility's service territory to conduct weatherization audits and install measures. This allows the local weatherization offices and PE to leverage funds to provide the most energy savings to customers in its service territory. In August 2010, PE filed and was approved for an expansion of its low income program to include refrigerator and freezer replacement. PE incorporated this into its limited income program in November 2010 and anticipates that the installation of these particular measures will increase in 2011. In 2010, the program completed 228 audits within its territory, installing approximately 3,501 measures. PE anticipates that as the American Reinvestment and Recovery Act funds deplete, the local weatherization agencies will complete significantly more projects under PE's low income program.

PE used its Watt Watcher Energy Awareness and Market Transformation campaign to educate all customer classes, motivate customers to participate in one or more programs, help customers make informed decisions and increase understanding of the benefits of the program. The "little decisions" could yield "big savings" campaign utilized print, radio, cinema, and on-line advertising outlets throughout 2010. PE partnered with Radio Disney for a school program that launched in October 2010. This initiative reached out to 12 schools through a Jeopardy-style quiz show.

#### *Commercial and Industrial Programs*

The first savings for the commercial and industrial programs was reported in the fourth quarter of 2010. While the reported commercial and industrial energy savings and participation numbers were drastically lower than forecasted, the company had an additional 12,000 MWh of savings under contract at the end of 2010, representing 385 percent of the cumulative 2010 plan forecast.

Moving into the next program cycle, PE will lower participation eligibility requirements (i.e., minimum levels of energy usage and demand) for its commercial and industrial custom and lighting efficiency programs. These changes allow for a greater penetration of the programs with small businesses and expand the measures and rebates available. Program changes will also include an expedited energy efficiency path for small commercial customers and additional marketing support for programs.

PE does not have a residential demand response program but is proposing three commercial and industrial demand response programs for the 2012 – 2014 EmPOWER cycle:

- The Conservation Voltage Reduction Program, which will target select distribution circuits where voltage reductions can be achieved while maintaining voltage within the regulatory requirements;
- The Customer Resources Demand Response Program, in customers would participate in the program by engaging the services of the Curtailment Service Providers who are under contract with Potomac Edison; and
- The Distributed Generation Program, which will target commercial, industrial and governmental customers that have a load of 300 kilowatts or larger and have existing backup generators rated at least 500 kilowatts. The focus of the program is to have these customers operate their existing backup generators during peak load periods; hence, reducing the demand on the grid.

**Figure C-9. Potomac Energy's Energy Efficiency & Conservation and Demand Response Reported Achievements\***

	<b>2010 Reduction</b>	<b>Percentage of 2010 Interim Target**</b>	<b>Program-to-Date Reduction</b>	<b>Percentage of 2011 Target</b>
<b>PE</b>				
Electric Consumption Reduction (MWh)	15,068	55%	40,227	37%
Demand Reduction (MW)***	5	36%	5	14%

\*Based on preliminary energy and demand savings from quarterly programmatic reports. These savings will be verified through a process currently under development.

\*\* Percentage of energy savings forecasted to be achieved in 2010 minus 2009 forecast.

\*\*\*PE does not have a residential demand response program, so all reductions are from energy efficiency program savings

**A.4.D: Delmarva Power and Light**

DPL received its Commission Order on August 13, 2009. DPL’s approved plan included four residential and four non-residential energy efficiency and conservation programs,<sup>30</sup>

<sup>30</sup>Approved residential programs include: the Lighting and Appliance Program; the Home Performance with Energy Star Program which includes Quick Home Energy Check-up and the Online Audit Calculator; the a no cost appliance replacement program for Low Income; the residential HVAC Program. Approved

as well as demand response and street lighting programs, which were designed to save 149,288 MWh by 2011 and 321,619 MWh by 2015. DPL's portfolio of energy efficiency and conservation programs is applicable across the residential, commercial, government, and institutional customer base. DPL's plan consists of a traditional set of programs, such as market buy-down or other incentives for the purchase and/or installation of energy efficient products or measures.

#### *Energy Efficiency and Conservation Programs*

In 2010, DPL's energy efficiency and conservation programs achieved 15 percent, or 22,925 MWh, of its 2011 energy efficiency and conservation electric consumption reduction target. This number includes all programs, including those started in 2009. DPL's portfolio of programs, including demand response, achieved 13 percent, or 18 MW of the company-set 2011 peak demand reduction target. The company-set demand response target was significantly higher than the 2011 EmPOWER Maryland goal; DPL achieved 25 percent of the 73 MW EmPOWER goal. Due to the fact that DPL was still ramping up its programs well into 2010, DPL fell short of its 2010 Interim Target for annual energy and demand savings in order to remain on target for 2011, reaching only 32 percent and 65 percent of its 2010 unofficial incremental benchmark for energy savings and demand reduction, respectively.

At the conclusion of 2010, DPL all programs in DPL's suite were up and running. Among the residential program offerings, DPL's most successful program to date continued to be the Lighting and Appliance program. The Appliance portion of the program experienced double the number of rebated appliances during 2010 from 2009 due to the increased rebate available through MEA's State Energy Efficiency Appliance Replacement Program funded by the American Reinvestment and Recovery Act of 2008. This program ran from April 2010 through November 2010 and offered additional rebates on utility rebated appliances as well as new rebates not offered under EmPOWER portfolio.

The appliance program exceeded several annual forecasts for DPL, rebating 1,879 appliances rather than the expected 830, 126 percent more than forecasted for 2010. In turn, this success generated 237 percent, or 147 MWh more in annualized energy savings than anticipated. DPL plans to enhance its appliance program to include additional appliances and rebates to match the levels resulting from the collaborative effort with MEA. The lighting program achieved 92 percent of its 2010 annual goal, rebating more than 152,000 bulbs. Lighting, alone, was responsible for more than half of the 2010 energy savings for DPL. To keep up with changing technology, DPL is proposing the addition of light emitting diode bulbs for future program years.

DPL offered HVAC rebates throughout 2010, which were not as successful as anticipated. Instead of rebating their forecasted 7,070 HVAC units, the company rebated just 199. Like in the Pepco service territory, low participation was due in part to DPL's

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commercial programs include: the Prescriptive Program; the Heating, Ventilation, and Air-Conditioning Program, Custom Incentive Program; the Building Commissioning and Operations & Maintenance Program.

requirements for participating contractors, which were much more stringent than other utilities. Those requirements have since been modified, and DPL expects that contractor and customer participation will improve dramatically through 2011.

DPL began its Income Eligible Energy Efficiency Program, a limited income energy improvement program, in March 2010, completing its first group of audits in the third quarter of 2010. In 2010, DPL weatherized nine homes, in which it installed a total of 129 measures, compared to their forecast of 3,031 participants. In late 2010, DPL filed and was approved for an expansion of its limited income program to include electric appliance replacement. Pepco works in coordination with DHCD to provide appliance replacement for homes being retrofitted under the DHCD Weatherization program, as well. Measures include air conditioning units, heat pumps, refrigerators and hot water heaters. DPL anticipates that this portion of the program will be available through 2011. DPL has expanded its contractor pool in 2010 as part of its execution plan to complete more audits and installations during 2011.

Throughout 2010, DPL's campaign targeted various audiences with program specific messages, beginning with radio spots, but later expanding its campaign to include television, newspaper, cinema, billboards and direct mail. A majority of the marketing was focused on building awareness around DPL's suite of program to improve winter energy bills. During the cooling season, DPL heavily promoted its demand response program, Energy Wise Rewards.

DPL attended several special events throughout its service territory to foster two-way dialogue with its customers. DPL also turned to social marketing, such as Twitter and Facebook, to target its customers with energy efficiency tips and programs.

#### *Commercial and Industrial Programs*

DPL offers prescriptive, custom, retrocommissioning, and HVAC programs for commercial and industrial customers. Overall, the commercial and industrial programs were well below their 2010 program targets, achieving just 3,290 MWh of the expected 19,539 MWh savings. Among its commercial and industrial programs, the Prescriptive Program contributed the most savings, but still only had 62 of an expected 80 participants and 3,086 MWh of an expected 8,922 MWh savings. This program offers rebates on standard commercial items such as overhead lighting, occupancy sensors and motors.

#### *Demand Response*

Demand response is defined as the change in electricity usage by end-use customers either in response to price changes or to incentive payments designed to induce lower electricity use when demand is higher. Pepco launched its EnergyWise Rewards program (similar in program design to BGE's PeakRewards) in June 2009. Participants can choose to have either a thermostat or a digital switch installed on their air conditioner or electric heat pump, which gives Pepco the ability to cycle electricity usage during periods of high demand. Events are usually called on the hottest summer days when electricity usage is at its peak and system reliability may be jeopardized. DPL installed 11,554 air

conditioning measures in 2010, exceeding its annual installation target. The utility has installed 13,807 measures program to date.

As discussed in the Pepco section, PSC temporarily suspended the installation of thermostats due to the same safety issue. However, DPL was still able to install load control devices on central air conditioners and heat pumps.

*Advance Metering Infrastructure*

Advance metering infrastructure or “Smart Grid” technology is generally defined as a two-way communication system and associated equipment and software, including metering equipment installed on an electric customer’s premises, that use the electric company’s distribution network to provide real-time monitoring, diagnostic, and control information and services. Advanced metering infrastructure is generally considered to be an initiative that can reduce peak demand and energy consumption beyond those reductions achieved through “traditional” energy efficiency and conservation and demand response programs. Additionally, advanced metering infrastructure and Smart Grid technology will improve the efficiency and reliability of the distribution and use of electricity by reducing blackout probabilities and forced outage rates and restoring power in shorter time periods.

In Order No. 83571, PSC postponed the decision on DPL’s request to proceed with deployment of its Advanced Metering Infrastructure Initiative. This deferment stemmed primarily from the U.S. Department of Energy’s decision not to grant DPL an award for American Recovery and Reinvestment Act funding under the Smart Grid Investment Grant. Without such federal funding the cost-effectiveness for the advanced metering infrastructure proposal became untenable. DPL’s request to establish a regulatory asset for the incremental costs associated with its proposed advanced metering infrastructure deployment was deferred as well.

**Figure C-10. Delmarva Power & Light Energy Efficiency & Conservation and Demand Response Reported Achievements\***

	<b>2010 Reduction</b>	<b>Percentage of 2010 Interim Target**</b>	<b>Program-to-Date Reduction</b>	<b>Percentage of 2011 Target</b>
<b>DPL</b>				
Electric Consumption Reduction (MWh)	11,706	32%	22,925	21%
Demand Reduction (MW)***	15	65%	18	13%

\*Based on preliminary wholesale energy and demand savings from quarterly programmatic reports. These savings will be verified through a process currently under development.

\*\* Percentage of energy savings forecasted to be achieved in 2010 minus 2009 forecast.

\*\*\*Demand reduction is from both the Peak Rewards program and the demand savings created through energy efficiency program savings.

## **A.5: Combined Heat and Power**

Lead Agency: MEA and MDE

### **Program Description**

Combined heat and power, also called co-generation, is a system which is designed to generate both power and thermal energy from a single fuel source. When electricity is generated, thermal energy is a by-product that is traditionally not used, however a combined heat and power system can utilize the thermal energy for heating or cooling. The conventional method of producing thermal energy and power separately has a typical combined efficiency rate of 45 percent, while combined heat and power systems can reach 80 percent efficiency levels. The increased efficiency means more energy is generated from a single fuel source, therefore, GHG emissions from a combined heat and power system is less than a typical system which produces electric and thermal energy separately. Adding these systems can greatly increase a facility's level of energy efficiency and decrease energy costs. Moreover, combined heat and power is an efficient, clean, and reliable approach to generating power while also reducing GHG emissions.

State agencies, such as MEA, MDE and DNR, continue to evaluate opportunities for combined heat and power in Maryland. Combined heat and power systems can be promoted by State agencies, such as MEA, through the enactment of incentives such as: (1) direct subsidies, tax credits or exemptions for purchasing, selling or operating combined heat and power systems; (2) tax credits for each kilowatt-hour or BTU generated from a qualifying facility; and, (3) feed-in tariffs. Also, education and outreach to inform the public of the many benefits associated with combined heat and power.

Currently, there are approximately 21 combined heat and power units located throughout Maryland. These units are fueled by a range of primary fuels, including fossil fuels, biomass, municipal solid waste, and other industrial waste products.

### **Estimated GHG Emission Reductions in 2020**

In order to account for similarities across programs, all emission benefits and costs associated with these programs have been aggregated under A: EmPOWER.

### **Implementation**

MEA has offered assistance to the State's industrial sector through the Maryland Save Energy Now program. Support offered through the program includes:

- Low cost energy assessments for industrial facilities in Maryland. The assessments include a one- to three-day site visit by the University of Maryland Manufacturing Assistance Program to evaluate energy use at the facility, identification of opportunities for energy efficiency improvements and combined heat and power, and a report on the assessment findings and recommendations.

- Free monthly training webinars on various industrial energy efficiency topics, including combined heat and power. The webinar series started in September 2010 and concluded in March 2011.
- Information on financial incentives and other helpful resources for businesses, including those offered by Maryland's utilities, MEA, and federal agencies such as the U.S. Department of Energy, and third party investors.

The Jane E. Lawton Conservation Loan Program provides eligible non-profit organizations (including hospitals and private schools), local governments (including public school systems and community colleges), and businesses in Maryland a unique opportunity to reduce operating expenses by identifying and installing energy conservation improvements. The program honors the late Delegate Lawton for her dedication to Maryland's environment and energy efficiency. The program allows borrowers to use the cost savings generated by added improvements as the primary source of revenue for repaying the loans. This neutral budget impact makes this an attractive financing opportunity for interested organizations.

Projects applying for funding through the Jane E. Lawton Conservation Loan Program should have a simple payback of ten years or less. All costs necessary for implementing an energy conservation project can be considered for funding, including the technical assessment, reasonable fees for special services, plans and specifications, and the actual costs of the conservation measures. The interest rate for all program loans made during FY11 will be 2.5 percent.

By offering the Jane E. Lawton Conservation Loan Program as a revolving loan fund rather than a one-time grant, Maryland is able to maximize the use of the funds. Repayments and interest earned by the fund will allow the program to continue making loans for the foreseeable future. To date, more than fifty loans have been made providing about \$21 million for energy efficiency improvements across Maryland.

## Maryland Renewable Energy Portfolio Standard (RPS)

### **B.1: The Maryland Renewable Energy Portfolio Standard Program**

Lead Agency: MEA

#### **Program Description**

The objective of the Renewable Energy Portfolio Standard (RPS) Program is to recognize and develop the benefits associated with a diverse collection of renewable energy supplies to serve Maryland. The State's RPS does this by recognizing the environmental

and consumer benefits associated with renewable energy. The RPS requires retail suppliers of electricity to meet a prescribed minimum portion of their energy supply needs with various renewable energy sources, which have been classified within the RPS Statute as Tier 1 and Tier 2 renewable sources. The program is implemented through the creation, sale and transfer of RECs. Electricity suppliers are required to purchase specified minimum percentages of their electricity resources via RECs from Maryland-certified Tier 1 and Tier 2 renewable resources. Tier 1 and the Tier 1 solar set-aside requirements gradually increase until they peak in 2022 at 18 percent and 2 percent, respectively, and are subsequently maintained at those levels.<sup>31</sup> Maryland's Tier 2 requirement remains constant at 2.5 percent through 2018, after which it sunsets. The development of renewable energy sources is further promoted by requiring electricity suppliers to pay a financial penalty for failing to acquire sufficient RECs to satisfy the RPS. The penalty is used to support the creation of new Tier 1 renewable sources in the State.

The Maryland RPS is designed to create a stable and predictable market for energy generated from renewables, and to foster additional development and growth in the renewable industry. Implementation of the RPS assists in overcoming market barriers seen as impediments for the development of the industry; moreover, increasing reliance upon renewable energy technologies to satisfy electric power requirements can provide benefits including reductions in emissions of pollutants, increases in fuel diversity, and economic and employment benefits to Maryland.

## **Estimated GHG Emission Reductions in 2020**

**Figure C-11. Low and High GHG Benefits for Energy-11**

Initial Reductions	5.86 MMtCO <sub>2</sub> e	MEA Quantification
Enhanced Reductions	9.96 MMtCO <sub>2</sub> e	MEA Quantification

Reduction above account for overlap which was handled separate from othe programs but did account for RGGI, EmPOWER, and Fuel Switching. Note that the SAIC Quantification handled RGGI reductions in a different way. After accounting for overlap between the energy programs, the MEA quantification and SAIC quantification of all energy programs produces net reductions within 4% of each other.

### **MEA Quantification**

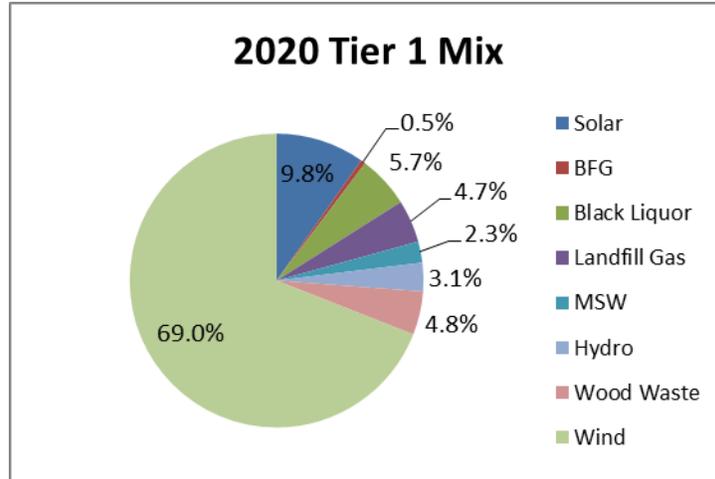
The current RPS escalates to 18 percent of electricity sales from renewable energy by 2020. The estimated avoided GHG emissions for the current RPS program range from 3.04 MMtCO<sub>2</sub>e to 7.36 MMtCO<sub>2</sub>e.

MEA made an estimate based on the historic and projected mix of RECs that would be used to meet the 2020 RPS compliance. Based on the BAU forecast, Maryland would

<sup>31</sup>"Tier 1 solar set-aside" refers to the set-aside (or carve-out) of Tier 1 for energy derived from a qualified solar energy facilities. The Tier 1 solar set-aside requirement applies to retail electricity sales in the State by electricity suppliers and is a sub-set of the Tier 1 standard.

need approximately 13.7 million RECs in 2020. The following chart depicts the projected REC mix used

**Figure C-12. 2020 Tier 1 REC Mix**



Based on this mix, and using conversion factors from EPA, the RECs would contain approximately 0.16 MtCO<sub>2</sub>e/MWh. Using projections from conventional energy, the same 13.7 million MWh would contain approximately 0.64 MtCO<sub>2</sub>e/MWh. When the reduction is applied to the appropriate mix of in-state and imported electricity, the net impact of the policy is a reduction of 7.36 MMtCO<sub>2</sub>e.

In addition to reducing carbon dioxide, the current RPS goal of 18 percent of the energy supply from renewable energy sources by 2020, would displace 6,300 metric tons of nitrogen oxides and 46,534 metric tons of sulfur dioxides.

**Figure C-13. Current RPS Program**

	Carbon Dioxide (million metric ton)	Nitrogen Oxides (metric ton)	Sulfur Dioxides (metric ton)
Business As Usual 2020 Emissions	54.50	72,502	261,541
Estimated 2020 Emissions with RPS	47.01	6,750	543
<b>Net Emissions Avoided</b>	<b>7.36</b>	<b>6,300</b>	<b>46,534</b>

**Implementation**

Under the RPS, electricity suppliers are required to meet a renewable energy portfolio standard. This is an annual requirement placed upon Maryland load serving entities, which include electricity suppliers and the utilities. Load serving entities file compliance reports with PSC verifying that the renewable requirement for each entity is satisfied.

Maryland's RPS requires electric suppliers to obtain RECs for a minimum percentage of their power generated from renewable energy resources. Implementation of the Maryland RPS can provide an incentive for renewable generators to locate in the PJM region and generate electricity. The renewable requirement establishes a market for renewable energy, and to the extent Maryland's geography and natural resources can be utilized to generate renewable electricity, power plant developers may locate projects within the State. Moreover, Maryland's RPS requires suppliers that do not meet the annual obligations to pay penalties, which in turn are used to support the creation of new Tier 1 renewable sources within the State. Additionally, on or before December 31, 2011, Tier 1 solar resources that are not located in Maryland are eligible only if sufficient offers from instate resources are not made.

Compliance fees are deposited into Maryland's Strategic Energy Investment Fund, dedicated to provide loans and grants that can indirectly spur the creation of new renewable energy sources in the State. As a special, non-lapsing fund, the Strategic Energy Investment Fund is also the depository of revenues generated through the sale of carbon allowances under RGGI. Indeed, the majority of the Strategic Energy Investment Fund results from the RGGI carbon dioxide allowance auctions. Auctions are held quarterly. At least 6.5 percent of the funds from RGGI allowances sold between March 1, 2009 and June 30, 2011 are to be allocated to renewable and clean energy, climate change programs, and energy related public education and outreach programs; an allocation of up to 10.5 percent of RGGI funds is provided for in subsequent auctions. Responsibility for developing renewable energy sources has been vested with MEA.

## **B.2: GHG Emission Reductions from Fuel Switching**

Lead Agency: MDE

### **Program Description**

GHG emissions from the energy supply sector in Maryland include emissions from fossil fuel-fired electricity generation and represent a substantial portion of the State's overall GHG emissions. On a consumption basis, Maryland imports a considerable amount (about 30 percent) of electricity generated out-of-state in the surrounding PJM grid region to meet retail electricity demand.<sup>32</sup> In the absence of State programs to curb emissions from out-of-state resources, the level of GHG emissions associated with meeting electricity demand in Maryland is expected to increase over time.

The 2008 Climate Action Plan included a policy, which defined a generation performance standard as a mandate for load serving entities, which include electricity suppliers and the utilities. The mandate would require load serving entities to acquire electricity on a portfolio basis, with the portfolio meeting a per-unit GHG emission rate below a specified standard. The generation performance standard policy would promote

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<sup>32</sup> The PJM wholesale market includes all or parts of Delaware, Illinois, Indiana, Kentucky, Maryland, Michigan, New Jersey, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia and the District of Columbia.

the purchase of energy and capacity from low-carbon or renewable technologies. The policy's goal is to enact a standard of no more than 1,125 pounds of GHGs per megawatt-hour (MWh) by 2013.

It is expected that the generation performance standard would reduce the amount of imports from states with a higher concentration of coal in the fuel mix. For example, Pennsylvania is a net exporter to Maryland and the majority of the emissions from the fuel mix are from coal-fired units. Even though Pennsylvania does not participate in RGGI, the generation performance standard would effectively limit the amount of electricity from coal-fired unit which would be imported from Pennsylvania into Maryland. Unless Pennsylvania coal-fired plants could sell the excess power elsewhere, the effect could potentially reduce the output from such plants and cause an economic loss. Whereas, low-carbon and renewable energy technologies would receive a premium from Maryland rate-payers.

**Estimated GHG Emission Reductions in 2020**

**Figure C-14. Low and High GHG Benefits for Energy-2**

Initial Reductions	1.00 MMtCO <sub>2</sub> e	MDE Quantification Below
Enhanced Reductions	1.00 MMtCO <sub>2</sub> e	MDE Quantification Below

**Estimates – MDE Quantification**

Quantification of GHG emissions will be driven by two numbers which will be affected by a myriad of factors. The GHG emissions from imported electricity are calculated simply by the multiplication of the amount of imported electricity (in MWh) and carbon-intensity of that electricity (in pounds of CO<sub>2</sub>-equivalent per MWh). But numerous assumptions have to be made before this calculation can be completed.

The baseline year for GGRA is 2006. For 2006, fossil-fuel electric generating units in Maryland supported 31.16 million MWh of consumption (from GHG inventory and SAIC ES-3 Page 80, Appendix B). While, imported power was 10.02 million MWh of Maryland’s consumption (for a total of 42.18 million MWh). To calculate the amount of imported electricity in 2020, it is necessary to first calculate the total amount of electrical consumption in Maryland in that time frame. From previous work (SAIC Policy ES-3 Page 80, Appendix B), total Maryland consumption is estimated to be 58.8 million MWh, of which 42.88 million MWh are generated instate. So, in 2020 Maryland will import 15.92 million MWh of electricity. This assumption will remain the same for both the low and high quantification analysis. However, other factors could drive this number higher or lower. For example, electrical distribution in Maryland is currently constrained by congestion, this may or may not be relieved by the building of additional transmission lines (which may or may not be built). Further, the EmPOWER Maryland program (and possible new programs) could reduce Maryland’s consumption such that the percentage of imported power decreases in the future.

One of the difficulties in quantifying the carbon-intensity of electricity is the availability of data. The PJM Interconnection's Environmental Information Services, Inc. (PJM EIS)

data system has the carbon intensity for the total PJM region system. The data for the PJM region is divided into RGGI (Delaware, Maryland, and New Jersey) and non-RGGI (7 remaining states and D.C.), but Maryland-specific data is not available. For the PJM region from 2006 to 2010, the carbon-intensity decreased from 1,251.8 to 1,167.6 pounds of CO<sub>2</sub>-equivalent per MWh. This is a reduction 84.2 pounds of carbon dioxide, which represents an annual reduction of 1.68 percent. This reduction was not consistent and factors like economic activity and weather can have a significant effect on the carbon-intensity of electricity. In general, an increase in economic activity and more intense weather tends to increase the carbon-intensity of electricity. However, the general trend of carbon-intensity in PJM has been decreasing over time.

For the 2006 baseline, the GHG emissions from imported power is 10.02 million MWh multiplied by 1,251.8 pounds of carbon dioxide per MWh, which equals 5.7 MMtCO<sub>2</sub>e (or 12,538,165,966 pounds). For 2020, the business-as-usual calculation is 15.92 million MWh multiplied by the same carbon intensity (1,251.8 pounds of carbon dioxide per MWh), which equals 9.0 MMtCO<sub>2</sub>e (19,927,889,748 pounds).

For the low quantification, it is assumed that the carbon-intensity trend from 2006 to 2010 continues to 2020. Therefore, the 2010 carbon-intensity of 1,167.6 pounds of carbon dioxide per MWh is reduced annually by 1.68 percent, which results in a low-case 2020 carbon intensity of 985.5 pounds of carbon dioxide per MWh). Multiplying this by the calculated 2020 electrical importation of 15.92 MWh equals 7.1 MMtCO<sub>2</sub>e (15,688,413,839 pounds). So the low-estimated reduction is 1.9 MMtCO<sub>2</sub>e (9.0 – 7.1).

Overlap is an issue which must be accounted for as part of this GHG emissions mitigation program, since these reduction could be partially or totally subsumed as part of other mitigation programs. So, only 1.00 MMtCO<sub>2</sub>e was attributed to this program.

## **B.3: Incentives and Grant Programs to Support Renewable Energy**

Lead Agency: MEA

### **Program Description**

MEA administers a number of incentives and grant programs to promote and accelerate the development of renewable energy production and a vital renewable energy economy in Maryland, from utility scale facilities to on-site distributed generation. The regulatory driver for these programs is Maryland's RPS. The RPS is a statutory goal committing the State to obtain 20 percent of the electricity consumed in Maryland from renewable resources by 2022, with interim targets of 7.5 percent by 2011 and 18 percent by 2020.<sup>33</sup>

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<sup>33</sup>The original RPS has been strengthened by the General Assembly in recent years. See "Renewable Portfolio Standard Percentage Requirements – Acceleration" (Senate Bill 209/House Bill 375, General Assembly 2008), which increased the RPS percentage requirements to 20 percent by 2022, including a 2 percent level for solar; and "Renewable Energy Portfolio Standard - Solar Energy" (Senate Bill 27, General Assembly 2010), which accelerates RPS requirements for solar energy in the early years (2011 through

*Commercial Clean Energy Grant Program.* The Commercial Clean Energy Grant Program provides financial assistance to businesses, non-profits, and government entities who install solar photovoltaic, solar water heating, geothermal heating and cooling and wind turbine systems at their place of business.

*Residential Clean Energy Grants Program.* The Residential Clean Energy Grant Program provides financial assistance to residents who install solar photovoltaic, solar water heating, geothermal heating and cooling and wind turbine systems at their residence. In 2012, MEA added Clean Burning Wood Stove incentives for both stick and pellet-fueled wood stoves to the Program to make its portfolio of clean energy conversion technologies available to a wider base of Maryland residents.

Through these two programs, MEA has awarded thousands of grants (ranging from \$500-\$50,000) to homeowners and businesses to offset the cost of installing wind, geothermal and solar photovoltaic systems. Demand has increased from 200 systems a year to 200 systems a month in 2010 and 2011, even with reduced incentives.

*Clean Energy Incentive Tax Credit Program.* Started in 2006, this program offers a State income tax credit to Maryland individuals and corporations that build and produce electricity generated by qualified renewable resources, in the amount of 0.85 cents per kilowatt-hour, and 0.50 cents per kilowatt-hour for electricity generated from co-firing a qualified resource with coal. The resources must be operational before 2016. MEA issues five-year credit certificates on a first-come, first-serve basis. Total program credits are capped at \$25,000,000 by 2016, with individual credits ranging between \$1,000 and \$2,500,000 per eligible project.<sup>34</sup> As of June 30, 2011, more than \$8.5 million in credits had been claimed over the past three years.

*Generating Clean Horizons Program.* Electricity is a significant part of the State's purchasing budget and has a considerable impact on Maryland's energy use and GHG emissions. By 2009, the State government spent approximately \$160 million per year on electricity and using 1.5 billion kilowatts per year.<sup>35</sup>

In 2009 MEA and DGS, in partnership with the University System of Maryland, launched the Generating Clean Horizons program to reduce the GHG footprint of the purchased electricity of State government and the University of Maryland. Through a competitive bid process, long-term power purchase agreements were awarded to three new, utility-scale renewable energy sources that collectively will provide 78 MW, approximately 16 percent of the annual electricity needs of State agencies and University

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2016), from 0.35 percent to 0.50 percent, while leaving unchanged the 2022 RPS goal of 2 percent for solar.

<sup>34</sup>Maryland Clean Energy Incentive Act of 2010" (House Bill 464) extended the existing clean energy incentive State income tax credit for 5 years, through December 31, 2015.

<sup>35</sup>Telephone conversation with Hatim Jabaji, Office of Energy Projects and Conservation, DGS, May 12, 2009.

of Maryland’s institutions over a 20-year period.<sup>36</sup> The awards were made to Constellation Energy for a 13 MW solar project on the Mount St. Mary’s University campus in Emmitsburg, Maryland; Synergics for a 10 MW solar project as part of its Roth Rock development in Western Maryland; and U.S. Wind Force, LLC, for a 55 MW on-shore wind energy project at the Pinnacle Wind Farm in West Virginia. See Figure C-22 below for project details.

The *Generating Clean Horizons* initiative significantly advances both the purchasing and building energy usage “lead by example” policies first articulated in the *2008 Climate Action Plan* and supports the development of utility-scale, commercial projects to provide clean energy to Maryland’s grid. Additionally, the State retains valuable renewable energy certificates (RECs) that can be used for its own RPS compliance needs.

**Figure C-15. Clean energy purchase partnership**

Bidder	Project	Project Type	State	Project Capacity (MW)	Annual Energy Output (MWh/yr)	Contract Escalation	Start Date	Term (yr)	Annualized Project Rate (\$/kWh)
US Windforce	Pinnacle	wind	WV	55	173,542	0%	Dec 2011	20	0.082
Synergic-SBR	Roth Rock Phase II	Wind	MD	10	30,605	50% CPI	Dec 2011	20	0.120
Constellation	St. Mary's Solar	Solar	MD	13	22,291	0%	Jan 2013	20	0.224

*Project Sunburst.* In 2010 MEA launched *Project Sunburst* to install major solar photovoltaic arrays on as many as 17 government buildings around the State. When completed in 2011, the installations will have a generating capacity of 8.91 MW, which at the time it was planned, would have more than doubled the amount of solar on Maryland’s grid. The program, administered by MEA, leverages federal stimulus funds to award grants to selected government entities at a rate of \$1,000 per kilowatt on installations. Award recipients include public school systems throughout the State, the City of Baltimore, Talbot County facilities, BWI Airport, and the Maryland Port Authority Marine Terminal.<sup>37</sup>

<sup>36</sup> The “Generating Clean Horizons” joint request for proposal, issued in February 2009, solicited proposals for renewable and low-carbon energy projects to supply electricity and RECs to State agencies and University System of Maryland institutions. Under its terms, State government and universities can purchase up to 20 percent of their annual electricity needs through as-needed contracts, not to exceed 20 years, with providers in Maryland and surrounding states. Power must be made available by December 31, 2014.

<sup>37</sup>“Governor O’Malley’s Project Sunburst Puts Solar Energy on 31 State Buildings, Nearly Tripling Solar Energy Produced in Maryland”, MEA Press Release, April 22, 2010. <http://www.energy.state.md.us/press.html>

MEA provides ongoing technical project assessment and procurement assistance to the Department of General Services and the University System of Maryland as a follow-on project.

*A CEEDI Grant Prince George's County to Develop Residential Solar Water Heating Business Models.* The goal of this 2012 project is to develop three Solar Water Heating (SWH) business models that present a compelling economic value proposition for Prince George's County residents to invest in up to 5,000 SWH systems at greatly reduced installed costs achieved through economies of scale. Three business models—based on water utility, electric utility, and private sector financing paradigms—will include an analysis of costs and benefits of surveys to assess demand, targeted marketing to create demand, installed SWH product, services such as installation and maintenance, warranties, billing methodologies, administration, etc. After all costs are calculated, there must be sufficiently high return and low risk to incent developers, utilities, and residents to invest in this technology.

*Biomass Programs.* MEA administers several tax and other incentive programs to promote the use of organic materials such as agricultural crops and residues, household, industrial, and forestry wastes, for biofuels and energy.<sup>38</sup>

Two new (2012) programs include the Clean Burning Wood Stove Incentive addition to the Residential Clean Energy Grant Program and the Game Changer Competitive Grant Program award to a large biomass boiler at Catoctin Mountain Growers.

*Geothermal Heating & Cooling Program.* Geothermal, or ground source, heat pumps provide cost-effective, eco-friendly heating and cooling for homes and buildings with energy savings of 25-50%, according to the [International Ground Source Heat Pump Association](#). In Maryland, the earth maintains a constant 55°F, below frost level (from 4-8 feet deep). This reservoir of energy can be converted for heating and cooling.

[HB 1186](#) was signed into law on May 22, 2012, the day that Maryland became the first state in the country to make the energy generated by geothermal heating and Cooling (GHC) technologies eligible for the Renewable Portfolio Standard (RPS) as a Tier 1 renewable source. To qualify, the GHC technologies must meet ENERGY STAR standards and displace electric or non-natural gas heating and/or old and presumed inefficient air conditioning. Home owners will be eligible to receive Renewable Energy Credits (RECs) for GHC systems that are commissioned on or after January 1, 2013.

*Land-based Wind Programs:* The wind industry in Maryland currently produces over 120,000 kilowatts of power. MEA's efforts to expand land-based wind energy

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<sup>38</sup> Biomass, along with other types of renewable energy sources, is eligible for the Maryland Clean Energy Production Tax Credit administered by the MEA. The tax credit is equal to 0.85 cents per kilowatt hour, up to \$2.5 million during a five year period. The commissioning deadline to qualify for the grant has recently been extended by five years, to December 31, 2015. Maryland Clean Energy Incentive Act of 2010 (House Bill 464).

production have focused on three sectors: i) small and residential scale, ii) community, or mid-size scale, and iii) utility scale:

- Residential: MEA administers the *Windswept* grant program, which supports the deployment of small and residential wind energy systems. This program typically supports between 10 percent and 30 percent of the total cost of installation, leveraging private and federal funds to expand small and residential wind energy below 100 kilowatts. As of June 30, 2011, the *Windswept* program resulted in 72 residential wind installations and 421 kilowatts of deployed capacity. MEA also works with local planning and zoning officials to remove zoning and permitting barriers to small and residential wind energy systems. Currently, 15 counties have enacted enabling wind ordinances, and 2 more are in some phase of development.
- Community and mid-size: MEA works with local governments and entrepreneurs to facilitate development of community-scale wind projects, suitable for such facilities as wastewater treatment plants, military installations, college campuses and communities.
- Utility: MEA supports developers as they investigate State policies and incentives, navigate through local ordinance rules, Certificate for Public Convenience or Necessity or exemption processes. MEA participates in public hearings to advocate for greater renewable energy deployment in the State.

*Game Changer Competitive Grant Program*. MEA launched this program in 2012 to provide cost-sharing grants for innovative clean energy generation projects in Maryland. The winning grantees embrace either a new technology or a new methodology that extends beyond existing renewable energy generation; the Game Changers seek to advance the market into uncharted territory. Winners were evaluated on the merits of their energy production, cost-effectiveness, market potential, project viability, cost share, project performance measurement and verification methodology, and project visibility. The projects are funded based on their ability to help the State meet its renewable energy portfolio standard of 20% by 2022. Grant recipients' progress towards that goal will be evaluated for two years following their award.

The five 2012 winning projects included:

- Catocin Mountain Growers (CMG) Greenhouse Biomass Boiler Project. An award of \$250,000 (8.3% of the total project cost of \$3,000,000) will assist CMG replace its traditional boiler fuels with clean woody biomass fuel in a clean, efficient, cost-saving biomass boiler. This boiler will be Maryland's first modern, large-scale biomass boiler project and will be the first of many other large biomass boiler projects that can take advantage of the state's 780,000 dry tons of available woody biomass.
- Skyline Innovations Multi-Family Solar Water Heating Project to Compare and Improve Efficiencies of Traditional & New Collector Technologies. An award of \$176,000 (13.2% of a total project cost of \$1,329,700) will help Skyline Innovations collect hot water consumption data and solar thermal collector performance data on three types of collectors from 6,000 multi-family housing

- MD Goes Green, Division of Land and Cultural Preservation Fund, Inc. Community-Scale Wind Project Assessments to Develop Community-Scale Wind Projects. An award of \$219,200 (9.1% of a total project cost of \$2,391,050) will help create opportunities for community-scale wind projects across Maryland. Led by the non-profit organization, MD Goes Green, Division of Land and Cultural Preservation Fund, Inc., five sites will be identified, resulting in the deployment of at least 850 kW of new community-scale wind generation within the next five years. The experiences of these sites will provide guidance for other communities to deploy wind energy generation throughout the state.
- TimberRock Energy Solutions with General Motors (GM) Development of a Solar PV/Energy Storage/Electric Vehicle Charging System. An award of \$170,118 (46% of a total project cost of \$365,481) will aid TimberRock Energy Solutions to install an electric vehicle (EV) charging system that collects and stores solar energy. The system will be located at GM's White Marsh electric vehicle motor plant. It is the first integrated configuration that enables solar energy to power a local building, an EV, as well as the power grid. This ground breaking project will demonstrate the viability of electricity as a transportation fuel and renewable energy to create that power.
- Standard Solar Installed Solar Energy Microgrid at the Konterra Mixed-Used Development. An award of \$250,000 (12.4% of a total project cost of \$2,007,000) will implement a 320-kW solar PV array and lithium ion battery storage system at a mixed-use development that will allow solar energy to flow after a power outage, thus creating the first solar powered microgrid in Maryland. The highly-visible project located at the intersection of I-95 and the Intercounty Connector will feature billboard-sized monitors visible from nearby highways that show motorists how much solar energy is being generated at any given time even during power outages.

Funding for the program comes from the Strategic Energy Investment Fund, which was created from public auctions of carbon credits through the Regional Greenhouse Gas Initiative.

### **Estimated GHG Emission Reductions in 2020**

In order to account for similarities across programs, all emission benefits and costs associated with this program have been aggregated under B.1: The Maryland Renewable Energy Portfolio Standard Program.

## **B.4: Offshore Wind Initiatives to Support Renewable Energy**

Lead Agency: MEA

### **Program Description**

Maryland waters are part of the Mid-Atlantic Bight region, a coastal area spanning from North Carolina to Massachusetts with substantial wind resources located in close proximity to coastal population centers. In fact, this area has the greatest renewable energy potential relative to other U.S. offshore regions in the Gulf of Mexico, Pacific, and Alaska.<sup>39</sup> Research indicates that the potential power supply available from offshore wind substantially exceeds the region's current energy use.<sup>40</sup> Maryland, therefore, has the potential to access large energy resources off the coast that could contribute to meeting future energy demands while simultaneously displacing fossil fuel generation.

The available offshore wind energy resources in the Mid-Atlantic Bight region without exclusions could produce on average a power output of 330 gigawatts,<sup>41</sup> according to researchers from the University of Delaware and Stanford.<sup>42</sup> According to the National Renewable Energy Laboratory, the shallow waters (typically 0 - 30 meters), which are characteristic of the Mid-Atlantic Bight region, are the most likely to be technically and commercially feasible at this time.<sup>43</sup> For 2006, the total demand for delivered power was estimated to be 185 gigawatts for the coastal jurisdictions of Connecticut, Delaware, Massachusetts, Maryland, North Carolina, New Jersey, New York, Rhode Island, and Virginia.<sup>44</sup> Estimates indicate that the available offshore wind energy resources in the region have the potential to provide for both current energy needs and up to 50 percent of the additional growth expected in regional demand for energy.<sup>45</sup>

Since there are negligible GHG emissions associated with the production of energy from wind resources, development of offshore wind energy can reduce the amount of air emissions from electricity by displacing conventional fossil fuel generation. In addition to providing clean energy, offshore wind would contribute to meeting the Maryland RPS, which requires 20 percent of the State's energy needs to be satisfied by renewable energy sources by 2022. The U.S. Department of Energy advises that wind turbines typically have a service life of at least 20 years and transmission lines can last more than 50 years; therefore, investments in achieving 20 percent wind power by 2020 could continue to

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<sup>39</sup>Mineral Management Service & U.S. Geological Survey, Survey of Available Data on OCS Resources and Identification of Data Gaps, OCS Report MMS 2009-015, Available: <http://www.doi.gov/ocs/report.pdf> (March 30, 2010).

<sup>40</sup>The Bight region is largely characterized by a Class 6 Wind Power Density. Wind power density is a measure of the energy available at a specific site that can be converted using a wind turbine. Wind power density ranges from the lowest measure, Class 1, to the highest measure, Class 7; therefore, the region with a Class 6 wind rating has the potential to provide significant high-quality wind resources.

<sup>41</sup>Noteworthy is that there were no exclusions (e.g., areas not suitable for wind energy development due to environmentally sensitive areas, shipping lanes and other constraints) considered in this analysis and that the actual numbers would be less.

<sup>42</sup> Kempton et al., Large CO2 Reductions via Offshore Wind Power Matched to Inherent Storage in Energy End-Uses, GRL, Vol. 34 (2007).

<sup>43</sup> Musial, W.; Butterfield, S., "Future for Offshore Wind Energy in the United States." National Renewable Energy Lab Report No. CP-500-36-313, (2004).

<sup>44</sup> Ibid.

<sup>45</sup> Ibid. When the efficiency of the turbines, related fuel use, and leakage are considered.

supply renewable energy through at least the year 2044 and transmission lines through at least 2072.<sup>46</sup> An offshore wind energy project is expected to provide economic and employment benefits as well as improvements to air quality.

### **Estimated GHG Emission Reductions**

In order to account for similarities across programs, all emission benefits and costs associated with this program have been aggregated under B.1: The Maryland Renewable Energy Portfolio Standard Program.

### **Implementation**

In April of 2009, the U.S. Dept. of Interior published a Final Rule that established protocols for the development of offshore wind energy projects.<sup>47</sup> These regulations empowered the Dept. of Interior's Minerals Management Service (now the Bureau of Ocean Energy Management) to offer leases for offshore wind energy on the Outer Continental Shelf after consultation with adjacent State governments through a State/Federal Task Force.

Upon request of Governor O'Malley, the Bureau of Ocean Energy Management established such a Task Force for Maryland, comprised of officials from state and federal agencies as well as elected officials from Maryland's coastal communities. In order to inform the Task Force, MEA and DNR's Chesapeake and Coastal Program developed a plan to collaborate on marine spatial planning, resource characterization and environmental impact assessment related to offshore wind energy.

In 2009, MEA and DNR partnered with The Nature Conservancy and Towson University to map habitat and wildlife data. DNR also engaged directly with groups representing both commercial and sport fisheries to determine the highest density of fisheries use of the planning area. MEA contracted with AWS TruePower to develop maps and wind-roses detailing wind speed and power over the planning area. In partnership with MEA, the University of Maryland's Center for Integrative Environmental Research studied and provided data layers for both military uses of the offshore wind planning space as well as transmission and interconnection opportunities.

In April, 2010, DNR and MEA conducted public open houses to allow citizens to ask questions and provide input. All of this information and several other physical, administrative and ecological datasets were compiled and published in an interactive online mapping tool called *Maryland Coastal Atlas*. With this information, Maryland made a recommendation to the Task Force. Upon consideration, the Task Force adopted the recommendation and the Bureau of Ocean Energy Management published the designated area in a Request for Interest to developers. Eight offshore wind developers responded with development proposals, and twelve stakeholders submitted comments.

