# Appendix C – Maryland Climate Policies

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# Appendix C – Maryland Climate Programs

**Acronyms Used:**

BGE – Baltimore Gas and Electric
$CO_2$-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
$MMtCO_2e$ – million metric tons of $CO_2$-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**

| Program Number | Program | Potential GHG Reductions ($MMtCO_2e$) |
|---|---|---|
| **ENERGY** | | |
| Energy-1 | Regional Greenhouse Gas Initiative | 12.26 – 17.71 |
| Energy-2 | GHG reductions from imported power | 1.90 – 2.75 |
| Energy-3 | Federal New Source Performance Standards | 3.22 – 4.84 |
| Energy-4 | Maximum Achievable Control Technology | 0.02 – 0.10 |
| Energy-5 | Prevention of Significant Deterioration | Not Quantified |
| Energy-6 | EmPOWER: Energy Efficiency in the Residential Sector | 5.40 – 7.27 |
| Energy-7 | EmPOWER: Energy Efficiency in the Commercial and Industrial Sectors | Combined with Energy-6 |
| Energy-8 | EmPOWER: Energy efficiency: appliances and other products | Combined with Energy-6 |
| Energy-9 | Energy Efficiency in the power sector: general | Combined with Energy-6 |
| Energy-10 | EmPOWER: Utility Programs | Combined with Energy-6 |
| Energy-11 | The Maryland Renewable Energy Portfolio Standard Program | 3.04 – 6.78 |
| Energy-12 | Incentives and Grant Programs to Support Renewable Energy | Combined with Energy-11 |
| Energy-13 | Offshore Wind Initiatives to Support Renewable Energy | Combined with Energy-11 |
| Energy-14 | Combined heat and power | Combined with Energy-6 |
| Energy-15 | Main Street | 0.01 – 0.02 |
| Energy-16 | Weatherization and energy efficiency for low income houses | 0.03– 0.04 |
| **Total** | | **25.88 – 39.51** |
| **TRANSPORTATION** | | |
| Transportation-1 | Maryland Clean Cars Program | Combined with Transportation-10 |
| Transportation-2 | Federal Medium and heavy Duty GHG Standards | 0.63 – 0.88 |

| | | |
|---|---|---|
| Transportation-3 | Clean Fuel Standard | 1.21 – 2.42 |
| Transportation-4 | The Transportation Climate Initiative | 0.03 – 0.07 |
| Transportation-5 | Public Transportation Initiatives | 1.35 – 1.97 |
| Transportation-6 | Initiatives to Double Transit Ridership by 2020 | Combined with Transportation-5 |
| Transportation-7 | Intercity Transportation Initiatives | 0.65 – 0.76 |
| Transportation-8 | Bike and Pedestrian Initiatives | 0.25 – 0.41 |
| Transportation-9 | Pricing Initiatives | 0.20 – 2.21 |
| Transportation-10 | Transportation Technology Initiatives | 6.03 – 9.48 |
| Transportation-11 | Electric Vehicle Initiatives | Combined with Transportation-10 |
| Transportation-12 | Low Emitting Vehicle Initiatives | Combined with Transportation-10 |
| Transportation-13 | Evaluate the GHG Emissions Impacts from Major New Projects and Plans | Not Quantified |
| Transportation-14 | Airport Initiatives | Combined with Transportation-10 |
| Transportation-15 | Port Initiatives | Combined with Transportation-10 |
| Transportation-16 | Freight and Freight Rail Strategies | Combined with Transportation-7 or Transportation-10 |
| Transportation-17 | Renewable Fuels Standard | Combined with Transportation-10 |
| Transportation-18 | Corporate Average Fuel Economy (CAFÉ) Standards: Model Years 2008-2011 | Combined with Transportation-1 |
| Transportation-19 | Promoting Hybrid and Electric Vehicles | Combined with Transportation-4 |
| Transportation-20 | Pay-As-You-Drive® Insurance in Maryland | 0.03 - 0.09 |
| **Total** | | **10.38 – 18.29** |
| **AG AND FORESTRY** | | |
| Ag and Forestry-1 | Managing forests to capture carbon | 0.21 – 2.70 |
| Ag and Forestry-2 | Creating ecosystems markets to encourage GHG emission reductions | 0.16 – 0.82 |
| Ag and Forestry-3 | Increasing urban trees to capture carbon | 0.03 – 1.32 |
| Ag and Forestry-4 | Creating and protecting wetlands and waterway borders to capture carbon | 0.05 – 0.65 |
| Ag and Forestry-5 | Geological opportunities to store carbon | Not Quantified |
| Ag and Forestry-6 | Planting forests in Maryland | 0.12 – 0.62 |