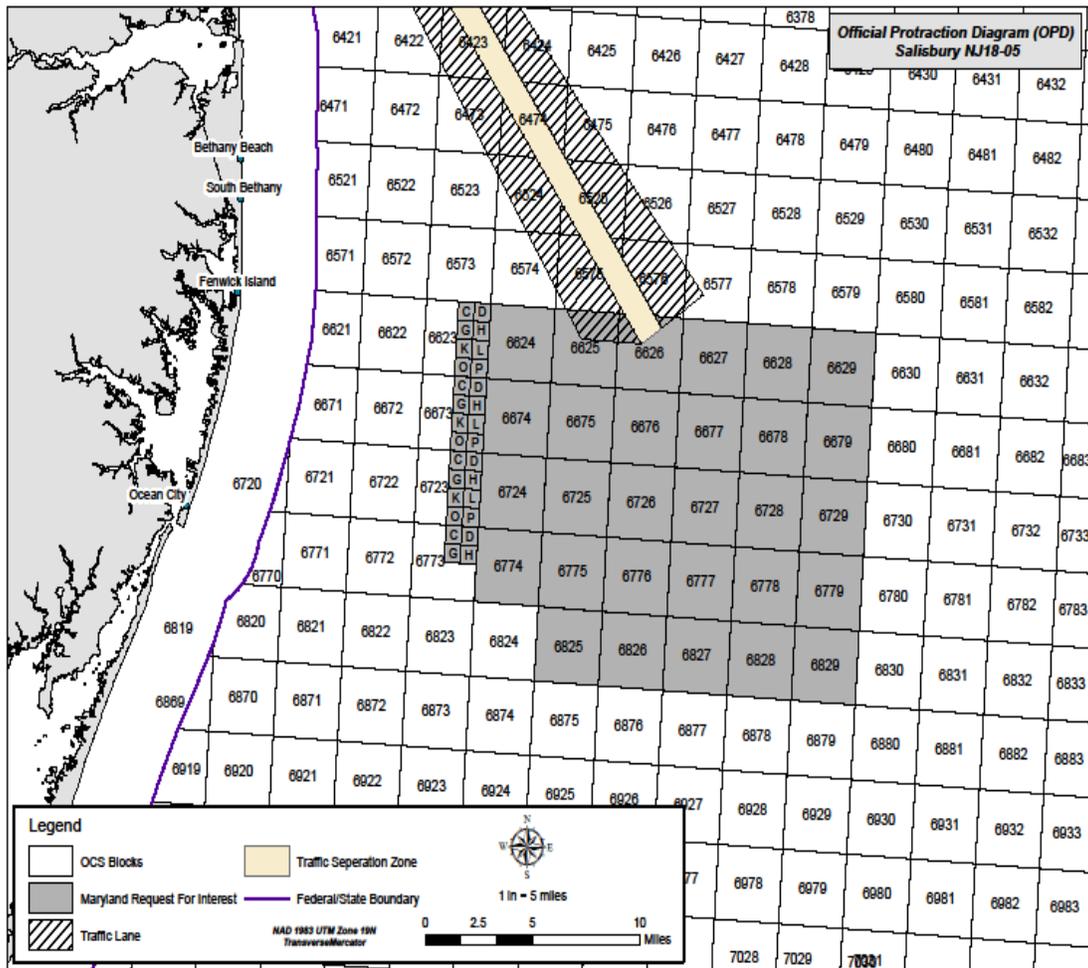
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<sup>46</sup> US Department of Energy, 20% Wind Energy by 2030, Increasing Wind Energy's Contribution to U.S. Electricity Supply, Available: <http://www1.eere.energy.gov/windandhydro/pdfs/41869.pdf>

<sup>47</sup> PART 585—RENEWABLE ENERGY AND ALTERNATE USES OF EXISTING FACILITIES ON THE OUTER CONTINENTAL SHELF, 30 CFR, pt.585, [http://www.boem.gov/uploadedFiles/30\\_CFR\\_585.pdf](http://www.boem.gov/uploadedFiles/30_CFR_585.pdf)

Comments submitted to the Bureau of Ocean Energy Management regarding the Request for Interest planning area focused largely on potential impacts on marine transportation, navigation, commerce and safety. The area was located adjacent to, and partially overlapped, a Transportation Separation Scheme that served the southern approaches to the Delaware Bay. (Figure C-23)

**Figure C-16. Bureau of Ocean Energy Management, Regulation and Enforcement Maryland Request for Interest Area Map<sup>48</sup>**



The Bureau of Ocean Energy Management convened a third Task Force meeting on March 23, 2011, to prepare for issuance of a Call for Information – the next administrative step towards area identification and leasing for development of offshore wind energy. At this meeting, MEA committed to engage stakeholders and gather

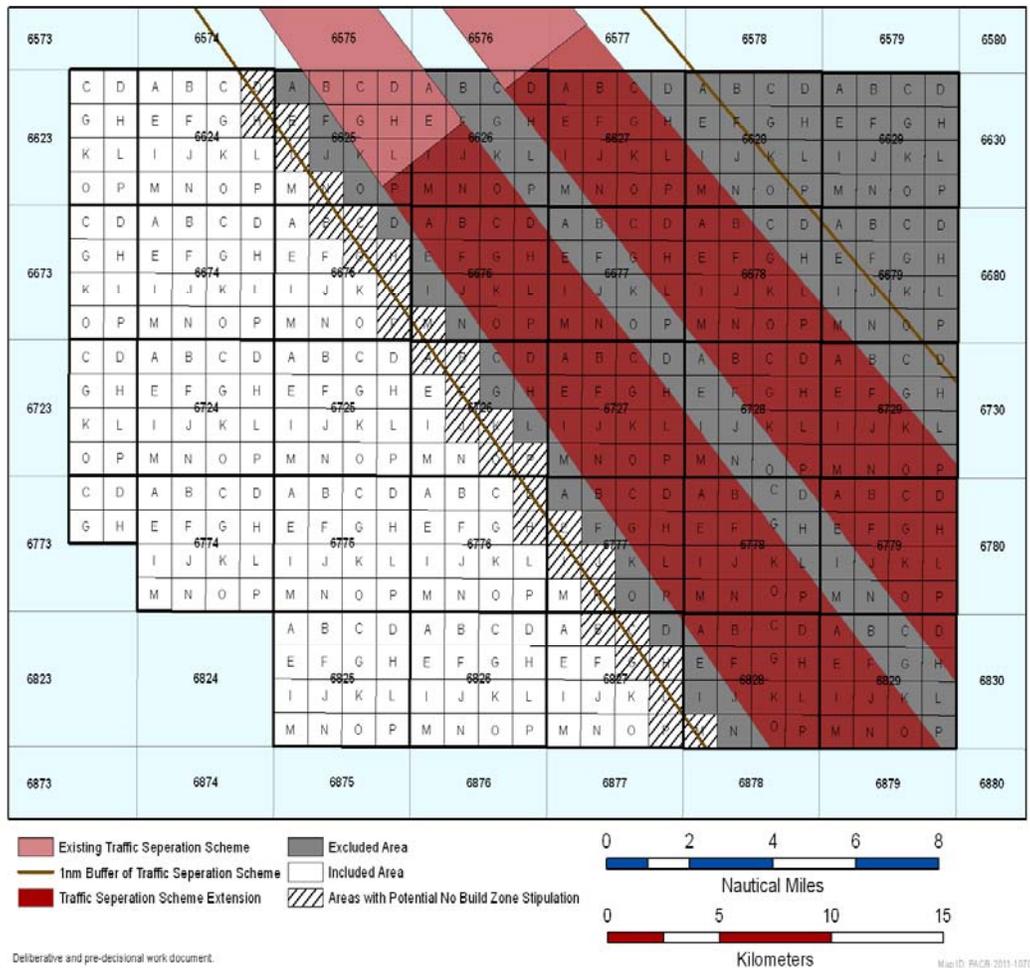
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[http://www.boemre.gov/offshore/RenewableEnergy/PDFs/stateactivities/MD\\_DEFiles/MarylandRFIMap\\_f orBOEMREwebsitev2.pdf](http://www.boemre.gov/offshore/RenewableEnergy/PDFs/stateactivities/MD_DEFiles/MarylandRFIMap_f orBOEMREwebsitev2.pdf)

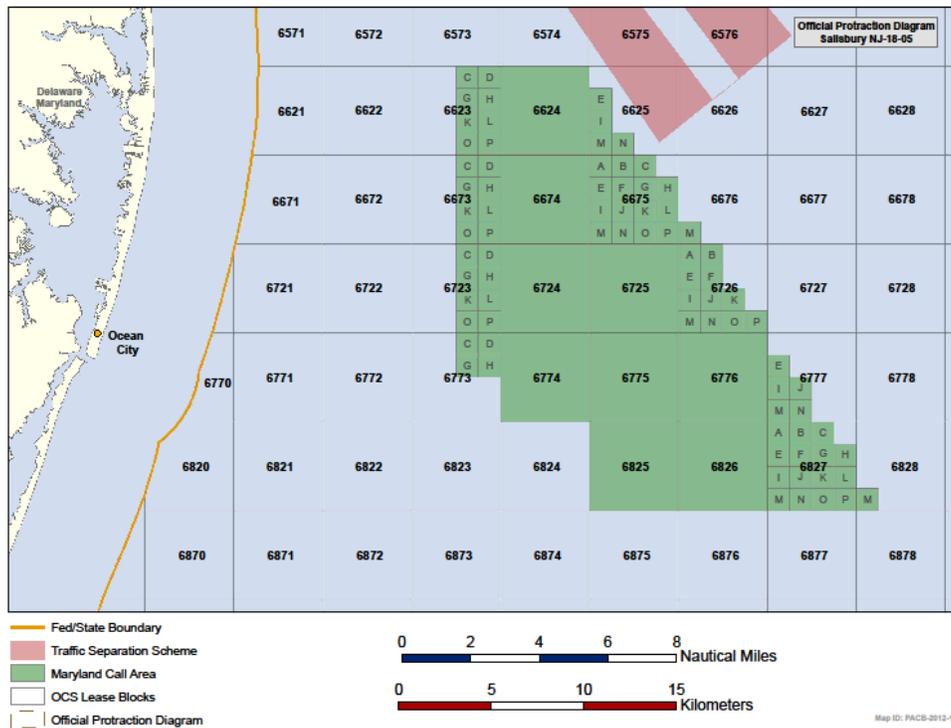
information related to marine transportation, navigation, commerce and safety in order to provide a State level recommendation on boundaries of an area.

On May 11<sup>th</sup>, 2011, MEA held a stakeholder discussion with groups that had offered comments to the Bureau of Ocean Energy Management RFI docket regarding maritime safety and navigation. Based on this additional input, the Bureau of Ocean Energy Management issued a new Call for Information and Nominations on Feb 3, 2012. (Figure C-24)

**Figure C-17. Bureau of Ocean Energy Management, Regulation and Enforcement Maryland Interest Area, proposed at June 24<sup>th</sup> Task Force Meeting**



BOEM Maryland Call for Information and Nominations Area



[http://www.boem.gov/uploadedFiles/BOEM/Renewable\\_Energy\\_Program/State\\_Activities/MD%20Call%20Map%20Without%20NOAA%20chart.pdf](http://www.boem.gov/uploadedFiles/BOEM/Renewable_Energy_Program/State_Activities/MD%20Call%20Map%20Without%20NOAA%20chart.pdf)

The Bureau of Ocean Energy Management received expressions of interest from new developers in addition to the RFI respondents. Stakeholder comments also seemed to indicate that the new area configuration represented less concern to shipping. However, the reduced area provides less deployment opportunity – ultimately no more than 1,000 megawatts of capacity.

In early 2013, the Bureau of Ocean Energy Management is expected to issue a Proposed Sale Notice that will ultimately culminate in a lease sale in the first half of the calendar year.

## C: The Regional Greenhouse Gas Initiative (RGGI)

Lead Agency: MDE

### Program Description

The Regional Greenhouse Gas Initiative (RGGI) is a cooperative effort by ten Northeast and Mid-Atlantic States to design and implement a regional GHG cap-and-trade program to reduce carbon dioxide emissions from fossil fueled power plants in the region. Electric generating units with a capacity of 25 megawatts (MW) or greater are subject to RGGI. RGGI is an unprecedented collaboration of environmental and energy agencies in the following states: Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island and Vermont.



Cap-and-trade programs limit the amount of pollution to a significantly lower level through an emissions cap applied to a specific geographic region. Cap-and-trade programs issue “allowances” equal to the number of tons of pollution allowed under the cap. An allowance permits a source to emit one ton of pollution. At the end of the year or specified time period, a source must have obtained, in this case purchased, allowances sufficient to cover each ton of pollution they released.

The current RGGI regional cap, which is based on the 2000-2002 average annual emissions from the power plants subject to RGGI, is 188,076,976 tons per year. The regional cap is apportioned among the participating states. Maryland's share of the regional cap is 37,503.983 tons. The goal of RGGI is to reduce carbon dioxide emissions from the regulated power sector by 10 percent by 2019.

The Healthy Air Act of 2006 required Maryland to join RGGI contingent upon an independent economic analysis showing that RGGI would benefit Maryland consumers and that RGGI would not increase electricity reliability concerns. MDE worked with a comprehensive group of stakeholders and adopted RGGI into Maryland regulations (Code of Maryland Regulations 26.09.01-04) in 2007. Details of the program are contained in the regulations and on the RGGI website: [www.rggi.org](http://www.rggi.org)

Most of the electricity generating plants in Maryland are subject to the RGGI program. Two industrial plants, New Page and RG Steel, are also subject to the RGGI program but may apply for an exemption under certain conditions. Figure C-2 lists the Maryland sources that are subject to RGGI.

**Figure C-17. Maryland Sources Subject to RGGI.**

<b>Owner</b>	<b>Plant</b>	<b>Location</b>	<b>Fuel</b>
AES Enterprise	Warrior Run	Allegany County	Coal
Allegheny Energy	R P Smith	Washington County	Coal
Con Edison Development & Old Dominion Electric Cooperative	Rock Springs	Cecil County	Natural Gas
Constellation Power	Brandon Shores	Anne Arundel County	Coal
	C P Crane	Baltimore County	Coal
	Gould Street	Baltimore City	Natural Gas
	Perryman	Harford County	Oil/Natural Gas
	Riverside	Baltimore County	Oil/Natural Gas
	Herbert A Wagner	Anne Arundel County	Coal/Oil/Natural Gas
	Westport	Baltimore City	Natural Gas
Gen-On	Chalk Point	Prince George's County	Coal/Natural Gas
	Dickerson	Montgomery County	Coal/ Natural Gas
	Morgantown	Charles County	Coal
RG Steel, LLC.	Sparrows Point	Baltimore County	Natural Gas/Blast Furnace Gas
New Page	Luke Mill	Allegany County	Coal
NRG Energy	Vienna	Dorchester County	Oil
Panda Energy	Brandywine	Prince George's County	Natural Gas

RGGI is a market-based control program that drives emission reduction in three ways. First, regional emissions must be below the defined cap. Over time, the cap gets smaller and smaller. Only enough allowances are made available each year to equal the cap. Sources that fail to hold enough allowances to cover their emissions are subject to serious enforcement actions and fines. In simple terms, the caps guarantee emission reductions over time. The second way that RGGI drives emission reductions is through the auction process, where sources are required to buy the allowances they need. By adding a cost to every ton of carbon dioxide emitted, sources have an economic incentive to minimize emissions whenever possible. This second option could result in emission levels ending up being below the cap level.

The third way that RGGI can drive emission reductions is linked to the way that some of the auction proceeds are used to promote energy efficiency programs and development of renewable energy. Unlike other pollutants, no control technologies exist to reduce carbon dioxide pollution at this time. Most of the RGGI emission reductions will be achieved through increased energy efficiency and reduced demand for electricity. Rather than provide allowances for free, the RGGI states auction a majority of their allowances and use the proceeds to, among other things, promote energy efficiency programs and develop renewable energy. RGGI has raised approximately \$800,000,000 in auction revenue to date. Maryland has received almost \$150,000,000. RGGI is moving forward with its thirteenth auction.

Some PJM states contiguous to Maryland, such as Pennsylvania, are not participating in RGGI; however, economic modeling determined that Pennsylvania electricity customers were paying for the effort in the RGGI region to lower emissions, through higher wholesale power prices in the PJM region market. However, the energy efficiency investments not funded through the auction in Pennsylvania, which are funded by the auction in the RGGI states, are not leading to similar changes in Pennsylvania electricity bills.

There are some general buyers in the auction but most of the participants have relationships to sources that have compliance obligations under one or more of the states' RGGI programs. The auctions run smoothly on an electronic platform and are monitored for misconduct.

As part of the original RGGI memorandum of understanding, there was a 2012 review of the program that will look at several programmatic issues including whether RGGI should lower the cap to achieve greater reductions. A cap of 91 tonnes was adopted and all RGGI states are in the process of update their regulations to reflect this change.

**Estimated GHG Emission Reductions in 2020**

If RGGI is strengthened because of the scheduled 2012 program-wide review or because a federal program is adopted, it is not unreasonable to assume that an additional 10 percent to 15 percent emission reduction could be achieved by 2020. By 2030, if there is a federal program, the RGGI reductions could be doubled. By 2050, the reductions could be three to four times greater than the currently projected reductions.

Additional analysis is being conducted by MDE to further evaluate the additional reductions that could be achieved between 2020 and 2050

**Figure C-18. Low and High GHG Benefits for Energy-1**

Initial Reductions	0.00 MMtCO <sub>2</sub> e	
Enhanced Reductions	3.60 MMtCO <sub>2</sub> e	MDE Quantification Below

**MDE Quantification**

For the original cap (188/166) it was agreed between state agencies that deal with energy that it would act as a framework for reductions of other energy sector programs.

RGGI and the signatory states made extensive modeling runs in the process of selecting 91 ton cap ([http://www.rggi.org/design/program\\_review/materials-by-topic/modeling](http://www.rggi.org/design/program_review/materials-by-topic/modeling)). From the baseline run it is projected the CO2e emission would be reduced 8.0 Million tonnes. RGGI's cap is in short tonnes so these are then converted to metric tonnes. Further, the model used (IPM) shut down plants based on an economic basis. The model projected two facilities closing in MD. However, MDE in consultation received confirmation from the sources that they didn't plan on closing. Therefore, the emission from these facilities were then added back in and the reduction calculated from there.

### **Other Environmental Benefits**

RGGI was included as part of the Maryland Healthy Air Act in 2006. The Healthy Air Act also requires significant reductions in nitrogen dioxide, sulfur dioxide and mercury.

Over 95 percent of the air pollution emitted from Maryland's power plants comes from the largest and oldest coal burning plants. The emission reductions from the Healthy Air Act come in two phases. The first phase requires reductions in the 2009/2010 timeframe and, compared to a 2002 emissions baseline, reduce nitrogen oxide emissions by almost 70 percent, sulfur dioxide emissions by 80 percent, and mercury emissions by 80 percent.

The second phase of emission controls occurs in the 2012/ 2013 timeframe. At full implementation, the Healthy Air Act will reduce nitrogen oxide emissions by approximately 75 percent from 2002 levels, sulfur dioxide emissions will be reduced by approximately 85 percent from 2002 levels, and mercury emissions will be reduced by 90 percent.

## **Other Energy Programs**

### **D.1: GHG Power Plant Emissions Reductions from Federal Programs**

Lead Agency: MDE

#### **Program Description**

The federal Clean Air Act Amendments of 1990 established the statutory authority for the Title V operating permits program. Prior to 1990, the federal Clean Air Act required permits only for new construction. States were required to issue air pollution permits to businesses that built new pollution sources or modified existing pollution sources. In creating these permit programs-- known as "preconstruction" or "new source review" permit programs--some states, such as Maryland, also chose to establish enhanced programs for regulating air pollution emissions from sources already in operation. These "operating permit programs," though not uniform in requirements or other characteristics,

proved to be effective tools for air pollution control. With Title V of the 1990 Clean Air Act Amendments, Congress adopted measures that required all states to develop and implement operating permit programs. Congress' main goal in establishing the Title V program was to achieve a broad-based tool to aid in implementing the Clean Air Act effectively and enhancing enforcement. Within this overarching goal, Congress intended the Title V program to realize nine more specific goals, as follows:

1. Improving State air pollution programs through better emissions inventories;
2. Providing resources through Title V fees;
3. Providing a vehicle for implementing the air toxics and acid rain programs;
4. Improving enforcement;
5. Achieving faster compliance;
6. Requiring compliance certifications from facility operators;
7. Listing all the applicable regulatory requirements in one document;
8. Providing regulatory certainty; and
9. Improving public participation.

The operating permit program is meeting these goals and is achieving enhanced compliance with air pollution requirements for industrial and commercial sources. Nationally, an estimated 17,000 sources of air pollution are required to obtain permits under operating permit programs administered by 112 state, territory, and local permitting authorities.

The Title V Program does not establish any new emissions limitations, standards, or work practices on an affected facility. There may, however, be additional record keeping, monitoring, and reporting requirements. Maryland received final full approval from EPA of its Title V permit program in February 2003.

### **Estimated GHG Emission Reductions in 2020**

This program will not result directly in any GHG reductions. However, Title V permitting will result in improved compliance with federal Clean Air Act requirements including GHGs and other pollutants, via the following:

- Improved clarity regarding applicability of requirements;
- Discovery and required correction of noncompliance prior to receiving a permit;
- Improved monitoring, recordkeeping, and reporting concerning compliance status;
- Self-certification of compliance with applicable requirements initially and annually, and prompt reporting of deviations from permit requirements;
- Enhanced opportunity for the public to understand and monitor sources' compliance obligations; and
- Improved ability of EPA, permitting authorities, and the public to enforce federal Clean Air Act requirements

### **Implementation**

Requirements for the Title V air operating permits program, with respect to GHG emissions, are established by the EPA's Greenhouse Gas Tailoring Rule, which was finalized in May 2010. As of July 1, 2011, new sources or existing sources, that were not previously subject to Title V requirements and that emit or have the potential to emit at least 100,000 tons per year CO<sub>2</sub>-equivalent, are now subject to the requirement to obtain a Title V air operating permit. MDE adopted the Tailoring Rule into appropriate locations throughout Title 26 of the Code of Maryland Regulations as of June 2011.

Beginning July 1, 2013, additional sources will be included under the Title V requirements and a possible permanent exclusion from permitting will be determined for some source categories. Additional details will follow in supplemental rulemaking. EPA is also establishing an enforceable commitment that EPA will complete a streamlining study by April 30, 2015 to evaluate the status of Title V permitting for GHG emitting sources. No sources with emissions below 50,000 tons per year CO<sub>2</sub>-equivalent and no modification resulting in net GHG increases of less than 50,000 tons per year CO<sub>2</sub>-equivalent will be subject to Title V permitting before at least 6 years from now to April 30, 2016.

## **D.1.A: Boiler Maximum Achievable Control Technology (MACT)**

**Agency: MDE**

### **Program Description**

EPA has developed new air-emissions requirements for industrial, commercial, and institutional boilers. A boiler is a fuel-burning apparatus or container usually used for heating water. The new regulation, known as National Emission Standard for Hazardous Air Pollutants for Industrial, Commercial, and Institutional Boilers, will affect thousands of boilers at facilities considered to be major and area sources of hazardous air pollutants. Major sources are defined as facilities with the potential to emit ten tons per year of any single hazardous air pollutant or twenty-five tons per year of any combination of hazardous air pollutants. Area sources include facilities with emissions below these major source thresholds. The federal Clean Air Act requires the development of national emission standards for hazardous air pollutants to reflect the application of maximum-achievable control technology (MACT) for boilers. These regulations were finalized for boilers at area sources for hazardous air pollutants on March 21, 2011. Standards for boilers located at major sources of hazardous air pollutants were also published in the federal register on March 21, 2011 but will not become effective until proceedings for judicial review are completed or until EPA completes its reconsideration of the rule, whichever is earlier.

The area source MACT requirements vary based on a boiler's size, fuel, and installation date. Requirements can include implementing improved work practices, boiler tune ups, energy assessments, and emission limits for mercury, carbon monoxide, and particulate matter. New area source boilers must comply with the applicable requirements upon

startup. Existing boilers have until March 21, 2012, to perform the required tune ups, and until March 21, 2014, to demonstrate compliance with emission limits and performs energy assessments. As currently stated, the major source Boiler MACT rule would establish emission limits for mercury, dioxin, particulate matter, hydrogen chloride, and carbon monoxide

The Boiler MACT’s requirement to conduct a tune-up of each oil and coal fired regulated boiler will improve efficiency, minimize fuel consumption, reduce hazardous air pollutants, and reduce GHG emissions. EPA claims there will be a one percent fuel savings due to these boiler tune-ups, which equates to an equivalent one percent reduction in GHG emissions.

Many of the facilities affected by the Boiler MACT rule are located in close proximity to neighborhoods and schools. EPA estimates that by reducing the facilities’ toxic mercury emissions and other harmful pollutants, cases of premature death from the inhalation of pollutants, chronic bronchitis, aggravated asthma, and acute respiratory symptoms will also be reduced. Reducing the public health impacts of these boilers through implementation of the Boiler MACT rule should also provide a small economic benefit by reducing health care expenses for affected families.

**Estimated GHG Emissions Reductions in 2020**

**Figure C-19. Low and High GHG Benefits for Energy-4**

Initial Reductions	0.07 MMtCO <sub>2</sub> e	MDE Quantification Below
Enhanced Reductions	0.07 MMtCO <sub>2</sub> e	MDE Quantification Below

**Estimates – MDE Quantification**

Coal and oil fired boilers located in Maryland which will be affected by the Boiler MACT currently have the potential to emit approximately 9.7 million tons of carbon dioxide per year.<sup>49</sup> Actual emissions from this sector have been calculated as approximately 1.45 MMtCO<sub>2</sub>e per year if the affected boilers operate at average 15 percent capacity factor.<sup>50</sup> Using MDE’s inventory of boilers that would be subject to the Boiler MACT, MDE has calculated that implementation of the Boiler MACT tune-up requirement could result in carbon dioxide reductions from 98,000 to 14,700 tons per year. This is based on the total carbon dioxide emissions for impacted boilers being reduced by 1 percent. To put this in perspective, 98,000 tons per year of carbon dioxide is comparable to the emissions from a 140 million BTU per hour boiler. Accounting for overlap, reductions are reduced to 0.07 MMtCO<sub>2</sub>e.

**Other Environmental Benefits**

The Boiler MACT rule was promulgated to specifically address emissions of particulate matter, mercury, hydrogen chloride, carbon monoxide, and dioxin/furans from boilers.

<sup>49</sup> Potential calculated based on 100 percent capacity factor for all solid and liquid fuel burning non-utility boilers greater than 10mmbtu. All solid fuel was assumed to be coal. All liquid fuel was assumed to be #2 fuel oil.

<sup>50</sup> A 15 percent capacity factor chosen to approximate typical boiler based on COMAR 26.11.09.08F.

The compliance requirements vary based on size, type of fuel, and the hazardous air pollutant emissions of the facility. The majority of effected boilers in Maryland will be oil burning boilers at area sources of hazardous air pollutants. These boilers will not be subject to specific emission limits but will be required to perform boiler tune ups. The reduced fuel consumption attributed to the boilers tune ups will result in a reduction in emissions. Using the same maximum 100 percent capacity factor and typical 15 percent capacity factor, a range of reductions from reduced fuel consumption has been calculated for the following pollutants.

Range of Potential nitrogen oxide reductions: 31 to 201 tons per year.

Range of Potential sulfur dioxide reductions: 38 to 255 tons per year

Range of Potential particulate matter reductions (oil only): 1 to 6 tons per year

### **Implementation**

MDE will adopt the final federal requirements into State regulations to insure that these requirements are implemented and enforced.

## **D,1,B: GHG New Source Performance Standard**

**Lead Agency: MDE**

### **Program Description**

As part of a court settlement reached in December of 2010, EPA will promulgate new regulations to reduce GHG emissions from fossil fuel power plants and petroleum refineries; there are no petroleum refineries in Maryland. EPA will use the New Source Performance Standard authority under the federal Clean Air Act for these new rules.

Implemented in the 1970s, EPA establishes New Source Performance Standard to address a variety of industrial sources of air pollution that significantly endanger public health and welfare and the environment. Each New Source Performance Standard has to be reviewed every eight years by EPA and revised, if appropriate.

For fossil fuel electricity generators, the new rule would apply to new or modified electricity generating units and create GHG emission guidelines for existing electricity generating units. EPA is coordinating this action on GHGs with a number of other required regulatory actions for traditional pollutants. Together, electricity generating units will be able to develop strategies to reduce all pollutants in a more efficient and cost-effective way than addressing the pollutants separately.

There are currently few potential projects in Maryland for new or modified fossil fuel electricity generating units. However, other states in the PJM grid region, such as Virginia and Pennsylvania, are constructing new fossil fuel electricity generating units and moving forward with modifications to existing electricity generating units. Since Maryland imports 30 percent of its needed electricity from states like Pennsylvania and Virginia, reductions in GHG emissions from the new GHG New Source Performance

Standard are expected to be evident when evaluating the carbon emissions profile from imported electricity.

EPA will propose GHG standards based on existing technologies for power plants in July 2011 and refineries in December 2011. The agency will issue final standards in May 2012 and November 2012 respectively.

### **Estimated GHG Emissions Reductions**

The amount of GHG reductions achieved will depend on the standards that EPA adopts. Presumably, the adopted standard will result in increased efficiencies in the production of electricity, which will in turn result in the reduction of GHG emissions. Fuel switching may also result in emissions savings. For now, the emissions reductions are included in D: Other Energy programs.

## **D.1.C: GHG Prevention of Significant Deterioration Permitting Program**

Lead Agency: MDE

### **Program Description**

The Prevention of Significant Deterioration program is a preconstruction review and permitting program applicable to new major stationary sources and major modifications at existing major stationary sources. A principal requirement of the Prevention of Significant Deterioration program is that a new major source or major modification must apply Best Available Control Technology, which is determined on a case-by-case basis taking into account, among other factors, the cost effectiveness of the control and energy and environmental impacts.

Generally, this analysis will involve (1) an assessment of existing air quality, which may include ambient monitoring data and air quality dispersion modeling results, and (2) predictions, using dispersion modeling, of ambient concentrations that will result from the applicant's proposed project and future growth associated with the project.

The Prevention of Significant Deterioration program's increment is the amount of pollution an area is allowed to increase. The Prevention of Significant Deterioration program's increments prevent the air quality in clean areas from deteriorating to the level set by the National Ambient Air Quality Standards. The National Ambient Air Quality Standards is a maximum allowable pollution amount. A Prevention of Significant Deterioration program increment, on the other hand, is the maximum allowable increase in concentration that can occur above a baseline concentration for a pollutant. The baseline concentration is defined for each pollutant and, in general, is the ambient concentration at the time that the first complete Prevention of Significant Deterioration permit application affecting the area is submitted. Significant deterioration is said to occur when the amount of new pollution would exceed the applicable Prevention of Significant Deterioration increment. It is important to note, however, that the air quality

cannot deteriorate beyond the concentration allowed by the applicable National Ambient Air Quality Standards, even if not all of the Prevention of Significant Deterioration increment is consumed.

### **Estimated GHG Emission Reductions in 2020**

Though no potential emissions reductions have been quantified at this time, this program will assist in further GHG reductions occurring in the future.

### **Implementation**

Requirements for the Prevention of Significant Deterioration program are established by EPA's Greenhouse Gas Tailoring Rule. On January 2, 2011, the requirements applied to sources' GHG emissions only if the sources are subject to the Prevention of Significant Deterioration program anyway due to their non-GHG pollutants. Therefore, EPA will not require sources or modifications to evaluate whether they are subject to this program's requirements solely on account of their GHG emissions. The Prevention of Significant Deterioration program's Best Available Control Technology will apply to projects that increase net GHG emissions by at least 75,000 tons per year CO<sub>2</sub>-equivalent but only if the project also significantly increases emissions of at least one non-GHG pollutant. Beginning July 1, 2011, the Prevention of Significant Deterioration program's Best Available Control Technology will apply to new sources that have the potential to emit 100,000 tons per year CO<sub>2</sub>-equivalent or modifications to existing sources that increases net emission of CO<sub>2</sub>-equivalent by at least 75,000 tons per year.

Information on GHG best available control technology determinations are required to be entered into EPA's clearinghouse. These determinations will include information on GHG emission reductions resulting from implementation of Prevention of Significant Deterioration program's best available control technology.

Beginning July 1, 2013, additional sources will be included under the Prevention of Significant Deterioration program requirements and a possible permanent exclusion from permitting will be determined for some source categories. Additional details will follow in supplemental rulemaking. EPA is also establishing an enforceable commitment that EPA will complete a streamlining study by April 30, 2015 to evaluate the status of Prevention of Significant Deterioration program permitting for GHG emitting sources. No sources with emissions below 50,000 tons per year CO<sub>2</sub>-equivalent and no modification resulting in net GHG increases of less than 50,000 tons per year CO<sub>2</sub>-equivalent will be subject to this program's permitting before at least 6 years from now to April 30, 2016.

## **D.2: Main Street Initiatives**

Lead Agency: DHCD

### **Program Description**

Buildings have a large impact on the natural environment. Energy use is the source of about 70 percent of GHG emissions and buildings represent up to 48 percent of total energy use.<sup>51</sup>

The American Recovery and Reinvestment Act of 2009 was an economic stimulus package enacted by the 111th U.S. Congress in February 2009. Of the economic stimulus package, \$3.2 billion was given to the U.S. Department of Energy's Energy Efficiency and Conservation Block Grant program.<sup>52</sup> Approximately \$2.7 billion was awarded through formula grants directly to local jurisdictions. Remaining amounts were allocated through competitive grants and with some funding for technical assistance tools to state, local, and tribal grantees. This program was intended to assist U.S. cities, counties, states, territories, and Indian tribes to develop, promote, implement, and manage energy efficiency and conservation projects and programs designed to reduce fossil fuel emissions; reduce the total energy use of the eligible entities; improve energy efficiency in the transportation, building, and other appropriate sectors; and create and retain jobs.

The ten largest Maryland counties and ten largest municipalities, based on population, were eligible to receive formula grants directly from the U.S. Department of Energy under the Energy Efficiency and Conservation Block Grant program. Maryland local and county governments ineligible for direct formula grants were eligible for competitive funds from MEA, which received approximately \$9.6 million in Energy Efficiency and Conservation Block Grant program for local and county projects. Under the competitive portion of the Energy Efficiency and Conservation Block Grant program, now known as Better Buildings, DHCD was awarded \$20 million in funding, which was in response to its winning application entitled "Investment in Main Street: Energy Efficiency for Economic Growth." DHCD's program, marketed as "Be SMART," is a holistic programmatic approach to target households, multifamily rental properties, and small commercial properties for energy-efficiency retrofits, primarily in certain targeted areas. Be SMART programs will provide increased comfort, safety and affordability to buildings in Maryland through energy efficiency improvements; the \$20 million in Be SMART financing is available for the purchase and installation of equipment and materials for energy efficiency measures. Such items include, but are not limited to ENERGY STAR qualified: HVAC systems, insulation, windows, draft stopping and duct sealing, appliances and fixtures, and water heating equipment. These improvements are expected to result in energy savings of 15-30 percent. This translates to significantly lower energy bills for consumers, more comfortable buildings and reduced consumption of fossil fuels.

DHCD's Be SMART initiative is also providing training for the implementation of the latest International Energy Conservation Code that will lead to a recognized certification for plan reviewers, inspectors, developers, engineers, and architects and will assist local jurisdictions in active compliance and enforcement of the energy codes. Most of the

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<sup>51</sup> Kaplow, Stuart D. "Maryland is Poised to be the 1<sup>st</sup> State to adopt the International Green Construction Code." March, 2011. [http://www.stuartkaplow.com/library3.cfm?article\\_id=185](http://www.stuartkaplow.com/library3.cfm?article_id=185)

<sup>52</sup> <http://www.eecbg.energy.gov/>

targeted areas are in Main Street Maryland program areas. Main Street Maryland is a comprehensive downtown revitalization program created in 1998 by DHCD.

DHCD also partnered with DNR to publish “Going Green Downtown: A Sustainability Guide for Maryland’s Main Streets.”

**Estimated GHG Emission Reductions in 2020**

**Figure C-20. Low and High GHG Benefits for Energy-15**

Initial Reductions	0.05 MMtCO <sub>2</sub> e	MDE Quantification Below
Enhanced Reductions	0.14 MMtCO <sub>2</sub> e	MDE Quantification Below

**Low and High Estimates – MDE Quantification**

A. Estimated GHG Reductions

On April 21, 2010, Maryland, through the competitive portion of the Energy Efficiency and Conservation Block Grant, within the American Recovery and Reinvestment Act of 2009, was awarded \$20 million. The program, which is funded for a period of three years, is being managed by DHCD. The program was developed to target commercial, multi-family and single-family properties for energy-efficiency retrofits. Fifteen cities/counties ('communities') in Maryland were identified as being eligible for the awards.

The focus of the program is commercial, multi-family, single-family retrofits that will result in significant, measurable reductions in energy consumption. The program would also be expected to result in the establishment of a Statewide bulk purchasing program for energy efficient supplies and equipment, along with the development of a Statewide green work force of contractors developed through job training and certification. DHCD plans to develop partnerships with lending institutions to provide home and building owners with access to low interest loans; repayment of the loans would be expected to replenish the funds, allowing additional Marylanders to finance energy efficiency retrofits. The funding would be available for use on the following:

- Energy star appliances
- Improvements in insulation, lighting and heating
- Energy efficient HVAC systems
- Energy efficiency windows and doors
- Weatherization

During a conversation with DHCD in April 2011, details on how the funds would be spent were not available, and thus the associated reduction of GHG emissions are based on assumptions (detailed below). Many of the assumptions are derived from a presentation prepared by DHCD, dated November 10, 2010, which provided projections as to how the funds would be spent.

The lower boundary of the reduction of GHG emissions expected by 2020 is based on the program not being replenished through the low interest loans, and therefore only existing

for a period of three years. The upper boundary is based on the program replenishing the available funds through the low interest loans, and therefore the program continuing indefinitely, or at least through 2020. Details regarding the cost of the equipment, the distribution of the funding within each focus (commercial, multi-family, and single-family properties), and the reduction of GHG emissions is provided below.

## B. Detailed Explanation of Methodology

### *Lower Boundary*

Per the conditions of American Recovery and Reinvestment Act, which has provided the funds for this program, the program will last for a period of three years. This assumption defines the lower boundary for the reduction in GHG emissions.

### *Upper Boundary*

By partnering with lending institutions, DHCD hopes to establish a low interest loan program to finance the purchase of the equipment; if successful, this program could become self-sustaining and continue to operate indefinitely. This assumption defines the upper limit for the reduction in GHG emissions.

Two central conclusions regarding the longevity and implementation of the program were made. The first is the assumption that equal amounts of the funding, or \$5.6 million ((\$6 + \$6 + \$4.8) over 3 years), will be spent each year for the duration of the program (either three years or indefinitely; see below). The second is the distribution of the funds between commercial, multi-family, single-family, and other programs funded through this program. Some limited details on the distribution of the funds were contained within the November 2010 presentation prepared by DHCD. Specifically:

- \$6 million retrofit financing for commercial properties
- \$6 million retrofit financing for multi-family properties
- \$4.8 million retrofit financing for single-family properties
- \$600,000 the development of an energy efficiency purchasing cooperative
- \$600,000 training related to the adoption of new building and energy costs

The last two items, the purchasing cooperative and training related to the adoption of new building and energy costs, do not directly result in the reduction of GHG; it is the actual installation/upgrade of the equipment, which is funded through the retrofit financing, that would result in the reduction of GHG emissions.

## C. Calculations

Overall, the calculations are very simple, and use the available funds as a basis. There are three major assumptions made in order to proceed with the calculations:

- The cost of the equipment,
- The annual distribution of how the funds are spent, and
- The percent reduction in GHG emissions for each energy efficiency upgrade.

All assumptions related to equipment costs are based on professional experience. A spreadsheet for each scenario has been set up, and allows for simple adjustments of the values; changes to assumed values (as currently entered) affect the reduction in GHG emissions.

The six scenarios are as follows:

- \$6 million Retrofit Financing – Commercial
  - Lower boundary – financed for 3 years
  - Upper boundary – financed indefinitely
- \$6 million Retrofit Financing – Multi-family
  - Lower boundary – financed for 3 years
  - Upper boundary – financed indefinitely
- \$4.8 million Retrofit Financing – Single family
  - Lower boundary – financed for 3 years
  - Upper boundary – financed indefinitely

The same methodology and assumptions are consistent for all of the scenarios. An example for one of the scenarios is provided here:

Retrofit financing – commercial

Lower boundary – financed for 3 years

1. A total of \$6 million is designated for retrofit financing – commercial. An equal amount will be spent each year that the program operates, or \$2 million per year.
2. An annual value of 350 MMBtu per commercial property was estimated, based on energy use being four times that of a single family property.
3. Assumed 100 percent of the funds will be spent each year. It is assumed that 15 percent will be spent on HVAC, 40 percent on windows/doors, and 45 percent on insulation/lighting. This equation establishes how much of the annual fund will be allocated to each type of upgrade.
4. A price is assigned to each upgrade: \$14,000 for HVAC, \$450 for window/door, and \$5,000 for insulation/lighting. As part of this, it is estimated that there is one HVAC upgrade per commercial property, 40 windows/doors per commercial property, and three insulation/lighting per commercial property. This equation establishes how many HVACs, windows/doors, and insulation/lighting will be installed.  
Note: The cost and number can also be adjusted based on the type of property. For instance, for a multi-family, each window is \$400, and there are 10 windows for each multi-family unit.
5. The energy efficiency value is assigned to each upgrade: 15 percent reduction for HVAC, 20 percent for windows/doors, and 15 percent for insulation/lighting. This equation calculates the reduction in MMBtu use, which is converted to reduction in GHG emissions.
6. The reduction in MMBtu for each upgrade, is calculated as follows:

$$\begin{aligned} &(\text{Annual MMBtu/property}) * (\% \text{ reduction of upgrade type}) = \text{MMBtu reduction/upgrade} \\ &(350 \text{ MMBtu/commercial property})(15\% \text{ reduction for HVAC}) = 52.5 \text{ MMBtu/HVAC} \end{aligned}$$

7. The total reduction in MMBtu, for the type of upgrade (i.e., HVAC, windows/doors, or insulation/lighting), is calculated as follows:

$$(\text{MMBtu reduction/upgrade}) * (\# \text{ of upgrades/year}) = \text{Total MMBtu reduction/Year per upgrade type}$$

$$(52.5 \text{ MMBtu/HVAC})(21 \text{ HVAC/year}) = 1,125 \text{ MMBtu/year from HVAC upgrades}$$

8. The total reduction in MMBtu emissions is the sum of the MMBtu reductions of the total of each type of upgrade, and is calculated as follows:

$$[\text{MMBtu reduction/yr per upgrade type i}] * [\text{MMBtu reduction/yr per upgrade type ii}] * [\text{MMBtu reduction/yr per upgrade type iii}] = \text{Total reduction per year in MMBtu}$$

$$1,125 \text{ MMBtu/year per HVAC} * 3,111 \text{ MMBtu/year per windows/door} * 3,150 \text{ MMBtu/year per insulation/lighting} = 7,386$$

9. The MMBtu value is converted to million metric tons of CO<sub>2</sub>e, with conversion factors provided by MDE, with the final values reported in the figure below.

These calculations are performed for each of the six scenarios. The results are presented in the summary figure below.

D. Results

**Figure C-21. Energy-15 Low Estimate Summary**

Year	MMtCO <sub>2</sub> e		
	2012	2015	2020
GHG emissions commercial	0.0023	0.0034	0.0034
GHG emissions Multi-family	0.0006	0.0009	0.0009
GHG emissions Single-family	0.0014	0.0021	0.0021
<b>TOTAL</b>	<b>0.0043</b>	<b>0.0064</b>	<b>0.0064</b>

**Figure C-27. Energy-15 High Estimate Summary**

Year	MMtCO <sub>2</sub> e		
	2012	2015	2020
GHG emissions commercial	0.0023	0.0057	0.0115
GHG emissions Multi-family	0.0006	0.0015	0.0029
GHG emissions Single-family	0.0014	0.0035	0.0070
<b>TOTAL</b>	<b>0.0043</b>	<b>0.0107</b>	<b>0.0214</b>

**Implementation**

DHCD received a \$20 million competitive award from the U.S. Department of Energy in 2010 to promote energy efficiency through its Energy Efficiency and Conservation Block Grant retrofit program. Now known as Better Buildings, DHCD’s award was titled “Investing in Main Street: Energy Efficiency for Economic Growth.” DHCD’s proposal was a holistic, community-based approach to target individual households, multifamily rental properties and commercial properties for energy efficiency retrofits that will result in significant, measurable reductions in energy consumption and accompanying savings.

The program includes an overall education and outreach component to provide stakeholders and community members with information for behavior changes that reduce energy consumption. Components of the program under development include: a Green Retrofit Improvement Program which targets small business owners; a Multifamily “Preservation and Energy Efficiency” program for renters; and an Efficient Home Program for homeowners.

The \$20 million in federal funds is expected to leverage more than five times that amount in other funds. Efforts will be focused in target communities where the following outcomes for homeowners, renters, and small business owners are anticipated: An estimated 2,000 homeowners will benefit from energy efficiency retrofits of their homes in the first three years; twenty buildings comprising approximately 2,000 affordable rental units will benefit from energy efficiency retrofits; a projected 900 historical commercial properties will benefit from energy audits and low-interest retrofit financing in concert with DHCD's Neighborhood BusinessWorks program; the establishment of sustainable financing resources for homeowners, rental properties and commercial properties; the creation of a Statewide Energy Efficiency Purchasing Cooperative to maximize purchasing power for retrofits; and provide funding for affordable housing, energy retrofits and energy efficiency.<sup>53</sup>

The targeted communities were selected by weighing what would benefit the greatest number of Marylanders, taking into consideration those areas that have not received an allocation of federal funding. The selected areas are all in communities where there is significant leveraging and partnership activity. Each area is a Main Street Maryland community, has numerous multi-family developments and is a target area for other funds through DHCD. The targeted communities include: Berlin, Cambridge, Chestertown, Cumberland, Denton, Easton, Elkton, Frostburg, Oakland, Princess Anne, Dundalk, Westminster, Havre De Grace, Salisbury, and Takoma Park.<sup>54</sup>

### **D.3: Weatherization and Energy Efficiency for Affordable Housing**

Lead Agency: DHCD

#### **Program Description**

Energy efficiency can be defined as using a particular technology that requires less energy to perform the same function. Energy efficiency is recognized as a cost effective way to achieve meaningful GHG reductions. The additional costs of efficiency upgrades are often offset by lower utility bills, making energy efficiency essential to affordable housing.

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<sup>53</sup> "Maryland to Receive \$20 Million as Part of U.S. Department of Energy's Retrofit Ramp-Up Initiative." April 21, 2010. <http://www.gov.state.md.us/pressreleases/100421.asp>

<sup>54</sup> Ibid.

Through various programs, DHCD works with other government agencies to incorporate energy efficiency into affordable rental housing developments and eligible low-income households. DHCD supports education and training on the benefits of energy efficiency in affordable rental housing which in turn promotes energy efficiency improvements and rental housing preservation efforts. DHCD also assists eligible low-income households with the installation of energy conservation materials in their dwelling units and energy audits/studies to determine the appropriate energy efficiencies for a building.

DHCD provides outreach and public education, performance contracting/shared savings arrangements, technical support resources for implementation, incentives for energy tracking and benchmarking, and public recognition programs. DHCD works with other agencies to support energy audits and energy efficiency retrofits in residential and commercial buildings, develop and implement advanced building codes and inspections, and create financial incentive programs for energy efficiency improvements through funding sources such as the Energy Efficiency and Conservation Block Grant program of the American Recovery and Reinvestment Act of 2009.

**Estimated GHG Emission Reductions in 2020**

**Figure C-22. Low and High GHG Benefits for Energy-16**

Initial Reductions	0.01 MMtCO <sub>2</sub> e	MDE Quantification Below
High Estimate	0.02 MMtCO <sub>2</sub> e	MDE Quantification Below

**The number above have been adjusted for overlap.**

**Low and High Estimates – MDE Quantification**

The American Recovery and Reinvestment Act of 2009 appropriated funding for the U.S. Department of Energy to award grants under the Weatherization Assistance Program. The purpose of the program was to increase the energy efficiency of residences owned or occupied by low income persons; the priority population included persons who are particularly vulnerable such as the elderly, persons with disabilities, families with children, high residential energy users, and households with high-energy burden.

A total of \$61.4 million was awarded to Maryland. Of this, approximately \$10 million was allocated to training and technical assistance; \$46.7 million for weatherization/retrofit efforts; and the remaining for supporting expenses such as software acquisition, weatherization tactics and auditor classes, and vehicle purchase. Overall, the grant was to be used to scale up existing weatherization efforts in Maryland, create jobs, reduce GHG emissions, and reduce expenses for Maryland’s low income families; this program is not available to commercial properties. Based on U.S. Department of Energy projections, an estimated 6,850 residences would be weatherized, with an annual reduction in gas consumption of 32 percent.

Available information on the details of the Weatherization Assistance Program, including distribution of the grant money, is summarized in the figure below. Within the web page the amount spent to date by each recipient is tabulated; however, details on what has in fact been completed could not be located. Since there was limited detailed information

on what weatherization/retrofit was in fact performed, but general statements regarding the cost per weatherization/retrofit, this value was chosen as the main variable within the calculations. Since limited details on how the money was being spent were identified, it was not possible to confirm the cost per property, the number of properties, and the reduction in natural gas usage. Therefore, the main assumptions are that the values that were identified in supporting documentation, and used in the calculations, are reflective of true conditions.

**Figure C-23. Summary of Funding Available to Maryland from the Weatherization Assistance Program**

Award Recipient	Award Amount	Training and Technical Assistance	Weatherization
Allegany County human resources	\$1,879,175	\$319,460	\$1,559,715
Baltimore, City of	\$15,713,551	\$2,671,304	\$13,042,247
Carroll County	\$917,052	\$155,899	\$761,153
Cecil County	\$810,808	\$137,837	\$672,971
Frederick, City of	\$1,468,005	\$249,561	\$1,218,444
Community Assistance Network, Inc	\$3,802,661	\$646,452	\$3,156,209
Diversified Housing Development, Inc.	\$1,800,000	\$306,000	\$1,494,000
Dorchester County	\$626,279	\$106,467	\$519,812
Garrett County	\$1,276,403	\$216,989	\$1,059,414
Howard County	\$1,140,723	\$193,923	\$946,800
Maryland Energy Conservation, Inc.	\$7,804,227	\$1,326,719	\$6,477,508
Montgomery County	\$5,479,944	\$931,590	\$4,548,354
Prince George's County	\$2,100,000	\$357,000	\$1,743,000
Shore Up, Inc.	\$3,042,015	\$517,143	\$2,524,872
Southern Maryland Tri-County Community	\$2,258,223	\$383,898	\$1,874,325
Timothy Jerome Kenny	\$3,831,986	\$651,438	\$3,180,548
Upper Shore Aging, Inc.	\$1,582,776	\$269,072	\$1,313,704
Washington County	\$733,968	\$124,775	\$609,193
<b>TOTAL</b>	<b>\$56,267,796</b>	<b>\$9,565,525</b>	<b>\$46,702,271</b>

Overall, the calculations are very simple, and use as a basis the cost per retrofit per property. In the figure above, a total value of \$46,702,271 was calculated to be available for weatherization/retrofit activities in Maryland. A review of available documentation from DHCD and U.S. Department of Energy provided two estimated costs for the weatherization of a single property, \$5,268 per property and \$6,500 per property respectively. Therefore, there are two scenarios:

- Total grant: \$46,702,271
  - Lower boundary - \$6,500 per property
  - Upper boundary - \$5,268 per property

Applying these values, applicable standards, and appropriate conversion values, the reduction in GHG emissions can be calculated. Both scenarios utilize the same methodology. An example for one of the scenarios is provided here:

- Upper boundary - \$5,268 per property

$$(\text{Total grant}) / (\text{cost per property}) = \text{Number of properties retrofitted}$$

$$(\$46,702,271) / (\$5,268 \text{ per property retrofit}) = 8,865 \text{ retrofits}$$

- The following values are given:
  - 32 percent reduction in natural gas usage
  - 87.1 MMBtu per property, average current residential usage, annual

$$(\text{Number of retrofits}) * (\text{current energy use/property}) * (\% \text{ reduction}) = \text{energy savings}$$

$$(8,865 \text{ retrofits}) * (87.1 \text{ MMBtu/property}) * (32\% \text{ reduction}) = 247,093 \text{ MMBtu savings}$$

- The MMBtu value is converted to million metric tons of GHG using conversion factors provided by MDE. The calculations and the final values are summarized in Figure 30.

**Figure C-24. Low and High GHG Benefit Estimate**

LOW Estimate	
\$6,500	cost per retrofit
7185	number of retrofits
0.0207	million metric ton GHG saved/not emitted, 2012
0.0311	million metric ton GHG saved/not emitted, 2015
<b>0.0311</b>	<b>million metric ton GHG saved/not emitted, 2020</b>
HIGH Estimate	
\$5,268	cost per retrofit
8865	number of retrofits
0.0256	million metric ton GHG saved/not emitted, 2012
0.0383	million metric ton GHG saved/not emitted, 2015
<b>0.0383</b>	<b>million metric ton GHG saved/not emitted, 2020</b>

## **Implementation**

The Green Grant Program is part of DHCD’s larger affordable rental housing preservation initiative funded in part by the John D. and Catherine T. MacArthur Foundation, known as the Maryland Base Realignment and Closure Preservation Initiative. The MacArthur Foundation’s support for this initiative is part of their Window of Opportunity campaign, a \$150 million, 10-year effort to preserve affordable rental

homes across the nation.<sup>55</sup> Maryland is one of twelve states and cities to have been awarded funding under Window of Opportunity.

Through the Green Grant Rental Housing Preservation Program, DHCD promotes energy efficiency in affordable rental housing developments in eight counties (Anne Arundel, Baltimore, Cecil, Frederick, Harford, Howard, Prince George's and St. Mary's) affected by the federal Base Realignment and Closure process. In partnership with MEA, the Green Grant program reimburses eligible applicants for costs associated with energy audits for multi-family rental housing or for the U.S. Green Building Council's LEED accreditation and training. The Green Grant funding comes in the form of a \$75,000 grant from the MacArthur Foundation, and matching funds of \$200,000 from MEA.<sup>56</sup> These are grant funds to reimburse applicants for costs incurred. Eligible applicants can receive funding for energy audits or LEED training. All property owners or individuals who receive funding are required to complete a survey at the completion of the energy audit or training, as appropriate.

The Green Grant Program is one of five programs established under the Maryland Base Realignment and Closure Preservation Initiative, with the other four including: 1) a revolving loan fund for preservation of affordable rental housing in eight Base Realignment and Closure counties (\$4 million), 2) data analysis and assessment to better identify and target preservation activities (\$250,000), 3) education and outreach efforts aimed at affordable rental property owners (\$125,000), and 4) a preservation compact designed to streamline loan documents and underwriting procedures for affordable rental projects (\$50,000).<sup>57</sup>

DHCD implements other programs that focus on energy efficiency improvements and affordable housing preservation efforts. DHCD operates the federally-funded Weatherization Assistance Program, which helps eligible low income households with the installation of energy conservation materials in their dwelling units. DHCD Multifamily Rental Housing programs provide incentives for sustainable development through its competitive awarding of federal Low Income Housing Tax Credits.

Funding from MEA supported the Multifamily Energy Efficiency and Housing Affordability program. MEA program funding of \$9.5 million, originating from the American Reinvestment and Recovery Act of 2009 funding and the Strategic Energy Investment Fund, complements DHCD's Multifamily Energy Efficiency and Housing Affordability program and the Green Grant under the Maryland Base Realignment and Closure Preservation Initiative. The program provides grants for the purchase and installation of energy efficiency improvements, and/or renewable energy improvements in affordable multifamily rental housing developments. These grants may be used to pay

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<sup>55</sup> DHCD. "Rental Housing Preservation Program - MD-BRAC - Green Grant."  
<http://www.mdhousing.org/Website/programs/RHPP/Default.aspx>.

<sup>56</sup> Ibid.

<sup>57</sup> DHCD. "Maryland Announces Opening of "Green Grant" Energy Efficiency Program." September 2, 2009.  
<http://www.dhcd.maryland.gov/website/About/PublicInfo/NewsEvents/newsDetail.aspx?newsID=226>

for energy efficiency items included in the DHCD Development Quality Standards, including, but not limited to: HVAC systems, insulation, windows, draft stopping and duct sealing, appliances and fixtures, and renewable energy generation, and water heating equipment. The maximum grant is \$500,000 per project or \$2,500 per rental housing unit, whichever is less. Priority in awarding grants is given to projects that have received or are in the pipeline to receive funding, with all funds needing to be expended by April, 2012.

Through the American Recovery and Reinvestment Act, Maryland received approximately \$52 million in funding for the U.S. Department of Energy's Energy Efficiency and Conservation Block Grant program. The ten largest Maryland counties and ten largest municipalities, based on population, are eligible to receive Energy Efficiency and Conservation Block Grant grants directly from the federal government. MEA received approximately \$9.6 million in Energy Efficiency and Conservation Block Grant funds for projects to be implemented in the remaining Maryland counties and municipalities not eligible to receive direct federal grants.

## **Energy Sector Overlap Analysis**

Since the Draft Report has been published, SAIC and MEA has performed an overlap analysis for the energy sector. While the accounting methods for RGGI differed between the two efforts, the final results were within 4% of each other.

For the MEA analysis, emissions reductions for each program (RPS, EmPOWER, and market-based fuel switching) were determined separately. For the RPS, the quantity of RECs were determined based on the BAU forecast adjusted for net sales applicable to the RPS. Next, a projected 2020 REC mix was calculated using historic and projected information. Using this REC mix, the 2020 emissions intensity was calculated with and without the RPS. The difference, when applied to the 2020 sales, is the reduction attributed to the RPS.

For EmPOWER, a 13.7% per capita reduction was assumed to be met by 2020 based on historic and projected performance of the programs. This has a direct result of reducing electricity consumption. Since Maryland would still be a net electricity importer even with the 13.7% per capita reduction, MEA assumed that reductions would come from imported electricity. While it is technically impossible to determine where actual electrons are produced and consumed, it is a reasonable estimate to assume that electricity produced in state would mostly likely be consumed in state, and that imports would make up the balance of the energy need. The actual result in reality may differ, but that is not knowable.

For the fuel switching analysis, MEA estimated that market-based fuel switching in PJM would continue its recent trend. As recently as 2007, natural gas and coal accounted for 7.7% and 55.3%, respectively, of energy produced in PJM. Through the first 6 months of 2012, these figures have changed to 19.4% and 40.3% for natural gas and coal, respectively. Due to a number of factors, such as low natural gas prices, increased cost of

environmental regulation, and economic retirement of coal units, the trend of increased natural gas production in PJM is likely to continue.

For the fuel switching analysis, MEA assumed that roughly 30% of electricity produced in 2020 would come from natural gas, that existing nuclear and hydro would remain constant, that new renewable energy would come online according to RGGI Inc's projections, and that coal would fill in the gap. The result is a roughly even split between natural gas, coal, and nuclear, with hydro and renewables filling in the balance.

MEA then performed a linear regression on generation and emission data from RGGI Inc's updated baseline projections to determine emission coefficients for different generating technologies. Using the coefficients from that analysis, a updated carbon intensity for imported electricity was calculated. Additionally, generation in Maryland was assumed to be impacted as well, with less coal production and increased natural gas production. On the balance, in-state coal generation went down more than in-state natural gas production increased, leading to an increase in imported electricity.

After applying the new carbon intensities for in-state and imported electricity, the fuel switching accounted for a reduction of 7.0 MMtCO<sub>2</sub>e by 2020.

These three policies interact with each other, meaning that a direct sum of the individual savings will overstate the emissions reductions if all three happen simultaneously. For example, EmPOWER will reduce the total energy used, which will reduce the number of RECs required for RPS compliance. Since the RECs contain lower carbon content on average than conventional energy, reducing the quantity of RECs will reduce the benefit of that policy. Additionally, reducing energy use through EmPOWER is assumed to reduce imported electricity. With the fuel mix changes, imported power will be much cleaner than in-state, but using less electricity means that fewer reductions are possible from that scenario.

To determine the projected reduction when all three policies are implemented at the same time, MEA reduced the total electricity use to the EmPOWER level, and then recalculated the RPS requirement based on the new level. Finally, the balance of imported electricity changed, and the fuel switching impact was based on the new mix. As a result, the simultaneous reductions achieved dropped from the individual sum of 24.9 MMtCO<sub>2</sub>e to 19.8 MMtCO<sub>2</sub>e.

The following table summarizes the SAIC overlap analysis and the MEA overlap analysis. As mentioned before, SAIC used a different methodology to apply reductions to RGGI. However, the final net reductions from the energy policies are within 4% of each other.

**Figure C-25. SAIC and MEA Overlap Analysis Summary**

Reduction Potential - Current Policies	SAIC	MEA
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Program Reductions		
RGGI	8.33	0.00
EmPOWER	3.65	10.58
RPS	3.40	7.36
Fuel Switching	0.00	6.97
Imported Power	1.53	0.00
GHG New Source	2.31	0.00
Other	0.14	0.00
Total Independent Reductions	0.00	24.91
<b>Combined Scenario Reductions</b>	<b>19.36</b>	<b>19.76</b>

# Sub-Appendix C-2: Transportation Programs

## E.1: Transportation Technology

Lead Agency: MDOT

### **Program Description**

Transportation technology initiatives are significant contributors to mobile source emissions reductions and are an important element of the State's efforts to help reduce GHGs. Projects fall across many diverse categories including: intelligent transportation systems, traffic operational improvements, engine replacements, and clean vehicle technology including State and federal initiatives.

### **Traffic Flow Improvements**

The Coordinated Highways Action Response Team program, operated by MDOT and the Maryland State Police focuses its operations on non-recurring congestion, such as backups caused by accidents. The Statewide Operations Center, and the three satellite operations centers in the region, survey the State's roadways to quickly identify incidents through the use of intelligent transportation system technology and direct emergency responders to the accident scenes. Quicker response helps save lives and restores normal roadway operation.

The Coordinated Highways Action Response Team program also includes traffic patrols, which have been operating during peak periods on many of the State highways in the region since the early 1990s. Based on collected data, it has been estimated that this program saved 37.3 million vehicle hours of delay Statewide (21.3 million hours of delay in the Baltimore region), 6.3 million gallons of fuel, and reduced overall mobile source emissions.

Maryland 511 is Maryland's official travel information service. Maryland 511 provides travelers with reliable, current traffic and weather information, as well as links to other transportation services. Maryland 511 helps motorists reach their destination in the most efficient manner when traveling in Maryland.

### **Truck Stop Electrification**

Truck stop electrification allows truckers to shut down their engine and obtain electric power and "creature comforts" while resting. Truck stop electrification reduces diesel emissions and noise as well as wear and tear on the truck engine.

Maryland truck stops provide electricity (110 volts AC), cab heating/cooling, television and movies, telephone and internet access. The Maryland sites currently being pursued are located in Baltimore, Jessup and Cecil Counties.

### **Timing of Highway Construction Schedules**

MDOT continues to evaluate new options to require non-emergency highway and airport construction be scheduled for off-peak hours that minimize delay in traffic flow.

### **Electronic Toll Collection**

The Maryland Transportation Authority commenced operation of its electronic toll collection system, MTAG, at the authority's three harbor crossing facilities in 1999. By fall 2001, all toll facilities in the region were equipped with electronic toll collection equipment.

### **Traffic Signal Synchronization**

The Maryland State Highway Administration has instituted a program to review and retime its 1,200 traffic signals in the Baltimore region. The timing of each traffic signal system is reviewed and updated every three years. In addition, systems in high profile corridors or corridors subject to significant traffic pattern change are evaluated on a more frequent schedule. This program results in smoother traffic flow as well as reduced emissions resulting from idling vehicles.

*Synchro* software is used to develop new timing plans and to calculate benefits from the new timing plans. This program has resulted in the following average annual benefits for the Baltimore region: 11.8 percent reduction in network delay; 8.5 percent reduction in arterial delay; 8.7 percent reduction in arterial stops; and 1.9 percent reduction in fuel consumption. Additional traffic signal control projects in the Baltimore region are planned for FY 2011 using federal funds.

### **Variable Message Sign**

A variable message sign is an electronic traffic sign used on roadways to give travelers information about special events. Such signs warn of traffic congestion, accidents, incidents, roadwork zones, or speed limits on a specific highway segment. In urban areas, variable message signs are used within parking guidance and information systems to guide drivers to available car parking spaces. The signs may also ask vehicles to take alternative routes, limit travel speed, warn of duration and location of the incidents or just inform of the traffic conditions.

### **Telework Partnership with Employers**

The Baltimore Metropolitan Council and the Metropolitan Washington Council of Governments participate in a bi-regional program to assist large and small employers to establish home-based telecommuting programs for their employees. This program, known as the "Telework Partnership with Employers," is funded by MDOT. In addition to the traffic and GHG reduction benefits, this program assists in perfecting marketing, outreach procedures, and administrative methods that may be used in other alternate commute programs. Since its kickoff in October 1999, over 25 large and small private sector employers as well as two nonprofit organizations have been recruited to participate in the bi-regional telework partnership program. In the Baltimore region, eight employers have taken advantage of this program and several others are currently considering the

program. Employers are recruited through outreach events. Employers that have signed up to participate in year-long pilot programs choose from a list of qualified regional and national telecommuting consultants whose services are paid for by MDOT.

### **Light-Emitting Diode Traffic Signals**

MDOT continues to work with Baltimore City and other State jurisdictions to find opportunities to replace traditional traffic signal heads with light-emitting diode signal heads. The light-emitting diode signal heads would have an expected 90 percent power savings for the 39,000 traffic signals in Baltimore City.

### Vehicle Technologies

Vehicle fuel economy standards are a key consideration in estimating future GHG emissions. By 2020, a number of State and federal initiatives that affect fuel economy standards will be in-place and significantly contribute to the 2020 transportation sector GHG reductions. Vehicle standards that have not been accounted for elsewhere in this document and would affect fuel economy and potential GHG emissions prior to 2020 include:

- Corporate Average Fuel Economy Standards (Model Years 2008-2011) – Vehicle model years through 2011 are covered under existing Maryland standards that will remain intact under the new national program.
- National Program (Model Years 2012-2016) – Fuel economy improvements begin in 2012 until an average 250 gram per mile carbon dioxide standard is met in the year 2016. This equates to an average fuel economy near 35 mpg.

### Transportation Fuels

Accounting for increases in the availability of renewable fuels in 2020 is an important component of estimating potential GHG emission reductions from the Maryland transportation sector. EPA issued the Renewable Fuel Standard Program final rule in March 2010, which mandates the use of 36 billion gallons of renewable fuel annually by 2022.

### Other Areas

Transportation technology initiatives also include projects at Baltimore Washington International Airport, such as aircraft taxi/idling/delay reduction strategies, vehicle fleet purchases, dedicated lanes, smart park facilities, auxiliary power units for ground service equipment, and facility electricity usage, and by the Maryland Port Administration, such as cargo handling equipment replacements and engine repowers, and truck replacements and engine repowers. Refer to Transportation-14: Airport Initiatives and Transportation-15: Port Initiatives for more GHG emission reduction strategies being implemented in these areas.

## **Estimated Greenhouse Gas Emission Reductions in 2020**

The emission reductions from this measure have been combined with the Maryland Clean Cars Program described in Transportation-1. Mobile source emission reductions are calculated using a model which addresses all of the various control programs at once. Because of this, it is most appropriate to use the total emission reduction from all of the

measures combined, instead of trying to show emission reductions on a measure by measure basis. In some cases, the reductions from individual measures can actually change, based upon the order in which the modeler applied each individual control program in the model.

**Figure C-26. Low and High GHG Benefits for Transportation-10**

Initial Reductions	8.10 MMtCO <sub>2</sub> e	MDOT Quantification Appendix D
Enhanced Reductions	8.61 MMtCO <sub>2</sub> e	MDOT Quantification Appendix D

The emission reductions from this measure have been combined with the federal fuel efficiency (or Corporate Average Fuel Efficiency) standards and the other transportation technology programs included in Transportation-10: Transportation Technology Initiatives. Mobile source emission reductions are calculated using a model which addresses all of the various control programs at once. Because of this, it is most appropriate to use the total emission reduction from all of the measures combined, instead of trying to show emission reductions on a measure by measure basis. In some cases, the reductions from individual measures can actually change, based upon the order in which the modeler applied each individual control program in the model.

The following programs have significant overlap between them with respect to implementation and emission reductions:

- E.1.A: Maryland Clean Cars Program
- E.2: Transportation Technology Initiatives
- E.1.D: Renewable Fuel Standard
- E.1.B: Corporate Average Fuel Economy

For this reason, MDE has decided to combine the potential 2020 benefits from these programs under one emission benefit estimate.

**Low and High Estimates – MDE Quantification**

The Maryland Clean Cars Program contains all the benefits associated with the various Maryland and federal fuel economy programs initiated between 2008 through 2025. These would include the model year 2008 through 2011 federal fuel economy standards, the Maryland Clean Cars Program and the 2012 through 2016 model year federal fuel efficiency standards, and the upcoming proposed 2017 through 2025 model year federal fuel economy standards.

The 2008 federal fuel efficiency standards are discussed in more detail in Transportation-18: Corporate Average Fuel Economy Standards: Model Years 2008-2011.

By 2030, as the fleet continues to turn over, the combined benefits from Maryland and federal fuel efficiency standards could be approximately 14.11 MMtCO<sub>2</sub>e.

## **Implementation**

Projects that contribute to a change in VMT growth and/or improve system efficiency are a subset of the State's complete Consolidated Transportation Program. Current Consolidated Transportation Program projects applicable to transportation technology initiatives include Coordinated Highways Action Response Team program implementation, State and local programs for signal synchronization, transit system upgrades, and high speed tolling at I-95 Fort McHenry toll plaza.

Funded and planned transportation system investments 2006-2020, which are defined in the Maryland 2009 - 2014 Consolidated Transportation Program and in the metropolitan planning organizations, transportation improvement programs, and long-range plans through 2020 include:

- Installation, repair and replacement of variable message signs
- Congestion management programs including the employment of variable message signs, closed circuit television, signal coordination, the deployment of local information technology system projects (transit signal priority systems, automatic passenger counters, traffic signal control software, etc.), and the development of park and ride facilities
- Congestion Mitigation and Air Quality Improvement Program projects
- Clean Air Partners projects
- Advanced transportation management systems utilizing fiber optics

Additionally, the following strategies were identified for further analysis and possible implementation under this program area:

- *Active Traffic Management / Traffic Management Centers* – Provide real-time, variable-control of speed, lane movement, and traveler information (for drivers and transit users) within a corridor and conduct centralized data collection and analysis of the transportation system. System management decisions are based on inroad detectors, video monitoring, trend analysis, and incident detection (currently performed by Coordinated Highways Action Response Team program).
- *Traffic Signal Synchronization / Optimization* – Traffic signal operations are synchronized to provide an efficient flow or prioritization of traffic, increasing the efficient operations of the corridor and reducing unwarranted idling at intersections. The system can also provide priority for transit and emergency vehicles. Specific performance measure is “reliability.” Traffic Signal Synchronization is currently performed by the Maryland State Highway Administration and local jurisdictions.
- *Timing of Highway Construction Schedules* – Consider requiring non-emergency, highway and airport construction be scheduled for off-peak hours that minimize the delay in traffic flow. Include incentives for completing projects ahead of schedule.
- *Green Port Strategy* – Develop and implement a “Green Port Strategy” consistent with industry trends and initiatives including EPA’s Strategy for Sustainable seaports (note: also applies to Transportation-15: Port Initiatives).

- *Reduce Idling Times* – Reduce idling time in light duty vehicles, commercial vehicles (including the use of truck stop electrification), buses, locomotive, and construction equipment.
- *Marketing and Education Campaigns* – Initiate marketing and education campaigns to operators of on-and off-road vehicles (note: this strategy also applies to Transportation-11: Electric Vehicle Initiatives and Transportation-12: Low Emission Vehicle Initiatives).
- *Technology Improvements for On-highway Vehicles* – Promote and incentivize fuel efficiency technologies for medium and heavy-duty trucks (on-highway vehicles) (note: this strategy also applies to Transportation-11: Electric Vehicle Initiatives and Transportation-12: Low Emission Vehicle Initiatives).

## **E.1.A: Maryland Clean Cars Program**

Lead Agency: MDE

### **Program Description**

In Maryland, motor vehicles account for approximately 30 percent of all GHG emissions. Vehicles sold in the U.S. must be certified through one of two certification programs: the Tier 2 federal program or the California Clean Car Program. The California Clean Car Program was the first and only program in the country to regulate GHG emissions from motor vehicles. This program establishes a fleet-wide average GHG standard. Each vehicle manufacturer demonstrates compliance with the fleet-wide average by sales-weighting the specific emission levels to which each vehicle is certified. These fleet average GHG requirements apply to vehicles up to 10,000 pounds, including vehicles such as passenger cars, sport utility vehicles, and light duty trucks.

Section 177 of the federal Clean Air Act authorizes other provides states the ability to adopt the California Clean Car Program in lieu of the federal program. The Maryland Clean Cars Act of 2007 required MDE to adopt regulations implementing the California Clean Car Program. Implementation of the program began with model year 2011 vehicles. In addition to Maryland, thirteen other states (California, New York, Massachusetts, Maine, Rhode Island, Connecticut, Vermont, Pennsylvania, New Jersey, Arizona, New Mexico, Oregon, and Washington) have also adopted and implemented the California Clean Car Program.

On May 7, 2010, EPA and the National Highway Traffic Safety Administration finalized new national GHG and fuel economy standards for passenger vehicles and light-duty trucks. The standards were finalized on May 7, 2010. These new standards will be phased in beginning in model year 2012 and, when fully implemented in model year 2016, will attain the same fuel economy and GHG reductions as the California Clean Car Program. This action brings both the federal standards and California standards into harmony, effectively creating one national standard.

In 2010, California began working on its next generation clean car program which would become effective for model year 2014 through 2025 vehicles. On May 21, 2010, President Obama also directed the National Highway Transportation Safety Administration and EPA to begin a process for evaluating and setting standards to improve fuel efficiency and reduce GHG emissions for passenger cars and light duty trucks built in model years 2017 and later. The federal agencies will work closely with the California Air Resources Board in developing new standards.

The National Highway Transportation Safety Administration and EPA, working with the California Air Resources Board, are currently meeting with stakeholders to gather information necessary to set aggressive light-duty vehicle standards for model year 2017 and beyond. The September 1, 2010 Notice of Intent described key elements of the program that the National Highway Transportation Safety Administration and EPA intend to propose in a future joint rulemaking, and identified potential standards that could be practically implemented nationally for the 2017 through 2025 model years and a schedule for setting standards as expeditiously as possible to provide sufficient lead time. The National Highway Transportation Safety Administration, EPA, and the California Air Resources Board are expecting to release the proposal in the September 2011 timeframe.

This joint program will achieve substantial annual progress in reducing transportation sector GHG emissions and fossil fuel consumption. Additionally, the program will encourage continuous technological innovation through performance-based standards, and will stimulate increases in the use of electric, hybrid, and other vehicles utilizing cutting edge technologies.

### **Estimated Greenhouse Gas Emission Reductions in 2020**

The following programs have significant overlap between them with respect to implementation and GHG emission reductions:

- E.1.A: Maryland Clean Cars Program
- E.2: Transportation Technology Initiatives
- E.1.D: Renewable Fuel Standard
- E.1.B: Corporate Average Fuel Economy

For this reason, MDE aggregated the potential 2020 benefits from these programs under one emission benefit estimate. Refer to E: Transportation Technology Initiatives for the description and data regarding the methodologies used to quantify these four programs.

### **Other Environmental Benefits**

The Maryland Clean Cars Program is also designed to reduce emissions of the ozone precursor pollutants, nitrogen oxides and volatile organic carbons and to also reduce emission of air toxics.<sup>58</sup> To ensure that specific emission levels are achieved on a fleet-

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<sup>58</sup> For purposes of this document and the Maryland Clean Cars Program, the terms volatile organic carbon and non-methane organic gases are used interchangeably. When referencing the California regulations or

wide basis, the Maryland Clean Cars Program also sets a fleet-wide average standard for these criteria pollutants. Compliance with this fleet-wide average standard is demonstrated by each vehicle manufacturer by sales-weighting the specific emissions levels to which each individual vehicle is certified. Additionally, the Maryland Clean Cars Program also has a zero emission vehicle component, which requires manufacturers to produce zero (or near zero) emission vehicles. This technology forcing component of the Maryland Clean Cars Program has facilitated the development of advanced technology vehicles such as hybrid and fuel cell vehicles.

Nitrogen oxide emission reductions will help Maryland meet air quality standards for ground level ozone and fine particulate matter. They will also significantly help Maryland reduce nitrogen pollution in the Chesapeake Bay. By 2030, nitrogen oxide emission is expected to reduce by 7.1 tons per day.

Volatile organic carbon emission reductions will help Maryland meet air quality standards for ground level ozone. By 2030, volatile organic carbon emission is expected to reduce by 4.8 tons per day.

The Maryland Clean Cars Program will also reduce emissions of air toxics like benzene, 1-3 butadiene, and acetaldehyde. By 2030, air toxics emissions could be reduced by 69.5, 8.9, and 15.7 tons per day, respectively.

### **Implementation**

This program has been implemented through regulations adopted by MDE into the Code of Maryland Regulations through Incorporation by Reference. The requirements are fully enforceable, and MDE is enforcing these regulations just as it enforces all its regulations.

## **E.1.B: Corporate Average Fuel Economy (CAFÉ) Standards: Model Years 2008-2011**

Lead Agency: MDOT

### **Program Description**

The Energy Independence and Security Act of 2007 established a goal for increasing the national fuel economy to 35 miles per gallon by the year 2020. This marked the first new Corporate Average Fuel Economy standard since the creation of these standards in 1975, over 30 years ago. The fuel economy standard is the sales-weighted fuel economy average for a vehicle manufacturer for the current model year of vehicles with a gross vehicle weight rating of 8,500 lbs or less. This new standard included passenger vehicles as well as light duty trucks.

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standards, non-methane organic gas is used since it is the terminology used in those regulations. When referencing benefits, volatile organic carbon is used for consistency with the MDE modeling.

Since introduction in 1975, Corporate Average Fuel Economy standards have increased very slowly from an initial 18 miles per gallon. Since 1990 the standard for passenger cars has been stable at 27.5 miles per gallon. Light duty trucks have experience a more gradual increase from 17.5 miles per gallon in 1982 increasing to just 22.2 miles per gallon in 2007. The Energy Independence and Security Act of 2007 requires the National Highway Traffic Safety Administration, the agency with the regulating authority on fuel economy, to gradually increase the fuel efficiency standard mpg until it achieves the 35 miles per gallon mark. Each year the National Highway Traffic Safety Administration must analyze the effect of its new proposed standard on the environment as well as employment. The new standard must be issued 18 months before the model year for a fleet. Manufacturers need this lead time in order make any changes to their vehicle lineup necessary to meet the new standard.

In passing the Energy Independence and Security Act of 2007, Congress instructed the National Highway Traffic Safety Administration to establish a credit trading and transferring system for manufacturer's to transfer credits between categories and to sell them to other manufacturers or non-manufacturers. This policy allowed greater opportunities for compliance with the increasing standards.

Since being passed and implemented, newer fuel efficiency and GHG standards have been adopted through a joint rulemaking between National Highway Traffic Safety Administration and EPA for model years 2012-2016. These new GHG standards along with a new, quicker, phase in of fuel economy standards will replace those adopted from the passage of the 2007 federal law. The 2008-2011 fuel efficiency standards will be enforced up to 2012 and will still provide GHG benefits into the future.

### **Estimated Greenhouse Gas Emission Reductions in 2020**

The following programs have significant overlap between them with respect to implementation and GHG emission reductions:

- E.1.A: Maryland Clean Cars Program
- E.1: Transportation Technology Initiatives
- E.1.D: Renewable Fuels Standard
- E.1.B: Corporate Average Fuel Economy

For this reason, MDE aggregated the potential 2020 benefits from these programs under one emission benefit estimate. Refer to E: Transportation Technology Initiatives for the description and data regarding the methodologies used to quantify these four programs.

### **Implementation**

This program has been implemented through regulations adopted by the National Highway Traffic Safety Administration. The requirements are fully enforceable, and this federal administration is enforcing these regulations just as it enforces all its regulations. Since its implementation, new national GHG and fuel economy standards have been adopted through a joint agency agreement between EPA and the National Highway Traffic Safety Administration. These new standards will improve upon the current

standards set forth in this program and succeed this program as the enforceable fuel economy standards.

While these standards are applicable through model year 2011 vehicles, these vehicles will remain in the fleet and will still be producing benefits in 2020.

## **E.1.C: National Fuel Efficiency & Emission Standards for Medium- and Heavy- Duty Trucks**

Lead Agency: MDE

### **Program Description**

The National Fuel Efficiency & Emission Standards for Medium- and Heavy- Duty Trucks program is the first program ever designed to reduce GHG emissions and improve fuel efficiency for medium- and heavy-duty vehicles. The program represents collaboration between EPA and the National Highway Traffic Safety Administration in response to President Obama's Presidential Memorandum issued in May of 2010. Medium- and heavy-duty vehicles make up the transportation segment's second largest contributor to oil consumption and GHG emissions.

EPA and the U.S. Department of Transportation are each proposing complementary standards under their respective authority covering model years 2014-2018. EPA and the National Highway Transportation Safety Administration are proposing emission standards for carbon dioxide and fuel consumption standards, respectively, for the following regulatory categories: Combination tractors, heavy-duty pickup trucks and vans, and vocational vehicles. EPA will propose standards for air conditioning related emissions of hydrofluorocarbons from pickups, vans and tractors, as well as nitrous oxide and methane standards applicable to all heavy-duty engines, pickups and vans. EPA is also proposing to include recreational on-highway vehicles in its rulemaking while the National Highway Transportation Safety Administration is not including them. For this proposal the heavy-duty fleet includes all onroad vehicles rated at 8,500 lbs or more, except those covered by the current GHG emissions and federal Corporate Average Fuel Economy standards for model years 2012-2016.

The proposed standards cover not only engines but also the complete vehicle. In order to account for the fact that many of these vehicles carry payloads of goods and equipment, the regulations has proposed two types of standard metrics: payload-dependent gram per mile standards for pickups and vans, and gram per ton-mile standards for vocational vehicles and combination tractors.

The proposed regulations set phase in standards for vehicle manufacturers similar to the national GHG standards. This program takes a sales-weighted approach to averaging the emissions from each model in order to determine a manufacturer's fleet wide average. The program also provides flexibility to manufacturers to meet the standards. The primary flexibility provision is an engine and vehicle averaging, banking, and trading

program. These programs would allow for emission and/or fuel consumption credits to be averaged, banked, or traded within each regulatory subcategory, but not across categories. EPA is also proposing to allow engine manufacturers to use carbon dioxide credits to offset methane or nitrous oxide emissions that exceed the applicable standards. In addition, the agencies are proposing three additional credit opportunities. The first is an early credit option for improvements in excess of a proposed standard prior to the model year it becomes effective. The second is a credit to promote implementation of advanced technologies, such as hybrids, and electric vehicles. The third credit applies to new and innovative technologies that reduce carbon dioxide emissions and fuel consumption, but for which the benefits are not captured over the test procedures used to determine compliance with the standards (i.e., off-cycle).

**Estimated Greenhouse Gas Emission Reductions in 2020**

Because this is a relatively recent initiative, and the full benefits of the effort depend on the turnover of the mobile fleet, significant additional reductions of GHGs are expected by 2030 and 2050. By 2030 and 2050, the GHG reductions increase to 1.13 and 1.6 MMtCO<sub>2</sub>e respectively.

**Figure C-27. Low and High GHG Benefits for Transportation-2**

Initial Reductions	0.88 MMtCO <sub>2</sub> e	MDOT Quantification Appendix D
Initial Reductions	0.88 MMtCO <sub>2</sub> e	MDOT Quantification Appendix D

**E.1.D: Renewable Fuels Standard**

Lead Agency: MDOT

**Program Description**

The Renewable Fuels Standard, regulated by EPA, was originally created under the federal Energy Policy Act of 2005. It established the first renewable fuel volume mandate in the U.S. Originally the program set a requirement that 7.5 billion gallons of renewable fuel be blended into gasoline in 2012. The Energy Independence and Security Act of 2007 greatly expanded the Renewable Fuel Standard in a number of ways. The new policy included diesel fuel as a medium for renewable fuel, along with gasoline. It also increased the volume of renewable fuels to be blended to 9 billion gallons in 2008 and 36 billion gallons in 2012. The federal law also developed new categories of renewable fuel and set limits on how much of the mandate could be met by certain fuels types, as well as required an application of lifecycle GHG performance threshold standards to ensure each category of renewable fuels emits fewer GHGs than the conventional fuel it replaces.

Biofuels must reduce lifecycle GHG emissions by at least 20 percent in order to qualify as a renewable fuel. The volume of ethanol included in the Renewable Fuels Standard is capped at 12 billion gallons in 2010 and increases to 15 billion gallons in 2015 where it is fixed thereafter. The new policy includes a mandate for advanced biofuels, which grow

from 1 billion gallons in 2010 to 21 billion gallons in 2022. To qualify as an advanced biofuel the fuel must reduce lifecycle GHG emissions by 50 percent. Corn-starch ethanol is directly excluded from this category and cannot be used to meet this part of the mandate. Ethanol created from non-starch parts of the corn plant (such as the stalk and cob) can qualify if they meet the GHG lifecycle emission reductions. Included is also a cellulosic and agricultural waste-based biofuel mandate. This grows from 100 million gallons in 2010 to 16 billion gallons in 2022. Cellulosic biofuels must reduce lifecycle GHG emission by at least 60 percent. The final category, bio-mass based biodiesel, has a mandate that grows from .5 billion gallons in 2009 to 1 billion gallons in 2012. Any fuel made from biomass feedstock that has a 50 percent lifecycle GHG reduction satisfies this part of the mandate.

In order to ensure that the fuel supply sold in the U.S. meets the mandated volume of renewable fuels, EPA established a system of tradable Renewable Identification Numbers, which are unique identifiers issued by the biofuel producer or importer at the point of production or port of importation. A unique number is generated for every qualifying gallon of renewable fuel.

EPA uses estimates provided by the U.S. Department of Energy’s Energy Information Agency, to determine the total volume of transportation fuel expected to be used in the U.S. during the next year. The mandate is computed and a preliminary standard is issued in the spring of the preceding year, with a final rulemaking in 2012, pending legal issues. Fuel blenders are required to include a quantity of biofuels equal to a percentage of their total annual sales. Each blender must show that it has enough Renewable Identification Numbers at the end of each year to meet its share for each of the four mandated standards.

The Renewable Fuels Standard is a federally-mandated program designed to reduce the nation’s need of foreign oil, and encourage the development and expansion of our nation’s renewable fuels sector. The program will also help reduce GHG emissions from transportation fuels through the use of renewable fuels.

**Estimated Greenhouse Gas Emission Reductions in 2020**

**Figure C-28. Low and High GHG Benefits for Transportation-2**

Initial Reductions	0.24 MMtCO <sub>2</sub> e	MDOT Quantification Appendix D
Initial Reductions	0.24 MMtCO <sub>2</sub> e	MDOT Quantification Appendix D

**E.2.B: Airport Initiatives**

Lead Agency: MDOT

**Program Description**

The following initiatives, supported by the Maryland Aviation Administration, are intended to reduce criteria pollutant emissions and will also serve to reduce GHG emissions. A 2011 energy audit is assisting the Maryland Aviation Administration in evaluating potential reductions in electricity consumption and conventional vehicle fuel use, which would result in less GHG emissions by using more energy efficient design and fuel conservation measures. Lower consumption and demand on electricity power plants would help to reduce GHGs. A future Air Quality Management Plan should also help in addressing future air quality requirements including GHG emissions reduction. More detail on these measures is provided below.

### **Compressed Natural Gas Buses**

The Maryland Aviation Administration has a fleet of approximately 20 buses that transport passengers from the terminal to various off-campus facilities, such as the consolidated rental car facility and long-term parking lots. To reduce emissions associated with the buses, these diesel-powered buses were replaced with compressed natural gas vehicles. Compressed natural gas offers air quality benefits by producing fewer overall emissions than diesel-powered engines.

### **Air Emissions Reductions**

To reduce air emissions, the Maryland Aviation Administration's Division of Maintenance uses alternative fuel or bi-fuel vehicles. Some of the vehicles use only compressed natural gas, while others use a combination of natural gas and fossil fuels. There are approximately 20 vehicles in the maintenance fleet that use alternative fuels, such as E-85 fuel, including vans, pick-up trucks and flat-bed trucks that are used daily. The Baltimore Washington International Thurgood Marshall Airport facilities also include an on-site quick-fill compressed natural gas fueling station.

### **BWI Energy Audit**

The environmental stewardship section of MDOT's 2010 Attainment Report identified that the Maryland Aviation Administration will conduct an energy audit at BWI to establish a baseline for developing conservation goals. The draft Energy Audit is completed, and Administration is investigating those energy usage improvements that will help reduce criteria pollutant and GHG emissions at the airport.

### **BWI Utility Master Plan**

The Maryland Aviation Administration has prepared a *Utility Master Plan for BWI Marshall Airport* to identify the many systems and utilities needed to operate the airport. The plan provides baseline energy consumption data and describes existing services used to operate BWI under current conditions, such as: water and sanitary services, glycol collection, natural gas consumption, electrical power, heating and air conditioning systems, fuel use and communication networks.

### **BWI Energy Efficiency**

The Maryland Aviation Administration is promoting efficient energy use in the terminal area by replacing the lighting with more energy efficient fixtures. Switching from T-12

fluorescent lights to T-8 lights with electronic ballasts is expected to reduce the electricity required to illuminate the airport by 30 percent.

Another program to reduce energy consumption has focused on BWI's heating, ventilation and cooling systems. Such systems have been upgraded as the airport expanded during the last decade. The new systems provide for a five to ten percent reduction in fuel use.

### **Enhanced Access to BWI by Other Travel Modes**

As aviation demand at BWI grows, surveys indicate that many passengers choose private vehicles and other gasoline-powered vehicles to access the airport. The Maryland Aviation Administration will continue to look for ways to encourage access to BWI using other modes that reduce criteria pollutants and GHG's.

### **BWI's Periodic Air Quality Assessments**

The Maryland Aviation Administration conducts periodic studies to assess air quality on, and in the vicinity of, BWI Marshall. Most recent studies for air quality include the *Air Quality Assessment Update 2006* (a study that is updated every five to 10 years to support the Maryland State Implementation Plan), and a *Final Draft, 2006 Greenhouse Gas Baseline Emissions Inventory (completed in 2008)*.

### **Estimated GHG Emission Reductions in 2020**

In order to account for similarities across programs, all emission benefits and costs associated with this program has been aggregated under E.2: Transportation Technologies.

### **Implementation**

The Maryland Aviation Administration supports a wide range of initiatives geared towards reducing GHG's, and improving the airport environment's air quality. There are many advances being made by the aviation industry to address GHG reduction, including testing and use of bio-fuels for aircraft use, and changing the fleet of airline ground support equipment, such as aircraft tugs and baggage belt loaders, to non-gasoline technologies (electric and/or natural gas). Many of these programs are part of the Environmental Impact Statements created for Maryland's State-owned airports. This process is part of the environmental permitting process required for project approval. Air quality analysis and general conformity considerations are part of the required evaluation in the federal Environmental Impact Statements process as well as comparable State processes. It is critical to note that Maryland Aviation Administration does not have the legal authority to prohibit airlines from using existing aircraft engine technologies that operate within the existing federal and State regulatory environment. Below is a listing of various efforts being discussed and/or implemented by the aviation industry to reduce criteria pollutants and GHG's, and an indication of whether Maryland Aviation Administration can control the implementation schedule of some of these efforts:

Airline Controlled Activities (Federally regulated)

- Aircraft taxi/idling/delay reduction strategies
- Aircraft engine modifications

#### Maryland Aviation Administration Controlled Activities (State initiatives)

- State Vehicle fleet purchases
- Lower Roadway Dedicated Lanes for commercial, curbside activities (already exists)
- Expanded Smart Park facilities (all parking facilities contain such facilities—no additional expansion of parking facilities are planned)
- Promote preferential airport parking for hybrids and low-emitting vehicles—have installed eight electric charging areas within the Hourly and Daily Garages
- Lower airport facility electricity usage through energy audit reduction strategies
- Promote reforestation and afforestation at BWI

#### Activities Not within Control of Maryland Aviation Administration and/or Airlines, Requiring Regional Planning Coordination and/or Business Partnership Efforts

- Promote hybrid car rentals and hybrid satellite lot shuttle vehicles
- Promote transit including MARC, Light Rail, and AMTRAK connections to BWI
- Promote sustainable lodging (hotels with energy efficient lighting, recycling, and conservation practices) around BWI
- Enhance Light Rail access to BWI
- Maryland Transit Administration's Yellow Line from Baltimore to BWI and Columbia
- Evaluate incentives for EPA SmartWay carriers in cargo activities at BWI

Consider low carbon footprint air travel incentives (carbon offsets) to passengers and airlines using BWI

## **E.2.C: Port Initiatives**

Lead Agency: MDOT

### **Program Description**

The Maryland Port Administration's Environmental Management System and other initiatives to reduce the environmental footprint from activities related to Maryland's deepwater seaport include emission reduction strategies consistent with the State's efforts to help reduce air emissions, including GHGs. Specific actions currently part of the Maryland Port Administration's emission reduction program include, but are not limited to, use of cleaner diesel fuel port fleet vehicles, use of diesel operated equipment, reduced truck emissions through turn time efficiency improvements, and idle reductions. Initiatives to encourage lower emissions and introduce cleaner technologies at the port are described in more detail below.

### **Port of Baltimore Initiatives**

In 2002, the Maryland Port Administration began developing assessments of relative mobile and off-road emission contributions from vessels and cargo handling activities at port facilities.

In 2006, the Maryland Port Administration partnered with Port stakeholders to oversee various physical and operational improvements to terminal gates at the Dundalk and Seagirt Marine Terminals. The purpose of the improvements was to expedite inbound and outbound vehicle traffic. A net benefit of these projects was overall reductions in idling time for heavy-duty diesel trucks and other vehicles visiting the terminals, resulting in reduced emissions.

Since 2006, the Maryland Port Administration has used ultra-low sulfur diesel fuel blended with bio-diesel in all of its "on road" as well as "off road" diesel engines. This included Administration owned vehicles such as gantry cranes, ship-to-shore cranes, mobile cranes, terminal service vehicles, stationary generators, fire pumps, off-road, and other cargo handling-equipment. The Maryland Port Administration annually exceeds EPA's 75 percent fleet vehicle alternative fuel purchasing requirements. To do so, the port administration purchases flex-fuel (ethanol/gas) fleet vehicles. The Maryland Port Administration also purchased four hybrid (electric/gas) fleet vehicles, one electric vehicle, and a hybrid aerial lift. Additionally, the Administration performs outreach to employees on "ozone alert days" in order to reduce activities which contribute to ozone pollution, such as vehicle fueling and combustion engine usage.

Beginning in the fall of 2006 and continuing through 2010, Maryland Port Administration applied for and received a series of EPA and U.S. Department of Energy grants to retrofit ship-to-shore crane and rubber tire gantry cranes with Diesel Oxidation Catalysts. Several grant awards from EPA and U.S. Department of Energy have allowed expansion of these efforts to a port-wide initiative involving private sector port operators, including railroad, harborcraft, dray truck and cargo handling equipment upgrades throughout the Port of Baltimore. Ongoing educational and outreach efforts regarding emission reductions and environmental stewardship take place through the Baltimore Port Alliance Environmental Committee.

Recent improvements in truck turn times have come through investment in technology improvements at the Seagirt Marine Terminal. This investment is a result of the 2010 partnership between the Maryland Port Administration and Ports America Chesapeake to operate the Seagirt Marine Terminal.

Current 2011 initiatives include development of a port-wide Dray Truck Replacement Program, energy efficiency improvements through energy performance contracts and alternative energy projects, and development of a strategy for further reducing carbon emissions.

A major initiative aimed at voluntarily reducing particulate matter and nitrogen emissions on a port-wide basis did not receive EPA funding in the most recent competitive round of

grants. Funding assistance remains a critical element of successful programs and the resulting achievement of intended GHG and other emission reductions.

### **Estimated GHG Emission Reductions in 2020**

In order to account for similarities across programs all emission benefits and costs associated with this program has been aggregated under E.2: Transportation Technologies.

### **Implementation**

Ongoing or planned administrative, management, maintenance, and operations strategies by the Maryland Port Administration that will result in voluntary reductions in energy consumption from the transportation sector are listed below. These strategies reduce GHG emissions through helping to decrease rates of energy consumption from transportation infrastructure and support facilities.

- *Green Port Strategy* will be developed consistent with industry trends and initiatives including EPA's Strategy for Sustainable Seaports.
- Applied for and received EPA grants for demonstration emission reduction projects on Maryland Port Administration fleet vehicles, cargo handling equipment at port terminals, and on construction equipment at Hart Miller Island and Poplar Island.
- Applied for and received EPA grant for a Port-wide assessment of technologies that can effectively reduce emissions related to cargo movement.
- Retrofit and repowered tugs with anti-idling technology and new engines.
- Flex-fuel vehicles, alternative fuel vehicle, and hybrid vehicles have been introduced into the Maryland Port Administration fleet.
- Plans to install a fuel tank capable of storing E-85 will be included in the new fuel island configuration at Dundalk Marine Terminal.
- Comply with national laws and regulations that increase environmental protection and maintain competitiveness
- Emission controls for ocean going vessels

## **E.2.D: Freight and Freight Rail Strategies**

Lead Agency: MDOT

### **Program Description**

The initiative to improve efficiency of freight transportation is part of the State's efforts to reduce the transportation sector's air emissions including GHGs. This program enhances connectivity and reliability of multimodal freight through infrastructure and technology investments, such as expansion and bottleneck relief on priority truck and rail corridors and enhanced intermodal freight connections at Maryland's intermodal terminals and ports. The following are a variety of initiatives to encourage and improve rail and freight transport.