| | | |
|---|---|---|
| Ag and Forestry-7 | Biomass for energy production | 0.50 – 3.07 |
| Ag and Forestry-8 | Conservation of agricultural land for GHG benefits | 0.28 – 0.28 |
| Ag and Forestry-9 | Buy local for GHG benefits | 0.03 – 0.05 |
| Ag and Forestry-10 | Nutrient trading for GHG benefits | 0.14 – 0.21 |
| **Total** | | **1.52 – 9.72** |
| **RECYCLING** | | |
| Recycling-1 | Recycling & Source Reduction | 2.00 – 2.32 |
| **Total** | | **2.00 – 2.32** |
| **MULTI-SECTOR** | | |
| Multi-Sector-1 | Greenhouse Gas Emissions Inventory Development | Not Quantified |
| Multi-Sector-2 | Program Analysis, Goals and Overall Implementation | Not Quantified |
| Multi-Sector-3 | Outreach and public education | 0.00 – 0.05 |
| **Total** | | **0.00 – 0.05** |
| **BUILDINGS** | | |
| Buildings-1 | Green building initiatives | Combined with Innovative Initiatives-5 |
| Buildings-2 | Building codes | 2.40 – 5.40 |
| **Total** | | **2.40 – 5.40** |
| **LAND USE** | | |
| Land Use-1 | Reducing transportation issues through smart growth | 0.96 – 1.01 |
| Land Use-2 | GHG targets for local government's transportation and land use planning | Combined with Land Use-1 |
| Land Use-3 | Land use planning GHG benefits | Combined with Land Use-1 |
| Land Use-4 | Growth boundary GHG benefits | Combined with Land Use-1 |
| **Total** | | **0.96 – 1.01** |
| **INNOVATIVE INITIATIVES** | | |
| Innovative Initiatives-1 | Leadership-By-Example – Local Government | 0.38 – 0.57 |
| Innovative | Leadership-By-Example – Federal | 0.28 – 0.87 |

| | | |
|---|---|---|
| Initiatives-2 | Government | |
| Innovative Initiatives-3 | Leadership-By-Example – Maryland University Lead by Example Initiatives | 0.55 – 0.57 |
| Innovative Initiatives-4 | Voluntary Stationary Source Reductions | 0.26 – 1.03 |
| Innovative Initiatives-5 | State of Maryland initiatives to lead by example | 0.20 – 2.30 |
| Innovative Initiatives-6 | State of Maryland carbon and footprint initiatives | Combined with Innovative Initiatives-5 |
| Innovative Initiatives-7 | Job creation and economic development initiatives related to climate change | Not Yet Quantified |
| Innovative Initiatives-8 | Public health initiatives related to climate change | Not Yet Quantified |
| Innovative Initiatives-9 | Title V Permits for GHG Sources | Not Quantified |
| **Total** | | **1.67 – 5.34** |

**TOTAL RANGE OF ESTIMATED GHG EMISSIONS REDUCTIONS**

| Sector | Total Expected GHG Reductions ($MMtCO_2e$) |
|---|---|
| Energy | 25.88 – 39.51 |
| Transportation | 10.38 – 18.29 |
| Ag and Forestry | 1.52 – 9.72 |
| Recycling | 2.00 – 2.32 |
| Multi-Sector | 0.00 – 0.05 |
| Buildings | 2.40 – 5.40 |
| Land Use | 0.96 – 1.01 |
| Innovative Initiatives | 1.67 – 5.34 |
| **Total** | **44.81 – 81.64** |

# Sub-Appendix C-1: Energy Programs

## Energy-1: 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

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-2. Maryland Sources Subject to RGGI.

| Owner | Plant | Location | Fuel |
|---|---|---|---|
| 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 noted above, RGGI's goal is to reduce carbon dioxide emissions from the power sector by 10 percent by 2019. Without any available technological controls, the concept was to make the reduction through reduced demand. By auctioning a portion of the $CO_2$ allowances, funds would be available to invest in energy efficiency. As a demonstration project, RGGI adopted a modest reduction goal and aimed to provide some funding toward that goal. RGGI envisioned stabilizing emissions through 2014 and beginning a 2.5 percent reduction per year in 2015 through 2019.