### **Auxiliary Power Units for Existing Locomotives**

Auxiliary power units have been installed on diesel locomotives to reduce the need for long idling periods. An auxiliary power unit eliminates emissions and conserves fuel by shutting down the main engine at idle regardless of weather conditions or operating location. It also protects the main locomotive engine during shut-down times by monitoring and maintaining the lube oil and water temperatures. Auxiliary power units are part of the locomotive emissions control strategies certified to meet the EPA Locomotive Rule.

### **Technology Advances for Non-highway Vehicles**

MDOT will continue to analyze and identify opportunities to incentivize retrofits or promote replacement of old, diesel-powered non-highway engines, like switch-yard locomotives, with new hybrid locomotives. Targeted engines could include State-owned switchers, like MARC. MDOT should also provide outreach to private operators, such as Amtrak, CSX, Norfolk Southern, and Canton Railroad.

### **Estimated GHG Emission Reductions in 2020**

In order to account for similarities across programs, all emission benefits and costs associated with this program has been aggregated under either E.2: Transportation Technologies.

### **Implementation**

No specific freight strategies are currently recommended in addition to projects identified in implemented and adopted transportation plans and programs, as identified below, for consideration before 2020. Recent developments and Maryland strategic involvement in the CSX Transportation National Gateway initiative will result in implementation of freight rail projects in Maryland and the mid-Atlantic region that will help reduce truck VMT in Maryland by 2020. Funding for the National Gateway is a public-private partnership between the federal government, six states and the District of Columbia, and CSX. The benefit of the National Gateway is assessed in this report.

The benefits of Norfolk Southern's Crescent Corridor initiative are not assessed in this report as direct GHG emission reduction benefits to Maryland are unknown, and a level of support and funding commitment from Maryland has not been recommended to date.

Projects that contribute to a change in VMT growth and/or improve system efficiency are a subset of the State's complete Consolidated Transportation Program. Currently funded and planned transportation system investments 2006-2020, which are defined in the Maryland 2009 - 2014 Consolidated Transportation Program and in the metropolitan planning organizations, transportation improvement programs, and long-range plans through 2020 include:

- Major roadway capacity projects impacting truck freight movement in Maryland planned for opening by 2020, such as:
  - I-695 from I-95 South to MD 122
  - I-695 from I-83 to I-95 North
  - MD 32 grade separation and interchange at I-795
  - MD 4 upgrade in Prince Georges County

- US 50 access control improvements in Wicomico County
- Long range projects associated with the Maryland Statewide Freight Plan to provide rail freight capacity improvements on railroads owned by Maryland

The State will continue to implement and look for areas to expand this ongoing effort while seeking funding sources at the State and federal level and continuing to work with State and federal lawmakers on legislation. Examples of initiatives that may be added or enhanced include (this list should not be considered exclusive):

- Providing climate change adaptation and mitigation for rail lines at risk from rising sea levels- The Amtrak North East Corridor lines in Harford County are a prime example.
- Advancing the construction timetable for high speed rail projects in the North East Corridor. For example, Maryland recently received \$22 Million from the High Speed Intercity Passenger Rail Program to begin Preliminary Engineering and National Environmental Policy Act analysis toward the replacement of the Susquehanna River Bridge on the Amtrak North East Corridor. This would provide additional tracks which would alleviate the chokepoint created by the current double tracked bridge and allow for expanded capacity for Amtrak, MARC and Norfolk Southern freight trains, as well as increased times. This would help alleviate current train idling and allow for the expansion of passenger and freight service that would alleviate road congestion for commuters and freight.
- Building the proposed CSX intermodal container facility, to be located south of CSX's Howard Street tunnel. This will remove a major freight bottleneck and enhance competitiveness of rail freight transport by allowing CSX to double stack containers, which will divert marginal long haul trucking and improve emissions by diverting cargo to rail.
- Replacing long haul truck freight hauling with rail hauling by 2020 (Norfolk Southern Crescent Corridor, CSX National Gateway)

### **E.3: Electric Vehicle Initiatives**

Lead Agency: MDOT

#### **Program Description**

Initiatives to encourage use of electronic vehicles are part of efforts by the State to help reduce air emissions, including GHGs, by providing viable alternatives to internal combustion engine vehicles. Electric vehicles can help to reduce mobile emissions because they are a clean vehicle technology, using battery power for propulsion rather than an internal combustion engine. The following are a variety of initiatives to encourage electric vehicle usage.

### *Electric Vehicles*

MDOT has been working closely with MDE, MEA, Baltimore City and the Baltimore Electric Vehicle Initiative to select appropriate locations for 65 electric vehicle re-charging stations around the State. Several of the re-charging stations will be located at MDOT and modal facilities such as the MDOT Headquarters in Hanover, the Baltimore Washington International Airport MARC/AMTRAK station, the BWI parking garage and park-and-ride lots maintained by MDOT modal agencies. MDOT's continued involvement in expanding the availability of electric vehicle recharging stations throughout the State will contribute to Statewide GHG emission reductions and complement the efforts of the 2010 Maryland General Assembly, which has passed legislation approving electric vehicle tax credits and electric vehicle use of high-occupancy vehicle lanes, and the 2011 Maryland General Assembly, which has passed legislation to create an Electric Vehicle Infrastructure Council, and establish a State income tax credit of 20 percent of the cost of electric vehicle charging equipment for individuals and businesses.

MDOT is working to form an Electric Vehicle Infrastructure Council comprised of State, local and private sector representative to develop a plan to implement electric vehicle infrastructure throughout the State. It is MDOT's goal to make the availability of electric vehicle rechargers as convenient as current conventional fueling systems.

MDOT is also working with the Transportation and Climate Initiative, a consortium of transportation, air and energy agencies in the North East and Mid-Atlantic, to develop a process and guidelines for incorporating electric vehicle rechargers in and near the I-95 corridor.

### **Non-MDOT Initiatives Underway**

#### **Maryland Electric Vehicle Initiative**

In March 2010, MEA launched a new program to promote the use of electric vehicles in Maryland. The Electric Vehicle Infrastructure Program initiative will provide aid in the installation of electric vehicle recharging units and truck stop electrification. The program, run by MEA and the Maryland Clean Cities Coalition, will provide \$1 million during the FY11 in grants to State and local governments as well as nonprofits and private entities.

Several plug-in electric vehicles are expected to be commercially available later this year, including the Chevy Volt and the Nissan Leaf. These vehicles will reduce the amount of gasoline utilized in the State while also reducing carbon emissions and promoting energy independence.

MDOT has been working with other State agencies to expand the availability of electric vehicle recharging systems. An initial 65 public electric charging stations are being installed in the Baltimore region. Almost a third are being installed on MDOT property, particularly at passenger transfer points such as BWI parking garages, train station

parking facilities and near I-95. MDOT installed 2 public recharging stations at MDOT headquarters for public usage.

### **Maryland Transit Administration Support for Howard County Electric Bus Project**

- Replace three diesel buses with electric buses to operate on Howard Transit's Green Route (serving downtown locations including the Columbia Mall, the Village of Wilde Lake, Howard Community College, and Howard County General Hospital)
- Install an inductive charger at Howard County Community College to provide energy to the bus batteries through electromagnetic induction
- Build a transit shelter and an "Energy Information Station" to provide real-time information on the charging process including the recording of emission reductions and cost savings
- This project is fully funded by TIGGER II Discretionary Grant Funds and is ready to proceed so has been added as an amendment to the FY 2011-2014 transportation implementation program.

### **Clean and Efficient Strategies**

MDE is supporting the installation of two "Quick Charge" recharging units in Baltimore City. These chargers allow the recharge of electric vehicles in under an hour as compared to the previous time of six hours. This increase in efficiency could encourage Baltimore City to purchase more electric vehicles for its downtown fleet.

MDE also worked with Johns Hopkins University to install a "Quick Charger" unit at its main campus.

### **Baltimore City Electric Vehicle Infrastructure**

This is a Baltimore Regional Transportation Board Congestion Mitigation and Air Quality Subcommittee recommendation for FY11 funding to install 8 electric vehicle charging units in public garages in Baltimore.

MDOT, MEA and MDE continue to analyze and consider other options to promote electric vehicles such as:

- Plug-in spaces at workplaces, hotels, toll plazas, etc
- Preferential parking for electric and low emitting vehicles

### **Estimated GHG Emission Reductions in 2020**

In order to account for similarities across programs, all emission benefits and costs associated with this program has been aggregated under E.2: Transportation Technologies.

### **Implementation**

The following strategies were identified for further analysis and possible implementation under this program area:

- *Incentives for Low-Carbon Fuels and Infrastructure* – Incentivize the demand for clean low-carbon fuels and the development of infrastructure to provide for increased availability/accessibility of alternative fuels and plug-in locations for electric vehicles (note: this strategy also applies to Transportation-12: Low Emitting Vehicle Initiatives).
- *Marketing and Education Campaigns* – Initiate marketing and education campaigns to operators of on-and off-road vehicles (note: this strategy also applies to Transportation-11: Electric Vehicle Initiatives and Transportation-12: Low Emission Vehicle Initiatives).
- *Technology Improvements for On-highway Vehicles* – Promote and incentivize fuel efficiency technologies for medium and heavy-duty trucks (on-highway vehicles) (note: this strategy also applies to Transportation-11: Electric Vehicle Initiatives and Transportation-12: Low Emission Vehicle Initiatives).

Additionally, there is discussion on creating smart outlets and the required communication between electrical distribution company and the vehicle. This type of technology may provide a solution in the future, but is not currently part of the initial electric vehicle and plug-in hybrid electric vehicle production. In the longer term, the enhanced electricity storage capacity of vehicle to grid systems may provide a significant share of the grid's total electricity load. But in the short run, electric vehicles and plug in hybrid electric vehicles, which only draw from the grid, may place more demand on the grid than it can currently meet. New electricity generation sources might be needed and there might be pressure to build more peak hour plants unless sufficient electricity generation sources are available and deployed in advance of the surge of potential demand from electric vehicles.

The biggest challenge with electric vehicles has been the battery that stores the energy needed to drive the vehicle, with challenges of cost, lifetime, and lifecycle emissions. There has been significant research to improve these variables and it is anticipated that if adequate public policy is implemented, costs may become competitive within four to seven years

The State will aggressively seek funding sources at the State and federal level and legislation to promote and develop the following projects (this list should not be considered exclusive):

- Plug-in and vehicle to grid requirements in zoning for parking lots for stores, offices, hotels/motels, schools, and government buildings
- Seek funding to enable low and moderate income drivers to buy electric vehicles, which are currently expensive to purchase
- Work with MEA and the Comptroller's Office to create tax incentives for purchasers of electric vehicles
- Requirements for photo-voltaic cells in parking lots as a power source for electric vehicles and plug-in hybrid electric vehicles.
- Require reserved parking at State agency and State university parking lots for electric vehicles and plug-in hybrid electric vehicles.

- Promote reserved parking at local and federal government and business facilities for electric vehicles and plug-in hybrid electric vehicles.
- Push for increased funding for electric vehicles and plug-in hybrid electric vehicles and vehicle to grid enhancement projects in Maryland through MEA or the U.S. Department of Energy grants
- Work with the University of Maryland to develop a vehicle to grid pilot program

### **E.3: Low Emitting Vehicle Initiatives**

Lead Agency: MDOT

#### **Program Description**

Initiatives to encourage use of low emitting vehicles are part of efforts by the State to help reduce air emissions, including GHGs, by providing lower emitting alternatives to internal combustion engine vehicles. Along with encouraging the use of low emitting vehicles, such as hybrids, programs such as car-sharing can help to reduce the number of personal cars by allowing rentals at locations like commuter rail stations so that people can travel by transit and then extend their trips by car for errands or recreation. The following are a variety of initiatives to encourage electric vehicle usage.

#### **Howard Transit Para-transit Fleet Replacement Vehicles**

This is a Baltimore Regional Transit Board Congestion Mitigation and Air Quality Subcommittee recommendation for FY11 funding for incremental cost to replace diesel vehicles with 4 hybrid electric sedans and 1 hybrid bus.

#### **Clean and Efficient Strategies**

Through both the use of State and federal funds, MEA has worked with several local governments to introduce new technologies designed to reduce GHG emissions of their in-use fleet as follows:

- Baltimore City - retrofit 108 trash haulers, 23 dump trucks and 49 fire-trucks with diesel oxidation catalysts and closed crankcase ventilation filtration systems; these systems also help reduce particulate matter emissions from both the exhaust systems and from the engine.
- Johns Hopkins University - retrofit its fleet of 10 diesel vehicles with diesel oxidation catalysts and closed crankcase ventilation filtration systems
- Howard County - retrofit 25 of their transit buses with diesel oxidation catalysts, closed crankcase ventilation filtration systems, and International Clean diesel kits. This project will reduce both particulate matter and nitrogen dioxide emissions.
- Anne Arundel County Public Schools - retrofit its fleet of fifty-one diesel-powered school buses with diesel oxidation catalysts and closed crankcase ventilation filtration systems.

MEA is in the process of retrofitting ten fire trucks for the City of Annapolis. These vehicles will be retrofitted with diesel oxidation catalysts and closed crankcase ventilation filtration systems.

## **Estimated GHG Emission Reductions in 2020**

In order to account for similarities across programs, all emission benefits and costs associated with this program has been aggregated under E.2: Transportation Technologies.

## **Implementation**

Projects that contribute to a change in VMT growth and/or improve system efficiency are a subset of the State's complete Consolidated Transportation Program. Current Consolidated Transportation Program projects applicable to transportation technology initiatives include Maryland Transit Administration diesel-hybrid electric bus purchases.

The following strategies were identified for further analysis and possible implementation under this program area:

- *Incentives for Low-GHG Vehicles* – Provide incentives to increase purchases of fuel-efficient or low-GHG vehicles / fleets.
- *Technology Advances for Non-highway Vehicles* – Encourage or incentivize retrofits and/or replacement of old, diesel-powered non-highway engines, such as switchyard locomotives, with new hybrid locomotives.
- *Incentives for Low-Carbon Fuels and Infrastructure* – Incentivize the demand for clean low-carbon fuels and the development of infrastructure to provide for increased availability/accessibility of alternative fuels and plug-in locations for electric vehicles (note: this strategy also applies to Transportation-11: Electric Vehicle Initiatives).

Maryland will continue to analyze many different strategies to promote lower emitting vehicles and seek funding sources at the State and federal level and to purchase low emitting buses and vehicles. Several of the examples listed below would also require legislation to implement. This list should not be considered exclusive:

- Incentivize hybrid vehicle use through tax discounts, dedicated lanes, and reserved parking spaces
- Support Expansion of hybrid vehicle and electric vehicle use in State, federal, and local government fleets
- Promote use of clean vehicles in business and rental car fleets
- Expansion of the Coordinated Highways Action Response Team program in Maryland
- Transit information system upgrades
- Traffic signal priority systems
- Increase smart park technology
- Enhance driver information technology
- Encourage retrofits and repowering of on and off road vehicles including addition of “add-on” emission control strategy.

## **Public Transportation**

## **F.1: Public Transportation Initiatives**

Lead Agency: MDOT

### **Program Description**

For several decades, VMT has been rising faster than the population has been increasing in Maryland and nationwide. Land use development over the past 40 to 50 years has put more people beyond the reach of easy access to transit facilities. The initiative to enhance public transit is part of MDOT's efforts to help make transit more viable for more people thereby reducing mobile emissions, including GHGs.

This program identifies strategies regarding land use planning and policy, pricing disincentives to auto use, and bike and pedestrian access improvements which aim to reduce GHG emissions produced by public transportation services by encouraging the use of public transportation. As such, this program directly supports another State program, specifically Transportation-6: Double Transit Ridership. The following are current and potential measures to encourage transit use in Maryland.

### **Charm City Circulator and Hampden Neighborhood Shuttle**

Three downtown routes, 7 days a week service, free, uses hybrid buses, air quality benefit calculations from this service started in 2009.

The Transit Vehicle Purchases Project will add hybrid-electric buses to the Charm City Circulator and extend service to Fort McHenry National Monument and Historic Shrine.

### **Locally Operated Transit Systems**

The Maryland Transit Administration provides funding to local jurisdictions and rural area transit systems around the State.

### **Smart Card Implementation**

The Maryland Transit Administration is implementing Smart Card Technology and fare collection equipment for the Baltimore Metro. Smart card will allow for quicker and seamless travel between different transit systems. Passengers will be able to pay for travel throughout the State with the swipe of a card, making transit travel more convenient.

### **Transit Oriented Development**

Transit Oriented Development is an important tool to help leverage future growth, public investments, and achieve Smart Growth and sustainable communities. Maryland has great transit oriented development potential, with more than 75 existing rail, light rail, and subway stations, and dozens more proposed in the next 20 years. People living within a half mile of a transit station drive 47 percent less than those living elsewhere and are up to five times more likely to use transit.

Legislation signed by Governor O'Malley in 2008 facilitates the development of transit oriented development in Maryland by authorizing MDOT to use its resources to support "designated" projects. Designated projects are those that are good models of transit oriented development, have strong local support, represent a good return on public investment, demonstrate strong partnerships, and can succeed with a reasonable amount of State assistance but not without State support.

Due to limited State and local resources, not all transit oriented development projects that represent good sustainable development can be "designated" under this program. Instead, projects are prioritized that meet the criteria above and cannot succeed without public sector support. Designated projects could benefit from several potential tools, depending on the needs of the particular project at the particular stage of development. Among the benefits are prioritization for transportation funds and resources, financing assistance, tax credits, prioritization for the location of State offices and support from the State Highway Administration on access needs. As of June 2010, Maryland has designated 14 projects for priority State support.

Transit oriented development is consistent with Governor O'Malley's Smart, Green and Growing initiative that brings together State agencies, local governments, businesses and citizens to: create more livable communities, improve transportation options, reduce the State's carbon footprint, support resource based industry, invest in green technologies, preserve valuable resource lands, and restore the health of the Chesapeake Bay.

### **Maryland Commuter Tax Credit**

As of January 2000, a tax credit has been in effect Statewide that allows employers to claim a 50 percent State tax credit for providing transit benefits to an employee of up to \$52.50 per month, which an employer may provide to an employee without tax consequences under the Federal tax law. The State tax credit has been more attractive to employers as a benefit to offer employees than the Federal law, which is a direct tax credit as opposed to an allowable business expense. This Maryland law encourages increased transit use by low and moderate-income employees. Under provisions of both the 1999 and 2000 Maryland laws, private non-profit organizations may also participate in the program.

Employers claim tax credits for providing transit passes and vouchers, guaranteed ride home, and parking cash-out programs. Similar to the federal benefits, the Maryland Commuter Tax Benefit program does not provide financial assistance to carpoolers. Information is available online and employers are able to register to participate in the program over the internet.

### **Guaranteed Ride Home**

Metropolitan Washington Council of Governments Commuter Connections operates a Guaranteed Ride Home program for the DC metropolitan region. The Guaranteed Ride Home program has recently been expanded to Cecil County, the Baltimore region and Southern Maryland.

**College Pass**

The Maryland Transit Authority manages a reduced transit pass program for Baltimore area college students.

**Ride Share**

The Baltimore region's original rideshare program began in 1974 as a joint effort of Baltimore City, the Regional Planning Council (now the Baltimore Metropolitan Council), and MDOT. Efforts to encourage ridesharing were expanded to cover the entire State in 1978 when the Maryland Ridesharing Office of the Maryland Transit Administration was established. Since it was formed, the Maryland Transit Administration has enhanced and expanded its activities to include both commuters and their employers. One such program provides funding support to local rideshare coordinators in order to strengthen ride matching and rideshare-support services at the jurisdictional level.

**Commuter Connections- Washington DC/Baltimore Region**

Commuter Connections provides complimentary information on a host of commuter programs. The Ridesharing Program facilitates persons interested in carpooling and/or vanpooling to and from work. Over 20,000 commuters rely on Commuter Connections to provide free up-to-the-minute ridesharing information at no cost. Telework, bicycling, and walking information is also available through the Commuter Connections web site. If people carpool, vanpool, use public transportation, or bicycle or walk to work two or more days a week, Commuter Connections will get them home in the event of an emergency as part of the Guaranteed Ride Home program.

**Non-MDOT Initiatives Underway:****Baltimore Collegetown Network**

The Baltimore Collegetown Network operates a free bus service available to students registered at Goucher, Towson, Notre Dame, Loyola, Johns Hopkins, Maryland Institute College of Art, and the University of Maryland Baltimore County. This service is paid for by those institutions.

**Hunt Valley Shuttle**

The Baltimore County Chamber of Commerce and the Hunt Valley Business Community are working to establish a bus shuttle between Hunt Valley and southern York County, PA, including the City of York.

**Kent Street Transit Plaza**

The Kent Street Transit Plaza and Pedestrian Corridor Project will expand bus ridership and safe access to the existing light rail system through design and construction of the Kent Street Plaza and Pedestrian Corridor from the Westport Light Rail Station to Annapolis Road.

**University of Maryland College Park Carpool Program and Shuttle Bus Service**

The University of Maryland College Park's shuttle bus operation has undertaken many steps to improve fuel efficiency and support campus sustainability efforts. The focus has been to reduce the use of diesel fuel and bus engine emissions. All buses in the fleet run on a mixture of bio diesel fuel.

The Smart Park Carpool Program is a service offered by the University of Maryland's Department of Transportation Services to connect commuter students who have similar commuting schedules. Not only do participants in carpools reduce vehicle emissions, but they also save money by benefiting from lower parking permit fees.

The University of Maryland's carpool program includes an internet-based tool that makes it easier for individuals to find others interested in carpooling.

*PlanMaryland*

PlanMaryland, the State's first comprehensive plan for sustainable growth and development, presents an opportunity to address climate change mitigation and adaptation issues in Maryland, in the context of many related quality-of-life, economic, social and environmental goals. The strategies identified for land use and location efficiency, in the 2008 Climate Action Plan, are directly tied to the objectives of PlanMaryland and are overall consistent with Maryland's Smart, Green and Growing policies. MDP is working with MDOT and MDE with a focus on policies and programs implemented by 2020 to reduce dependence on motor vehicle travel (especially single-occupant vehicles). These policies and programs may include incentives and requirements for projects and regional land use patterns that shorten trip length and greatly facilitate the use of alternative transportation mode choices to reach employment, shopping, recreation, education, religious and other destinations. The benefits of PlanMaryland are documented separately from this document through MDP's role. There are VMT related benefits associated with PlanMaryland that will accrue to the transportation sector.

**Estimated GHG Emission Reductions in 2020**

**Figure C-29. Low and High GHG Benefits for Transportation-5**

Initial Reductions	2.00 MMtCO <sub>2</sub> e	MDOT Quantification Appendix D
High Estimate	2.89 MMtCO <sub>2</sub> e	MDOT Quantification Appendix D

**Implementation**

The State has identified additional strategies to address the expected gap in meeting the transit ridership goal defined in the 2008 Climate Action Plan (e.g. a doubling of 2000 transit ridership by 2020). The intent is for these strategies to complement and support funded the Maryland Transit Administration's and the Washington Metropolitan Area Transit Authority plans and programs identified for implementation by 2020 in the 2011-2016 Consolidated Transportation Program and metropolitan planning organization's transportation implementation plans and long-range plans.

- Implement Bicycle and Pedestrian Improvements to Support Transit
- Reduce GHG Emissions from Transit Vehicles
- Bus Priority Improvements
- Plan Transit in Conjunction with Land Use

This initiative is included and funded through the current Maryland Consolidated Transportation Program, metropolitan planning organization's transportation implementation plans and land restoration programs. MDOT is the lead implementing agency. Progress is discussed at metropolitan planning organization meetings and conformity is discussed at interagency consultation groups. MDOT will seek funding sources at the State and federal level and legislation to promote and develop the following projects (this list should not be considered exclusive):

- Expand transit oriented development
- Expanded Transportation Management Associations
- Promote Live Near Your Work
- Increased security at park and ride lots and on transit vehicles
- High Efficiency / Low Rolling Resistance Tires: Evaluate further the use and efficiency of low rolling resistance tires for heavy duty diesel vehicles (includes transit vehicles) where appropriate
- Improved transit access to large and critical employers including hospitals, colleges and universities
- Other entities will look at:
  - Expanding Zipcar service to Baltimore (MARC, AMTRAK, Light Rail), BWI Airport, and Frederick (MARC)
  - Increasing public/private commuter shuttles to transit stops

## **F.2: Intercity Transportation Initiatives**

Lead Agency: MDOT

### **Program Description**

Traffic congestion along the Interstate 95 corridor has been steadily increasing over the past decades. The State is implementing strategies to help reduce mobile emissions, including GHGs, by providing viable alternatives to single occupant vehicle use as well as improvements to the transportation system. These strategies enhance connectivity and reliability of non-automobile intercity passenger modes through infrastructure and technology investments, such as expansion of intercity passenger rail and bus services as well as improved connections between air, rail, intercity bus and regional or local transit systems. The following are some examples of ongoing programs designed to enhance Maryland's commuter and intercity rail systems to give travelers viable alternatives to driving their personal vehicles to work, pleasure or errands.

### **MARC Station Parking Enhancements**

Maryland Area Regional Commuter (MARC) rail services have been enhanced through construction of additional parking at stations throughout the Baltimore region.

A feasibility study is underway for structured parking (garage or parking deck) at the Odenton Station for 2,500 spaces on State-owned property.

Phase I of the Halethorpe MARC Station park-and-ride lot expansion is complete, providing 428 additional parking spaces. The scope of the work included high level platforms, new shelters, and improved accessibility for persons with disabilities, lighting and streetscaping. Phase II, which includes a pedestrian bridge and high level platforms, is in the project initiation stage.

### **National Gateway**

The National Gateway Project is a package of rail infrastructure and intermodal terminal projects that will enhance transportation service options along three major freight rail corridors owned and operated by CSX through the Midwest and along the Atlantic coast. The improvements will allow trains to carry double-stacked containers, increase freight capacity and make the corridor more marketable to major East coast ports and shippers.

### **Refurbishing MARC and other rail vehicles**

In order to insure the reliability, safety and comfort of MARC equipment the rolling stock is periodically overhauled. Twenty-six MARC cars were refurbished between FY05 and FY08.

Between FY05 and FY12, twenty-three locomotives are scheduled to be overhauled and retrofitted to cleaner federally required standards in force at the time of the improvement.

### **Update on Maryland High Speed Rail**

In September 2010, MDOT signed an agreement with the Federal Railroad Administration that obligated \$9.4 million in high-speed stimulus funds to complete environmental and engineering work to replace the BWI Station, which serves Baltimore/Washington International Airport. As of March 2011, MDOT is advancing preliminary work on BWI station improvements.

MDOT is also awaiting a grant agreement with the Federal Railroad Administration to complete engineering and environmental studies for a Baltimore and Potomac tunnel replacement in Baltimore.

### **Estimated GHG Emission Reductions in 2020**

In order to account for similarities across programs, all emission benefits and costs associated with this program has been aggregated under F: Public Transportation.

### **Implementation**

Improving passenger convenience for intermodal connections at airports, rail stations, and major bus terminals have been identified as the primary pre-2020 unfunded intercity

transportation strategies. Primary strategies for intercity passenger transportation in Maryland by 2020 include improving:

- Passenger access, convenience, and information across all modes at BWI Airport
- Travel time, reliability and overall level of service improvements on the MARC Penn Line and Amtrak NorthEast Corridor (consistent with the MARC Growth and Investment Plan and Northeast Corridor Infrastructure Master Plan)

Projects that contribute to a change in VMT growth and/or improve system efficiency are a subset of the State's complete Consolidated Transportation Program. Currently funded and planned transportation system investments 2006 - 2020, which are defined in the Maryland 2009 - 2014 Consolidated Transportation Program and in the metropolitan planning organizations transportation improvement programs, and Long-Range Plans through 2020 include:

- Long range projects associated with the MARC Growth and Investment Plan, such as:
  - Baltimore intercity bus terminal
  - MARC infrastructure and operations improvements
  - Planning and engineering for BWI MARC/Amtrak Station improvements and the Baltimore and Potomac tunnel

The GHG reduction benefit from full implementation of the National Gateway and Northeast Corridor Infrastructure Master Plan are included in the unfunded GHG reduction program assessment.

## **G: Pricing Initiatives**

Lead Agency: MDOT

### **Program Description**

This program addresses transportation pricing and travel demand management incentive programs. It also tests the associated potential GHG emission reduction benefits of alternate funding sources for GHG beneficial programs. Projects are tied to commute alternative and incentive programs including specific projects such as ridesharing (Commuter Connections), guaranteed ride home, transportation demand program management and marketing, outreach and education programs (Clean Air Partners), parking cash-out subsidies, transportation information kiosks, local car-sharing programs, telework partnerships, parking impact fees, and vanpool programs.

The following are a variety of pricing initiatives to reduce GHGs.

### **Electronic Toll Collection**

The Maryland Transportation Authority commenced operation of its electronic toll collection system, MTAG, at the authority's three harbor crossing facilities in 1999. By fall 2001, all toll facilities in the region were equipped with electronic toll collection equipment. As of January 2004, 45 percent of vehicles using the Maryland Transportation Authority facilities used electronic toll tags. The Maryland Transportation Authority is a

member of the E-Z Pass Inter-Agency Group, a coalition of Northeast Toll Authorities. Reciprocity with the E-Z Pass system in was established in 2001, enabling travelers in Maryland, as well as at most toll facilities in New York, New Jersey, Delaware, Pennsylvania, Massachusetts, Virginia, and West Virginia, to pay tolls using one electronic device.

At present high speed toll lanes, such as Fort McHenry Tunnel, are under study.

**Programs Under Consideration**

The State continues to work with metropolitan planning organizations, the Maryland General Assembly, and stakeholders to identify additional pricing initiatives to consider. Several of these efforts are described below.

**High Occupancy Toll Lanes**

High occupancy toll lanes continue to be evaluated in Maryland for reducing peak hour congestion, but they have to be coupled with strategies that reduce their potential negative impacts. Care must be taken to ensure that these lanes do not adversely affect drivers with no transit options, extreme commutes, lower incomes, and jobs with inflexible hours.

**VMT Fees**

Maryland is working with the I-95 corridor coalition to evaluate efforts in other areas to establish GHG emission-based road user fees Statewide to complement or replace motor fuel taxes.

**Congestion Pricing and Managed Lanes**

Maryland continues to work with the metropolitan planning organizations to evaluate local pricing options in urban areas, charges to local motorists to use a roadway, bridge, or tunnel during peak periods, with revenues used to fund transportation improvements and systems operations meeting State goals.

**Parking Impact Fees**

Maryland continues to analyze parking pricing policies that ensure effective use of urban street space. Provision of off-street parking should be regulated and managed with appropriate impact fees, taxes, incentives, and regulations.

**Employer Commute Incentives**

Maryland continues to look for opportunities to strengthen employer commute incentive programs by increasing marketing and financial and/or tax based incentives for employers, schools, and universities to encourage walking, biking, public transportation usage, carpooling, and teleworking.

**Estimated GHG Emission Reductions in 2020**

**Figure C-30. Low and High GHG Benefits for Transportation-9**

Initial Reductions	0.41 MMtCO <sub>2</sub> e	MDOT Quantification
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		Appendix D
Enhanced Reductions	2.30 MMtCO <sub>2</sub> e	MDOT Quantification Appendix D

### **Implementation**

Projects that contribute to a change in VMT growth and/or improve system efficiency are a subset of the State’s complete Consolidated Transportation Program. Currently funded and planned transportation system investments 2006 - 2020, which are defined in the Maryland 2009 - 2014 Consolidated Transportation Program and in the metropolitan planning organizations, transportation improvement programs, and long-range plans through 2020 include implementation of Baltimore regional ride share and guaranteed ride home programs and Metropolitan Washington Council of Government's Commuter Connections program. Additional Consolidated Transportation Program projects related to pricing incentives include Maryland Transportation Authority projects, primarily the Inter-county Connector and I-95 Express Toll Lanes. Also included are State funded commute alternative incentive programs in the Baltimore and Washington regions.

Strategies that amplify GHG emission reductions from other strategies by supporting Smart Growth, transit, and bike and pedestrian investments have also been considered. Detailed definitions of these strategies, outlined in four strategy areas, are as follows:

- *Maryland Motor Fuel Taxes or VMT Fees* – There are two primary options for consideration, both of which would create additional revenue that could be used to fund transportation improvements and systems operations to help meet Maryland GHG reduction goals; they are:
  - (1) Increase the per gallon motor fuel tax consistent with alternatives under consideration by the Blue Ribbon Commission on Maryland Transportation Funding, and
  - (2) Establish a GHG emission-based road user fee (or VMT fee) Statewide by 2020 in to replace or in addition to existing motor fuel taxes.
- *Congestion Pricing and Managed Lanes* – Establish as a local pricing option in urban areas that will charge motorists more to use a roadway, bridge or tunnel during peak periods, with revenues used to fund transportation improvements and systems operations to help meet Maryland GHG reduction goals.
- *Parking Impact Fees and Parking Management* – Establish parking pricing policies that ensure effective use of urban street space. Provision of off-street parking should be regulated and managed with appropriate impact fees, taxes, incentives, and regulations.
- *Employer Commute Incentives* – Strengthen employer commute incentive programs by increasing marketing and financial and/or tax based incentives for employers, schools, and universities to encourage walking, biking, public transportation usage, carpooling, and teleworking.

## **Other Innovative Transportation Strategies & Programs**

## **H.1: Evaluate the GHG Emissions Impacts from Major New Projects and Plans**

Lead Agency: MDOT

### **Program Description**

This proposal focuses on the process of evaluating GHG emissions of all State and local major projects. The goals of this program are to understand the impacts of new, major projects on the Governor's GHG reduction commitment; and to develop guidance for the State and other major project sponsors to use. MDOT identified three potential strategies under this program:

- Actively Participate in Framing National GHG Emissions Evaluation Policy;
- Evaluation of GHG Emissions through the National Environmental Policy Act Process; and
- Evaluation of GHG Emissions of selected projects through Statewide/regional planning at the discretion of the metropolitan planning organization.

A process for addressing GHGs is currently being considered along with other options on a national level. MDOT is of the position that before the State establishes a formal evaluation process for transportation GHGs, Maryland should wait and see what is proposed on a national level.

### **Estimated GHG Emission Reductions in 2020**

The implementation strategies under this program are assumed to contribute to the overall goal of reducing GHG emissions from the transportation sector; however, the GHG emissions impact of implementing this program was not quantified.

### **Implementation**

MDOT will continue to analyze and develop implementation strategies to evaluate the GHG emission impacts of major projects and plans. MDOT is currently working with the American Association of State Highway and Transportation Officials and the Northeast Association of State Transportation Officials on a national level to develop a unified procedure for measuring and determining the effects of projects on GHG emissions. Potential implementation strategies for this program have been identified as follows:

**Actively Participate in Framing National GHG Emissions Evaluation Policy** – Given the recent EPA proposed ruling that carbon emissions endanger Americans' health and well-being, Maryland should actively participate in framing national policy rather than implementing specific, state guidance requiring GHG emissions evaluation of all major projects on both the National Environmental Policy Act and statewide/regional planning level.

**Evaluation of GHG Emissions through the National Environmental Policy Act Process** – The impact of GHGs on major capital projects through the current National Environmental Policy Act decision-making process should be encouraged. GHGs should be considered during the impact assessment phase when conducting alternatives analyses for all major capital projects. Where appropriate, the alternatives analysis should be accompanied by analysis of potential alternatives, such as transit-oriented land use and investment; adding toll lanes and express bus; express toll lanes; a hybrid transit-oriented express toll lane; or a rail and express bus scenario. Where the proposed projects may lead to increased GHG emissions, mitigation measures should be considered. The GHG analysis should be included as part of the Air Quality Technical Report and should allow for the demonstration of GHG benefits as well as impacts through both quantitative and qualitative components with the understanding that appropriate and/or approved emissions models and methodologies may not be available. The GHG analysis would be required:

- If there is an Environmental Impact Statement, Categorical Exclusions will be screened out.
- For any roadway capacity enhancement project which is identified for analysis through interagency consultation.
- For active projects that have yet to receive federal sign-off on draft National Environmental Policy Act documents. It is recommended that any project with approved draft documents would be “grandfathered” through the process.

**Evaluation of GHG Emissions through Statewide/Regional Planning** – The impact of GHGs should be addressed in the Statewide and/or regional planning processes. The process would be similar to the current conformity process for ozone and particulate matter; however, instead of setting a budget, a mechanism for tracking GHG emissions reductions would be established. Regional level analyses (determining the GHG impacts on a larger scale than just the project level) account for control strategies that are in place such as fleet make up, analysis years, VMT increases, etc.

## **H.2: Bike and Pedestrian Initiatives**

Lead Agency: MDOT

### **Program Description**

This initiative is part of the State's efforts to help reduce mobile emissions, including GHGs, by providing viable alternatives to single occupant vehicle use. Building appropriate infrastructure for additional bicycle and pedestrian travel in urban areas provides viable alternatives to traveling by car. Increased use of bicycles and sidewalks can help reduce the number of short trips currently taken in motor vehicles, thereby reducing mobile emissions of air pollution and GHGs. The following are some current and potential measures to help Maryland's bicyclists and pedestrians to travel efficiently and safely to their destinations.

### **Bicycle/Pedestrian Enhancements**

Through MDOT, the Maryland State Highway Administration has worked to engineer, implement, and promote new and improved bicycle and pedestrian facilities. They have also developed the *Maryland State Highway Administration Bicycle and Pedestrian Guidelines* to provide general guidance on design. The State has a policy of considering sidewalks to reinforce pedestrian safety and promote pedestrian access adjacent to roadway projects being constructed or reconstructed. Special efforts are made to facilitate pedestrian travel near schools.

In addition, bicycle safety and travel are being accommodated by construction of wider shoulders and curb lanes to separate motor vehicles from cyclists. In regard to bicycle or pedestrian travel in controlled access roadway corridors, there is almost always a separation between these modes and motor vehicles. Only along roadways where speeds or mix of the travel modes could result in serious accidents are sidewalks and bicycle travel not promoted.

Improvements to existing sidewalks or new sidewalk construction have taken place along many roadways in the Baltimore region. These roads include MD 2, MD 435, MD 26, MD 134, MD 140, MD 7, MD 150, MD 542 and MD 648. Cyclist and pedestrian multi-use travel routes in the Baltimore region include: the Maryland and Pennsylvania Heritage trail extension, Broken Land Parkway Pathway, Centennial Access Trail, Wakefield Community Trail, Broad neck Peninsula Trail, and the South Shore Trail.

### **Maryland Trails Plan**

*Maryland Trails: A Greener Way to Go* is Maryland's coordinated approach to developing a comprehensive and connected statewide, shared-use trail network. This plan focuses on creating a state-wide transportation trails network. The Maryland Trails plan identifies approximately 820 miles of existing transportation trails and 770 miles of priority missing links (160 trail segments) that, when completed will result in a statewide trails network providing travelers a non-motorized option for making trips to and from work, transit, shopping, schools and other destinations.

### **Bike Racks on Buses, MARC, Subway, Light Rail**

In Maryland, public transportation accommodates bicycles to facilitate longer trips. The Maryland Transit Administration allows bicycles to be attached to the front of commuter buses so that cyclists can add to their trip range. Public transportation and bicycles provide more mobility options to everyone, helps improve air quality, and reduces traffic congestion.

In addition, the Maryland Transit Administration allows riders to bring bicycles onto Light Rail, Metro Subway, and, in some cases, MARC trains.

### **Construction of Bike Lanes and Bike Paths**

Additional bicycle paths being considered include, but are not limited to, the Capital Crescent Trail, Patuxent Branch, Rock Creek, B & A, BWI, North Central Rail, and Fair Hill Trails. The State and regional goal is to have many of these trails link to form a bicycling network connecting the metro areas and beyond and the East Coast Greenway.

### **East Coast Greenway**

The East Coast Greenway is the planned backbone of an emerging network of trails along the eastern seaboard from Maine to Florida that could contribute, both actually and symbolically, to priorities such as:

- Increasing transportation options
- Reducing roadway congestion
- Enhancing local economic development
- Connecting people and communities
- Helping to create new and inviting public spaces
- Improving community walking and cycling environments, vital for smart growth initiatives
- Mitigating climate change through zero GHG emission travel

### **Bike Stations**

Bike stations are currently located at major transit modal connector stations such as Camden Yards, Hunt Valley, Shady Grove METRO, and Glen Burnie.

### **Bike Rentals**

Many jurisdictions are promoting bike rentals. The City of Annapolis has a system in place for bike rentals and a promotional website. This encourages locals and tourists to travel around downtown by bike. Bike rentals could be expanded to other areas in Maryland.

### **Bike Racks**

There has been a big push to expand provision of bike racks at transit stations and elsewhere, such as downtown areas. Accordingly, the City of Annapolis is installing bicycle racks outside of downtown businesses.

### **Estimated GHG Emission Reductions in 2020**

In order to account for similarities across programs, all emission benefits and costs associated with this program has been aggregated under F: Public Transportation

### **Implementation**

Bike and pedestrian initiatives include infrastructure design and construction policies; funding, regulatory, and land use strategies; and education and marketing measures. These strategies result in improved bike and pedestrian amenities, resulting in an increase in the number of trips made on foot or bicycle, particularly in urban areas and adjacent to Maryland's trail networks. These initiatives recognize that local governments are responsible for the design and maintenance of approximately 80 percent of roads in Maryland. Land use and location efficiency strategies addressing density, mix of uses, and urban design represents a very strong predictor of bike and pedestrian travel.

Potential implementation strategies are as follows:

- Promote use and regular review/updates to existing manuals and design standards;

- Improve bike/pedestrian access through corridor retrofits and new roadway construction projects (e.g. Complete Streets);
- Update existing land use policy guidance and zoning/development standards to include provisions for bike and pedestrian supportive infrastructure;
- Place bike facilities and supportive infrastructure at strategic locations, including transit stations and government facilities;
- Provide funds for low-cost safety solutions;
- Encourage bicycle travel through education, safety, and marketing programs

Projects that contribute to a change in VMT growth and/or improve system efficiency are a subset of the State's complete Consolidated Transportation Program. Currently funded and planned transportation system investments 2006 - 2020, which are defined in the Maryland 2009 - 2014 Consolidated Transportation Program and in the metropolitan planning organizations transportation improvement programs, and long-range plans through 2020 include:

- Complete Streets implementation
- Projects supporting completion of the Statewide transportation trails network
- Improved bicycle and pedestrian access to transit facilities
- Implementation of a number of local and regional sidewalk, trail, recreation and enhancement programs.
- Maryland State Highway Administration's Sidewalk Program and Community Safety and Enhancement Program

Metropolitan planning organizations and state departments of transportation are required by the Clean Air Act Amendments of 1990 and the Safe, Accountable, Efficient, Flexible, Transportation Efficiency Act to identify Transportation Emissions Reduction Measures that provide criteria pollutant emission-reduction benefits. Applicable measures in this implementation plan include: sidewalk and street rehabilitation, bicycle and pedestrian facilities improvements, acquisition of scenic easements, streetscapes, and functional/safety improvements.

The State will continue to implement and look for areas to expand this ongoing effort. Examples of additional initiatives that may be added or enhanced by others include (this list should not be considered exclusive):

- Advance timetable for multi-use trails from 2020/30 to 2015 for trails such as:
  - Cromwell Valley, Red Line Trail and Southwest Area Park Trail in Baltimore County
  - Little Pipe Creek and Westminster Community Trail in Carroll County
- Expand local bicycle enhancement policies such as:
  - Separate cycling facilities along heavily traveled roads and at intersections
  - Provide extensive bike parking, integration with transit, training and promotional events
  - Use land use policies to foster compact, mixed use developments that generate shorter trips
  - Coordinate implementation of this multi-faceted, self-reinforcing set of policies

- Expand bike share systems

## **Sub-Appendix C-3: Agriculture and Forestry**

### **I: Forestry and Sequestration**

#### **I.1: Managing Forests to Capture Carbon**

Lead Agency: DNR

##### **Program Description**

Healthy and vigorous forests provide both direct benefits to GHG reductions and also serve as the preferred land-use strategy for avoiding emissions and capturing airborne GHGs. The State will promote sustainable forestry management practices in existing Maryland forests on public and private lands to capture carbon. The enhanced productivity resulting from enrolling unmanaged forests into management regimes will yield increased rates of carbon dioxide sequestration in forest biomass, increased amounts of carbon stored in harvested, durable wood products which will result in economic benefits, and increased availability of renewable biomass for energy production.

DNR will work with the General Assembly and various State agencies (MDE, MDA, and the Maryland State Highway Administration), as well as local and county governments, conservation organizations, private landowners, sawmills, arboreal industries and others to implement this program. By 2020, the implementation goal is to improve sustainable forest management on 30,000 acres of private land annually; improve sustainable forest management on 100 percent of State-owned resource lands. Additionally, 50 percent of State-owned forest lands will be third-party certified as sustainably managed. DNR will continue to support the Forestry for the Bay program, which reaches forest owners with management messages and will partner with the Pinchot Institute with support from Center for AgroEcology to develop best management protocols for forest harvests associated with expected biomass markets.<sup>59</sup>

Cooperation between State agencies and landowners is essential in forest management and carbon sequestration. DNR and MDA will work together on controlling invasive, destructive insects and diseases that threaten the health and vigor of forests, and DNR will work with the National Resource Conservation Service State Technical Committee, Forestry Sub-committee to increase landowner assistance for forest improvements. DNR will also continue to explore potential of establishing a carbon credit market aggregation

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<sup>59</sup> See existing biomass guidelines established for North East U.S.  
[http://www.forestguild.org/publications/research/2010/FG\\_Biomass\\_Guidelines\\_NE.pdf](http://www.forestguild.org/publications/research/2010/FG_Biomass_Guidelines_NE.pdf)

service with private entities as well as draft legislation to amend the Woodland Incentive Program to allow use with federal cost-share programs. This will be accomplished through the development and adoption of the Statewide Forest Assessment and Response plan, which is a 5-year strategic planning document enabling access to federal funds, as mandated by the 2008 Farm Bill.

**Estimated GHG Emission Reductions**

**Figure C-31. Low and High GHG Benefits for Ag and Forestry-1**

Initial Reductions	1.80 MMtCO <sub>2</sub> e	MDE Quantification Below
Enhanced Reductions	1.80 MMtCO <sub>2</sub> e	MDE Quantification Below

**Estimate – MDE Quantification**

Forest management practices can provide carbon sequestration in the State. The enhanced productivity resulting from enrolling unmanaged forests into management regimes will yield increased rates of carbon sequestration in forest biomass; increased amounts of carbon stored in harvested, durable wood products; and, increased availability of renewable biomass for energy production. Maryland will promote sustainable forest management practices in existing Maryland forests on public and private lands. By 2020, the implementation goal is to improve sustainable forest management on 30,000 acres of private land annually; improve sustainable forest management on 100 percent of State-owned resource lands; and third-party certify 50 percent of State-owned forest lands as sustainably managed. Using the assumptions above, the total managed forest area is multiplied by an applicable sequestration rate to obtain the yearly CO<sub>2</sub>-equivalent for the practices. The result is 2.70 MMtCO<sub>2</sub>e estimated to be sequestered in 2020. This result is adjusted for overlap resulting in 1.80 MMtCO<sub>2</sub>e.

**B. Detailed Explanation of Methodology**

To obtain a 2020 carbon sequestration amount for the forest management of private land and State owned land, a data table was created to calculate the acres of managed forest land times the applicable rate of carbon sequestration per acre.

Carbon is sequestered, or captured out of the air by living plants and trees. By employing forest management practices a forest can actively capture carbon at a higher rate than if a forest was left alone and dead trees and overgrowth can choke out the living trees. The goal is to improve sustainable forest management on 30,000 acres of private land annually; improve sustainable forest management on 100 percent of State-owned resource lands; and third-party certify 50 percent of State-owned forest lands as sustainably managed to capture the most carbon.

The total 2020 year carbon sequestration or credit is 2.70 MMtCO<sub>2</sub>e; this is calculated by adding the Private Forest Stewardship Impact 2.15 MMtCO<sub>2</sub>e to the State Forest 0.55 MMtCO<sub>2</sub>e. For data and assumptions see the figure below.

Calculations for 2020 involve, the private lands of 30,000 acres multiplied times the carbon rate of 4.43 tonnes CO<sub>2</sub>-equivalent per acre and divided 1,000,000 conversion factor to get 0.13 annual MMtCO<sub>2</sub>e, then added to the previous 20 years of private land improvements sequestration to get 2.15 MMtCO<sub>2</sub>e sequestration credit plus adding the State lands of 62,500 acres multiplied times the carbon rate of 0.98 tonnes CO<sub>2</sub>-equivalent per acre and divided 1,000,000 conversion factor to get 0.06 annual MMtCO<sub>2</sub>e, then added to the previous 20 years of State land improvements sequestration to get 0.55 MMtCO<sub>2</sub>e sequestration credit, for a total of 2.70 MMtCO<sub>2</sub>e sequestration credit.

### C. Calculations

Total MMtCO<sub>2</sub>e = Private + State

The Yearly Private FS Impact MMtCO<sub>2</sub>e = (FS acres \* 4.43 tonnes CO<sub>2</sub>-equivalent per acre / 1,000,000) + previous years credit (up to 20 years prior)

The Yearly State Forest MMtCO<sub>2</sub>e = (State acres \* 0.98 tonnes CO<sub>2</sub>-equivalent per acre per 1,000,000) + previous years credit (up to 20 years prior)

Also, see data figure below.

### D. Data and Data Sources

#### *Explanation of Figure Columns*

[1] Private Forest Service Impact – Private lands data from 2006-2010 is actual acres recorded by DNR, and then assume average of 30,000 acres from 2011 – 2020. Forest Service Impacts include forest management planning, timber stand improvements, habitat work, and area of timber harvest planning.

[2] Carbon Rate Source = 6.9 tonnes CO<sub>2</sub>-equivalent per acre from – 1.5 tonnes CO<sub>2</sub>-equivalent per acre for unmanaged forest vs. 8.4 tonnes CO<sub>2</sub>-equivalent per acre for managed forest, therefore a total of 6.9 tonnes CO<sub>2</sub>-equivalent per acre sequestration rate for forest management. (R. Birdsey, USFS-NRS, March 11, 2011). Predictions for carbon response rate to forest management were based on the Carbon On-Line Estimator model developed jointly by National Council for Air and Stream Improvement, Inc. and the USFS <http://www.ncasi2.org/> . Rate used was 4.43 tonnes CO<sub>2</sub>-equivalent per acre for each acre improved in a year. This is the average between DNR 6.9 tonnes CO<sub>2</sub>-equivalent per acre and 1.96 tonnes CO<sub>2</sub>-equivalent per acre from the Maryland D-GORCAM model report for public forest improvements.

[3] Annual MMtCO<sub>2</sub>e = Private Forest Service Impact acres times carbon rate

[4] Yearly MMtCO<sub>2</sub>e = Annual sequestration plus all annual sequestration from previous 20 years. Assume after 20 years sequestration acres drop out of credit as land management activities rotate and age of trees are less active.

[5] State management and third party certification, assume 62,500 acres per year.

[6] Carbon Rate Source = From the Maryland-GORCAM report, Valuing Timber and Carbon Sequestration in Maryland, April 24, 2007: Page 14 – Expected pounds of carbon sequestration for four forest management scenarios.

Using scenario # 4, un-managed and comparing to scenario #1, most management actions; calculated as follows:

- For Loblolly Pine 2.47 tonnes CO<sub>2</sub>-equivalent per acre vs. 4.46 tonnes CO<sub>2</sub>-equivalent per acre = 1.99 tonnes CO<sub>2</sub>-equivalent per acre
- For Red Maple 1.47 tonnes CO<sub>2</sub>-equivalent per acre vs. 3.40 tonnes CO<sub>2</sub>-equivalent per acre = 1.93 tonnes CO<sub>2</sub>-equivalent per acre
- Average of the two tree types was assumed =1.96 tonnes CO<sub>2</sub>-equivalent per acre

The Rate used was 0.98 tonnes CO<sub>2</sub>-equivalent per acre for each acre improved in a year. Maryland already has an aggressive forest maintenance program so the rate used is 50 percent of the MD-GORMAC report of 1.96 tonnes CO<sub>2</sub>-equivalent per acre.

[7] Annual MMtCO<sub>2</sub>e = State Forest acres times carbon rate

[8] Yearly MMtCO<sub>2</sub>e = Annual sequestration plus all annual sequestration from previous 20 years. Assume after 20 years sequestration acres drop out of credit as land management activities rotate and age of trees are less active.

**Figure C-32. Carbon Sequestration Potential for State and Private Lands**

Year	Private Forest Service Impact Acres[1]	Carbon Rate tons CO <sub>2</sub> -equivalent per acre [2]	Annual MMtCO <sub>2</sub> e [3]	Yearly MMtCO <sub>2</sub> e (Stack credit from previous year) [4]	State Forest dual-certified 500,000 acres [5]	Carbon Rate tons CO <sub>2</sub> -equivalent per acre [6]	Annual MMtCO <sub>2</sub> e [7]	Yearly MMtCO <sub>2</sub> e (Stack credit from previous year) [8]
2006	34,914	4.43	0.15	0.15		0.98	0.00	0.00
2007	29,407	4.43	0.13	0.28		0.98	0.00	0.00
2008	46,218	4.43	0.20	0.49		0.98	0.00	0.00
2009	40,008	4.43	0.18	0.67		0.98	0.00	0.00
2010	33,845	4.43	0.15	0.82		0.98	0.00	0.00
2011	30,000	4.43	0.13	0.95		0.98	0.00	0.00
2012	30,000	4.43	0.13	1.08	62,500	0.98	0.06	0.06
2013	30,000	4.43	0.13	1.22	62,500	0.98	0.06	0.12
2014	30,000	4.43	0.13	1.35	62,500	0.98	0.06	0.18
2015	30,000	4.43	0.13	1.48	62,500	0.98	0.06	0.25
2016	30,000	4.43	0.13	1.61	62,500	0.98	0.06	0.31

2017	30,000	4.43	0.13	1.75	62,500	0.98	0.06	0.37
2018	30,000	4.43	0.13	1.88	62,500	0.98	0.06	0.43
2019	30,000	4.43	0.13	2.01	62,500	0.98	0.06	0.49
<b>2020</b>	<b>30,000</b>	4.43	<b>0.13</b>	<b>2.15</b>	<b>62,500</b>	0.98	<b>0.06</b>	<b>0.55</b>
	484,392		2.15		562,500		0.55	

**TOTAL 2.70 MMtCO<sub>2</sub>e**

#### E. Assumptions

- Baseline is existing forest unmanaged.
- Acreage of forest lost or gained is ignored.
- DNR assumption for private land improvement of 30,000 acres managed annually.
- Private land management enacted through education, incentives and public support.
- Forest Service impact rate – use the average between DNR 6.9 tonnes CO<sub>2</sub>-equivalent per acre and 1.96 tonnes CO<sub>2</sub>-equivalent per acre from Maryland-GORCAM report = 4.43 tonnes CO<sub>2</sub>-equivalent per acre.
- Assume 562,500 acres of State forest management.
- Public land management ensured through policy.
- State forest rate – third party certification process, plus overall State forest maintenance, but Maryland already has an aggressive forest maintenance program so the rate used is 50 percent of the Maryland GORMAC report 1.96 tonnes CO<sub>2</sub>-equivalent per acre.
- Forest management improvements yield a uniform and constant carbon response regardless of geographic location, type, age, pre-treatment growth rate, intensity of activity, post-treatment growth rate, soils, hydrologic regime, and absence of biotic disturbances during the management period (Note: this is not an exhaustive list of factors affecting forest carbon rates).
- Stacking credit of CO<sub>2</sub>-equivalent sequestration from previous years for 20 years prior only.
- US Forest Service – FIDO 2.45 million acres of forest in Maryland.  
Approximately 26 percent State, fed or local owned = 647,170 acres.  
Approximately 74 percent private owned = 1,806,753 acres. Therefore, 484,392 total acres of private land is 27 percent with forest management and 562,500 acres of State land is 87 percent- with forest management and third party certified as sustainably managed.

#### **Implementation**

Since 2006, DNR has implemented 60,000 acres of forest stand improvements; prepared 125,000 acres of new private forest management plans. DNR has successfully retained third-party certification for 200,000 acres of sustainably managed publicly owned forests; over 1,300 private landowners retain 142,000 acres of forest certified by American Tree Farm System.. In 2009, DNR implemented a Carbon Sequestration Pilot project to assess forest planting and management techniques for approximately 174 acres of Maryland

forests. The Woodland Incentive Program statute, Natural Resources Article §5-304, was amended in 2010 and a State-wide Forest Assessment was completed.

The impact of the Emerald Ash Borer (*Agilus planipennis*) is not under control within Maryland forests. Gypsy moth (*Lymantria dispar*) spraying occurs annually. DNR continues to support the Forestry for the Bay program, which reaches forest owners with management messages, and will soon release the best management protocol manual for forest harvest associated with expected biomass markets. The Woodland Incentive Program statute was amended in 2010 and a Statewide Forest Assessment was completed. The potential of establishing a carbon credit aggregation service with private entities, however, continues to be explored. The current productivity of these programs cannot be attained if there is a future reduction in staff and funding.

DNR will promote sustainable forestry management practices in existing Maryland forests on public and private through a suite of efforts, policies and programs, including:

Public Lands/State Forest System:

- Dual Third Party Certification for Forest Sustainability
- Continuous Forest Inventory
- State Forest Annual Workplans

Private Lands:

- Technical Assistance
- Forest Stewardship Plan Implementation
- Financial Assistance
  - State and Federal Cost Sharing
    - Woodland Incentive Program
    - Environmental Quality Incentive Program
    - Conservation Reserve Enhancement Program

## **I.2: Planting Forests in Maryland**

Lead Agency: DNR

### **Program Description**

Increasing forest and tree cover provides additional benefits for mitigation of GHGs in addition to sequestration. This program promotes forest cover and associated carbon stocks by regenerating or establishing healthy, functional forests through afforestation (on lands that have not, in recent history, been forested, including agricultural lands) and reforestation (on lands with little or no present forest cover) where current beneficial practices are not displaced. Successful establishment requires commitment for as long as twenty years. Forest patches should be sufficient in size to function as a community of trees and related species.

This program also promotes the implementation of practices, such as soil preparation, erosion control, supplemental planting, to ensure optimum conditions to support forest

growth. Included in this is identification of areas, including wetlands, in need of physical intervention to return forest habitats to full vigor. Additional areas of concern are linking islands of fragmented forests to restore function, recovering severely disturbed lands, and reversing the effects of continued toxicity on those disturbed lands.

DNR will work with the General Assembly and various State agencies (MDE, MDA, and the Maryland State Highway Administration), as well as local governments, conservation organizations, private landowners, sawmills, arboreal industries and others to implement this program. By 2020, the implementation goal is to achieve afforestation and/or reforestation of 43,030 acres for Years 2011-2020. Planted acreage for Years 2006 – 2010 was intentionally not included here since this planting has already been accomplished. Private landowner subscription to planting programs can be highly variable due to a myriad of factors – mostly economic – and thus the goal focuses on future efforts and to utilize prior gains as a "hedge" against potential disinterest from private landowners.

DNR will continue to support the Forestry for the Bay program, which reaches forest owners with management messages. DNR will also partner with the Pinchot Institute with support from Center for AgroEcology to develop best management protocols for forest harvests associated with anticipated biomass markets. DNR will continue participating in the development of the BayBank and Landsaver programs utilizing the U.S. Forest Service grant awarded to the Pinchot Institute for Conservation, and will draft regulations pursuant to the passage of No-Net-Loss legislation and the Sustainable Forestry Act of 2009. Beginning in 2009, afforestation and buffer planting on public land accomplishments will be reported, and DNR will work with federal and State partners, local governments, and non-profits to create, restore, and enhance forests.

**Estimated GHG Emission Reductions in 2020**

**Figure C-33. Low and High GHG Benefits for Ag and Forestry-6**

Initial Reductions	1.79 MMtCO <sub>2</sub> e	
Enhanced Reductions	1.79 MMtCO <sub>2</sub> e	DNR Quantification

**Estimate – DNR Quantification**

The Maryland Forest Service is working with forest carbon scientists from the U.S. Forest Service-Northern Research Station to refine methodologies, protocols and metrics for properly measuring CO<sub>2</sub>-equivalent attenuation benefits resulting from forestry activities. To provide a generally reliable starting point for understanding the contribution of forests, and as importantly, forest management, the best available carbon accounting tools were employed utilizing metrics historically collected. Using data that has been collected systematically for the past decade or more will help to establish a better understanding of trends in forests, which require very long-term planning horizons when implementing changes in management goals. As forest carbon accounting protocols become more refined, the underlying assumptions will undoubtedly change as well.

**Figure C-34. Potential Carbon Sequestration from Reforestation**

MMtCO <sub>2</sub> e Reforestation						
	Private Lands		Public Lands			
	Loblolly	Mixed Upland	Loblolly	Mixed Upland		
	Pine <sup>60,61,62,63,4</sup>	Hardwood <sup>133,134,136,64</sup>	Pine <sup>133,134,135,136</sup>	Hardwood <sup>133,134,136,65</sup>	Total	
Year	(Acres)	(Acres)	(Acres)	(Acres)	(MMtCO <sub>2</sub> e)	
2006	1,887	210	685	893	0.17	
2007	1,791	199	94	485	0.12	
2008	2,148	239	196	719	0.15	
2009	6,785	754	106	663	0.38	
2010	1,798	200	128	588	0.11	
2011	1,887	210	128	663	0.12	*est.
2012	1,887	210	128	663	0.11	*est.
2013	1,887	210	128	663	0.11	*est.
2014	1,887	210	128	663	0.11	*est.
2015	1,887	210	128	663	0.10	*est.
2016	1,887	210	128	663	0.10	*est.
2017	1,887	210	128	663	0.10	*est.
2018	1,887	210	128	663	0.09	*est.
2019	1,887	210	128	663	0.09	*est.
2020	1,887	210	128	663	0.09	*est.
<b>Total</b>	<b>33,283</b>	<b>3,698</b>	<b>2,489</b>	<b>9,978</b>	<b>1.95</b>	<b>MMtCO<sub>2</sub>e</b>

Figure C-35 Potential Carbon Sequestration from Afforestation

MMtCO <sub>2</sub> e Afforestation			
	Loblolly	Mixed Upland	
	Pine <sup>66,67,68,69</sup>	Hardwood <sup>70,140,142,71</sup>	Total
Year	(tons CO <sub>2</sub> -equivalent)	(tons CO <sub>2</sub> -equivalent)	(tons CO <sub>2</sub> -equivalent)
2006	11,345	45,382	0.06
2007	4,761	19,044	0.02
2008	17,171	68,685	0.09
2009	17,166	68,665	0.09
2010	10,263	41,053	0.05

<sup>60</sup> Includes soil carbon estimate of 34.51 tonnes per acre

<sup>61</sup> Assumes constant rate of reforestation annually, based on median acreage planted years 2006-2010.

<sup>62</sup> From Carbon On Line Estimator report for Maryland

<sup>63</sup> U.S. Dept of Agriculture Forest Service-NRS GTR NE-343

<sup>64</sup> Assumes 90 percent reforestation post-harvest is pine. See Figure above

<sup>65</sup> Assumes 90 percent reforestation post-harvest is pine. See Figure above

<sup>66</sup> Includes soil carbon average of 26.17 tonnes per acre per year.

<sup>67</sup> Assumes constant rate of afforestation annually, as based on median acreage planted years 2006-2010

<sup>68</sup> From Table 4, Carbon On Line Estimator report for Maryland. Based on U.S. Dept of Agriculture Forest Service-NRS GTR NE-343

<sup>69</sup> Assumes 80 percent of all afforestation is mixed hardwood.

<sup>70</sup> Includes soil carbon average of 17.93 tonnes per acre per year.

<sup>71</sup> From Figure above.

2011	9,910	39,641	0.05	*est.
2012	9,557	38,229	0.05	*est.
2013	9,204	36,816	0.05	*est.
2014	8,851	35,404	0.04	*est.
2015	8,498	33,992	0.04	*est.
2016	8,145	32,580	0.04	*est.
2017	7,792	31,168	0.04	*est.
2018	7,439	29,755	0.04	*est.
2019	7,086	28,343	0.04	*est.
2020	6,733	26,931	0.03	*est.
Total	143,922	575,688	0.72	MMtCO <sub>2</sub> e

### **Implementation**

By 2020, the implementation goal for this program is to achieve afforestation and/or reforestation of 43,030 acres for Years 2011-2020. To accomplish this, DNR will work with federal and state partners, local governments, and non-profits to create, restore, and enhance forests. As of June 2011, the Forest Brigade has met its goal of planting one million trees. Since 2006, DNR has achieved 3,894 acres of afforestation and reforested 6,469 acres. The current productivity of this program cannot be attained if there is a future reduction in staff and funding.

DNR will implement this program through a suite of efforts, policies and programs, including:

Public Lands

- State Forest System Annual Workplan Implementation
- Natural Filters

Private Lands:

- Technical Assistance
  - Forest Stewardship Plan Implementation
- Financial Assistance
  - State and Federal Cost Sharing
    - Woodland Incentive Program (WIP –MD Forest Service)
    - Environmental Quality Incentive Program (EQIP – Federal/NRCS)
    - Conservation Reserve Enhancement (CREP – Federal/NRCS)

## **I.3: Creating and Protecting Wetlands and Waterway Borders to Capture Carbon**

Lead Agency: DNR

### **Program Description**

Wetlands and marshlands provide one of the best ways to prevent property damage and maintain healthy environments in coastal areas. To ensure that wetland buffers will be available for Maryland, current wetlands need to be able to move inland as sea level rises. Without inland areas to which these wetlands can migrate, the Chesapeake Bay’s coastal

wetlands could simply be drowned by rising Bay waters. Acquisition of lands adjacent to existing tidal marsh in fee simple or by conservation easements is essential for wetlands to migrate landward as sea level rises.

Wetlands with long periods of inundation or surface saturation during the growing season are especially effective at storing carbon in the form of peat. Salt marsh and forested wetlands tend to release less methane than freshwater marsh. Riparian wetlands can also capture carbon washed downstream in litter, branches, and sediment. Because they accumulate sediment and bury organic matter, floodplain and tidal wetlands are especially effective as carbon sinks. These lands also reduce nutrient, sediment, and other pollution into the Chesapeake Bay and other bodies of water.

DNR will work with the General Assembly and various State agencies (MDE, MDA, and the Maryland State Highway Administration), as well as local governments, conservation organizations, private landowners, sawmills, arboreal industries and others to implement this program. Meetings will be held with local governments to refine local policies toward establishment, expansion and protection of riparian zones and wetlands. DNR will continue to support the Forestry for the Bay program, which reaches forest owners with management messages.

Targets for forested buffers and on the ground wetland restoration, as established under Maryland's Phase II Watershed Implementation Plan (WIP) for the Chesapeake Bay TMDL, include the restoration of 1,142 acres of wetlands on state and public land and planting 645 acres of streamside forest buffers on state and public lands.

DNR and MDE are working together to promote wetland carbon sequestration. Estuarine wetlands are known to be very efficient at sequestering carbon<sup>72</sup>. There are three potential components to this program: the Blackwater National Wildlife Refuge, a Power Plant Research Project study located in Dorchester County, and the Sea Level Affecting Marshes Model.

The Blackwater National Wildlife Refuge contains a large estuarine wetland system that is threatened by subsidence and sea level rise. The Power Plant Research Program entered into a memorandum of understanding with the University of Maryland to study carbon sequestration processes in selected marsh segments in the Blackwater National Wildlife Refuge. Sequestration in a natural marsh and a manmade marsh, which is a restored area of inundated marsh, were compared with a view to understanding how marsh restoration may be used as a climate change mitigation technique through offsetting emissions of carbon dioxide. The aim of this project is to develop a terrestrial carbon sequestration protocol that is generally applicable to estuarine wetlands and tidal

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<sup>72</sup>US Climate Change Science Program, 2007. The First State of the Carbon Cycle Report: The North American Carbon Budget and Implications for the Global Carbon Cycle. A Report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research [King, A.W., L. Dilling, G.P. Zimmerman, D.M. Fairman, R.A. Houghton, G. Marland, A.Z. Rose, and T.J. Wilbanks (eds.)]. National Oceanic and Atmospheric Administration, National Climatic Data Center, Asheville, NC, USA, 242 pp.

marshes and which will lead to projects that produce carbon offsets that can be used to compensate for GHG emissions.

The protection and restoration of wetlands can offer significant opportunities for carbon sequestration. A DNR Power Plant Research Project study<sup>73</sup> of wetlands in Dorchester County demonstrates this potential. Dorchester County was chosen as it contains extensive coastal marshes. Areas for potential restoration were identified in DNR’s Green Infrastructure data set. Satellite derived net primary productivity is used to estimate gross sequestration and net accumulation was estimated based on the current understanding of carbon dynamics in coastal wetlands.

In 2011, DNR completed a study using the Sea Level Affecting Marshes Model to identify areas projected to convert into new wetlands under future sea level rise conditions. Using this modeling the State is able to target lands that may support coastal wetland establishment. These areas are otherwise known as wetland migration areas. The modeling will be used to target wetland restoration and land conservation in areas identified as potential wetland migration areas. Targeting these areas may help maintain coastal wetlands into the future. Future carbon sequestration can be achieved through wetland establishment and restoration activities that enhance these targeting areas for wetland migration. Modeling results are accessible on DNR’s *Coastal Atlas* (<http://www.dnr.state.md.us/ccp/coastalatlantis/index.asp>).

**Estimated GHG Emission Reductions in 2020**

**Figure C-36. Low and High GHG Benefits for Ag and Forestry-4**

Low Estimate	0.43 MMtCO <sub>2</sub> e	DNR Quantification Below
High Estimate	0.43 MMtCO <sub>2</sub> e	DNR Quantification Below

**Estimate – DNR Quantification**

#1: Research to date has shown that restored marshes are effective at sequestering carbon and may initially be more productive than natural, extant, marsh. Important research is ongoing on the fate of the sequestered carbon, particularly the potential for these systems to reemit carbon in the form of methane, itself a potent GHG.

Based on observed sequestration rates, it was estimated (Needelman, 2007) that fully restoring the Blackwater marsh system could sequester as much as 15 percent of carbon dioxide cap set for Maryland in the RGGI program – up to 0.15 MMtCO<sub>2</sub>e (150,000 milligrams carbon dioxide per year.)

There are a number of groups around the country working on similar projects. At the national level, these programs are being coordinated under the leadership of Restore America’s Estuaries. The output of this coordination is to be a protocol for creating GHG offsets through marsh/wetland restoration. The protocol would be managed by the Climate Action Reserve, a group that manages offset projects. Maryland is an active

<sup>73</sup> D. Strebel, “Wetland Restoration Potential for Carbon Sequestration”, report to PPRP (2010)

participant in the protocol development and it is anticipated that protocol demonstration projects will occur in the State.

#2: Estimates of carbon sequestration for the potential wetland restoration projects in Dorchester County are shown in the Figure C-56.

**Figure C-37. Estimated Carbon Sequestration from Dorchester County wetland restoration projects.**

Project Type	Total Area (Hectares)	Sequestration Rate (milligrams carbon per hectare per year)	Estimated Sequestration (MMtCO <sub>2</sub> e per year)
Green Infrastructure to herbaceous wetland	7600	5.9	0.17
Green Infrastructure to forested wetland	7700	4.7	0.13
Agricultural lands to herbaceous wetlands	97000	5.7	0.20

#3: Estimates of the potential for carbon sequestration in future wetlands created by sea level rise has yet to be determined.

**Implementation**

This program is being implemented through a suite of programs and strategies. DNR is planting forested stream buffers and pursuing the creation, protection and restoration of wetlands to promote carbon sequestration through several means, including undertaking on-the-ground wetland restoration projects through its Coastal Wetlands Initiative, the development of a terrestrial carbon sequestration protocol; a DNR Power Plant Research Project wetland study in Dorchester County, and the Sea Level Affecting Marshes Model. Targets for forested buffers and on the ground wetland restoration, as established under Maryland’s Phase II Watershed Implementation Plan (WIP) for the Chesapeake Bay TMDL, include the restoration of 1,142 acres of wetlands on state and public land and planting 645 acres of streamside forest buffers on state and public lands.

There are a number of groups around the country working on similar projects. At the national level, these programs are being coordinated under the leadership of the non-governmental organization, Restore America’s Estuaries. The output of this coordination is to be a protocol for creating GHG offsets through marsh/wetland restoration. The protocol would be managed by the Verified Carbon Standard, (<http://v-c-s.org/>) a non-governmental organization that manages offset projects. Maryland is an active

participant in the protocol development and it is anticipated that protocol demonstration projects will occur in the State.

Currently there are no financial or regulatory drivers to implement this program. DNR continues to evaluate the need for financial or regulatory drivers to implement this program. This program could ultimately be implemented through a suite of strategies including green infrastructure planning, offsets under RGGI or other offset trading mechanisms, tax incentives, fee-in-lieu payments, and acquisition of landward properties to allow migration of coastal wetlands at risk of inundation from sea level rise.

## **I.4: Biomass for Energy Production**

Lead Agency: DNR

### **Program Description**

Maryland is working to promote the use of locally produced woody biomass for generation of thermal energy and electricity. Energy from forest by-products can be used to offset fossil fuel-based energy production and associated GHG emissions. There are many end users that could potentially benefit from such a program, including Maryland's public schools which could enjoy wood heating and cooling; hospitals which could utilize wood as primary heating/cooling source; municipalities which could utilize local fuel markets as key component of their urban tree management programs; and all rural landowners which would have access to a wood fuel market..

Woody biomass is a feedstock that can be used in a number of energy applications. Wood chips, forest thinning remnants, and urban wood waste are all examples of woody biomass that can be used to generate thermal power (heat and cooling), electric power, or liquid fuels. Advanced technology supports the generation of energy through clean, efficient methods that address particulate matter generation as well as GHG emissions.

The Maryland Wood Energy Coalition is composed of representatives of State agencies, university extension, non-profits, and business committed to increasing the adoption of high efficiency, low emission wood energy technologies that meets Maryland air quality standards. The Pinchot Institute for Conservation released a comprehensive analytical study in September 2010 of the distribution of Maryland's diverse woody biomass resources and the opportunity to develop optimal scale projects. Utilizing this report and other sources, the Maryland Wood Energy Coalition determined that the efficient use of woody biomass in Maryland can best be achieved through small to medium-sized commercial and institutional applications for government, schools, and businesses as well as residential thermal applications.

Debates continue within the scientific community on the effects of atmospheric carbon resulting from wood combustion. However, consensus is converging on the concept that wood combustion should be regarded as carbon neutral. The assumption that wood combustion is in fact carbon neutral was bolstered by EPA research that indicates that carbon neutrality is highly probable. If a determination is made that wood combustion is

not a contributory agent towards overall atmospheric carbon, then substituting wood for fossil fuels is clearly a net reduction in carbon emissions.

The following hypothetical example illustrates the potential opportunity for reducing GHG emissions if Maryland would pursue the development of wood energy. The factors utilized in the example are verifiable and taken from published reports documenting the metrics involved.

Thousands of potential sites exist within Maryland, such as schools, hospitals, and college campuses, which would be prime candidates for wood-fired combined-heat-and-power systems. These systems provide the heating and cooling needs for the facilities they serve and utilize excess thermal capacity to generate electricity. Thousands of additional sites exist, such as residential communities, businesses, and institutions, throughout Maryland ideally suited for simple thermal-only systems, which are designed to provide only the heating and cooling needs of the facility.

**Estimated GHG Emission Reductions in 2020**

**Figure C-37. Low and High GHG Benefits for Ag and Forestry-7**

Initial Reductions	0.33 MMtCO <sub>2</sub> e	DNR Quantification Below
Enhanced Reductions	0.33 MMtCO <sub>2</sub> e	DNR Quantification Below

**Estimate – DNR Quantification**

The amalgam of State policies affecting energy development currently presents numerous barriers to the development of potential wood energy systems; therefore, our estimate of carbon reductions must necessarily be 0 MMtCO<sub>2</sub>e. However, presuming adjustments to policy, installing a very modest number of wood energy systems (18 appropriately sized boiler units) Maryland could avoid 4.47 MMtCO<sub>2</sub>e of fossil fuel emissions by 2020.

Debates continue within the scientific community on the effects of atmospheric carbon resulting from wood combustion. However, consensus is converging on the concept that wood combustion should be regarded as carbon neutral. We assume that wood combustion is in fact carbon neutral. Accepting that assumption is bolstered by EPA’s recent announcement that their research indicates neutrality is highly probable. Therefore, if wood combustion is not a contributory agent towards overall atmospheric carbon, then substituting wood for fossil fuels is clearly a net reduction in carbon emissions.

The following hypothetical example illustrates the potential opportunity for reducing GHG emissions if Maryland would pursue the development of wood energy. The factors utilized in the example are verifiable and taken from published reports documenting the metrics involved.

Literally thousands of potential sites exist within Maryland (e. g. schools, hospitals, college campuses, etc.) which would be prime candidates for wood-fired combined-heat-and-power systems. These systems provide the heating and cooling needs for the facilities they serve and utilize excess thermal capacity to generate electricity. Thousands

of additional sites exist (e. g. residential communities, businesses, institutions, etc.) throughout Maryland ideally suited for simple thermal-only systems (i.e., designed to provide only the heating and cooling needs of the facility). For purposes of this exercise, we assumed that Maryland aggressively address the political and financial barriers immediately, and would thus enable the first systems to come “on-line” in 2015. We further assumed the annual installation of 3 systems per year, which would be a very reasonable estimate.

Example scenario:

Wood-fired heating and cooling system of 4 mmbtu (120 horsepower) operating for 7,000 hours per year would require 3,000 tons of wood chips annually.

Conservatively, 1 ton of wood displaces 60 gallons of #2 heating oil. Each 1,000 gallons of oil emits 22,300 pounds of carbon dioxide (11.15 tons).

Therefore, if 3,000 tons of wood chips displace 180,000 gallons of heating oil, there is a displacement of 1,882 tons of CO<sub>2</sub>-equivalent.

Assuming three systems installed per year beginning in 2015, the potential displacement of CO<sub>2</sub>-equivalent is displayed in Figure C-61.

**Figure C-38. Potential CO<sub>2</sub>-equivalent displacement from 3 wood-firing systems.**

	Total No.	Annual	Cumulative	
	Systems	Displacement	Displacement	
Year	Installed	(tonnes carbon dioxide per year)	(tonnes carbon dioxide per year)	
2015	3	5,474	5,474	
2016	6	10,947	21,895	
2017	9	16,421	76,631	
2018	12	21,895	262,735	
2019	15	27,368	897,676	
2020	18	32,842	3,065,236	
	18	114,946	4,329,646	
		<b>4.33</b>	<b>MMtCO<sub>2</sub>e</b>	

### Other Environmental Benefits

Sustainable and renewable forestry practices underscore the benefits of utilizing the available wood supplies for an alternative energy source. Incorporating Maryland’s annually renewed stocks of unutilized wood as fuel presents Maryland with multiple opportunities:

- Improving the energy situation,

- Extracting greater value from urban and rural forests,
- Maintaining a healthy and clean environment, and
- Improving stewardship abilities through enhanced management opportunities.

An estimated 800,000 tons of wood waste is generated annually in Maryland from urban activities such as tree maintenance, land clearing and waste collection centers and is grossly underutilized due to lack of markets.

The fact remains the bulk of Maryland's total energy portfolio (40 percent) is simple thermal demands. This presents a significant market opportunity for wood-based energy. Thermal applications represent a two-fold opportunity to improve forest conditions:

1. Enhanced management capabilities resulting from entirely new market opportunities for urban wood.
2. Clearly demonstrating the enhanced benefits that communities receive from their local forests through proper management. (Ex: reduction in carbon footprint, clean energy, boost to local economy, reduced energy costs, energy independence, improved health of local trees and forests, reduction in waste, and an obvious linkage between local trees and public facilities.)
3. Our strategy is geared toward sizing systems strictly to the available fuel supply – a key concept of sustainability often overlooked within the architectural and engineer designs of energy systems.

## **Implementation**

Key actions to support this program include the development of policies that recognize wood as preferable renewable resources and the largest source of energy consumption in Maryland. DNR will also be working to offer incentives for the utilization of locally produced wood to meet thermal energy needs. The goal of this program is to foster the development of 18 wood energy projects by the 2020.

Numerous barriers exist to advancing wood energy in Maryland: awareness of wood as a viable, and preferred, energy source; State procurement systems that currently do not recognize wood energy systems as option for consideration in HVAC design; lack of emission standards reflecting the state-of-art emission controls, etc.

The favorable economic structure of wood energy systems would likely lead to the development of wood energy market in Maryland, if not for the many barriers currently existing hindering facilities from taking advantage of these systems.

Removing, or at least reducing, these barriers would enable residential and commercial stakeholders to pursue adopting wood energy systems. Leveling the playing field within State government to recognize that wood energy is comparable to wind and solar as a viable and desirable form of renewable energy would be a logical first step. Some other measures that would accelerate the advancement of wood energy include:

- Educating State agency leadership of the numerous benefits of wood energy and catalog solutions for removing barriers to implementation.

- Developing policy recognizing thermal energy (i.e., heating/cooling) as the single largest source of energy consumption in Maryland, and offer incentives for utilizing locally produced wood in meeting these thermal energy needs.
- Modifying State energy policies to specifically recognize wood as a preferred renewable energy source on par with solar, geothermal, and wind.
- Expanding existing financial incentive programs for renewable energy development to also include wood.

Various grants, loans, and cost-share programs offered by MEA, MDE, and other agencies will support implementation. Amendments to a number of existing laws and regulations would offer additional implementation assistance, including:

- Amending Renewable Fuels Standard to accommodate renewable thermal energy.
- Recognizing modern emission control technologies utilized by wood energy systems in air quality permitting regulation.
- Specifically including wood energy systems as option for HVAC design in State buildings.

Additionally, DNR is working with several outside groups to promote and advance implementation, including:

- U.S. Forest Service -- Woody Biomass Utilization Program  
<http://www.fs.fed.us/woodybiomass/index.shtml>
- Fuels for Schools -- a venture between public schools, State foresters, and Regional Foresters of the Forest Service to help public schools retrofit their current fuel or gas heating system to small-scale biomass heating systems.  
<http://www.fuelsforschools.info/>
- Biomass Energy Resource Center -- assists communities, colleges and universities, State and local governments, businesses, utilities, schools, and others in making the most of their local energy resources.  
<http://www.biomasscenter.org/>
- Alliance for Green Heat -- promotes high-efficiency wood combustion as a low-carbon, sustainable, local and affordable heating solution.  
<http://www.forgreenheat.org/>

The current productivity of this program cannot be attained if there is a future reduction in staff and funding.

**Early Action(s):**

- Pinchot Institute for Conservation authored 200-page report investigating opportunities and challenges for wood energy in Maryland, released in September 2010. Key findings include: smaller scale systems are best suited for Maryland; modifying existing energy policies to address thermal energy applications would remove a lot of barriers.
- Ancillary to the published report described above, a suite of science-based guidelines establishing forest biomass harvesting Best Management Practices were developed and released in September 2010 in collaboration with Pinchot Institute for

Conservation, Maryland Center for Agro-Ecology, and the DNR Forest Service. These were vetted extensively with private landowners and forest industry.

## **I.5: Conservation of Ag Land for GHG Benefits**

Lead Agency: MDA

### **Program Description**

Land conservation offers an important mechanism for mitigating and adapting to climate change. Healthy and vigorous forests and grass lands provide both direct benefits to GHG reductions and also serve as the preferred land-use for avoiding emissions and capturing GHGs. Wetlands and marshlands provide one of the best ways to prevent property damage and maintain healthy environments in coastal areas as well as reduce nutrient, sediment, and other pollution into the Chesapeake Bay and other bodies of water. Deforestation and other land-use changes account for as much as 25 percent of global GHG emissions. In addition, the increasing rate of sea level rise and associated erosion threaten Maryland’s shoreline and associated coastal wetlands, removing another natural sink for GHGs. For these reasons and more, MDA is working to safeguard Maryland’s network of natural areas, agricultural lands and coastal lands through MDA's established conservation programs and practices.

MDA will decrease the conversion and development of agricultural lands through the protection of productive farmland and will continue to pursue policies and programs that complement those of DNR and MDP by preserving existing forested, grassed, and wetland areas on agricultural land. Policies and programs promoting the installation of forest and grass buffers and wetlands on agricultural land will also be pursued. MDA and its partners will also collaborate to implement policies, programs, and strategies to sequester additional carbon and avoid or reduce GHG emissions associated with growth and development.

### **Estimated GHG Emission Reductions in 2020**

**Figure C-39. Low and High GHG Benefits for Ag and Forestry-8**

Initial Reductions	0.18 MMtCO <sub>2</sub> e	2008 Climate Action Plan, Appendix D <sup>74</sup> Pg. 31 of 341)
Enhanced Reductions	0.18 MMtCO <sub>2</sub> e	2008 Climate Action Plan, Appendix D <sup>75</sup> Pg. 31 of 341)

<sup>74</sup>

[http://www.mde.state.md.us/programs/Air/ClimateChange/Documents/www.mde.state.md.us/assets/document/Air/ClimateChange/Appendix\\_D\\_Mitigation.pdf](http://www.mde.state.md.us/programs/Air/ClimateChange/Documents/www.mde.state.md.us/assets/document/Air/ClimateChange/Appendix_D_Mitigation.pdf)

<sup>75</sup>

[http://www.mde.state.md.us/programs/Air/ClimateChange/Documents/www.mde.state.md.us/assets/document/Air/ClimateChange/Appendix\\_D\\_Mitigation.pdf](http://www.mde.state.md.us/programs/Air/ClimateChange/Documents/www.mde.state.md.us/assets/document/Air/ClimateChange/Appendix_D_Mitigation.pdf)

### **Other Environmental Benefits**

Many of the policies and programs sponsored by MDA not only preserve farmland and protect natural resources, but also provide other environmental benefits. Besides maintaining prime farmland and woodland as a viable local base of food and fiber production in the State, the preservation of agricultural land curbs the expansion of random urban development, safeguards wildlife habitat, and enhances the ecology of the Chesapeake Bay and its tributaries. Other environmental benefits continue to be under assessment.

The preservation and protection of agricultural land limits the expansion of random urban development, safeguards agricultural and forest lands as both open space and wildlife habitat, and enhances the environmental quality of the Chesapeake Bay and its tributaries by reducing sediment and nutrient loss. By the close of the 2010 fiscal year, the Maryland Agricultural Land Preservation Foundation had helped to permanently protect from development more than 280,000 acres on approximately 2,100 farms in all of Maryland's 23 counties. Although participation levels vary year to year, when fully implemented at its authorized 100,000 acres, the Conservation Reserve Enhancement Program will have planted up to 16,000 acres of marginal land into grass, shrubs, and trees, established 77,000 acres of riparian buffers and 5,000 acres of water and wetland habitat, and restored 2,000 acres for declining, threatened, or endangered species

### **Implementation**

Established in 1977 and one of the first programs of its kind in the country, the Maryland Agricultural Land Preservation Foundation retains prime farmland and woodland as a viable local base of food and fiber production in the State through the purchase of permanent preservation easements. The Maryland Agricultural Land Preservation Foundation has become one of the nation's leaders in agricultural land preservation and is a central element of Maryland's "Smart, Green and Growing" initiative. Combining the Foundation's program with county and other State land preservation programs, Maryland has preserved more agricultural land for future production than any other state in the Union. By the end of the 2010 fiscal year, more than 280,000 acres on approximately 2,100 farms have been permanently protected from development. Farmland has been successfully preserved in all of Maryland's 23 counties. Today, the Maryland Agricultural Land Preservation Foundation manages a public investment of over \$600 million in permanently preserved land.

Since 1997, Maryland has partnered with the U.S. Department of Agriculture in the Conservation Reserve Enhancement Program to offer rental payments for long-term, leased easements, along with other cash incentives, to encourage agricultural producers to protect environmentally sensitive lands and improve wildlife habitat. When fully implemented at its authorized 100,000 acres, the Conservation Reserve Enhancement Program will have planted up to 16,000 acres of marginal land into grass, shrubs, and trees, established 77,000 acres of riparian buffers and 5,000 acres of water and wetland habitat, and restored 2,000 acres for declining, threatened, or endangered species.

Although participation in both programs is voluntary, the financial incentives provided by the purchase of easements through the Maryland Agricultural Land Preservation Foundation guarantees that the land will be permanently preserved for agricultural use and helps to keep Maryland’s agricultural base intact. Similarly, Maryland landowners participating in the Conservation Reserve Enhancement Program can receive five types of payments that incentivize the installation and maintenance of eligible conservation practices.

MDA continues to work independently as well as with its climate change partners at DNR, MDE, and MDP to not only protect existing agricultural lands, forests, and wetlands, but also promote the adoption and installation of beneficial conservations practices. MDA and its partners will collaborate with the General Assembly, federal and local governments, conservation/environmental organizations and foundations, as well as private property owners in implementing policies, programs, and strategies to sequester additional carbon and avoid or reduce GHG emissions associated with development. MDA will protect 962,000 acres of productive farmland from development by 2020

## I.6: Increasing Urban Trees to Capture Carbon

Lead Agency: DNR

### Program Description

DNR is currently working to maintain and improve the health and longevity of trees in urban areas and increase the urban tree canopy cover throughout Maryland. Trees in urban areas help absorb GHG emissions from power production, vehicles and the operation and maintenance of the built environment. Urban trees shield buildings from cold winds and lower ambient summertime temperatures, reducing heating and cooling costs and the demand for energy production. Reduced heat slows the formation of ground level ozone as well as the evaporation of fuel from motor vehicles.

Figure C-40. Urban Tree Assessments

County (total census designated places)	Assessment status	Assessment Date Completed	Current Urban Tree Canopy %	Goal Set	Urban Tree Canopy Goal	Achieve by date
<b>Allegany (total 8 places)</b>				N		
-- Cumberland	Complete	10/1/2008	48%	TBD		
<b>Anne Arundel (total 32 places)</b>	Complete	2/19/2010	58%	TBD		
-- Annapolis	Complete	6/1/2006	41%	Y	50%	2036
<b>Baltimore (total 30 places)</b>	Complete	4/1/2009	49%	TBD		
Baltimore City	Complete	1/1/2006	20%	Y	46%	2036
<b>Dorchester (total 11 places)</b>				N		
-- Vienna	None	n/a		Y	TBD	
-- Cambridge	None	n/a		Y	TBD	
<b>Frederick (total 22 places)</b>				N		

-- Frederick County Board of Education	Complete		12%	Y	20%	2038
-- Brunswick	Complete		38%	Y	48%	
-- City of Frederick	Complete	10/1/2009	14%	Y	40%	2035
-- Lake Linganore Watershed	Underway					
<b>Howard (total 5 places)</b>	Complete	12/1/2009	50%	TBD		
<b>Kent (total 5 places)</b>				N		
-- Rock Hall	Underway					
-- Millington	Underway					
-- Chestertown	Complete	4/1/2009	25%	Y	40%	2020
-- Betterton	Underway			TBD		
<b>Montgomery (total 48 places)</b>	Complete			TBD	TBD	
-- Rockville	Complete	5/1/2009	44%	N		
-- Takoma Park	Complete	12/3/2010	59%			
<b>Prince George's (total 27 places)</b>	Complete		44%	TBD	TBD	
-- Bowie	Complete	3/1/2009	46%	N		
-- Edmonston	Complete	3/1/2009	32%	N		
-- Greenbelt	Complete	2/1/2009	62%	Y	Hold at 62%	
-- Hyattsville	Complete	8/1/2008	41%	TBD		
-- Forest Heights	Complete	6/22/2010	34%	TBD		
<b>Washington (total 25 places)</b>				N		
-- Williamsport	Complete		TBD	TBD		

The Urban Tree Canopy Initiative is a component of the Maryland Commission on Climate Change, as well as is a goal of the Chesapeake Executive Council Riparian Forest Buffer Directive No. 03-01. The Urban Tree Canopy Initiative continues to be an overarching program for the Maryland Forest Service Urban & Community Forestry program.

The original concept was to target incorporated municipalities for participation in the Urban Tree Canopy Initiative. The thirty-seven municipalities, which are participating in the Urban Tree Canopy Initiative, include Annapolis, Baltimore, Bowie, Cumberland, Edmonston, Greenbelt, Hyattsville, and Rockville as well as Baltimore County's 29 communities. All of these communities have received tree canopy assessments performed by the University of Vermont and funded by the Chesapeake Bay Trust's Urban Greening Initiative grant program and DNR's Maryland Forest Service. Of these communities, three have developed goals: Annapolis 50 percent, City of Baltimore 40 percent and Frederick County Board of Education 20 percent. The remaining communities have experienced difficulty in developing and adopting goals. However, some communities (such as Greenbelt with 62 percent canopy coverage) are moving ahead with planting plans to maintain their tree cover. Others continue evaluating how to proceed.

In 2010, the Maryland Forest Service changed the direction of the Urban Tree Canopy Initiative. Instead of targeting individual communities, the emphasis has been redirected toward counties -particularly counties with significant urban areas. With this re-focus, those highly urban communities can benefit. These communities are census designated

communities and typically have no staff or budget for such an initiative. Assessments have been completed for Anne Arundel (thirty-one communities) and Howard (five communities). Urban Tree Canopy assessments were completed in FY11 by the University of Vermont for Montgomery (forty-seven communities) and Prince George’s (twenty-two communities) Counties’, and the town of Williamsport. With this change in direction, the goal of the Chesapeake Executive Council Riparian Forest Buffer Directive No. 03-01 can be accomplished. The directive requires the following: “Establish urban tree canopy goals for 50 percent (74 communities) of the area developed primarily before stormwater management regulations (pre-1984) by 2020”.

One method to increase urban tree canopy coverage is the Marylanders Plant Trees program. In the summer of 2008, the Maryland Forest Service was tasked with developing a citizen component of the Urban Tree Canopy Initiative. This new program would assist citizens with planting trees in their neighborhoods and ultimately increase the canopy coverage of the State.

On Arbor Day 2009, Governor O’Malley launched the Marylanders Plant Trees Initiative <http://www.trees.maryland.gov/> to encourage Marylanders to plant 50,000 trees by the end of 2010 with a grand total of 600,000 trees by 2020 to promote a more sustainable future for generations to come. This program is part of the Smart, Green & Growing Statewide initiative. Similar to Baltimore County’s “Growing Home” campaign, Marylanders Plant Trees Initiative utilizes a coupon to entice citizens to plant trees. The \$25 coupon can be used to purchase a native tree with a net value of \$50. A website was developed to provide technical assistance on tree planting such as right tree-right place and other tree planting tips. The website also contains the list of acceptable native trees for coupon use, a list of participating nurseries and lastly a page in which citizens can report the number and location of their tree plantings. This information is automatically tallied into a registry dial on the website and the Maryland BayStat website. In this manner the citizens can track the Initiative’s progress on a weekly basis. The most interesting aspect of the website is the Tree Benefits Calculator designed by Davey with funding from the U.S. Forest Service. The Benefits Calculator was updated to allow multiple trees to be inputted and will allow the State to obtain Statewide benefits based on the trees registered. Since 2008, 82,700 trees have been planted and registered.

The Urban Tree Canopy Initiative targets Maryland counties, particularly counties with significant urban areas. Through this program, DNR is currently working to establish urban canopy goals for 50% (74 communities) of the area developed primarily before 1984. By 2020, the overall goal is to plant 12,500,000 trees through the FCA Marylanders Plant Trees and Tree-Mendous and 5-103 planting programs. For measurement purposes, trees include 450 container grown seedlings per acre.