As part of the original RGGI memorandum of understanding, there is a 2012 review of the program that will look at several programmatic issues including whether RGGI should lower the cap to achieve greater reductions. The other option would be that a federal GHG control program would be adopted which would drive deeper reductions than those currently required by RGGI.

## Estimated GHG Emission Reductions in 2020

**By 2020, the potential emission reductions from the RGGI program are estimated to be 17.71 $MMtCO_2$-equivalent.**

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-3. Low and High GHG Benefits for Energy-1

| | | |
|---|---|---|
| Low Estimate | 12.26 $MMtCO_2e$ | SAIC Quantification Appendix B, Pg. 80 |
| High Estimate | 17.71 $MMtCO_2e$ | MDE Quantification Below |

**High Estimate – MDE Quantification**

A. Estimated GHG Reductions

The RGGI regional cap is 188,076,976 tons per year. RGGI envisioned stabilizing emissions through 2014 and beginning a 2.5 percent reduction per year in 2015 through 2019. There are two possible ways for the RGGI cap to be made more stringent. As part of the original RGGI memorandum of understanding, there is a 2012 review of the program that will look at several issues including whether RGGI should adjust the cap and achieve greater reductions. The other option would be that a federal carbon dioxide control program would be adopted which would drive deeper reductions than those currently required by RGGI.

There is a reasonable chance that between 2012 and 2020 that the RGGI reduction requirement could be made more stringent. 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 reduction could be achieved by 2020; that by 2030, the RGGI reductions could be doubled; and, that by 2050, the reductions could be three to four times greater than the predicted reductions in 2020. Therefore, it is estimated that RGGI could avoid 17.71 million metric tons of carbon dioxide ($MMtCO_2e$) in 2020.

B. Calculations

High Quantification was determined using the following formulas:

$AVG_{0810} = Total_{0810}/3$

Where

$AVG_{0810}$ = Average allocation from the years 2008 to 2010
$Total_{0810}$ = Total allocation from 2008 to 2010
$RED_{10} = AVG_{0810}/10$

Where

$RED_{10}$ =10% Reduction
$RGGI_{2020} = AVG_{0810} - RED_{10}$

Where

$RGGI_{2020}$ = 2020 high quantification RGGI cap
$ALL_{MD} = RGGI_{2020}*(ALL_{MD00}/SUM_{00})$

Where

$ALL_{MD}$ = Allocation for Maryland
$ALL_{MD00}$ = Allocation for Maryland in 2000
$SUM_{00}$ = Sum of all allocations for RGGI states in 2000
$RED_{HIGH} = BAU_{2020} - ALL_{MD}$

Where

$RED_{HIGH}$ = High quantification reduction
$BAU_{2020}$ = 2020 Business As Usual (see SAIC ES-3 policy in Appendix B)

## 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.

## Economic Benefits, Job Creation and Job Protection

The Healthy Air Act required a comprehensive, independent study which projected RGGI's economic impact. This study, conducted by the University of Maryland's Center

for Integrated Environmental Research, looked at how RGGI would affect consumers, create jobs and impact Maryland's economy. The study estimated that RGGI would create as many as 2500 jobs in Maryland by 2020.

The study also analyzed the economic benefits that could be accrued assuming several different auction scenarios (the auction of 25 up to 100 percent of allowances). The study assumed that the auction proceeds would be used to promote energy efficiency and renewable energy. The study concluded that auction of 100 percent of the allowances auction scenario, where the most revenue would be spent on energy efficiency, resulted in the maximum benefit to Maryland citizens. Even though electricity prices will rise in the future (not solely due to RGGI) because of energy efficiency programs, usage would decline so that a net positive benefit in the form of lower household electricity bills occurs would result. The study projected an average net benefit of approximately $20 per year for Maryland ratepayer.