**Estimated GHG Emission Reductions in 2020**

**Figure C-41. Low and High GHG Benefits for Ag and Forestry-3**

Initial Reductions	0.02 MMtCO <sub>2</sub> e	DNR Quantification Below
Enhanced Reductions	0.02 MMtCO <sub>2</sub> e	DNR Quantification Below

Estimate – DNR Quantification

**Figure C-42. Urban Forest Carbon Calculation**

	<b>Forest Conservation Act and NRA 5-103(h) Tree Planting</b>	<b>TreeMendous Maryland &amp; Marylanders Plant Trees Programs</b>	
Year	Number of Trees Planted	Number of Trees Planted	MMtCO <sub>2</sub> e
2006	929,110	8,178	0.0004
2007	1,094,310	6,057	0.0010
2008	812,420	2,160	0.0013
2009	512,440	39,020	0.0016
2010	837,070	11,643	0.0027
2011	837,070	11,643	0.0040
2012	837,070	11,643	0.0050
2013	837,070	11,643	0.0058
2014	837,070	11,643	0.0069
2015	837,070	11,643	0.0111
2016	837,070	11,643	0.0158
2017	837,070	11,643	0.0195
2018	837,070	11,643	0.0223
2019	837,070	11,643	0.0262
2020*	837,070	11,643	0.0339
	<b>12,556,050</b>	<b>317,058</b>	<b>0.16 MMtCO<sub>2</sub>e</b>

**Note:** 2020 estimates reflect values for trees planted in 2020 (if grown to 2021), so trees planted in 2019 will collect 0.0262 MMtCO<sub>2</sub>e in 2020.

The original Urban Tree Policy (Policy AFW-2) from the 2008 Climate Action Plan was designed to increase urban tree canopy from 28 percent to 38 percent by 2020, enhancing green infrastructure, and improving urban wood recovery. The urban tree canopy policy reduces GHG emissions directly from new carbon sequestration resulting from the new trees and indirectly from the reduction in electricity used for cooling due to the shade and local climate effects of the trees. The GHG reductions are listed in Figure C-52.

**Figure C-43: GHG Emission Reductions Resulting from 2008 Climate Action Plan Policy AFW-2.**

<b>Emissions Category</b>	<b>GHG Reductions (MMtCO<sub>2</sub>e)</b>		
	<b>2012</b>	<b>2015</b>	<b>2020</b>
Cumulative Carbon Sequestration by Planted Trees	0.016	0.0398	0.16
Annual Carbon Sequestration by Planted Trees	0.00399	0.00691	0.0261

Reduced Electricity Demand for Cooling and Heating	<i>De minimis</i>
--	-------------------

### Detailed Explanation of Methodology

The MD Forest Service estimated carbon sequestration using software developed by the U.S. Forest Service. The iTree program was released in 2006 and is peer-reviewed by urban forestry experts and continues to be expanded and improved upon. The program is used to report on urban forests and the services they provide, from the individual tree scale to an entire State.

An analysis tool of the iTree program, iTree-Eco, was developed to use air pollution and meteorological data and whole inventories of trees or random samples to quantify ecosystem services provided by urban trees. It is an adaptation of the Urban Forest Effects model which was co-developed by the U.S. Forest Service Northern Research Station, the U.S. Department of Agriculture State and Private Forestry's Urban and Community Forestry Program and Northeastern Area, the Davey Tree Expert Company, and State University of New York College of Environmental Science and Forestry. This tool was utilized to develop parameters for individual tree species commonly planted by contractors in Maryland to estimate the amount of carbon that could potentially be captured in the next 10 years.

iTree-Eco depends on field data to develop estimates of the ecosystem services produced by urban trees. In the case of a whole inventory, specific details of each tree are collected by field crews; details such as crown shape, crown die-back, bole diameter, etc. Thus a fairly accurate assumption can be made about how ecosystem services are produced in a city or other area for trees of varying size and health.

### Calculations

The following Steps describe the quantification approach summarized above:

#### Step 1: Identify a Representative Sample of Maryland Trees:

To create an estimate of the potential for planted trees to sequester carbon between 2006 and 2020, parameters were developed for six tree species commonly used for planting.

These species, Eastern White Pine (*Pinus strobes*), Northern Red Oak (*Quercus rubra*), Pin Oak (*Quercus palustris*), American Sycamore (*Platanus occidentalis*), Dogwood (*Cornus spp.*), and Sweetgum (*Liquidamber styraciflua*), were assumed to be planted at a rate of 25 percent White Pine for the total tree species planted in a year and 15 percent of the total for the other tree species.

#### Step 2: Determine Carbon Sequestration Per Calendar Year:

The calculations for the total goal were started in 2006 with 929,110 trees planted. This reflects the number of trees planted for Forest Conservation Act mitigation, Reforestation Law [NRA 5-103{h}] plantings, and from the Marylander’s Plant Trees program. They assumed that trees were two year, bare root stock from local nurseries of approximately 0.5 inches in diameter, the industry standard, and was the default for subsequent years’ newly planted trees. Following years were estimated using assumptions about the trees’ size and health. For example, a tree planted in 2006 used the same carbon sequestration estimate until 2011, at which point the rate changed to reflect trees growth, assuming the trees grew nominally with an 80 percent survival rate. The parameters were entered into iTree-Eco, which provided a pound/year estimate of the carbon sequestered by each tree.

To determine how much carbon could potentially be captured by trees planted by 2020, carbon uptake estimates were produced for each tree type at 5 year increments; 2006, 2011, 2016, and 2021. The parameters for each year were estimates of how the average tree of one of the selected species would look in each of those years (see figure below). Five year increments were used because growth conditions vary widely across the State and from site to site. Soil conditions, rainfall amounts, competition from other plants, damage from insects, deer, voles, etc. and other stresses can inhibit growth in any planting. So, it was felt that 5 year increments would require fewer model runs and still provides an accurate estimate of what carbon could be sequestered by the trees planted during the 15 year time period using current levels of funding and staffing.

Once estimates were acquired for the carbon each tree could capture at five year increments from iTree-Eco, estimates of carbon captured for every year between 2006 and 2020 were computed. A simple spreadsheet combined the carbon rates for each tree, which were multiplied by the number of actual trees planted (2006 to 2010) or assumed to be planted (2010 to 2020). This provided a yearly estimate of carbon captured for all trees planted and for each cohort (for example all the trees planted in 2006). So, as the trees were “grown” in the spreadsheet, and reached 5 years of age, the rate of carbon sequestration changed, and every five years until the cohort reached 2021. Thus, the 2006 cohort had 15 years of growth and the 2020 cohort had 1 year of growth. The output can be seen in the figure below. Future years used the average number of trees planted between 2006 and 2010, or 837,070 trees.

Step 3: Determine Annual Number of Trees to be Planted

**Figure C-44. Carbon Benefits from Planted Trees**

	<b>Forest Conservation Act and NRA 5-103(h) Tree Planting</b>	<b>TreeMendous Maryland &amp; Marylanders Plant Trees Programs</b>		
Planted Year	Number of Trees Planted	Number of Trees Planted	MMtCO <sub>2</sub> e/Year	
2006	929,110	8,178	0.0004	
2007	1,094,310	6,057	0.0010	
2008	812,420	2,160	0.0013	

2009	512,440	39,020	0.0016	
2010	837,070	11,643	0.0027	
2011	837,070	11,643	0.0040	* est
2012	837,070	11,643	0.0050	*
2013	837,070	11,643	0.0058	*
2014	837,070	11,643	0.0069	*
2015	837,070	11,643	0.0111	*
2016	837,070	11,643	0.0158	*
2017	837,070	11,643	0.0195	*
2018	837,070	11,643	0.0223	*
2019	837,070	11,643	0.0262	*
2020	837,070	11,643	0.0339	*
	<b>12,556,050</b>	<b>317,058</b>	<b>0.16</b>	

Step 4: Determine Total GHG Reductions from Sequestration:

Figure C-45. Forest Conservation Act and NRA 5-103(h) Trees Planting Carbon Calculations; Tree-Mendous and Marylanders Planting Trees Tree Planting Carbon Calculations.

FCA and NRA 5-103(h) Tree Planting Carbon Calculations																	Convert to	TOTAL	TOTAL	
Year	Trees Planted																TOTAL lbs. C	Metric Tonne	MTCO <sub>2e</sub>	MMTCO <sub>2e</sub>
	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021				
2006	981,610	264,642	264,642	264,642	264,642	712,649	712,649	712,649	712,649	712,649	2,580,064	2,580,064	2,580,064	2,580,064	2,580,064	4,865,644	22,387,776	10,155	37,212	0.037
2007		1,136,310	306,349	306,349	306,349	306,349	824,961	824,961	824,961	824,961	824,961	2,986,677	2,986,677	2,986,677	2,986,677	2,986,677	20,283,588	9,200	33,715	0.034
2008			827,953	223,216	223,216	223,216	223,216	601,094	601,094	601,094	601,094	601,094	2,176,192	2,176,192	2,176,192	2,176,192	12,603,101	5,717	20,948	0.021
2009				533,895	143,938	143,938	143,938	143,938	387,608	387,608	387,608	387,608	387,608	1,403,290	1,403,290	1,403,290	6,723,660	3,050	11,176	0.011
2010					837,070	234,536	234,536	234,536	234,536	631,578	631,578	631,578	631,578	631,578	2,286,556	2,286,556	8,669,146	3,932	14,410	0.014
2011						837,070	234,536	234,536	234,536	234,536	631,578	631,578	631,578	631,578	631,578	2,286,556	6,382,590	2,895	10,609	0.011
2012							837,070	234,536	234,536	234,536	234,536	631,578	631,578	631,578	631,578	631,578	4,096,035	1,858	6,808	0.007
2013								837,070	234,536	234,536	234,536	234,536	631,578	631,578	631,578	631,578	3,464,457	1,571	5,759	0.006
2014									837,070	234,536	234,536	234,536	234,536	631,578	631,578	631,578	2,832,879	1,285	4,709	0.005
2015										837,070	234,536	234,536	234,536	234,536	631,578	631,578	2,201,301	998	3,659	0.004
2016											837,070	234,536	234,536	234,536	631,578	631,578	1,569,723	712	2,609	0.003
2017												837,070	234,536	234,536	234,536	234,536	938,145	426	1,559	0.002
2018													837,070	234,536	234,536	234,536	703,609	319	1,170	0.001
2019														837,070	234,536	234,536	469,073	213	780	0.001
2020															837,070	234,536	234,536	106	390	0.000
2021	Total lbs. Carbon/yr	264,642	570,991	794,207	938,145	1,620,689	2,373,837	2,986,251	3,464,457	4,096,035	6,595,028	9,388,322	11,594,997	13,242,257	15,528,813	20,100,949	93,559,620		155,512	

Tree Mendous and Marylanders Plant Trees Tree Planting Carbon Calculations																	Convert to	TOTAL	TOTAL	
Year	Trees Planted																TOTAL lbs. C	Metric Tonne	MTCO <sub>2e</sub>	MMTCO <sub>2e</sub>
	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021				
2006	8,178	2,205	2,205	2,205	2,205	5,937	5,937	5,937	5,937	5,937	21,495	21,495	21,495	21,495	21,495	40,537	186,517	85	310	0.00031
2007		6,057	1,633	1,633	1,633	1,633	4,397	4,397	4,397	4,397	15,920	15,920	15,920	15,920	15,920	15,920	108,120	49	180	0.00018
2008			2,160	582	582	582	1,568	1,568	1,568	1,568	5,677	5,677	5,677	5,677	5,677	5,677	32,880	15	55	0.00005
2009				39,020	10,520	10,520	10,520	10,520	28,329	28,329	28,329	28,329	28,329	102,560	102,560	102,560	491,402	223	817	0.00082
2010					11,643	3,139	3,139	3,139	3,139	8,453	8,453	8,453	8,453	8,453	30,602	30,602	116,025	53	193	0.00019
2011						12,538	3,380	3,380	3,380	3,380	9,103	9,103	9,103	9,103	9,103	32,955	91,989	42	153	0.00015
2012							11,643	3,139	3,139	3,139	3,139	3,139	3,139	3,139	3,139	8,453	54,820	25	91	0.00009
2013								11,643	3,139	3,139	3,139	3,139	3,139	3,139	3,139	8,453	46,367	21	77	0.00008
2014									11,643	3,139	3,139	3,139	3,139	3,139	3,139	8,453	37,914	17	63	0.00006
2015										11,643	3,139	3,139	3,139	3,139	3,139	8,453	29,461	13	49	0.00005
2016											11,643	3,139	3,139	3,139	3,139	8,453	21,009	10	35	0.00003
2017												11,643	3,139	3,139	3,139	3,139	12,556	6	21	0.00002
2018													11,643	3,139	3,139	3,139	9,417	4	16	0.00002
2019														11,643	3,139	3,139	6,278	3	10	0.00001
2020															11,643	3,139	3,139	1	5	0.00001
2021	Total Carbon/yr	2,205	3,838	4,420	14,940	21,811	27,956	32,081	53,028	61,481	85,900	105,876	118,438	201,122	231,725	283,072	1,247,893		2,074.2	
	Metric Tonnes C/y	1	2	2	7	10	13	15	24	28	39	48	54	91	105	128		566		
	MMTCO <sub>2e</sub> /yr	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0001	0.0001	0.0001	0.0002	0.0002	0.0003	0.0004	0.0005				0.002

## **Implementation**

DNR is working with the General Assembly and various State agencies (MDE, MDA, and the Maryland State Highway Administration), as well as local governments, conservation organizations, private landowners, arboreal industries and others to implement this program. DNR will be working overtime with local communities to secure funding for conducting urban tree canopy assessments and encourage the adoption and implementation of urban tree canopy goals by local communities will continue.

Additionally, DNR will provide outreach and education on the significance of trees and their role in the built environment and control methods for invasive species as well as develop incentives for diverting wood from waste-stream to value-stream. And finally, from an adaptation perspective, DNR is working to encourage policies requiring tree canopy around at risk populations such as schools (green schools program), nursing homes, shelters and public buildings. The current productivity of this program cannot be attained if there is a future reduction in staff and funding.

To date, seventy-nine communities have received urban tree canopy assessments, seventy-five communities are awaiting completion of their urban tree canopy assessments, and eight communities have established goals. The Marylanders Plant Trees program's tree registry states that 182,000 trees have been planted and registered as of August 2012. DNR has received a grant from the U.S. Forest Service which has enabled the Chesapeake Bay Trust to award funding to help communities in Maryland implement "greening" plans that increase forest canopy, reduce stormwater runoff, improve air quality, and enhance the quality of life in urban areas.

The Maryland DNR Forest Service assists local jurisdictions through the implementation of the below statutes and regulations and also via requests for assistance from the locals. Tree planting assistance for local governments and citizens is also provided through the TreeMendous Maryland and Marylanders Plant Trees programs.

Funding to implement the urban canopy implementation plan's tree plantings can be obtained from the local jurisdiction's Forest Conservation ordinance fee-in-lieu fund.

## **J.1: Creating Ecosystem Markets to Encourage GHG Emissions Reductions**

Lead Agency: DNR

### **Program Description**

Increased attention to the benefits and cost efficiencies that ecosystem markets could provide has spurred DNR to evaluate the potential its programs and policies may have for

fostering market development, as DNR is the lead regulatory or administrative agency for several ecosystem markets that provide carbon sequestration benefits. Maryland's Forest Conservation Act and Critical Area Act require mitigation for natural resource impacts generated through land development, and mitigation banking is an option to address these mitigation requirements. DNR works with landowners to conduct forest management, reforestation and afforestation projects. Although not developed at the State level, species habitat banking may be another market arena that has future potential for DNR's involvement. Beyond these programmatic linkages, DNR also owns and manages lands and purchases easements from willing landowners. These lands can potentially provide a supply of ecosystem market credits.

In fall 2010, DNR convened the Ecosystem Services Working Group, which consisted of representatives from State agencies, the private sector, and a non-profit organization. The Working Group assessed existing programs to determine which practices and programs could play a role in promoting private sector involvement in developing ecosystem markets. Ecosystem services programs, policies, and current or potential markets assessed by the Ecosystem Services Working Group include wetlands, streams and waterways, forests, critical areas, species and habitats, nutrients, carbon and biomass.

The Ecosystem Services Workgroup released its final report in October 2011 with recommendations identified for expanding the role of ecosystem markets in Maryland. As the next step in this process, Governor O'Malley has directed his Chesapeake Bay cabinet agencies to work together to review the recommendations and propose an action plan and timeline for expanding ecosystem markets in Maryland.

If it is ultimately determined that certain markets should be fostered and that this would advance our natural resource goals, mitigation benefits could begin to be calculated. Benefits would fall into two categories: 1) Avoidance / minimization benefits and 2) Net environmental enhancements. Avoidance / minimization benefits would be achieved when the costs to replace ecosystem services become a disincentive to a development project. Net environmental enhancements would be those benefits achieved when replacement ratios exceed 1:1 or if economic efficiencies derived through the market place allow more restoration and conservation projects to be conducted at lower costs.

The following is a list of ecosystem services program, policies, and current or potential markets that were analyzed and assessed by the Ecosystem Services Working Group.

#### *Wetlands*

Once receiving authorization to permanently impact a wetland, an applicant can propose mitigation, purchase credit from an approved wetland mitigation bank, or payment in the MDE In-Lieu Fee Program. If an approved wetland mitigation bank is within an approved service area and has available credits, the applicant must purchase credit from this bank rather than paying into the In-Lieu Fee Program. MDE's Wetland & Waterways Program is well established as the lead authority at the State level. Interjurisdictional cooperation, however, is paramount to the Program's successful

implementation and pursuing banking opportunities, specifically with how it relates to the U.S. Army Corps of Engineers based in Baltimore.

### *Streams and Waterways*

Stream and waterway markets and mitigation activities require great cooperation at all levels of government, especially between Maryland and the U.S. Army Corps of Engineers. This process, coupled with the process of creating stream mitigation banks, fosters high transaction costs and market uncertainty, thereby reducing market options. A major challenge is that there is no developed, accepted protocol for assessing and characterizing impacted streams. Therefore, there is no empirical or objective method of calculating the ecological impacts that need to be mitigated.

### *Forests*

Maryland's Forest Conservation Act requires that a certain amount of forests be retained or replanted in response to land use changes of one acre or greater. This is not intended as a no-net-loss program; rather, it seeks to reduce the rate of forest loss resulting from development. The preferred order of mitigation is onsite retention or planting; offsite retention or planting; retention and creation banks; and, lastly, fee-in-lieu payments. Administration of the Forest Conservation Act programs occurs at the local government level with very little inter-jurisdictional consistency on mitigation rules, creating a barrier for markets implemented at the watershed or State level. Further, almost all counties collect fee-in-lieu payments, but it is unknown exactly how funds are expended. While the Forest Conservation Act has been very successful in slowing the rate of forest loss, there continues to be great concern over losing any forest at all because of the critical ecosystem services they provide. In 2009, Governor O'Malley appointed a Sustainable Forestry Council to develop a definition and implementation plan for a No Net Loss policy recommendation for Maryland forests. Current fee-in-lieu pricing is well below the actual costs of developing banks, and the low fees may potentially block out the market for Forest Conservation Act banks.

### *Critical Areas*

Maryland's Critical Area Program for the Chesapeake and Atlantic Coastal Bays was established in 1984 by the Critical Area Protection Act. The law identifies the Critical Area as all tidal waters and wetlands and all land within 1,000 feet of these resources. A basic premise of this program is that land use and development in the Critical Area, because of the physical proximity of this land to Maryland's ecologically sensitive aquatic resources, must be carefully managed, and in some areas, limited by certain density and use restrictions. Generally, impacts to resources located within the Critical Area must also be mitigated within the Critical Area. Successful implementation of this program requires a high level of intergovernmental cooperation since local governments implement these Statewide laws and regulations.

Specific to ecosystem markets, four market opportunities within the Critical Area Program have been identified: Forest Clearing; Forest Interior Dependent Species

Habitat; Forest Buffer Impacts; and, Stormwater Pollutant Removal. However, mitigation banks are underdeveloped thus far in Maryland.

### *Species and Habitats*

Habitat banks, or conservation banks, are parcels of land that are conserved and managed to protect specified federal and State rare, threatened, and endangered species and their critical habitat. The banks are used to offset development impacts occurring elsewhere to the same resources and must be approved by the U.S. Fish and Wildlife Service and DNR. Currently, Maryland has no formal bank program for federal and State listed endangered species. Development of a new program may require additional administrative budget and staff, or partnership with a non-profit organization, such as the Bay Bank, to help facilitate. At this time, a few conservation banks are in early stages of development, including Tiger Beetle habitat (U.S. Fish and Wildlife Service, DNR) and Brook trout habitat (The Bay Bank). The potential benefits of a market approach for certain appropriate species and habitats need to be explored.

### *Nutrients*

Maryland's Nutrient Trading Program is a public, voluntary marketplace for the buying and selling of nutrient credits. The program, administered by MDA, establishes economic incentives for the use of existing and/or additional agricultural practices and structures to offset new or increased nutrient loads and maintain reductions from all sources within a watershed. The requirements and procedures for point-to-nonpoint agricultural trading, which were issued in April 2008, provide the mechanism for generating credits from agricultural sources and describe how credits will be exchanged between buyers and sellers. The program is operational and accessible, however, no transactions have occurred, and large-scale trading is not expected until new statewide growth offset policies are finalized. More information about the nutrient trading program can be found in this plan under Ag and Forestry-10: Nutrient Trading for GHG Benefits.

### *Carbon: RGGI and Maryland CO<sub>2</sub> Budget Trading Program Offsets*

Started in 2009, the Maryland CO<sub>2</sub> Budget Trading Program is the regulatory subtitle for Maryland's participation in RGGI. The RGGI Model Rule, from which Maryland adopted its regulations, contains a voluntary carbon offsets chapter that outlines a process for submitting and approving voluntary offsets projects that eventually generate CO<sub>2</sub> offset allowances. CO<sub>2</sub> offset allowances are traded through a public access website called the CO<sub>2</sub> Allowance Tracking System located on RGGI's website. At this point, the regulations for the offsets program under the Maryland CO<sub>2</sub> Budget Trading Program restrict most Maryland-based offsets projects.

### *Carbon: Greenhouse Gas Emissions Reduction Act of 2009 - Offsets and Early Reductions*

GGRA requires the 2012 Plan to provide for the use of offsets and early voluntary action credits to achieve compliance with the GHG reduction goal. Based on GGRA, offset credits would be generated by alternative compliance mechanisms executed within the State, including carbon sequestration projects. The legislation also contains language for

providing 'credit' to GHG sources for voluntarily reducing GHG emissions in advance of implementing GGRA.

*Carbon: Greenhouse Gas Emissions Reduction Act of 2009 - Nutrient Trading with Carbon Co-Benefits*

One GGRA program under development to assist in achieving the GHG reduction goal is Nutrient Trading with Carbon Co-benefits. Since many of the agronomic, land use, and structural practices promoted by the Maryland Nutrient Trading Program administered by MDA also store carbon and lower other GHG emissions, the existing nutrient marketplace provides a platform for the addition or “stacking” of a voluntary carbon component.

A public and private stakeholder advisory process, started in November 2009, has begun assessing mitigation activities, determining a menu of eligible practices, and developing draft policies and guidelines that could be used to implement a complementary carbon trading program.

*Biomass*

Markets for woody biomass may contribute to the sustainable management and conservation of Maryland’s forests by expanding the range of forest management opportunities available to landowners and resource managers. The State will promote the use of locally produced woody biomass for generation of thermal energy and electricity. Energy from forest by-products would offset fossil fuel-based energy production and associated GHG emissions.

Maryland has up to 3,000 opportunities to produce both usable heat and electricity in the most fuel-efficient manner available, and biomass may be an ideal fuel for a number of combined heat and power facilities. State agency leadership will be briefed on the numerous benefits of wood energy and catalog solutions for removing barriers to developing this technology. Furthermore, State agency leadership should begin developing policy that recognizes thermal energy (i.e., heating/cooling) as the largest source of energy consumption in Maryland. Additionally, incentives to utilize locally produced wood should be offered to meet thermal energy needs. State energy policies should be modified to specifically recognize wood as a preferred renewable energy source on par with solar, geothermal, and wind. Financial incentive programs should be established that encourage wood energy development.

**Estimated GHG Emission Reductions in 2020**

With the exception of the GHG reduction benefits for nutrient trading, under Maryland’s Nutrient Trading Program, potential reductions from ecosystem markets cannot be quantified until an active set of markets has been established and protocols to assess GHG benefits have been developed. In order to account for similarities across programs, all emission benefits and costs associated with the Nutrient Trading program are discussed and aggregated under J.2: Nutrient Trading for GHG Benefits.

## **Implementation**

The formation of the Ecosystem Services Workgroup originated from the 2010 Green Jobs and Industry Task Force Recommendations prepared for Governor O'Malley, under the leadership of DBED. The Green Jobs and Industry Task Force was convened to determine how Maryland can promote green, environmentally-friendly jobs and work toward a more sustainable economy. Formed in fall 2010, the Ecosystem Services Workgroup is an interagency and private sector group that was charged to evaluate the potential of existing and future ecosystem service markets in Maryland to advance conservation and restoration goals, including the State's GHG reduction goal, generate new jobs and improve the efficiency of government spending. Workgroup tasks addressed the following five elements:

1. Identify & compile Maryland's ecosystem markets and trading programs
2. Review other states' ecosystem markets & policies
3. Assess current status in term of market impacts
4. Address ecosystem services valuation
5. Develop policy recommendations to foster and take advantage of market opportunities

The Ecosystem Services Workgroup produced an interim report in December 2010 that evaluates the status of potential or existing forest, nutrient, wetland, species habitat, carbon, stream and Critical Area resource markets in the Maryland. The report also highlights success stories of ecosystem service markets in other jurisdictions, provides observation by workgroup members and provides a list of recommended future actions to Executive Branch on the next steps that should be taken to foster and take advantage of market opportunities. This report constitutes a workplan for the continuance of the Ecosystem Services Workgroup, in preparation for the final report released in October 2011. Governor O'Malley has directed his Bay cabinet agencies to work together to review the recommendations and propose an action plan and timeline for expanding ecosystem markets in Maryland.

This program is still under development. If determined to be feasible, the program will be implemented through new legislation, as needed and adoption of new regulations or amendment of existing regulations by the appropriate State agencies, including DNR, MDE and MDA.

## **J.2: Nutrient Trading for GHG Benefits**

Lead Agency: MDA

### **Program Description**

Since many of the agronomic, land use, and structural practices promoted by the Maryland Nutrient Trading Program administered by MDA also store carbon and lower other GHG emissions, the existing nutrient marketplace provides a platform for the

addition or “stacking” of a voluntary carbon component. A public and private stakeholder advisory group started in November 2009 to assess mitigation activities, determine a menu of eligible practices and develop the policies and guidelines to implement a complementary carbon trading program. Just like the nutrient market upon which it will be based, carbon trading offers entities under regulatory requirements a potentially more cost-effective means to meet their obligations while providing farmers and landowners the opportunity to receive compensation for implementing and maintaining conservation practices.

MDA will add carbon credits and enhanced nutrient credits to the Maryland Nutrient Trading Program. Carbon and enhanced nutrient credits would be “stacked” onto existing nutrient credits as tradable commodities, thereby increasing the potential value of the total credit package and taking an incremental step in creating a comprehensive environmental marketplace. Encouraging trades between nonpoint sources, such as agricultural operations, and point sources, such as wastewater treatment plants, industrial facilities, and highway contract and development projects, would create new possibilities for GHG reductions while also improving water quality, reducing fertilizer runoff and soil erosion, restoring wetlands and wildlife habitat, providing supplemental income for farmers and foresters, and promoting Smart Growth goals by preserving agricultural and forested lands.

**Estimated GHG Emission Reductions in 2020**

**Figure C-46. Low and High GHG Benefits for Ag and Forestry-10**

Initial Reductions	0.09 MMtCO <sub>2</sub> e	MDE Quantification Below
Enhanced Reductions	0.57 MMtCO <sub>2</sub> e	MDE Quantification Below

**Low and High Estimates – MDE Quantification**

The Center for Integrative Environmental Research together with the World Resources Institute developed a dynamic systems model of agriculture in Maryland to calculate carbon sequestration and marketable supply resulting from various nutrient trading activities through 2030. The December 2010 "Multiple Ecosystem Markets in Maryland, Quantifying the Carbon Benefits Associated with Nutrient Trading" report quantifications form the basis for an estimated carbon credit calculation of 0.822 MMtCO<sub>2</sub>e of sequestration. Using the report (page 19), the adjusted carbon is calculated by reducing the total carbon high estimate from the Center for Integrative Environmental Research Report number by 20 percent. The result is 0.8224 MMtCO<sub>2</sub>e in 2020. MDE estimated an additional 0.21 MMtCO<sub>2</sub>e of GHG emission reductions through more efficient use of fertilizer and reduced runoff and volatilization.

Based on analysis and calculations, the total annual estimated benefits of the nutrient trading program for GHG emission reductions is 1.03 MMtCO<sub>2</sub>e emissions in 2020 for the high estimate model.

*Assumptions*

- Nutrient Management Plans – State law. Assumed 80 percent of land was associated with a plan; added 20 percent additional in increments.
- Conservation tillage – Low till methods have a small cost, assumed 2 percent property per year in cropland management.
- Cover crops – plant land that would sit open in off planting season; reduce runoff and sediment assumed 7 percent participation per year.
- Forest and Grass riparian buffer – 35 foot buffer, applied at 3 percent for forest and 1 percent grass.
- Wetland restoration (also called Critical Area Market) – redevelopment, increase 3 percent a year.
- Could include Species and Habitat Markets, Habitat banks, or conservation banks, are parcels of land that are conserved and managed to protect specified federal and State rare, threatened, and endangered species and their critical habitat.

### **Implementation**

Maryland's Nutrient Trading Program is a public, voluntary marketplace for the buying and selling of nutrient credits. The program, administered by MDA, establishes economic incentives for the use of existing and/or additional agricultural practices and structures to offset new or increased nutrient loads and maintain reductions from all sources within a watershed. The requirements and procedures for point-to-nonpoint agricultural trading were issued in April 2008, provide the mechanism for generating credits from agricultural sources, and describe how credits will be exchanged between buyers and sellers. The program was developed with input from the private sector. The program is operational and accessible, however, no transactions have occurred and large-scale trading is not expected in the near term because of the large Phase I Watershed Implementation Plan growth allocations for wastewater treatment plans.

The Maryland Nutrient Trading Program developed by MDA already maintains the embedded capacity to stack carbon and sediment on the Maryland nutrient trading platform, which is based on the World Resources Institute's NutrientNet suite of tools and incorporates both the Chesapeake Bay Program models and the enhanced capabilities of the national Nutrient Tracking Tool developed by U.S. Department of Agriculture's Natural Resources Conservation Service. Through a federal grant awarded to the World Resources Institute in 2010, MDA joined with agencies from four other Bay states in the development, testing, and rollout of an interstate trading model, as well as a farm profit calculator to help landowners, producers, and service providers conduct cost benefit analysis of trading participation.

MDA received a Natural Resources Conservation Service's State Conservation Innovation Grant to use the online nutrient calculation tool to assess and inventory voluntary agricultural conservation practices to determine compliance with the Chesapeake Bay watershed's total maximum daily load limits for nitrogen and phosphorous. This inventory has served as a resource for a 2010 MDE study conducted by the University of Maryland's Center for Integrative Environmental Research investigating both the carbon sequestration potential associated with nutrient trading and marketable supply expectations under differing regulatory and pricing structures.

MDA will continue to train State soil conservation staff and other interested third parties in the use of the Nutrient Trading Program’s online assessment tool, marketplace, and registry and continue to hold public meetings across the State to provide an overview of both point and nonpoint source policies, the salient features of the Nutrient Trading Program, and future carbon stacking opportunities. Work with DNR, MDE, and other public and private stakeholders will continue to develop menus, policies, and guidelines for use in the complementary program of carbon reduction that can be added to the nutrient trading platform. By 2020, MDA aims to achieve participation by 10 percent of farms and landowners in providing nutrient and carbon credits to an active environmental market in Maryland and establish commonalities among Bay State trading programs and create a shared platform to facilitate interstate trades. The Maryland program offers a template that can be used as a model for basin-wide trading programs in other parts of the country.

## **Sub-Appendix C-5: Buildings Programs**

### **K: Building and Trade Codes**

Lead Agency: DHCD

#### **Program Description**

Given the long lifetime of most buildings, amending State and/or local building codes to include minimum energy efficiency requirements and periodically updating energy efficiency codes provides long-term GHG savings. DHCD is in charge of adopting the Statewide building code known as the Maryland Building Performance Standards.<sup>76</sup> DHCD’s Maryland Codes Administration adopts the Maryland Building Performance Standards through the regulation process, which includes a public informational hearing and a public comments period. Prior to starting the regulation process, the Maryland Codes Administration also seeks preliminary input from local building code officials.

As required by Statute, Maryland’s core building code is based on two International Code Council publications – the International Business Code and the International Residential Code. Both sets of codes are incorporated by reference into the Maryland Building Performance Standards regulations and form the critical foundation for the Statewide standards. The Maryland Codes Administration also incorporates the International Energy Conservation Code into other codes recommended by the State Fire Marshall and the Department of Labor Licensing and Regulation.

The Maryland Building Performance Standards is updated by regulation every three years following the three-year cycle of the International Code Council for publishing new editions of the International Residential Code and the International Business Code.

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<sup>76</sup> Annotated Code of Maryland, Public Safety, Title §12–503 Maryland Building Performance Standards.

Except for energy conservation standards, DHCD may not adopt provisions that are more stringent than what is contained in either international code.

The Maryland Building Performance Standards Statute requires local jurisdictions with building code authority to adopt the standards; however, local jurisdictions may amend the standards to suit local conditions (e.g., coastal communities may require stricter standards related to storm surge, wind, tides, etc.). Except for energy conservation standards, local jurisdictions may also adopt amendments that lessen certain requirements of the Maryland Building Performance Standards. DHCD does not have authority over the final form of the standard that is implemented by the local jurisdictions since local jurisdictions may make amendments and oversee compliance and enforcement activities within their respective jurisdictions. In addition, DHCD does not have authority over related local development activities such as planning, zoning, environmental permitting, etc. Therefore, the successful adoption and implementation of building codes depends on strong partnerships between the State and local jurisdictions with code authorities.

**Estimated GHG Emission Reductions in 2020**

**Figure C-47. Low and High GHG Benefits for Buildings-2**

Initial Reductions	3.15 MMtCO <sub>2</sub> e	
Enhanced Reductions	3.15 MMtCO <sub>2</sub> e	

**Implementation**

The Maryland Building Performance Standards adopted most recently (January 1, 2010) includes the 2009 International Energy Conservation Code, which is the latest energy code published by the International Code Council. Local jurisdictions were required to adopt the 2010 standard within six months (July 1, 2010).

One of the ways DHCD continually helps to reduce energy consumption in new or renovated buildings is through the timely adoption of the latest Statewide building codes, by incorporating the most recently published energy code into the Maryland Building Performance Standards. The most recently adopted standard has been estimated to achieve 15 percent energy efficiency improvements over the prior 2006 energy code. The next energy code will be released in 2012 and that code is expected to achieve an additional 15 percent in energy efficiency improvements over the 2009 codes.

DHCD will continue to provide training on the newest version of the Maryland Building Performance Standards to local jurisdictions, architects, engineers, green building professionals, and other stakeholders. DHCD will also continue to improve, assess, and adopt the latest building codes following the International Code Council three-year cycle of development; participate in the process to improve and develop building codes on a national level, including participation in annual conferences and code development hearings, as funding permits; and identify opportunities to improve and expand much-needed training on building codes, especially those that will continue to be developed relating to energy efficiency and other green building standards.

In 2011, approximately sixty local jurisdictions will adopt the current Maryland Building Performance Standards; this will be the first time that common standards will exist Statewide. DHCD will track local jurisdictions to ensure that updated information is available on the Maryland Codes Administration Web site.

As noted above, the most recent Maryland Building Performance Standards were adopted in January 2010 which includes 2009 International Energy Conservation Code that established 15 percent energy efficiency improvements over 2006 International Energy Conservation Code standards. In July 2010, the Maryland Building Performance Standards were adopted by local jurisdictions. Timely adoption of 2012 international codes into the 2013 Maryland Building Performance Standards will provide an additional 15 percent energy efficiency improvement over the 2009 International Energy Conservation Code.

More recently, in the 2010 General Assembly, Maryland passed House Bill 972 (Chapter 369) – Building Codes – International Green Construction Code. Also adopted in the 2010 session was House Bill 630 (Chapter 135) – Building Standards – High-Performance Homes.

## **Sub-Appendix C-5: Zero Waste**

### **L: Zero Waste**

Lead Agency: MDE

#### **Program Description**

In Maryland, waste diversion is defined as the amount of waste recycled and the amount of waste diverted from entering the waste stream through source reduction activities. Waste diversion saves energy, reduces GHGs and other pollutants generated in the manufacturing process and at landfills, saves natural resources, and reduces the amount of waste disposed at solid waste acceptance facilities (*e.g.*, incinerators, landfills, etc.). MDE promotes and encourages waste diversion across Maryland. The promotion and encouragement of waste diversion is accomplished by partnering with Maryland's jurisdictions and the public and private sectors to develop markets for recyclable materials and by working with other State agencies to increase the volume of materials that are diverted from landfills.

In 2012, MDE created a Zero Waste Action Plan. Zero waste is a concept that calls for nearly complete elimination of waste sent to landfills or incinerators for disposal. Instead, the great majority of waste is reused, recycled, composted, or prevented through source reduction. The Zero Waste Action Plan recognizes that in the short term, production of energy from waste through waste-to-energy (WTE) technologies will provide greenhouse gas reductions as the State transitions toward zero waste. The Action

Plan covers the years 2013 through 2030 and establishes the following recycling and waste diversion rate goals:

	<b>2020</b>	<b>2030</b>
<b>Waste Diversion Goal</b>	65%	80%
<b>Recycling Goal</b>	60%	75%

MDE strives to reduce the amount of waste generated (equal to the amount of waste disposed plus the amount of waste recycled) per person through source reduction programs designed to reduce the amount of waste entering the waste stream. MDE’s waste generation goal is to maintain a maximum 1.26 tons per person per year waste generation by increasing the source reduction credit rate achieved from 3.55 percent in 2006 to 4.19 percent in 2015 and 5.00 percent in 2020.

MDE also strives to reduce the amount of waste disposed in Maryland through programs that expand recycling and enhance the re-use of products. MDE’s main waste disposal goal is to reduce the amount of waste disposed by 10.66 percent by 2015 and 28.88 percent by 2020. In accordance with the zero waste goals established above, MDE will also work to increase the recycling rate achieved from 41.16 percent in 2006 to 48.11 percent in 2015 and 60.00 percent in 2020.

The Action Plan sets forth specific policies to achieve these goals, including actions aimed at increasing recycling of key wastes such as packaging (including beverage containers) and food scraps. It seeks to target all sources of waste, including commercial, institutional, multifamily, and residential generators as well as State government. Finally, it emphasizes product stewardship and extended producer responsibility, which are policies that place the environmental and economic costs of products throughout their life-cycle on the producers of those products. The Plan provides estimated timeframes for each action. Most of the actions identified in the Plan are projected to take effect by 2020. Many of the items in the Zero Waste Action Plan will require enabling legislation or new MDE regulations. MDE does not currently have the authority to require additional recycling or waste reduction activities by local or State governments or the business sector.

Composting of food scraps will be one of MDE’s major focuses in increasing waste diversion through 2020. Food scraps and yard trimmings comprise an estimated 27.28% of the waste stream (US EPA 2010). In 2010, Maryland recycled 68.51% of yard trimmings but only 4.78% of food scraps. Capturing additional organics, especially food scraps, would provide a significant portion of the additional recycling needed to meet zero waste goals. To illustrate, the following table lists a few scenarios under which the State could meet its zero waste goal of 60% recycling in 2020 with increased composting:

*Scenarios for Meeting 2020 Zero Waste Goals with Composting*

	No Increase in Composting	Small Increase in Composting	Medium Increase in Composting	Large Increase in Composting
Recycling Rate, Food	4.78% (2010 rate)	50%	68.51%	90%

Recycling Rate, Yard Trim	68.51% (2010 rate)	90%	90%	90%
<b>Recycling Rate Needed for All Other Waste</b>	<b>67.15%</b>	<b>54.89%</b>	<b>51.44%</b>	<b>47.44%</b>

### Estimated Greenhouse Gas (GHG) Emission Reductions

**Figure C-48. Low and High GHG Benefits for Recycling-1**

Low Estimate	2.80 MMtCO <sub>2</sub> e	MDE Quantification Below
High Estimate	4.80 MMtCO <sub>2</sub> e	MDE Quantification Below

#### **Low and High Estimates – MDE Quantification**

Reductions in GHG emissions are calculated using the EPA Waste Reduction Model, also known as the WARM model. This model calculates the benefits of recycling and source reduction (waste diversion) end-of-life waste management practices (vs. landfilling and incineration) and is based on a life-cycle approach (*i.e.*, from production of a product → use of a product → disposal/recycling of a product → production of a product) of a product. The low 2.0 MMtCO<sub>2</sub>e estimate is the result of Maryland maintaining a 7.45 pounds per person per day waste generation rate and an average recycling rate equal to the 2006 – 2008 recycling rate through 2020. The high 2.32 estimate raises the recycling rate to 55 percent. Without additional enabling legislation, MDE does not have the authority to require additional waste diversion activities over what the Counties are currently performing.

#### **Other Environmental Benefits**

The EPA Waste Reduction Model has produced the following energy scenarios over the life-cycle (*i.e.*, from production of a glass bottle → use of a glass bottle → disposal/recycling of glass bottle → production of a new glass bottle) of common recyclable materials when comparing alternative solid waste management methods vs. the landfilling of a product. (Figure C-74).

**Figure C-49. Per Ton Energy Use (British Thermal Unit (BTU)<sup>^</sup>)**

Material	BTU (million) – Landfilled	BTU (million) – Source Reduced	BTU (million) – Recycled	BTU (million) – Combusted
Aluminum Cans	0 **	(126.75) **	(206.95) **	0.12 **
PET Plastic Bottles	0 **	(71.28) **	(53.36) **	(10.57) **
Newspaper	0 **	(36.87) **	(16.91) **	(8.59) **
Glass	0 **	(7.46) **	(2.66) **	0.02 **

<sup>^</sup> BTU = 1 British Thermal Unit is a unit of power that is equal to the amount of energy needed to heat 1 pound of water 1° F. It is also used to describe the heat value (energy content) of fuels.

- \*\* Values vs. the landfilling of the material. Assigns BTU (million) – Landfilled a value of 0. A negative value (*i.e.*, a value in parentheses) indicates a reduction in energy consumption, while a positive value indicates an increase in energy consumption compared to the landfilling of a material.

In all cases where either recycling or source reduction is used instead of landfilling, there were savings in the amount of energy used. Only when combusting a material instead of landfilling were there increases in the amount of energy used.

Other savings from the recycling of materials are related to conserving natural resources and preserving landfill space. Consider the following:

- According to the Gale Book of Averages and Conservatree.com, recycling 1 ton of paper saves an average of 7,000 gallons (26 liters) of water; 3.3 cubic yards (2.5 cubic meters) of landfill space; and 24 40 foot tall and 6 – 8 inch diameter trees.
- According to Reynolds Metal Company, recycling aluminum saves 4 pounds of bauxite ore for every pound of aluminum recycled
- RRR Technologies reports that natural resources saved by glass recycling are as follows: 1,330 pounds of sand, 433 pounds of soda ash, 433 pounds of limestone, and 151 pounds of feldspar. EPA reports that 1 ton of glass made from 50 percent recycled material saves 250 pounds of mining waste.
- RRR Technologies also reports that in 1987, the U.S. used almost one billion barrels of petroleum just to manufacture plastics. That is enough to meet U.S. demand for imported oil for five months.
- In 2009, 82,020,000 tons of municipal solid waste was recycled or composted in the U.S. According to the EPA Measuring Recycling: A Guide for State and Local Governments, the average municipal solid waste landfill capacity is 1,000 pounds (0.5 tons) per cubic yard. This calculates to a savings of 164,040,000 (*i.e.*,  $82,020,000 \div 0.5$ ) cubic yards of landfill space saved by recycling and composting in 2009.

### **Implementation**

- Pursuant to 2012 House Bill 929, State government is required to reduce by recycling the amount of the solid waste stream generated for disposal by at least 30 percent or to an amount that is determined practical and economically feasible, but in no case may the amount to be recycled be less than 15 percent. State Agency Recycling Plans require the recycling of glass, paper, metal, and plastic at State-owned or State-operated buildings.

- A State Agency Recycling Plan was developed and implemented as a result of 2010 House Bill 595, which requires recycling of glass, paper, metal, and plastic at State-owned or State-operated buildings. Agencies are now revising their plans to meet the higher goal instituted by 2012 House Bill 929. MDE has encouraged all agencies to strive for at least 40% recycling by 2015.
- Group meetings were held and MDE met with State agencies on a one-on-one basis in order to assist with implementation of recycling programs for glass, paper, metal, and plastic at State-owned or State-operated buildings.
- Regular Solid Waste and Recycling Managers' meetings were held with counties in order to provide technical information to assist in improving waste diversion programs throughout the State.
- A Solid Waste Management Study Group was formed, as a result of the passage of 2010 House Bill 982, for the purpose of evaluating solid waste management processes that reduce the solid waste stream through recycling and source reduction, including: the expansion of recycling efforts in nonresidential markets; the feasibility of commodity-specific targets; and long term funding for solid waste and recycling management.
- A Composting Workgroup was formed in May 2012 in response to 2011 House Bill 817. The law requires MDE, MES, and MDA to study composting in the State and to report to the General Assembly by January 1, 2013 on ways to promote composting in the State.
- MDE participated in conference calls and meetings with State, federal, and local organizations designed to improve waste diversion (*i.e.*, recycling and source reduction) programs.
- Regular County Solid Waste and Recycling Managers' meetings were held, designed to present counties with technical information to assist in improving their waste diversion programs.
- MDE participated in conference calls and meetings on the proper disposal of pharmaceuticals.
- MDE participated in conference calls and meetings with the Association of State and Territorial Solid Waste Management Officials Product Stewardship Task Force to increase awareness of Product Stewardship and with the Solid Waste Recycling Task Force to promote actions that reduce waste, conserve resources, prevent pollution, and foster sustainability through identifying recycling opportunities.
- MDE participated in conference calls pertaining to the National Vehicle Mercury Switch Recovery Program that voluntarily recovers mercury switches from end of life vehicles before they are shredded for recycling.
- MDE regularly participates in the National Partnership for Environmental Priorities program that focuses on reducing the use of potentially hazardous chemicals from products and processes by forming partnerships representing industry, business, municipalities, federal facilities, and tribes with EPA.
- MDE, in partnership with the Maryland Environmental Service, operates a program to increase the number of used oil collection facilities, provide public education material, and maintain an information center to encourage citizens to recycle used motor oil.

- MDE actively participates in the Maryland Recycling Network, a non-profit, volunteer organization committed to promoting waste reduction, recycling, and the conservation of natural resources.
- The MDE provided assistance and sample language to counties to help them revise their county recycling plans to address multifamily residential recycling.
- State government is required to purchase products with recycled content whenever practicable. A 5 percent pricing preference over similar items not made from recycled material is allowed.
- State government agencies have been encouraged to join the State Electronics Challenge, a voluntary program that helps government agencies implement environmentally sound management of their electronics. MDE and Maryland Department of Transportation have joined the State Electronics Challenge.
- State government requires that the following language be included on all Maryland Invitation to Bid Solicitations and Purchase Orders: "All products used in packing, to cushion and protect during the shipment of commodities, are to be made of recycled, recyclable, and/or biodegradable materials".
- Leasing contracts must allow State offices to establish recycling programs.

## **Sub-Appendix C-6: Leadership-By-Example**

### **M: Leadership-By-Example**

#### **M.1: Leadership-By-Example: State of Maryland Initiative**

Lead Agency: DGS

##### **Program Description**

Through lead-by-example programs, state government in Maryland aims to improve efficiency, reduce waste, and integrate renewable energy practices in all of its agencies' operations and facilities, as well as their purchasing practices. DGS currently oversees the following lead-by-example programs are embodied in five major initiatives:

- Maryland Green Building Council
- Maryland Green Purchasing Committee
- State Energy Database
- Renewable Energy Portfolio

The first two, The Maryland Green Building Council, and Maryland Green Purchasing Committee are addressed in this Section.<sup>77</sup> Collectively, the programs significantly advance the policy recommendations of the Maryland Commission on Climate Change for the State and local governments to lead by example by reducing their carbon footprints in the construction and operation of their buildings and facilities and in their purchasing practices.<sup>78</sup>

## **Existing Programs – High Performance Buildings**

### *1. Design/Construction.*

Two laws are driving the design and construction of high performance State buildings and schools. The first, the *High Performance Buildings Act of 2008*, requires all new and significantly renovated State buildings over 7,500 square feet, and all new public schools that receive State construction funds, to meet the LEED Silver building standard.<sup>79</sup> The second, *High Performance Buildings Act - Applicable to Community College Capital Projects*, requires community college capital projects that receive State funds to meet or exceed the LEED Silver standard required under the *High Performance Buildings Act*.<sup>80</sup> The Maryland Green Building Council makes recommendations about the State High Performance Building Program, which requires all new or substantially renovated State owned or funded buildings 7,500 gross square feet or larger to achieve USGBC LEED Silver certification.

State capital projects completed or in the pipeline include the following:

- 2008 and 2009 – Two pilot projects were completed and certified LEED Silver.
- Fiscal Year 2009 – Nine projects were funded for design; they are located in five counties and Baltimore City. Several are under construction and one, Pharmacy Hall at the University of Maryland Baltimore Campus (renovations and additions), was completed with LEED certification pending at the time of the *2010 Annual Report*.
- Fiscal Year 2010 - 17 projects were funded for design or design/construction, in nine counties and Baltimore City. Most are in the design phase; several are under construction.

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<sup>77</sup>The third initiative, Maryland Environmental Footprint, is addressed in policy Innovative Initiatives-5, “State of Maryland Carbon and Footprint Initiatives.” The last two, Generating Clean Horizons and Project Sunburst, are addressed in policy Energy-12, “Incentive and Grant Programs to Support Renewable Energy”.

<sup>78</sup> Maryland Climate Action Plan, August 2008.

[http://www.mde.state.md.us/assets/document/Air/ClimateChange/Appendix\\_D\\_Mitigation.pdf](http://www.mde.state.md.us/assets/document/Air/ClimateChange/Appendix_D_Mitigation.pdf)

<http://www.mde.state.md.us/assets/document/Air/ClimateChange/Chapter4.pdf>

The Commission’s lead by example recommendations are contained in the Plan’s Policy Option RCI-4, “Government Lead-by-Example: Improve Design, Construction, Appliances, and Lighting in New and Existing State and Local Buildings, Facilities and Operations” (Appendix D-3, pp. 28-38, and Chapter 4, p. 81), and Policy Option CC-4, “State and Local Governmental GHG Emissions (Lead-by-Example in Purchasing and Procurement)” (Appendix D-5, pp. 10-12, and Chapter 4, p. 109).

<sup>79</sup> Senate Bill 208, Chapter 124, Acts of 2008.

<sup>80</sup> Senate Bill 234 / House Bill 1044, Chapters 527 and 528, Acts of 2010. The requirement applies to capital projects that have not initiated a request for proposals for the selection of an architectural and engineering consultant on or before July 1, 2011.

- Fiscal Year 2011 – Three projects were funded for design; they are located in three counties.
- Fiscal Year 2012 – At the time of the *Maryland Green Building Council 2012 Annual Report*, twenty-two (22) public school projects with LEED certification have been completed, twenty (20) are under construction, and twenty-four (24) are in the design/planning phase. All sixty-six (66) projects are LEED Silver or Gold certified or the LEED certification Silver or Gold status is pending.<sup>81</sup>

In addition, the State will, through Fiscal Year 2014, contribute 50 percent of the extra costs incurred by public schools meeting a LEED Silver rating or comparable standard required under the *High Performance Buildings Act of 2008*.

## 2. Operation.

DGS administers energy performance contracts to reduce electricity consumption in a number of State agency buildings. As of March 2011, 27 projects were under development with energy service companies. Project costs are to be paid from cost avoidance from guaranteed annual energy savings, which are significant. DGS oversees the monitoring and verification of actual savings throughout the payback period to ensure that the guaranteed savings are met.<sup>82</sup> This initiative is financed in part by the State Agency Loan Program, a revolving loan program through which MEA provides zero-interest loans to State agencies for energy efficiency improvements.<sup>83</sup>

In the Maryland Consolidated Capital Bond Loan of 2012, the Public School Construction Program was approved for a total of \$326.393 million in new bond authorization, with \$25 million of this amount dedicated to an energy efficiency initiative that is intended to promote projects that improve the energy efficiency of schools, including improvements to HVAC systems, lighting, mechanical systems, windows and doors, and any other type of improvement that is specifically designed to improve the energy efficiency of a school building, per standards to be developed by the Interagency Committee (IAC) in collaboration with the Maryland Energy Administration.

## **Existing Programs – Procurement**

State government has massive purchasing power to select efficient goods from companies that practice energy reduction and sequestration of carbon dioxide as a powerful market stimulant for green businesses and jobs. The Maryland Green Purchasing Committee provides assistance to State units in developing strategies and best practices for

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<sup>81</sup> Detail on individual projects is found in Maryland Green Building Council 2012 Annual Report, <http://www.dgs.maryland.gov/press/pubs/2009GreenBldgReport.pdf>, 2010 Annual Report, <http://www.dgs.maryland.gov/pdfs/2010GreenBldgReport.pdf>, and 2012 Annual Report, <http://www.dgs.maryland.gov/pdfs/2012GreenBldgReport.pdf>

<sup>82</sup> For a list of facilities, estimated cost savings and carbon dioxide emission reductions, and the DGS oversight process, see <http://www.dgs.maryland.gov/greeneffort>.

<sup>83</sup> EmPOWERingMaryland Clean Energy Programs Fiscal Year 2011 Draft, MEA, pp. 7-8. [energy.maryland.gov/documents/fy11programbook.pdf](http://www.energy.maryland.gov/documents/fy11programbook.pdf). State Agency Loan Program has been used to upgrade lighting, controls, boilers, chillers, and other energy equipment in State buildings and facilities. Principal funding comes from the RGGI's auction revenues and the American Recovery and Reinvestment Act. <http://www.energy.state.md.us/Govt/stateLoan.html>

implementing environmentally preferable purchasing practices, maintains a Best Practices Purchasing Manual, and maintains Purchasing Guidelines. The General Assembly established a legislative framework under the *Green Maryland Act of 2010* for environmentally preferable purchasing throughout State government. The law establishes the Maryland Green Purchasing Committee and annual reporting requirements for State agencies and directs DGS and MDE to develop implementing strategies, best practices and specifications. It boosts the State's required purchase of recycled paper from 40 percent to 90 percent of total volume purchase and increases the price preference for recycled products from five percent to eight percent. It also establishes preferential purchasing and goal setting to increase the use of compost as fertilizer in public lands and programs.<sup>84</sup>

#### Programs under Consideration

- DGS will work with the Governor and General Assembly to amend the State's high performance buildings standards to:
  - Require government-owned buildings, including public schools and hospitals, undergoing major renovations for which permits are requested between 2012 and 2013 to meet LEED Gold ratings or a comparable standard.
  - Require new construction and major renovations for which permits are requested between 2013 and 2020 to meet LEED Platinum ratings or a comparable standard.
- DGS will develop and administer an audit and tracking protocol to ensure that State building systems are installed and are performing as designed to meet high performance criteria.
- DGS will develop and administer a training program for technical personnel in charge of operating State building systems to ensure that the systems are operated and maintained to achieve the building's highest energy efficiency and performance standards.
- DGS will benchmark State buildings to compare efficiency among similar buildings to set priorities for improvement.
- DGS will work with State agencies to provide meters, energy accounting systems, and trained staff to measure and verify energy consumption and account for improvements and implementation of energy efficiency programs.
- DGS will develop and administer education and outreach programs to local governments, businesses, and institutions to promote widespread adoption of the State's lead-by-example practices in buildings, operations and purchasing.<sup>85</sup>
- DGS will develop strategies to encourage State and local government agencies, businesses and industry, and citizens to consider at the purchase stage, the end-of-life disposal stage of equipment and goods.

### **Estimated Greenhouse Gas Emission Reductions in 2020**

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<sup>84</sup> Senate Bill 693 / House Bill 1124, Chapters 593 and 594, Acts of 2010.

<sup>85</sup> Some of these programs are recommended in the 2008 Climate Action Plan, *supra.*, fn. 2.

**Figure C-50. Low and High GHG Benefits for Innovative Initiatives-5**

Initial Reductions	0.56 MMtCO <sub>2</sub> e	MDE Quantification Below
Enhanced Reductions	0.88 MMtCO <sub>2</sub> e	MDE Quantification Below

**High Estimate – MDE Quantification**

**Figure C-51. Summary of Estimated Avoided GHG Emissions in 2020 (MMtCO<sub>2</sub>e)**

Emissions Reductions	Low Estimate	High Estimate
1. eFootprint	0.39	0.79
2. Local Government	0.45	0.90
3. Schools	0.20	0.40
4. DGS Environmental Performance Contracts and Public School Energy Efficiency Initiatives	0.10	0.10
5. LEED	0.26	0.38
<b>Total</b>	<b>1.45</b>	<b>2.56</b>

1. Maryland eFootprint (Innovative Initiatives-6)

2008 base year emissions for State government operations were obtained from the eFootprint web site ([http://www.green.maryland.gov/carbon\\_footprint\\_page.html](http://www.green.maryland.gov/carbon_footprint_page.html)). The benefits for 25 percent reduction from the base year (2008) and 50 percent reduction from the base year are summarized in the Figure C-93.

**Figure C-52. Summary of GHG benefits for a 25 Percent Reduction**

2008 Base Year MMtCO <sub>2</sub> e	25% Reduction	Low Estimate	50% Reduction	High Estimate
1.58	1.19	0.40	0.79	0.79

2. Emissions for Local Governments

Six counties and three cities have prepared climate plans using the methods developed by the International Council for Local Environmental Initiatives. Part of these plans identifies emissions that result from government operations. Using base line data in the plans, the benefits are calculated for a 25 percent reduction from the base year and 50 percent reduction from the base year.

**Figure C-53. Summary of County Data with a 25 Percent GHG Reduction**

County	Base Year	Base Year Emissions		25% Reduction from Base	Low Estimate	50% Reduction from Base	High Estimate
		Metric tons of CO <sub>2</sub> -	MMtCO <sub>2</sub> e				

		<b>equivalent</b>						
Baltimore City	2007	608,988	0.61	0.46	0.15	0.30	0.30	
Frederick	2007	134,667	0.13	0.10	0.03	0.07	0.07	
Montgomery	FY2005		0.45	0.34	0.11	0.23	0.23	
Howard	2007	340,042	0.34	0.26	0.09	0.17	0.17	
Prince Georges	FY2007	95,877	0.10	0.07	0.02	0.05	0.05	
Baltimore County	2006	142,701	0.14	0.11	0.04	0.07	0.07	
Annapolis	FY2006	11,991	0.01	0.01	0.00	0.01	0.01	
Chevy Chase	2007	162	0.00	0.00	0.00	0.00	0.00	
Takoma Park	1990	1,901	0.00	0.00	0.00	0.00	0.00	
					<b>0.45</b>			<b>0.89</b>

### 3. Emissions for Public Schools

The data is from the Maryland Public School Construction Program and includes schools that are currently used for educational purposes.

(<http://www.pscp.state.md.us/fi/MainFrame.cfm>). To estimate emissions:

- STEP 1: Determine the square footage of the school.
- STEP 2: Determine the average annual electricity intensity for building space.

Use Education as the Principal Building Activity. The Annual Electricity Intensity = 11.0 kilowatt-hour per square foot (Source: 2003 Commercial Buildings Energy Consumption Survey, Energy Information Administration (<http://www.eia.doe.gov/emeu/cbecs/>))

- STEP 3: Calculate electricity consumption.
  - Space (in square feet) X Annual Electricity Intensity (11 kilowatt-hour per square foot) = Annual Electricity Consumption
- STEP 4: Calculate the GHG emissions associated with estimated annual electricity consumption. Use EPA's eGRID emissions factors for 2005 US Emission Factors for Grid Electricity by eGRID Sub-region

**Figure C-54. 2005 GHG Emissions Rates**

Region	Pounds carbon dioxide/MWh	Pounds methane / gigawatt-hour	Pounds per nitrous oxide / gigawatt-hour
RFC East	1,139.07	30.2721	18.7146
RFC West	1,537.82	18.2348	25.7088

The base year for these calculations is 2005. A 25 percent to 50 percent reduction is assumed for 2020.

**Figure C-55. Comparison of 25 Percent and 50 Percent GHG Reductions**

	Base Year 2005	25% Reduction from Base	Low Estimate	50% Reduction from Base	High Estimate
		2020		2020	
MMtCO <sub>2</sub> e	0.80	0.6	<b>0.20</b>	0.4	<b>0.40</b>

#### 4. Energy Performance Contracts

Estimates from work conducted by SAIC under contract to MDE.

**Figure C-56. GHG Reductions from Environmental Performance Contracts**

Emissions Category	GHG Reductions (Million Metric Tons CO <sub>2</sub> e)		
	2012	2015	2020
Environmental Performance Contracts	0.1	0.1	0.1
In-State Electricity	0.0	0.0	0.0
Imported Electricity	0.0	0.0	0.0
Natural Gas	0.0	0.0	0.0

#### 5. LEED

The Lead by Example program is heavily dependent of implementation of the LEED Silver standard for new construction and renovation. According to a report prepared for the City of Santa Rosa in 2007,<sup>86</sup> in order to maximize the benefits from LEED requirements, it is prudent to mandate minimum requirements at some level higher than the minimum point level required for LEED certification. The following figure is from the report:

**Figure C-57. Commercial Building GHG Emission Reductions due to Energy Efficiency**

Approximate LEED Level	LEED NC Point Level	Metric Tons of GHG Reductions	
		2015	2020
Not Certified	20	1,500	2,400
Certified	26	1,800	2,800
Silver	33	2,000	3,200
Gold	39	2,600	4,000

The author also points out those green building requirements have to be aggressive in order to offset growth in the commercial and residential building sector. That is, if State facilities are to have a measurable impact on GHG emissions, they must be designed and built to the highest standard possible. Base line certification will not be sufficient. Setting a point standard, rather than mandating LEED certification may be more effective in ensuring GHG reductions.

<sup>86</sup> Wanless, Eric (2007) Green Building Policy Options for Reducing Greenhouse Gas Emissions: Analysis and Recommendations for the City of Santa Rosa. Report commissioned by the Accountable Development Coalition

LEED emissions were calculated using the assumptions about the number of buildings in the program description and the GHG reductions described in the quantification document. Base reductions represent 2020 Silver LEED and aggressive reductions represent 2020 Gold LEED

**Figure C-58. GHG Reductions from LEED certified Public School Projects**

				Metric Tons GHG Reductions		Estimated Benefits Metric Tons		Low Estimate MMtCO <sub>2</sub> e
Fiscal Year	Projects	Certification	Points	2015	2020	2015	2020	2020
2012	66	Silver	33	2,000	3,200	132000	211200	0.21
							<b>Total</b>	<b>0.26</b>
				Metric Tons GHG Reductions		Estimated Benefits Metric Tons		High Estimate MMtCO <sub>2</sub> e
Fiscal Year	Projects	Certification	Points	2015	2020	2015	2020	2020
2012	66	Gold	39	2,600	4,000	171600	264000	0.26
							<b>Total</b>	<b>0.26</b>

**Implementation**

The State’s lead-by-example programs in high performance buildings and procurement are statutorily driven. DGS shares responsibility with the Board of Public Works, MDE, the Department of Budget and Management, Maryland Green Building Council, and Maryland Green Purchasing Committee for administering them. Programmatic progress is tracked in annual reports which both the Maryland Green Building Council and the Maryland Green Purchasing Committee are required to submit to the General Assembly

**Innovative Initiatives-3: Leadership by Example: Maryland Colleges and Universities**

Lead Agency: MDE

**Program Description**

Leadership by example accomplishes not only the fulfillment of a task or tasks, but also provides direction for others. Leadership by example offers a guide for others to do something they haven’t done or aren’t even sure is possible. As the State endeavors to achieve a 25 percent reduction of GHG emissions by 2020 (2006 baseline), leadership by example emerges as an essential element and becomes increasingly more crucial to a successful outcome as more businesses and households endeavor to reduce GHG emissions but need direction.

In Maryland, the presidents’ of 22 colleges and universities have signed the American College and University Presidents Climate Commitment. The commitment requires each school to complete a GHG inventory, develop a climate action plan and implement strategies to reduce GHG emissions to achieve a set target. Schools are encouraged to commit to become climate neutral by a certain date, as established by each university. Climate neutrality requires GHG emissions sourced from the school, to be reduced or mitigated from a base year, with remaining emissions offset by purchasing carbon credits or other means.

All of the Maryland institutions have committed to other tangible actions in addition to the general requirements of the commitment, as depicted in Figure C-85, including:<sup>87</sup>

1. Establish a policy that all new campus construction will be built to at least the U.S. Green Building Council’s LEED Silver standard or equivalent.
2. Adopt an energy efficient appliance purchasing policy requiring purchase of Energy Star certified products in all areas for which such ratings exist.
3. Establish a policy offsetting all GHG emissions generated by air travel paid for by the institution.
4. Encourage use of and provide access to public transportation for all faculty, staff, students and visitors to the institution.
5. Within one year of signing this document, begin purchasing or producing at least 15 percent of the institution’s electricity consumption from renewable sources.
6. Establish a policy or a committee that supports climate and sustainability shareholder proposals at companies where our institution’s endowment is invested.
7. Participate in the Waste Minimization component of the national RecycleMania competition, and adopt three or more associated measures to reduce waste.

### **Estimated GHG Emission Reductions in 2020**

**Figure C-59. Low and High GHG Benefits for Innovative Initiatives-3**

Low Estimate	0.37 MMtCO <sub>2</sub> e	MDE Quantification Below
High Estimate	0.37 MMtCO <sub>2</sub> e	MDE Quantification Below

#### **Estimates – MDE Quantification**

In Maryland, the presidents of 22 colleges and universities have signed the American College & University Presidents’ Climate Commitment, which requires each school to complete a GHG inventory, develop a climate action plan and implement strategies to reduce GHG emissions to achieve a set target. Of the Maryland institutions participating in the commitment, thus far 21 have completed a GHG inventory and nine have completed a climate action plan. The target dates vary by institution.

Each college and university participating in the commitment is required to develop a GHG inventory. To estimate the lower bound of GHG emission reductions expected by 2020, only schools with established targets for 2020 were included. The total estimated GHG emissions reduction in 2020 by 17 Maryland colleges and universities is 782,262

<sup>87</sup> ACUPCC Reporting System, November 10, 2010, available: <http://acupcc.aashe.org/>.

metric tons of carbon dioxide equivalents (0.782 MMtCO<sub>2</sub>e). To estimate the upper bound, established targets for 2020 were used if available; otherwise, it was assumed each school would reduce emissions from scope 1 and scope 2 by 20 percent by 2020 based upon each school's base year.<sup>88</sup> The estimated GHG emissions reduction in 2020 including all 21 Maryland colleges and universities which have completed a GHG emission inventory is 820,989 metric tons of carbon dioxide equivalents (0.821 MMtCO<sub>2</sub>e).<sup>89</sup>

## B. Detailed Explanation of Methodology

Each college and university participating in the commitment is required to develop a GHG inventory. The GHG emission reductions were estimated by combining the business-as-usual baselines for 2020 from each school, then projecting the reductions expected in 2020. The business-as-usual baselines for each school (see Figure C-86) were projected for 2020 by using available data from each school's inventory. If only one year of data was available, the baseline emissions were assumed to increase by 2 percent each year.

To estimate the lower bound of GHG emission reductions expected by 2020 (Figure C-87), only schools with established targets for 2020 were included. The column labeled "assumptions for 2020 reductions" describes the established targets for 2020 according to school. The business as usual baselines for each school are transferred directly from Figure C-86. The result of applying the established target for 2020 for each school to the business as usual baseline is the amount in metric tons of carbon dioxide equivalents (metric tons of CO<sub>2</sub>-equivalent) contained in the "2020 Reductions" column. The sum of the "2020 Reductions" column provides the final result. By including only schools which have an established GHG emission target in 2020, the total estimated GHG emissions reduction in 2020 by 17 Maryland colleges and universities is 782,262 metric tons of carbon dioxide equivalents (0.782 MMtCO<sub>2</sub>e).

To estimate the upper bound (Figure C-88), established targets for 2020 were used if available; otherwise, it was assumed each school would reduce emissions from scope 1 and scope 2 or from scope 1, 2, and 3 (depending upon the inventory information available), by 20 percent by 2020 based upon each school's base year. In Figure C-88, the column labeled "assumptions for 2020 reductions" describes the established targets for 2020 according to school or if the school does not have a 2020 target, it is assumed that emissions from scope 1 and scope 2 will be reduced by 20 percent by 2020 based upon each school's base year. The business as usual baselines for each school are transferred directly from Figure C-86. The result of applying the established target for 2020 for each school to the business as usual baseline is the amount in metric tons of

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<sup>88</sup> Scope 1 emissions are considered direct emissions from sources that are either owned or controlled by the school. Scope 2 emissions are indirect emissions resulting from the generation of electricity, heating and cooling, or steam generated off-site but purchased by the school. Scope 3 emissions are indirect emissions from sources not owned or directly controlled by the school but related to the school's activities, such as travel and commuting. (As defined by the EPA: <http://www.epa.gov/greeningepa/ghg/index.htm>)

<sup>89</sup> One school has not completed a GHG inventory at this time and therefore, was not included in this estimation.

CO<sub>2</sub>-equivalent contained in the “2020 Reductions” column. The sum of the “2020 Reductions” column provides the final result. The estimated GHG emissions reduction in 2020 including all 21 Maryland colleges and universities which have completed a GHG emission inventory is 820,989 metric tons of CO<sub>2</sub>-equivalent (0.821 MMtCO<sub>2</sub>e).

### C. Calculations

In Figure C-86, actual data and projections from each school are used when available. If only one data point was available for the base year, then each subsequent year was assumed to increase by 2 percent or  $X_i * (1.02)$ , where X is the value for year i.

If a baseline projection was not available for 2020, the amount of GHG emissions is projected using the method of least squares to fit a straight line to the arrays of known variables to determine the GHG emissions according to year, using the following formula:

$$GHG_i = \text{Slope} * \text{Year}_i + \text{intercept}$$

Where

$$GHG_i = \text{Baseline GHG emissions projected in year } i$$

The 2020 reductions in Figures C-87 and C-88 were estimated using the following formula:

$$RED_{2020i} = BAU_{2020i} - [(1 - TAR_i) * SCP_i]$$

Where

$RED_{2020}$  = the total GHG emissions reduction estimated for 2020 based upon the assumptions for each school

$BAU_{2020}$  = The business as usual emissions estimated for each school (i) in 2020

$TAR_i$  = Percentage reduction target for 2020 for each school (i) in 2020

$SCP_i$  = Scope 1, Scope 1 and 2, or Scope 1, 2, and 3 emissions (depending upon each school’s applicable target for 2020) estimated in 2020

### D. Data and Data Sources

**Figure C-60: Baseline GHG Emissions (metric tons of CO<sub>2</sub>-equivalent) Projections**

	2005	2006	2007	2008	2009	2010	2015	2020
Bowie State University	14,348	14,086	17,824	18,244	19,846	21,320	28,692	<b>36,065</b>
Community College of Baltimore County			18,135	18,498	18,868	19,245	21,248	<b>23,460</b>
Coppin State				3,975	4,055	4,136	4,566	<b>5,041</b>

University								
Frostburg State University	30,299	30,335	30,370	32,388	33,300	34,212	38,775	<b>43,337</b>
Goucher College								<b>11,500</b>
Harford Community College				6,057	6,178	6,302	6,958	<b>7,682</b>
Howard Community College	30,045	30,839	34,095	35,710	37,734	39,759	49,883	<b>60,007</b>
McDaniel College				15,259	15,564	15,875	17,528	<b>19,352</b>
Morgan State University					45,753	46,668	51,525	<b>56,888</b>
Mount St. Mary's University	15,621	15,826	16,899	16,734	17,021	17,307	18,740	<b>20,173</b>
Salisbury University	26,696	27,230	27,775	28,330	28,897	29,475	32,542	<b>35,929</b>
St. Mary's College of Maryland	14,289	16,036	21,085	25,937	19,322	20,379	25,701	<b>31,367</b>
Towson University			52,653	53,706	54,780	55,876	61,691	<b>68,112</b>
University of Baltimore				16,220	16,544	16,875	18,632	<b>20,571</b>
University of Maryland, Baltimore				166,307	169,633	173,026	191,034	<b>210,917</b>
University of Maryland, Baltimore County			89,761	90,952	92,143	93,335	99,291	<b>105,246</b>
University of Maryland, Center for Environmental Science				13,399	13,667	13,940	15,391	<b>16,993</b>
University of Maryland, College Park	365,334	370,506	387,967	405,428	422,889	440,350	527,655	<b>614,959</b>
University of Maryland, Eastern Shore					23,207	23,671	26,135	<b>28,855</b>
University of Maryland, University College				22,806	23,262	23,727	26,197	<b>28,924</b>
Washington			15,289	15,595	15,907	16,225	17,914	<b>19,778</b>

**Figure C-61: Schools with Established 2020 GHG Reduction Targets  
(metric tons of CO<sub>2</sub>-equivalent)**

<b>Institution</b>	<b>Assumptions for 2020 Reductions</b>	<b>2020 Business As Usual Emissions</b>	<b>2020 Reductions</b>
Bowie State University	20% reduction in total scopes 1 & 2	36,065	7,213
Community College of Baltimore County			
Coppin State University	15% reduction in total scopes 1 & 2	5,041	1,008
Frostburg State University	50% reduction in total scopes 1, 2, 3	43,337	21,669
Goucher College	20% reduction in total Scopes 1, 2, 3	11,500	2,300
Harford Community College			
Howard Community College	90% reduction in total Scopes 1, 2, 3	60,007	56,597

McDaniel College	25% reduction in total scopes 1 & 2	19,352	4,838
Morgan State University			
Mount St. Mary's University			
Salisbury University	30% reduction in total scopes 1, 2, 3	35,929	10,779
St. Mary's College of Maryland	30% reduction in total Scopes 1, 2, 3	31,367	9,410
Towson University	20% reduction in total scopes 1 & 2	68,112	13,622
University of Baltimore	50% reduction in total scopes 1, 2, 3	20,571	10,285
University of Maryland Baltimore	25% reduction in total scopes 1, 2, 3	210,917	52,729
University of Maryland Baltimore County	25% reduction in total scopes 1, 2, 3	105,246	26,312
University of Maryland Center for Environmental Science	23% reduction in total scopes 1, 2, 3	16,993	3,908
University of Maryland College Park	50% reduction in total scopes 1, 2, 3	614,959	307,480
University of Maryland Eastern Shore	20% reduction in total scopes 1 & 2	28,855	5,771
University of Maryland University College	25% reduction in total scopes 1, 2, 3	28,924	7,231
Washington College	25% reduction in total scopes 1, 2, 3	19,778	4,944
TOTAL (metric tons of CO <sub>2</sub> -equivalent)			546,097
Total Emissions Avoided (MMtCO <sub>2</sub> e)			<b>0.546</b>

**Figure C-62: ACUPCC Schools with Estimated 2020 GHG Reductions  
(metric tons of CO<sub>2</sub>-equivalent)**

Institution	Assumptions for 2020 Reductions	2020 Business As Usual Emissions	2020 Reductions
Bowie State University	20% reduction in Total Scopes 1, 2, 3	36,065	7,213
Community College of Baltimore County	20% reduction in total scopes 1 & 2	23,460	4,692
Coppin State University	20% reduction in total scopes 1 & 2	5,041	1,008
Frostburg State University	50% reduction in total scopes 1, 2, 3	43,337	21,669
Goucher College	20% reduction in Total Scopes 1, 2, 3	11,500	2,300
Harford Community College	20% reduction in total scopes 1 & 2	7,682	1,536
Howard Community College	90% reduction in Total Scopes 1, 2, 3	60,007	54,006
McDaniel College	25% reduction in total scopes 1 & 2	19,352	4,838
Morgan State University	20% reduction in total scopes 1 & 2	56,888	11,378
Mount St. Mary's University	20% reduction in total scopes 1 & 2	20,173	4,035
Salisbury University	30% reduction in total scopes 1, 2, 3	35,929	10,779
St. Mary's College of Maryland	30% reduction in Total Scopes 1, 2, 3	31,367	9,410
Towson University	20% reduction in total scopes 1 & 2	0	0
University of Baltimore	20% reduction in total scopes 1 & 2	68,112	13,622
University of Maryland Baltimore	50% reduction in total scopes 1, 2, 3	20,571	10,285
University of Maryland Baltimore County	25% reduction in total scopes 1, 2, 3	210,917	52,729
University of Maryland Center for Environmental Science	25% reduction in total scopes 1, 2, 3	105,246	26,312
University of Maryland College Park	23% reduction in total scopes 1, 2, 3	16,993	3,908
University of Maryland Eastern Shore	50% reduction in total scopes 1, 2, 3	614,959	307,480
University of Maryland University College	20% reduction in total scopes 1 & 2	28,855	5,771
Washington College	25% reduction in total scopes 1, 2, 3	28,924	7,231
TOTAL (mtCO <sub>2</sub> )			565,146

Total Emissions Avoided (MMtCO<sub>2</sub>e) **0.565**

Source:

American College & University Presidents' Climate Commitment,  
<http://www.presidentsclimatecommitment.org/>

#### E. Assumptions

It is assumed that only Maryland colleges and universities which have signed the commitment currently have a GHG reduction target. The base year for each school is established by the school and varies according to institution. If only one or two years of GHG emissions are available, GHG emissions are estimated for future years increasing at two percent per year. If a school has an established GHG emission reduction target for 2020, it is expected that the school will meet the established target in 2020. For the high estimate, it is assumed that schools which do not have an established target will reduce scope 1 and scope 2 GHG emissions by 20 percent according to each school's base year.

#### **Implementation**

Figure C-89 below summarizes the progress and commitments of the Maryland institutions of higher learning that have signed the commitment. Of the 22 Maryland institutions, 20 have completed a GHG inventory and nine have completed a climate action plan thus far. The targets vary by institution, with some target dates as soon as 2012. For more aggressive reductions, the target dates are extended to 2030 and beyond.

**Figure C-63 Summary of ACUPCC Maryland Institutions**

Institution	GHG Inventory Completed	Climate Action Plan Completed	Target	Target Date	Baseline	Carbon Neutral Target	Tangible Actions						
							1	2	3	4	5	6	7
Bowie State University	X	X	20% reduction in electricity emissions	2012	2007	X	X	X	X	X	X	X	X
Coppin State University	X		Report In Progress				X						X
Community College of Baltimore County	X		Report In Progress				X	X		X			X
Frostburg State University	X	X	100% reduction in total scopes 1, 2, 3	2030	2007	X		X			X		X
Goucher College	X		Report In Progress				X	X		X	X		X
Harford Community College	X		Report In Progress				X	X					X
Howard Community College	X	X	10% reduction in electricity emissions	2012	2007		X	X					
McDaniel College	X	X	33% reduction in total scope 2	2025	2008	TBD		X			X		X
Morgan State University			Report In Progress				X	X	X	X	X	X	X
Mount St. Mary's University	X	X	100% reduction in total scopes 1, 2, 3	2050	2007	X		X					X
Salisbury University	X		100% reduction in total scopes 1, 2, 3	2050	2005	X	X	X					
St. Mary's College of Maryland	X		Report In Progress				X	X			X		X
The Universities at Shady Grove			Report In Progress				X	X		X			X
Towson University	X	X	20% reduction in scope 1	2020	2007	X	X			X			X
University of Baltimore	X		90% reduction in total scopes 1, 2, 3	2035	2008	X	X	X		X	X		X
University of Maryland Baltimore	X	X	25% reduction in total scopes 1, 2, 3	2020	2008	TBD	X			X			
University of Maryland Baltimore County	X	X	100% reduction in total scopes 1, 2, 3	2075	2007	X	X	X		X	X		X
University of Maryland Center for Environmental Science	X		90% reduction in total scopes 1, 2, 3	2050	2008	X	X				X		X
University of Maryland College Park	X	X	100% reduction in total scopes 1, 2, 3	2050	2005	X	X			X			X
University of Maryland Eastern Shore	X		Report In Progress				X	X	X	X	X	X	X
University of Maryland University College	X		25% reduction in total scopes 1, 2, 3	2020	2008	X	X	X					
Washington College	X		100% reduction in total scopes 1, 2, 3	2050	2007	X	X	X					X
<b>TOTAL</b>	<b>20</b>	<b>9</b>											

## M.4: Leadership-By-Example: Local Government

Lead Agency: MDE

### **Program Description**

Maryland county and municipal governments, together with the State, are adopting policies and practices to obtain high performance and energy-efficient buildings, facilities and vehicle fleets, and reduce the carbon footprint in purchasing, procurement and other government operations. Some jurisdictions have conducted GHG inventories, adopted climate action plans and targets, and implemented tracking protocol, such as those provided by the International Council for Local Environmental Initiatives. Where local government protocols for tracking quantifiable reductions exist, MDE conducted a survey to track actual and projected success in GHG emissions reductions. MDE's Statewide survey data results provide a 2010 snapshot of actual local government GHG reduction programs.

### **Estimated GHG Emission Reductions in 2020**

**Figure C-64. Low and High GHG Benefits for Innovative Initiatives-1**

Initial Reductions	0.25 MMtCO <sub>2</sub>	MDE Quantification Below
Enhanced Reductions	0.25 MMtCO <sub>2</sub>	MDE Quantification Below

### **Estimates – MDE Quantification**

Quantification of GHG emissions resulting from local government's efforts to show leadership by example is difficult for a variety of factors. First, local governments are comprised of both counties as well as cities, which means that there is a question of overlap between cities inside a county. Second, there is not a universal base year and/or goal(s) year. Further data is incomplete for a majority of the counties, less than 30 percent of counties have completed a GHG inventory. Further, there is concern that the counties reductions will be included in part of the State's Leadership-by-example efforts.

This analysis looks at seven counties that have completed inventories and goals. The goals are reduced to an annual reduction per county (total goal divided by number of years). The annual rate is then multiplied by the GGRA Goal year (2020) minus the base year of the county. The lone exception is Montgomery County which has a base year (2005) which is less than the GGRA base year (2006), in this case 2006 is used as a base year. This is done since any reduction made by Montgomery County in 2005 would be included in MDE's baseline inventory. For the low quantification, it is assumed that the counties just meet their target and no further counties adopt GHG goals. The result of this calculation is a reduction of 378,753 tons of CO<sub>2</sub>-equivalent. For the high quantification, it is assumed either the existing seven counties with goals increase them and/or additional counties add significant reduction goals. It is assumed this result in a 50 percent increase in what would be achieved in the low-quantification scenario. So, an aggressive adoption of County GHG goals could result in a reduction of 568,130 tons of CO<sub>2</sub>-equivalent. Overlap is an issue which must be accounted for as part of this GHG

emissions mitigation program, since these reduction could be partially or totally subsumed as part of other mitigation program.

**Figure C-65. Summary of County Government Climate Change Actions**

County	GHG Inventory (status)	GHG Targets	Base Year	Goal Year	Target	2020 Goal	Base Inventory	Reduction (metric tons of CO <sub>2</sub> -equivalent)
Allegany	None currently planned	No						
Anne Arundel	Partial, In Progress	No						
Baltimore City	2007 updating 2011	Yes	2007	2015	15%	24%	608,908	146,137.9
Baltimore County	2006 GHG inventory completed for emissions related to County government operations (excluding schools and public libraries)	Yes	2006	2012	10%	23%	142,701	32,821.2
Calvert		No						
Caroline		No						
Carroll		No						
Cecil		No						
Charles		No						
Dorchester		No						
Frederick	Completed	Yes	2007	2025	25%	18%	134,667	24,240.1
Garrett		No						
Harford	In Progress	No						
Howard	Yes	Yes	2007	2014	7%	13%	294,130	38,236.9
Kent	Energy Conservation Study being completed by Washington College	No						
Montgomery	Completed		2005	2050	80%	25%	453,000	113,250.0
Prince George's	In progress		2008	2015	10%	20%	95,887	19,177.4
Queen Anne's	Completed, 2008	Yes	2009	2014	20%	44%	11,113	4,889.7
Somerset		No						
St. Mary's		No						
Talbot		No						
Washington		No						
Wicomico		No						
Worcester		No						
							<b>TOTAL</b>	<b>378,753</b>

**Implementation**

In 2010, MDE launched a comprehensive survey to gain a Statewide view of local government's actions that will contribute to Maryland's sustainability and GHG reduction goals. MDE expects to finalize data collection and share results toward the end of 2011. Survey results to date show many local governments have GHG emissions reduction

efforts underway. Some are already identifying significant GHG reductions; others are in planning stages along the continuum of conducting GHG inventories, adopting reduction targets, developing and implementing climate action plans, and tracking progress.<sup>90</sup>

MDE and DNR are collaborating to provide forums for local governments and universities in the State to network and share best practices for implementing climate programs. MDE's survey results will inform this process. The work will also build on DNR's online Sustainability Network, where citizens, businesses and organizations can share sustainability and GHG projects and connect with others across the State interested in starting sustainability plans, energy reduction programs, rain gardens, and other green projects.<sup>91</sup>

## **M.4: Leadership-By-Example – Federal Government**

Lead Agency: MDE

### **Program Description**

Federal agencies with facilities located in Maryland would implement a comprehensive suite of lead-by-example programs to improve efficiency, reduce waste, and integrate renewable energy and sustainable practices into their operations, facilities and fleets. This would include tools to benchmark and track energy use and GHG emissions and transparently report progress toward meeting well-defined targets. Examples of programs include energy reduction in public buildings, facilities and lands, improved efficiencies in fleet vehicles and fuels, water conservation, waste reduction and recycling, purchasing of products and services with lower life-cycle impacts, and greater use of renewable energy.

### **Estimated Greenhouse Gas Emission Reductions**

#### **Figure C-66. Low and High GHG Benefits for Innovative Initiatives-2**

<sup>90</sup> See, e.g.:

City of Annapolis <http://www.sustainableannapolis.com>

Baltimore City <http://www.cleanergreenerbaltimore.org/>

Baltimore County

<http://www.epa.gov/ttn/chief/conference/ei18/session7/brady.pdf> Calvert County

<http://www.co.cal.md.us/greenteam/>

Cecil County [http://www.ccgov.org/dept\\_planning/index.cfm](http://www.ccgov.org/dept_planning/index.cfm)

Charles County <http://www.charlescounty.org/PF/sw/recycling/>

Chestertown <http://chestertowngoesgreen.com>

Frederick County <http://www.frederickcountymd.gov/index.aspx?NID=3530>

Harford County <http://www.harfordcountymd.gov/Green/>

Howard County [www.livegreenhoward.com](http://www.livegreenhoward.com)

Montgomery County <http://www.montgomeryplanning.org/environment/sustainable/index.shtm>

Prince Georges County

<http://www.princegeorgescountymd.gov/Government/AgencyIndex/GoingGreen/>

Town of Somerset [http://www.townofsomerset.com/environment/Climate\\_change.html](http://www.townofsomerset.com/environment/Climate_change.html)

<sup>91</sup> <http://www.dnr.state.md.us/sustainability/network.asp>

Initial Reductions	0.27 MMtCO <sub>2</sub> e	MDE Quantification Below
Enhanced Reductions	0.27 MMtCO <sub>2</sub> e	MDE Quantification Below

### Estimates – MDE Quantification

The White House’s Council on Environmental Quality released Guidance for Federal Greenhouse Gas Accounting and Inventories, as part of President Obama’s Executive Order 13514. The order establishes a federal government-wide target of a 28 percent reduction by 2020 in direct GHG emissions such as those from fuels and building energy use (Scope 1 and 2), and a target 13 percent reduction by 2020 in indirect GHG emissions, such as those from employee commuting and landfill waste (Scope 3).

Scopes 1, 2, and 3 emissions data, reduction goals, total number of employees and total number of facilities were obtained for 41 Federal agencies via agency sustainability plans (Figure C-84). MDE calculated Scopes 1, 2, and 3 reductions for each federal agency from this data.

**Figure C-67. Federal Agency Scopes 1, 2, and 3 Emissions and Reductions**

Agency	Scope 1&2 Goal (%)	Scope 3 Goal (%)	Scope 1&2 Emissions (MMtCO <sub>2</sub> e)	Scope 3 Emissions (MMtCO <sub>2</sub> e)	Total Employees	Total Facilities	Scope 1&2 Reductions (MMtCO <sub>2</sub> e)	Scope 3 Reductions (MMtCO <sub>2</sub> e)
Advisory Council on Historic Preservation	N/A	N/A	Blank	44.3	36	1	0	
Commodity Futures Trading Commission	N/A	N/A	N/A	N/A	669	4	0	
Court Services and Offender Supervision Agency	30	21?	?	969.812	?	?	0	
Department of Agriculture	21	7	616728	258765	110-115000	26026	129512.88	1
Department of Commerce	1	6	0.3619284	0.1832843	43000	858	0.003619284	0.01
Department of Defense	34	13.5	78.4	7	2328937	211266	26.656	
Department of Education	0	3	232	14965	4348	26	0	
Department of Energy	28	13	4634	0.858	127376	19214	1297.52	
Department of Health and Human Services	15.2	3.3	0.96	0.29	83745	3983	0.14592	

Department of Homeland Security	25	7.2	1717333.5	1602912.6	237629	14190	429333.375	1154
Department of Housing and Urban Development	47.4	16.2	17715	31726	9462	108	8396.91	5
Department of Justice	16.4	3.8	1.61	0.62	112000	3861	0.26404	
Department of Labor	27.7	23.4	231403.1	86414.1	16404	4768	64098.6587	202
Department of State	20	2	139067	33652	14664	10	27813.4	
Department of the Interior	20	9	0.8351128	0.3614084	70000	47518	0.16702256	0.032
Department of the Treasury	33	11	0.2633017	0.5100492	125881	697	0.086889561	0.050
Department of Transportation	12.3	10.9	857.9	309.5	58011	11594	105.5217	
Department of Veterans Affairs	29.6	10	2.991	1.077	284316	7186	0.885336	
Environmental Protection Agency	25	N/A	0.14078	0.067315	17208	171	0.035195	
Farm Credit Administration	N/A	10	0	1921	287	0	0	
Federal Housing Finance Agency	50	5	13.5	1135.2	455	3	6.75	
General Services Administration	28.7	14.6	2270645	156676	12827	9624	651675.115	22
Marine Mammal Commission	N/A	35?	Blank	Blank	23?	Blank	0	
Millennium Challenge Corporation	N/A	15	2.174	2.513	279	2	0	
National Aeronautics and Space Administration	18.3	12.6	1.356	0.171	18490	4884	0.248148	0
National Archives and Records Administration	7	10	75.517	15.309	3611	68	5.28619	
National Capital Planning Commission	N/A	20	N/A	60.58	44	1	0	
National Endowment for the Humanities	N/A	6.4	N/A	392.7	173	1	0	

National Labor Relations Board	20	5	124.5	2721.1	1740	56	24.9	
National Mediation Board	Blank	?	Blank	Blank	49	1?	0	
Nuclear Regulatory Commission	4.4	3	13800.4	21552.7	2752	2	607.2176	
Office of Personnel Management	20	5	6547.18	21295.49	6568	73	1309.436	10
Overseas Private Investment Corporation	?	?	Blank	Blank	230	1	0	
Peace Corps	20	20	64.8	1164.6	3200	461	12.96	
Pension Benefit Guaranty Corporation	Blank	5	0	427.5	980	11	0	
Railroad Retirement Board	27.2	6.2	4100	542	900	56	1115.2	
Small Business Administration	28	9	291.3	11057	4740	190	81.564	
Social Security Administration	21.2	13	126204.7	150103	70898	1649	26755.3964	1
Tennessee Valley Authority	17	20.7	0.573	0.102	12457	2876	0.09741	0
US Army Corps of Engineers	23	5	338989	162274	35438	888	77967.47	
United States Postal Service	20	20	5.28	8.09	581775	33620	1.056	
<b>Totals</b>	<b>690.4</b>	<b>344.8</b>	<b>5,488,921</b>	<b>2,561,118</b>	<b>4,291,579</b>	<b>405,947</b>	<b>1420149.206</b>	<b>2139</b>

The White House established a 2008 baseline of 68.9 MMtCO<sub>2</sub>e for federal government-wide emissions. If the 28 percent reduction goal is applied to the 2010 Scopes 1 and 2 goal, and is added to the 13 percent reduction to the 2010 Scope 3 goal, a composite 20.5 percent reduction is produced. This translates to a total federal reduction of 14.12 MMtCO<sub>2</sub>e in 2020.

To obtain the low estimate, 1/51 of the total federal reductions was assumed, resulting in 0.277 MMtCO<sub>2</sub>e of reductions in 2020.

## **Implementation**

*Executive Order 13514.*

The federal government is the single largest energy consumer in the U.S. economy.<sup>92</sup> In 2009 President Obama signed an executive order, “Federal Leadership in Environmental, Energy, and Economic Performance”, which calls on the federal government to reduce its GHG emissions from direct sources (e.g. federal buildings and fleets) to 28 percent below 2008 levels by 2020 and implement aggressive energy and water efficiency programs (*Executive Order 13514*, issued October 8, 2009).<sup>93</sup> To meet this directive, federal agencies are undertaking projects to increase their use of renewable energy, make their buildings and vehicles more efficient, and limit their use of fossil fuels. Federal agencies are specifically directed to set agency-wide reduction targets for Scope 1, 2 and 3 GHG emissions and to develop and implement Strategic Sustainability Performance Plans designed to meet the targets.

The executive order sets the following federal government-wide targets for fleet vehicle fuel, water efficiency, recycling and waste diversion, procurement, net zero-energy buildings, storm water management, and Livability Principles:

- 30 percent reduction in fleet vehicle petroleum use by 2020;
- 26 percent reduction in water consumption by 2020;
- 50 percent reduction in solid waste by 2015;
- 95 percent of procurement contracts to meet defined sustainability requirements;
- Net-zero energy design by 2030 for buildings planned in 2020 and later ;
- Storm water management requirements of Energy Independence and Security Act of 2007;
- Development of guidance for locating federal buildings in alignment with Livability Principles of the U.S. Department of Housing and Urban Development, EPA, and the U.S. Department of Transportation.<sup>94</sup>

In July 2010 the President expanded the federal government-wide target to require a 13 percent reduction by 2020 for GHG emissions from indirect sources, such as employee travel and commuting.<sup>95</sup> The President’s Council on Environmental Quality estimates that, combined, the government-wide goals could result in a cumulative reduction of 101 million metric tons of carbon dioxide emissions nationwide, equivalent to the emissions from 235 million barrels of oil.<sup>96</sup>

Oversight of Executive Order 13514 is provided by the Office of Management and Budget with support by the President’s Council on Environmental Quality and the Federal Environmental Executive.

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<sup>92</sup> “President Obama Sets Greenhouse Gas Emissions Reduction Target for Federal Operations”, The White House, Office of the Press Secretary, January 29, 2010. In 2008, the federal government spent more than \$24.5 billion on electricity and fuel. <http://www.whitehouse.gov/the-press-office/president-obama-sets-greenhouse-gas-emissions-reduction-target-federal-operations>.

<sup>93</sup> Executive Order 13514, “Federal Leadership in Environmental, Energy, and Economic Performance”, issued October 5, 2009. <http://www.hss.doe.gov/nuclearsafety/env/rules/74/74fr52117.pdf>

<sup>94</sup> Ibid.

<sup>95</sup> “President Obama Expands Greenhouse Gas Reduction Target for Federal Operations”, The White House, Office of the Press Secretary, July 20, 2010. <http://www.whitehouse.gov/the-press-office/president-obama-expands-greenhouse-gas-reduction-target-federal-operations>.

<sup>96</sup> <http://www.whitehouse.gov/administration/eop/ceq/sustainability/fed-ghg>

*Progress to Date.*

The federal government has already achieved substantive results towards improved energy efficiency and cleaner energy. Data for FY09 shows that the federal government decreased energy consumption per square foot of building space by approximately 13.1 percent compared with FY03, surpassing the FY09 goal of 12 percent. The federal government also purchased or produced 2,331 gigawatt-hours of electricity from renewable sources – approximately 4.2 percent of its electricity use – surpassing the goal of 3 percent for FY09.<sup>97</sup>

*Tracking of federal facilities in Maryland.*

By January of 2011, all federal agencies were to submit their Scope 1, 2 and 3 inventories to an internal GHG Reporting Portal managed by the U.S. Department of Energy's Federal Energy Management Program.<sup>98</sup> Accounting is expected to be at the agency and facility levels, down to zip codes.

*Executive Order 13514* also calls for the Office of Management and Budget to periodically prepare agency scorecards tracking their progress toward meeting the targets and to publish scorecard results on a public website. The website is expected to be up and running in 2011. Agency data will not be publicly available for certain high security facilities and operations, however. Nationally, the General Services Administration owns and operates about 20 percent of all federal facilities; the remainder is under the control of the U.S. Department of Defense or other national security agencies. In Maryland, this ratio is even more tilted toward national security facilities. In some cases even the existence of such a facility is high security and no public reporting will occur. In other facilities there may be some limited reporting.<sup>99</sup> While this will prevent a full picture of federal lead-by-example programs in Maryland, the public website will enable a detailed tracking of progress toward the GHG reduction targets for many of the federal facilities located in the State.

*State-Federal Facility Partnerships.* The Maryland Clean Energy Center is working to increase State funding and support for Federal Facility Partnerships, to leverage the requirement for federal facilities and military bases to provide 25 percent of their power from on-site renewable sources by 2025.<sup>100</sup>

## **Maryland Innovative Initiatives**

### **N.1: Voluntary Stationary Source Reductions**

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<sup>97</sup> U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, EERE News, "DOE Announces Winners of 2010 Federal Energy and Water Management Awards", October 7, 2010.

<sup>98</sup> FEMP Reporting Portal

<sup>99</sup> Telephone conversation with Sarosh Olpadwala, U.S. General Services Administration, September 13, 2010.

<sup>100</sup> The Current, MCEC Newsletter, April 2011.

**Lead Agency: MDE**

### **Program Description**

GGRA provides two paths for sources in the State's manufacturing sector to follow to potentially get credit for any voluntary programs that they are implementing.

First, companies may simply take totally voluntary action and provide a good faith estimate of potential emission reductions. These efforts can then be acknowledged and, if appropriate, included in the plan as a reduction. The uncertainty of the emission reduction calculations will be a critical factor in whether or not the reductions are included as a reduction in the plan.

There are literally hundreds of manufacturers and other businesses in Maryland who are developing and implementing voluntary GHG or "carbon footprint" reduction strategies. Several examples include Perdue's efforts to install thousands of solar panels at their corporate offices in Salisbury Maryland and Northrop Grumman's energy reductions achieved through alternative workweek programs, tele-working, managed print services, high efficiency lighting, shipping load consolidation, and reflective roof systems.

The second, more formal mechanism included in GGRA, allows a company to implement an early voluntary GHG emissions reduction plan and secure a formal "credit" for those actions. These early reduction plans must be approved by MDE before January 1, 2012. Under the provisions of GGRA, a source that implements an approved voluntary reduction plan "may be eligible to receive voluntary early action credits under any future State law requiring GHG emissions reductions from the manufacturing sector."

Under GGRA, Voluntary Early Reductions are credits for GHG emission reductions which take place before a mandatory GHG emission program required GHG reductions. Companies identifying measures to reduce GHG emissions will usually implement the least costly strategies first. Typically these are GHG reduction measures resulting in greater efficiency, lower costs and decreased GHG emissions. During the development of GGRA, it was made clear Maryland industry, which already have made decisions to adjust business processes and have already reduced GHG emissions, wanted assurance that they will not be penalized later with tighter emissions limitations, without receiving some sort of "credit" for their early efforts. The credit concept ensures that proactive voluntary actions by companies, which result in GHG reductions now, count in their favor later and help counter potential financial burdens to those companies once more costly reduction strategies are required. It is expected many of the least expensive reduction tactics will be among those first implemented, and that there will be a point when they alone will not help Maryland to meet its GHG emissions goals. When this occurs, it will be necessary to implement more costly reduction programs to reach mandated GHG targets.

Since a future GHG program could be one required by either State or federal law, it is important for a Maryland voluntary early reduction program to comply with federal, regional and State programs currently in existence. This creates an incentive for companies to implement GHG reduction measures before the advent of a mandatory

program. Offering a program resulting in credits for early voluntary reductions is consistent with proposed federal GHG legislation. Although implementation of an early reduction program in Maryland is still under development, participation in such a program would be voluntary.

### **Estimated GHG Emissions Reductions**

**Figure C-68. Low and High GHG Benefits for Innovative Initiatives-4**

Initial Reductions	0.17 MMtCO <sub>2</sub> e	MDE Quantification Below
Enhanced Reductions	0.17 MMtCO <sub>2</sub> e	MDE Quantification Below

#### **Estimates – MDE Quantification**

Reductions in GHG emissions from VERs will depend on how many sources in Maryland’s manufacturing sector elect to engage in voluntary GHG reduction programs, as well as the amount of GHG emissions reductions achieved by each source that participates. In 2009, Maryland’s manufacturing sector reported approximately 8.6 million tons of CO<sub>2</sub>-equivalent through their emission certification reports.

## **N.2: Buy Local for GHG Benefits**

Lead Agency: MDA

### **Program Description**

Although farm stands and farmers’ markets have been around forever, the phenomenal surge in the locally grown movement has been fueled by not only by an increased awareness of the benefits of fresh, healthful foods, but also the fears raised by well publicized episodes of product contamination and foodborne illness. MDA’s “Buy Local” campaign continues to be highly successful in promoting local farms as preferred sources of food to Marylanders by helping agricultural producers market their products directly to supermarket, food service, institutional, and other wholesale buyers, as well as consumers.

Increasing the sale and consumption of locally grown products will increase the sequestration of carbon dioxide on Maryland’s agricultural lands. The enhanced productivity resulting from increased agricultural production will yield increased rates of carbon sequestration in agricultural biomass, increased amounts of carbon stored in harvested crops, and increased availability of renewable biomass for energy production.

In the past two years the growth of the public’s interest in the source of their food coupled with MDA programs has sparked unprecedented consumer preference for locally-grown and -made agricultural products. Agriculture provides a traceable and healthy supply of local foods. Buying locally-grown products strengthens local economies and the health of our environment and our families, keeps land open and productive and improves quality of life. Farmers’ markets provide an important source of income for farmers as more and more consumers seek the freshness, quality, and wide

selection of locally-grown produce. By talking one-on-one with farmers, consumers develop a bond of trust in the integrity and accountability of our growers.

### **Estimated GHG Emission Reductions in 2020**

**Figure C-69. Low and High GHG Benefits for Ag and Forestry-9**

Initial Reductions	0.02 MMtCO <sub>2</sub> e	SAIC Quantification Appendix B, Pg. 142
Enhanced Reductions	0.02 MMtCO <sub>2</sub> e	SAIC Quantification Appendix B, Pg. 142

### **Implementation**

MDA received legislative authority to regulate the use of the terms “locally grown” and “local” when advertising or identifying agricultural products. In cooperation with the University of Maryland and Maryland farmers’ market managers, MDA was awarded a federal matching grant to assess the economic impact of farmers’ markets, identify ways to expand their customer base and increase sales, and explore the formation of a statewide market association. Through a partnership including MDA, the University of Maryland School of Nursing, the Future Harvest/Chesapeake Alliance for Sustainable Agriculture, the Southern Maryland Agricultural Development Commission, and the Maryland Organic Food and Farming Association, U.S. Department of Agriculture funding was received to promote the use of locally-produced, sustainable protein foods in the healthcare facilities and institutions.

MDA promotes the sustainable production and consumption of local agricultural goods and thereby helps to displace the production and consumption of products transported from other states and countries. In addition to the energy savings and GHG reductions resulting from decreased transportation emissions, greater demand for local products preserves the agricultural landscape, supports agro-biodiversity, and encourages beneficial environmental practices. MDA works with farmers, local governments, restaurants, food distributors and retailers, value-added producers, public and private institutions, and trade associations to maintain and expand its popular “Buy Local” program. By 2020, MDA aims to raise the number of farmers’ markets by 20 percent, establish a State farmers’ market association, and increase direct sales (buy/grower) by 20 percent.

MDA’s Marketing Department will work with farmers, local governments, restaurants, food distributors and retailers, value-added producers, public and private institutions, and trade associations to maintain and expand its popular “Buy Local” program. The web site Maryland’s Best has been created as an online tool to find local products from Maryland farmers.

## **N.3: Pay-As-You-Drive®<sup>101</sup> Insurance in Maryland**

<sup>101</sup> Pay-As-You-Drive is a registered trademark of Progressive Casualty Insurance Company.

Lead Agency: MIA

### **Program Description**

Pay-As-You-Drive® automobile insurance is also known as use-based insurance. Generally, use-based insurance plans are designed to align the amount of premium paid with actual vehicle usage. The distance an automobile is driven, the speed at which it is driven, and the time of day it is driven all are factors that can be used to determine premiums under a use-based plan.<sup>102</sup>

Under traditional automobile insurance plans, insurance companies rely on the consumer to provide information at the time the policy is written about the number of miles the consumer expects to drive during the policy period. In contrast, under use-based plans, the consumer generally uses a telematics device to provide information about actual mileage and other driving behaviors to the insurance carrier. The carrier can use that information to adjust the price of coverage based on the degree of risk posed by the insured's actual driving behaviors.

In the fall of 2008, Progressive Insurance Group started offering its "MyRate" use-based program in Maryland. Consumers who elect to participate in this program receive a wireless device that plugs into their car. This device measures "how, how much and when the car is being driven" (Progressive News Release, September 15, 2008). "Cars driven less often, in less risky ways and at less risky times of day can receive a lower premium (Progressive News Release, September 15, 2008). Customers signing up for the program could receive up to a 10 percent discount and at renewal could earn up to a 25 percent discount. There is a thirty dollar technology expense for the cost of the wireless device and transmission of the data. This is imposed each policy period.

As of 2008, the GMAC Insurance Group also offered a Pay-As-You-Go insurance program to OnStar subscribers in Maryland. It works as a discount program: the fewer miles driven, the higher the discount earned. Customers driving less than 2500 miles annually may be eligible for up to a 50 percent discount. All information is transmitted through the OnStar Vehicle Diagnostic reports, so it is necessary to have an OnStar equipped vehicle with an active OnStar subscription.

As of August 2011, the Progressive and GMAC Insurance Groups were the only insurers offering a use-based insurance program for private passenger automobiles in Maryland<sup>103</sup>. Some carriers are offering programs or pilot programs similar to Pay-As-You-Drive® in other states.<sup>104</sup>

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<sup>102</sup> Consumers receive discounts off of their insurance premiums for participating in most use-based programs.

<sup>103</sup> Two additional companies offer a commercial product (Montgomery Mutual and Ohio Casualty); however, it is unlikely that the usage will be reduced since this is a commercial product.

<sup>104</sup> Although currently only available in Texas, MileMeter Insurance Company offers a mileage based program that is available to consumers on-line. The rates for this program are based on the consumer's age, location and vehicle. The consumer purchases a specific number of miles for a 6 month period of time. When the consumer runs out of miles they may purchase more. This program relies exclusively on

## **Estimated GHG Emission Reductions in 2020**

**Figure C-70. Low and High GHG Benefits for Transportation-20**

Initial Reductions	0.02 MMtCO <sub>2</sub> e	SAIC Quantification Appendix B, Pg. 217
Enhanced Reductions	0.02 MMtCO <sub>2</sub> e	SAIC Quantification Appendix B, Pg. 217

## **N.4: Job Creation and Economic Development Initiatives**

Lead Agency: DBED

### **Program Description**

This program promotes economic development opportunities associated with reducing GHG emissions in Maryland. It is based on Governor O'Malley's aggressive goal of creating, retaining or placing 100,000 green jobs in the State by 2015.<sup>105</sup> To support this goal, DBED formed a Green Jobs & Industry Task Force of public- and private-sector leaders representing diverse businesses and organizations.

The goal of the Green Jobs & Industry Task Force was to help Maryland create green jobs and move toward a smarter, greener Maryland economy. Specifically, the task force was charged with developing recommendations for the State to leverage Maryland's considerable workforce and natural resources to create and retain green jobs; utilize scarce and finite natural resources; protect and restore our environment; and support the use of clean and efficient energy.<sup>106</sup>

The Green Jobs and Industry Task Force issued recommendations to Governor O'Malley in July, 2010. The task force made six recommendations: Strengthen coordination and communication across State agencies, partners and stakeholders to provide strategic vision for advancing a green economy; promote energy and resource efficiency efforts; develop and foster clean, local energy production and industrial capacity; capitalize upon economic opportunities to restore and protect Maryland's natural resources; promote sustainable development practices that create jobs, generate prosperity and make Maryland more self-reliant; and increase access to capital for green businesses and projects.<sup>107</sup>

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vehicle's odometer to track mileage. Allstate is currently offering a program in Illinois which will give an additional discount based on when the policyholder drives, mileage, hard braking rapid acceleration and speed. Driving performance is tracked by device which is plugged into the policyholder's vehicle.

<sup>105</sup> The Governor's Workforce Investment Board, "Maryland's Energy Industry Workforce Report," September 2009, Accessible at: <http://www.mdworkforce.com/pub/pdf/energyworkforce.pdf>

<sup>106</sup> Ibid.

<sup>107</sup> DBED, "Green Jobs and Industry Task Force Report: A Report to Governor Martin O'Malley," July 2010, Accessible at: [http://issuu.com/cybermaryland/docs/green\\_jobs\\_task\\_force\\_report](http://issuu.com/cybermaryland/docs/green_jobs_task_force_report).

The Green Jobs and Industry Task Force issued its next steps, to be pursued jointly with the Office of the Governor:

- Prioritize recommendations, placing greatest emphasis on those with the most potential to create jobs and promote economic recovery immediately; develop an action plan to implement these recommendations;
- Outline the budgetary and workforce resources necessary to implement these changes; draft legislation for consideration at future General Assembly sessions to implement recommendations requiring legislative action; and
- Convene short-term public-private working groups to handle specific issues raised within the recommendations.<sup>108</sup>

### **Estimated Greenhouse Gas Emission Reductions in 2020**

The GHG reductions associated with this program are not applicable. While this program is not directly tied to a quantifiable reduction in GHG, it will help to reduce them. For example, if selected industries are forced to move offshore, then global GHG emissions may rise due to a lack of comparable controls outside the U.S.

### **Implementation**

Maryland could one day establish itself as a leader in developing the green industry. Opportunities for job creation exist in designing and constructing green buildings; weatherizing existing buildings; retrofitting older buildings with energy efficient appliances and technologies; expanding the construction, maintenance, and operation of common-carrier and public transportation networks and systems; designing, constructing, and operating windmills, biomass generators, and solar collectors; and research and development on a wide array of new practices and technologies that can abate GHG production. DBED works with public and private sectors to create these job opportunities in Maryland.

DBED's mission is to attract new businesses, stimulate private investment, create jobs and encourage the expansion and retention of existing companies by providing workforce training and financial assistance to businesses relocating to or expanding within Maryland. DBED promotes doing business in Maryland at home and abroad to spur economic development and international trade. DBED's business development units are primarily charged with job creation and retention; and its financing and training programs are designed to support all businesses and industries, including those in the renewable energy and sustainability sectors.

To spur economic development in Maryland, DBED participates on both multi-agency initiatives and green business organization activities. DBED participates in multi-agency initiatives such as the Maryland Commission on Environmental Justice and Sustainable Communities, the U.S. 40 Carbon Neutral Corridor Interagency Steering Committee, and the Power Plant Research Program Advisory Committee. DBED supports and participates in the activities and programs of green business organizations such as the

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<sup>108</sup> Ibid.

Maryland Clean Energy Center, the Maryland-Asia Environmental Partnership, and the Chesapeake Sustainable Business Alliance.

DBED targets a substantial part of its marketing efforts toward national trade shows and events that promote renewable energy and sustainability. Trade shows are more likely to attract participation by businesses within the renewable energy and sustainability sectors, which DBED then targets as potential prospects for relocation or expansion in Maryland. Examples of these events include the American Wind Energy Association Conference, The Renewable Energy Technology Conference and Exhibition 2011, the Renewable Energy World Conference, and the World Energy Engineering Congress.

DBED's business development units provide one-on-one assistance to businesses seeking to create jobs in the renewable energy and sustainability sectors. The types of assistance provided may include site location assistance, technical assistance, workforce training and financing. DBED also supported Maryland Green Travel, a Statewide program created to encourage environmentally-friendly practices and promote the State as a "green" destination to eco-minded travelers. The voluntary program helps businesses evaluate procedures, set goals and take specific actions towards environmental sustainability. Already, hotels with green practices are reducing waste, recycling and conserving energy and water.

## O: Future or Developing Programs

### O.1: The Transportation and Climate Initiative (TCI)

Lead Agency: MDE/MDOT

#### **Program Description**

The Transportation and Climate Initiative (TCI) is a regional effort of Maryland and 10 other Northeast and Mid-Atlantic states and the District of Columbia to reduce GHG emissions in the region's transportation sector, minimize the transportation system's reliance on high-carbon fuels, promote sustainable growth to address the challenges of vehicle-miles traveled, and help build the clean energy economy across the region.

Recognizing that the transportation sector currently accounts for approximately 30 percent of GHG emissions in the Mid-Atlantic and Northeastern U.S.<sup>109</sup>, the energy, environment and transportation agency heads from the region convened a summit in Wilmington, Delaware in June 2010 to launch TCI.<sup>110</sup> On June 16, 2010 they

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<sup>109</sup> TCI Declaration of Intent, June 16, 2010. <http://www.georgetownclimate.org/state/files/TCI-declaration.pdf>

<sup>110</sup> Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont and the District of Columbia were represented. All but Pennsylvania and the District of Columbia are also members of RGGI, and all eleven states are signatories to the 2009 Northeast and Mid-Atlantic Low Carbon Fuel Standard Memorandum of Understanding. Both initiatives are summarized later in this chapter.

unanimously signed a Declaration of Intent, affirming their intent to work collaboratively to “reduce greenhouse gas emissions, minimize our transportation system’s reliance on high-carbon fuels, promote sustainable growth, address the challenges of vehicle-miles traveled and help build the clean energy economy” in the Mid-Atlantic/ Northeast region.<sup>111</sup> The collaborative is also expected to advance current efforts of individual TCI states to:

- “Reduce traffic congestion;
- Encourage job growth and accommodate the flow of goods and services;
- Establish state and local land use strategies that increase commercial and residential housing density and encourage transit-friendly design;
- Improve the performance of existing highway, transit and other transportation modes while enhancing neighborhoods and urban centers; and
- Promote mixed-use development that supports viable alternatives to driving.”<sup>112</sup>

### **Estimated Greenhouse Gas Emission Reductions in 2020**

**Figure C-71. Low and High GHG Benefits for Transportation-4**

Initial Reductions	0.03 MMtCO <sub>2</sub>	MDE Quantification Below
Enhanced Reductions	0.03 MMtCO <sub>2</sub>	MDE Quantification Below

#### **Estimates – MDE Quantification**

The 2008 Climate Action Plan predates TCI launch and includes no quantification of GHG emissions reductions for this initiative. Quantification is under development by TCI. The emissions reduction potential is significant. Although TCI has not formulated specific reduction goals at this time, the 3-year strategic work plan builds on reduction targets established in the climate action plans and statutes adopted by most TCI states and commits to developing key sets of data and metrics to:

- Establish baselines for emissions and energy use in transportation systems; and,
- Inform deliberations on establishment of regional goals that support and advance state goals.

Methods to measure and track the success of the TCI initiative are being developed in the three-year work plan. These may eventually be used to measure and track GHG reductions from this and related transportation programs in the 2012 GGRA Plan.

They include:

- Metrics to provide tools to measure effectiveness of individual reduction strategies and programs, both regionally and in states; and,
- Model policies, programs and rules for implementation at the state level, as well as, methods to evaluate the effectiveness.

<sup>111</sup> Declaration of Intent, fn. 1, supra.

<sup>112</sup> Ibid.

This program has overlap with the E.1.A: Maryland Clean Cars Program, O.2: Clean Fuels Standard and E.3: Electric Vehicles. The assumptions used for this quantification are:

- The statutory/regulatory requirements of the Maryland Clean Car Program and the Clean Fuels Standard are met first.
- TCI will incentivize the introduction and use of 5,000 (low) and 10,000 (high) additional electric vehicles on Maryland's roads in 2020.
- All vehicles incentivized by this program will be electric vehicles (no plug-in hybrids assumed for this analysis) that have no tailpipe GHG emissions.
- Electric vehicles will replace gasoline powered vehicles.
- Since electric vehicles are replacing gasoline vehicles, there is no net increase in congestion or delay on the roadways.
- The vehicles accumulate 18,000 miles per year.
- Any GHG emissions associated with recharging electric vehicles are accounted for from the stationary source producing the power.
- The benefits were calculated using MDOT methodology in Appendix D for calculating VMT reduction.

## **Implementation**

With support from the Georgetown Climate Center, the TCI states contribute in-kind staff resources to implementing the goals articulated in the *Declaration of Intent*. TCI is organized into a steering committee, an overall staff work group and four topic-specific work groups. Working through the summer and fall of 2010, they produced a three-year work plan which was approved by TCI agency heads in October 2010. The plan focuses on four key areas:

- Developing clean vehicles and fuels, with a particular emphasis on creating a regional electric vehicle charging network.
- Promoting the development of sustainable communities.
- Improving the efficiency of freight transportation.
- Implementing communication and information technology throughout the region.

Agency heads will meet at the second annual summit in June 2011 to provide guidance on further work plan development and implementation.

Although TCI has not formulated specific reduction goals at this time, the 3-year strategic work plan builds on reduction targets established in the climate action plans and statutes adopted by most TCI states and commits to developing key sets of data and metrics to:

- Establish baselines for emissions and energy use in transportation systems; and
- Inform deliberations on establishment of regional goals that support and advance state goals.

Methods to measure and track the success of the TCI initiative are being developed in the 3-year work plan. These may eventually be used to measure and track GHG reductions from this and related transportation programs in the 2012 GGRA Plan.

They include:

- Metrics to provide tools to measure effectiveness of individual reduction strategies and programs, both regionally and in states.
- Model policies, programs and rules for implementation at the state level as well as approaches to evaluate their effectiveness.

In August of 2010, TCI submitted an application for a \$3 million TIGER II planning grant from the federal Departments of Housing and Urban Development and of Transportation for the strategic planning and pilot deployment of an electric vehicle charging infrastructure for the Interstate-95 corridor and connecting east-west interstates. TCI exceeded the required 20 percent match with commitments from public and private partners in the TCI states. Maryland was successful in obtaining a \$67,500 in-kind contribution of engineering services from an in-state producer of electric vehicle charging stations. The grant process was highly competitive and although the TCI application was ranked near the top, it did not receive an award. However, the process produced strategic planning and partnering opportunities that TCI is building on as it moves the electric vehicle initiative forward and pursues other funding opportunities.

Through regional planning, including coordination with Metropolitan Planning Organization partners in their role as metropolitan transportation agencies, TCI is positioned to maximize the impact of transportation investments. The regional approach is also designed to boost the effectiveness of existing state programs, accelerate the growth of clean energy jobs, and promote public and private sector innovation.

TCI agency heads met in June 2011. TCI is expected to provide strategic guidance to TCI agency staff working group on plan implementation.

## **O.2: Clean Fuels Standard**

Lead Agency: MDE

### **Program Description**

The Clean Fuels Standard program is a cooperative effort being undertaken by eleven Northeast and Mid-Atlantic states to design and implement a regional low carbon fuel standard to reduce the carbon intensity of transportation fuels. The Clean Fuels Standard is a collaboration of commissioners from both the environmental and energy agencies and is modeled after the successful RGGI program. This regional program is being pursued by the following eleven Northeast and Mid-Atlantic states: Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island and Vermont.

Transportation fuels account for approximately one-third of GHG emissions from the Northeast and Mid-Atlantic states. A clean fuel standard is designed to reduce the GHG

emissions from these fuels. This program would be a market-based program to address the carbon content of fuels by lowering their carbon intensity through the use of low-carbon fuel alternatives. Carbon intensity is defined as the amount of GHGs released per unit of energy produced by the fuel over its full lifecycle. By analyzing the amount of GHG emissions released during the fuels' full lifecycle, including production, transport, and consumption, the fuels can be measured and compared with respect to their carbon intensity. The nation's first clean fuel standard was initiated by California in 2007, and similar programs are being considered in Oregon, Washington, and ten Midwestern states.

The Clean Fuels Standard program would require regional fuel suppliers to demonstrate that the average carbon intensity of fuels used in the region is reduced over time. A credit trading system could provide opportunities to control costs by allowing a supplier to purchase credits from low carbon fuel producers and average them with higher carbon fuels delivered to customers. Rather than imposing restrictions on specific fuel types, this approach allows fuel providers to choose among different fuels, based on cost effectiveness and environmental impact, in order to meet the carbon intensity reduction target set by the program. This program would allow the fuel industry flexibility to determine when and where new infrastructure can be introduced most efficiently, such as the use of electric vehicles or additional supplies of liquid low carbon fuels.

The Memorandum of Understanding signed by the eleven Northeast and Mid-Atlantic Governors in December 2009 committed the states to conduct an economic analysis, develop preliminary recommendations on program elements, and draft a program framework based on this previous work. The Northeast States for Coordinated Air Use Management is providing the technical support to the states in the development of this program. On August 18, 2011, Northeast States for Coordinated Air Use Management, on behalf of the 11 Northeast and Mid-Atlantic states, released a report entitled "*Economic Analysis of a Program to Promote Clean Transportation Fuels in the Northeast/Mid-Atlantic Region*". This report describes the economic impacts of a Clean Fuels Standard designed to reduce the carbon intensity of fuels used for transportation in the region by 5 percent to 15 percent over the next 10 to 15 years. The report suggests that transitioning to lower carbon fuels such as electricity, advanced biofuels and natural gas could help reduce GHG emissions, enhance energy independence, reduce vulnerability to price swings in imported oil, and strengthen the region's economy.

Key findings of the report indicate that a regional Clean Fuels Standard could:

- reduce transportation-related GHG emissions by 5–9 percent by replacing gasoline and diesel with lower carbon fuels;
- reduce gasoline and diesel use by 12–29 percent (4–9 billion gallons annually) in year 10 when the program is fully implemented;
- enhance energy security by replacing transportation fuels made from imported oil with domestic alternatives such as advanced biofuels, electricity and natural gas (gasoline and diesel would still remain dominant fuels in the region);

- achieve net savings on transportation costs when oil prices are high, with near parity at low oil price levels; and
- create a small but positive impact on jobs, gross regional product, and disposable person income within the region under a wide range of possible compliance scenarios.

Stakeholder meetings to present and discuss the findings of this analysis will be held in Boston and Baltimore in September 2011. At these meetings, Northeast States for Coordinated Air Use Management and state staff will present the assumptions and findings of the economic analysis, take questions and comments on the analysis, and discuss next steps.

This analysis suggests that a Clean Fuels Standard could reduce GHG emissions from the transportation sector, promote a more diverse fuel mix that would diminish the region's reliance on imported oil, and help protect consumers from price volatility in the global oil market. The results of the economic study indicate that the higher the price of gasoline and diesel, the greater the savings would be for consumers. The Clean Fuels Standard can result in economic growth and job creation under a wide range of possible market responses to the program's carbon intensity reduction requirements.

### **Estimated GHG Emission Reductions**

This plan is not projected to be operational by 2020 so not benefit has been attributed to it.

## **Sub-Appendix C-7: Land Use Programs**

### **P.2: GHG Benefits from Priority Funding Areas**

Lead Agency: MDP

#### **Program Description**

Maryland established Priority Funding Areas to preserve existing communities; target State resources to build on past investments; and reduce development pressure on critical farmland and natural resource areas. By encouraging projects in already developed areas, Priority Funding Areas prevent the GHG emissions associated with sprawl.

Priority Funding Areas are geographic growth areas defined under State law and designated by local jurisdictions to provide a map for targeting State investment in infrastructure. A map of the Priority Funding Areas in Maryland is available on MDP's website at: <http://planning.maryland.gov/OurProducts/pfamap.shtml>. The law directs the use of State funding for roads, water and sewer plants, economic development and other growth-related needs to Priority Funding Areas, recognizing that these investments are the most important tool the State has to influence growth and development.

As required by Maryland law, many State agencies provide funding for “growth related” development and infrastructure only within Priority Funding Areas. Rather than requiring additional outlays beyond current funding to support compact development, the Priority Funding Area law instead requires a reallocation of existing funding. Maryland’s Smart Growth Subcabinet provides an Annual Report on the Implementation of the Smart Growth Areas Act, which describes the State agency programs that are restricted to Priority Funding Areas and the amount of funds allocated within the fiscal year – see MDP’s [website at: http://planning.maryland.gov/OurProducts/PublicationsPlain.shtml#annual](http://planning.maryland.gov/OurProducts/PublicationsPlain.shtml#annual).

Some examples of Priority Funding Area-restricted State agency programs that prevent GHG emissions by supporting compact development patterns include:

- The Maryland Department of Housing and Community Development’s “State funded neighborhood revitalization projects,” which include funding from Community Legacy, Community Investment Tax Credit, Maryland Capital Access Program, and Neighborhood Business Works.
- The Maryland Department of Business and Economic Development’s Maryland Economic Development Assistance Authority and Fund, which provides both loans and grants to businesses and local jurisdictions.
- The Maryland Department of Environment’s Maryland Water Quality Revolving Loan Fund, which provides financial assistance to public entities and local governments for wastewater treatment plant upgrades.
- Maryland Department of Transportation “growth related” projects, which include all major capital projects (unless granted an exception) and are defined as “any new, expanded, or significantly improved facility or service that involves planning, environmental studies, design, right-of-way, construction, or purchase of essential equipment related to the facility or service”.

The Rural Legacy Program assists counties and municipalities in their efforts to preserve areas rich in agricultural, historic, scenic, and cultural resources, and provides opportunities to acquire parkland. Maryland structured the program to encourage local land trusts and local jurisdictions to prepare rural legacy plans that seek to protect significant and threatened resources. Through an annual competitive selection process, counties choose plans to submit to the State for funding.

Priority Funding Areas were established by the 1997 Priority Funding Areas Act (the Smart Growth Act).<sup>113</sup> The law also directs MDP to coordinate the process of updating these areas by providing technical assistance, review, comment and the opportunity for public review. Although these areas have been in existence for more than a decade, there have been significant changes to the designation process, especially for municipalities, as a result of the passage of House Bill 1141 in 2006. The Smart Growth Act authorizes counties and municipalities to designate areas appropriate for growth as Priority Funding

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<sup>113</sup> The criteria for Priority Funding Areas are defined in the Annotated Code of Maryland, State Finance and Procurement Article, §5-7B-02 and §5-7B-03.

Areas. Since October 1, 2006, municipalities must follow the same criteria as counties.<sup>114</sup> In 2009, the Smart Growth Goals, Measures, and Indicators and Implementation of Planning Visions law established a goal to increase the percentage of growth within Priority Funding Areas and decrease it outside these areas. Local governments are also required to set growth goals to keep pace with the State goal and report annually on ordinances and regulations that support the goal.

### **Estimated GHG Emission Reductions in 2020**

The estimated GHG emission reductions for this program are aggregated in Land Use-1 and assume that 75 percent of Maryland's new development between 2011 and 2020 will be compact development. MDP will achieve this goal by achieving the following subgoals:

- 25 percent / 75 percent split between new multi-family and single-family homes (current trend, based on the past decade, was a 22 percent / 78 percent split, although the multi-family share has been trending higher in the last few years)
- 80 percent of homes located within the Priority Funding Area (current trend, 75 percent)
- 84 percent of residential lots within Priority Funding Areas equal to or smaller than ¼-acre (current trend, 72 percent)
- Similar or higher share of future nonresidential development in compact form (nonresidential development mostly follows population)

### **Implementation**

Maryland has enacted measures, such as the Smart Growth Goals, Measures, and Indicators and Implementation of Planning Visions law and the Sustainable Communities Act of 2010, to help direct growth and development to Priority Funding Areas. In addition, MDP is working with other State agencies to develop Plan Maryland and Maryland's Phase I Watershed Implementation Plan, which supports Priority Funding Areas.

The Smart Growth Goals, Measures, and Indicators and Implementation of Planning Visions bill (Senate Bill 276/House Bill 295) requires local planning commissions or boards to submit annual reports to local legislative bodies beginning July 1, 2011 that include specified smart growth measures and indicators and information on a local land use goal as part of the report. With the exception of jurisdictions that issue less than 50 building permits per year, the measure and indicators that must be reported are the following: amount and share of growth that is being located inside and outside the Priority Funding Area; net density of growth that is being located inside and outside the Priority Funding Area; creation of new lots and the issuance of residential and commercial building permits inside and outside the Priority Funding Area; development capacity analysis, updated once every 3 years or when there is a significant zoning or land use change; and number of acres preserved using local agricultural land preservation funding.

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<sup>114</sup> Locally designated Priority Funding Areas are evaluated by the MDP against criteria in §5-7B-02 and §5-7B-03.

The Sustainable Communities Act of 2010 broadened an existing tax credit focused on historic structures to one that emphasizes the importance of dense, sustainable development near mass transit in a variety of urban centers throughout the State. This tax credit supports the goals of the Main Street Maryland Program that aims to strengthen traditional downtown business districts. The Sustainable Communities Act also supports transit-oriented development that allows Marylanders greater choice in how they move between home, work, and play.

While the goal is to direct as much growth to appropriate areas as possible, some growth will inevitably occur outside of the Priority Funding Areas. Maryland works to protect valuable forests and farms from being developed. Once a property converts to a developed use, it rarely, if ever, is returned to its previous State of field or forest. Organizations including the Maryland Agricultural Land Preservation Foundation, the Maryland Environmental Trust, Program Open Space, and others work diligently to make sure that these lands remain in their current State into the future to protect the Chesapeake Bay and to make certain that future generations can enjoy them.

The implementation of PlanMaryland is a priority. Implementation will require both an evaluation of existing plans, programs and procedures and recommendations for additional programs and policies, many in support of Priority Funding Areas. Additionally, the development and implementation of the accounting for growth strategy of Maryland's Phase I Watershed Implementation Plan, which creates strong disincentives for sprawl development, also continues.

## **Q: Outreach and Public Education**

Lead Agencies: MDE

### **Program Description**

State-sponsored public education and outreach combined with community actions form the foundation for behavioral and life style changes necessary to reduce GHG emissions. This program is designed to encourage continuation of existing efforts and to promote new actions. The State supports current educational efforts and action campaigns of: State agencies, such as MDE, DNR, the Maryland State Department of Education, and University of Maryland; electric utilities; non-profit organizations; faith communities; and others. This combination of efforts insures that scientifically based factual information is made available through public education and outreach efforts and reaches all segments of the public. Many of these activities are already underway. Education and outreach program goals include:

- Educate and coordinate legislatures and agencies on climate change, conservation, and energy efficiency for government facilities, operations, and transportation.
- Develop Maryland-specific lessons on climate change, energy conservation, and energy efficiency aligned with the Voluntary State Curriculum and Core Learning Goals, and integrate into K-12 curriculum.
- The Governor's Regional Environmental Education Network.

- Support on-going efforts by higher education institutions to include climate change as part of their overall educational and facilities-management practices.
- Organize an annual one-day conference for regional public media representatives on: the state of climate change mitigation in Maryland and the level of attainment of State GHG goals; latest climate science and observations; climate change impacts on public health, regional environment, the Chesapeake Bay, and the economy; and applications of climate-friendly technologies.
- Collaborate with counties and utilities to educate and stimulate commercial organizations and homeowners to adopt climate friendly measures and promote climate friendly products.
- Develop/distribute guidelines to encourage farmers and forestry operators to practice climate friendly measures. Develop a website to host voluntary experts to answer climate-related questions from this target audience.

### **Estimated GHG Emission Reductions in 2020**

**Figure C-72. Low and High GHG Benefits for Multi-Sector-3**

Initial Reductions	0.03 MMtCO <sub>2</sub> e	MDE Quantification Below
Enhanced Reductions	0.03 MMtCO <sub>2</sub> e	MDE Quantification Below

#### **Estimates – MDE Quantification**

This section presents a theoretical exercise in estimating GHG emissions reductions that could result from outreach (marketing) campaigns. Note: the data presented here has not been approved by MDE or any other agency. Its intended purpose is illustrative.

Education and outreach campaigns are most effective when they are targeted to a specific purpose. Much has been written about social marketing and it has had wide application in Canada and throughout the U.S. This report presents three theoretical campaigns that are categorized by their levels of effort, Big, Medium and Small. These categories apply to the size of the target audience as well as the financial commitment needed to effect the desired behavioral changes and environmental benefits.

#### *Big Effort*

This idea is a subset of work that utilities are conducting as part of the EmPOWER Maryland program. EmPOWER Maryland is a Statewide program that, among other goals, seeks to reduce per-capita energy consumption 15 percent by 2015.

For this exercise, the quarterly EmPower reports from BGE and PEPCO were used. Together, these companies provide utilities to a majority of Maryland consumers. EmPower Maryland has an enormous outreach campaign designed to encourage energy efficiency measures and, thereby, reduced consumption. There are three components that are being marketed to residential customers: lighting, appliances and quick home energy checkups. The baseline data was extracted from the utilities' reports to PSC.

Both utilities conducted extensive campaigns to promote the use of compact fluorescent lights, rebates for qualifying energy-efficient appliances and home energy check-ups. These included print and media campaigns, working with retailers and direct mailing of program information included with monthly bills. The utilities spend over \$1 million on these and other campaigns to fulfill their obligations under EmPower Maryland.

These programs were rolled out in 2009 and are on-going. It is assumed that as people received the message, barring any issues such as economic constraints, that customers would steadily increase the purchase of compact fluorescent lightbulbs and energy-efficiency appliances and would sign up for the home energy check-ups.

The metric used in the reports is actual gross annualized energy savings in MWh. The MMtCO<sub>2</sub>e reduction is calculated to illustrate GHG reductions potential as participation in the programs increase.

**Figure C-73. High Range GHG Benefits (MMtCO<sub>2</sub>e)**

2009 Base	2015 Modest (15%)	2020 High (20%)
0.0372	0.0428	0.0465

*Medium Effort*

The project in the medium effort is based on a conceptual interpretation of work conducted by Douglas McKenzie-Mohr in Canada. This type of campaign targets motorists with under-inflated tires on light and medium-duty vehicles. Typically, outreach would be conducted at points of service like gas stations and vehicle repair shops. The number of vehicles targeted for evaluation and corrective action is based on the scope of the project. That is, the campaign could be scaled from Statewide to county-wide to small events like car care clinics. This example uses Statewide VMT for light and medium duty vehicles.

Based on data gathered at MDE-sponsored clean car clinics, approximately 60 percent of light and medium duty vehicles have improperly inflated tires. This example assumes that all 4 tires are under-inflated by 10 pounds per square inch. The under-inflations are assumed to lower gas mileage by 3 percent. The goal of this sample campaign would be to have 20 percent of motorists regularly check tire pressure and take needed corrective action.

This project is to be run in 2010 and in 2020. The base case assumes 60 percent of the light and medium duty VMT driven on under-inflated tires. The assumed fuel economy is the Corporate Average Fuel Economy standard for new vehicles in those years. In reality, fuel economy would be somewhat less if we account for Maryland’s fleet including older and improperly maintained vehicles. The federal fuel standard represents a “best case” scenario. Fuel economy was reduced by 3 percent to account for under-inflated tires.

The target case is the result of a “successful” campaign that reduces the number of vehicles with under-inflated tires to 40 percent. Note: the smaller benefit in 2020 is the result of a higher Corporate Average Fuel Economy standard; the cars are cleaner.

**Figure C-74. Middle Range GHG Reductions (MMtCO<sub>2</sub>e)**

Year	60% under-inflated	40% under-inflated	Benefit
2010	0.000436	0.000291	0.000145
2020	0.000375	0.000250	0.000125

*Small Effort*

The small effort considers a community-based effort to encourage people to ride bikes to work. The results are based on estimates derived from Bike to Work days in the Baltimore Metropolitan Region in 2008, 2009 and 2010. The Baltimore Metropolitan Council participates in National Bike to Work Day and promotes the event extensively on the web and through local interest groups.

For this exercise, it is assumed that people do not bike to work for distances greater than 15 miles. Most bikers are assumed to bike within 2.5 and 5.5 miles; 10 percent bike 15 miles, 20 percent bike 7.5 miles, 30 percent bike 5.5 miles and 40 percent bike 2.5 miles. Each bike trip was assumed to replace one car trip. Based on survey data from 2009, 43 percent of the people who participated in Bike to Work Day would have driven a car as their usual transportation. The carbon emissions benefits of biking to work are compared to driving a vehicle for the same distance and are weighted by the number of people who chose to ride a bike and who would have driven as their usual commute mode. The GHG emissions avoided are expressed in pounds because the numbers are small. The numbers after 2010 are extrapolated. Increasing the number of people who replace vehicle commute trips with bike commute trips shows a benefit in GHG emissions avoided. In 2020 the benefit is estimated to be 0.000007 MMtCO<sub>2</sub>e emissions avoided.

**Figure C-75. Bike to Work Benefits**

Year	People	GHG emissions avoided (pounds)	GHG emissions avoided (Metric Tons)	GHG emissions avoided (MMtCO <sub>2</sub> e)
2008	344	3,017	1.3685	0.000001
2009	430	3,770	1.7100	0.000002
2010	568	4,977	2.2575	0.000002
2111	671	5,881	2.6677	0.000003
2012	783	6,861	3.1122	0.000003
2013	895	7,841	3.5568	0.000004
2014	1,007	8,821	4.0013	0.000004
2015	1,119	9,801	4.4458	0.000004
2016	1,231	10,781	4.8903	0.000005
2017	1,343	11,761	5.3349	0.000005

2018	1,455	12,741	5.7794	0.000006
2019	1,567	13,721	6.2239	0.000006
2020	1,679	14,701	6.6684	0.000007

## **Implementation**

Outreach and public education are supporting efforts to other programs. They do not exist as separate, quantifiable entities. In the 2008 Climate Action Plan, these activities were presented as part of the cross-cutting group of policies which were not quantified. There is, therefore, no base line from which to estimate benefits.

There are many models from which to estimate emissions benefits from social programs. Surveys, like the ones performed by the Clean Air Partners to evaluate the effectiveness of Ozone Action Day messaging, are one way to assess how effectively a set of messages has been delivered and received. These work well to assess actions taken in response to specific episodes, in this case code red ozone days. They do not attempt to quantify reductions in ozone pollution. Other well-documented social engineering techniques have been used to promote recycling in communities. The attitudes and actions of people are quantified and the tons of recycled materials are measured. There is not an environmental benefit directly ascribed to the outreach program because there are usually many external factors that confound the quantification effort (both positive and negative).

All programs to reduce GHG emissions should include an educational component to ensure that people understand what is trying to be accomplished. Extending the traditional methods to include social media and other evolving communication techniques must be considered for successful education and outreach.

### *MADE-CLEAR*

In addition to taking action to mitigate climate change, Maryland schools are expected to implement climate change curriculum at all levels of the education system. The National Science Foundation has awarded a highly competitive, \$1 million two-year planning grant to the University System of Maryland to implement the Maryland-Delaware Climate Change Education, Assessment and Research, also know as MADE-CLEAR, project in collaboration with University of Maryland Center for Environmental Science, the University of Maryland, and the University of Delaware.<sup>115</sup> The award funds a two-year strategic planning process that will build on partnerships among the two states' universities, public schools, federal agencies, and public and private sectors to assess needs and identify key stakeholders and resources needed to implement an innovative P-20 climate change curriculum, develop new pathways for teacher education and professional development leading to expertise in climate change content and pedagogy, and promote better communication for public understanding of the science of climate change. A strategic plan will be developed and will serve as the basis of a proposal for a full implementation grant of several million dollars per year. The overall goal of the project is to establish a coordinated national network of partnerships devoted to

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<sup>115</sup> National Science Foundation award information available at:  
<http://www.nsf.gov/awardsearch/showAward.do?AwardNumber=1043262>.

increasing the adoption of educational programs and resources related to the science of climate change and its impacts.

### *College Climate Action Group*

MDE is facilitating a group called the College Climate Action Group, for Maryland colleges and universities which have either signed the American College and University Presidents' Climate Commitment or are considering implementing strategies to reduce GHG emissions. The MDE-coordinated College Climate Action Group is envisioned to provide a forum for Maryland colleges and universities to share information relating to the implementation of a climate action plan or target. The meetings will be held quarterly in 2011.

### *Maryland State Department of Education*

The Maryland State Department of Education has developed Environmental Literacy Curriculum,<sup>116</sup> which includes climate change topics. The curriculum is additional to the Maryland-Delaware Climate Change Education, Assessment and Research plan. Climate change instructional resources for teachers are provided by the National Oceanic and Atmospheric Administration under the Communications and Education Program. The Maryland Environmental Literacy Standards are based on national standards and provide a flexible structure that allows for more in-depth study of particular issues using critical thinking skills and investigation to learn long-term reasoning, research and interpretation skills. The purpose of Maryland's Environmental Education program is to enable students to make informed and responsible decisions about the environment in all its complexity and take actions to increase public awareness about environmental issues, and to preserve and protect the unique natural resources of Maryland.

The Maryland State Department of Education's Environmental Education website hosts a Climate Change Education resource page and classroom toolkit. Lessons, websites, and unit plans for all appropriate grade levels are included on the site. The agency incorporated language from the national Climate Literacy Standards into the draft Maryland State Environmental Literacy Standards. These standards represent what an environmentally literate Maryland high school graduate will know about climate and climate change, as well as describe the analysis and decision-making skills involved in the investigation of environmental issues. Input on the standards was garnered from more than 100 members of the education and climate science communities. The Climate Literacy Standards define climate literacy as one who “understands the influence of climate on you and society and your influence on climate”.<sup>117</sup> Moreover, a climatically literate person:

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<sup>116</sup> Curriculum information available:

<http://www.marylandpublicschools.org/MSDE/programs/environment/?WBCMODE=PresentationUnpubli%25%3E%25>

<sup>117</sup> Climate Literacy: Essential Principles and Fundamental Concepts, 2007, NOAA, AAAS Project 2061.

- Understands the essential principles and fundamental concepts about the functioning of weather and climate and how they relate to variations in the air, water, land, life and human activities both in time and space;
- Can communicate about the climate and climate change in a meaningful way;
- Is able to make scientifically informed and responsible decisions regarding the climate.

### *GREENet*

The Governor's Regional Environmental Education Network, also known as GREENet, was created in the Fall of 2008 to serve as a communications tool for formal educators, informal environmental educators, non-profits, community groups, State agencies, and others interested in and engaged in environmental education. There is a network contact for every county in Maryland. The network forum is available online:  
<http://mdinformee.ning.com/>.