The study also estimated a positive impact on gross State product of approximately $200 million by 2015 and subsequent years. MDE is conducting additional analyses to update the economic impact information for RGGI.

Further analyses for the economic benefits, job creation and job protection in Maryland from this program is included in Chapter 7 of this plan.

## Implementation

The RGGI program is mandated by State law and is fully implemented and enforceable.

## Supporting Laws and Regulations

- Maryland Healthy Air Act (2006) - http://www.mde.state.md.us/programs/Air/Documents/26-11-27_MD_Healthy_Air_Act.pdf
- Maryland Strategic Energy Investment Act (2008) - http://mlis.state.md.us/2008rs/bills/hb/hb0368e.pdf
- Maryland $CO_2$ Budget Trading Program Regulations (COMAR 26.09) http://www.dsd.state.md.us/comar/subtitle_chapters/26_Chapters.aspx#Subtitle09

## Links to Supporting Documentation

- Regional Greenhouse Gas Initiative (general information, 2005 RGGI MOU, etc.) http://www.rggi.org/home
- Maryland $CO_2$ Budget Trading Program http://www.mde.state.md.us/programs/Air/RGGI/Pages/Air/RGGI.aspx
- University of Maryland, Center for Integrative Environmental Research's studies on Maryland's participation in RGGI:

- Economic and Energy Impacts from Maryland's Potential Participation in the Regional Greenhouse Gas Initiative, http://www.cier.umd.edu/RGGI/documents/UMD_RGGI_STUDY_FINAL.pdf
- The Role of Energy Efficiency Spending in Maryland's Implementation of the Regional Greenhouse Gas Initiative, http://www.cier.umd.edu/RGGI/CIER_RGGI_Energy_Efficiency_Spending_Study[1].pdf

# Energy-2: GHG Emission Reductions from Imported Power

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.[1] 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 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

[1] 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.

loss. Whereas, low-carbon and renewable energy technologies would receive a premium from Maryland rate-payers.

## Estimated GHG Emission Reductions in 2020

**By 2020, the potential emission reductions from this program are estimated to be 2.75 MMt$CO_2$e.**

**Figure C-4. Low and High GHG Benefits for Energy-2**

| | | |
|---|---|---|
| Low Estimate | 1.90 MMt$CO_2$e | MDE Quantification Below |
| High Estimate | 2.75 MMt$CO_2$e | MDE Quantification Below |

**Low and High 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 $CO_2$-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 $CO_2$-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 $MMtCO_2e$ (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 $MMtCO_2e$ (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 $MMtCO_2e$ (15,688,413,839 pounds). So the low-estimated reduction is 1.9 $MMtCO_2e$ (9.0 – 7.1).

For the high quantification, the rate of the carbon-intensity trend from 2005 to 2010 is assumed to increase by 50 percent for subsequent years. The carbon intensity in 2005 was 1,292.0 pounds of carbon dioxide per MWh, from which we subtract the 2010 rate (1,167.6 pounds of carbon dioxide per MWh) resulting in an annual reduction of 1.93 percent. The rate is increased by 50 percent, which is 2.89 percent. A 2.89 percent annual reduction is possible depending upon on a federal climate and/or energy program, significant Renewable Portfolio Standard (RPS) activity in PJM states, adoption of RGGI by other PJM states, Maryland developing a generation performance standard, a carbon-tax being added to imported electricity in Maryland, or some combination of these or other unknown factors. The high-estimate is a carbon-intensity rate of 870.8 pounds of carbon dioxide per MWh, which could result in 2020 emissions of 6.3 $MMtCO_2e$ (13,863,231,652 pounds). Therefore, the high-estimate reduction is 2.75 $MMtCO_2e$ (9.0-6.3).

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.

## Other Environmental Benefits

No other environmental benefits were identified for this version of the draft 2012 GGRA Plan but will be provided in future iterations.

## Economic Benefits, Job Creation and Job Protection

Analyses for the economic benefits, job creation and job protection in Maryland from this program is included in Chapter 7 of this plan.

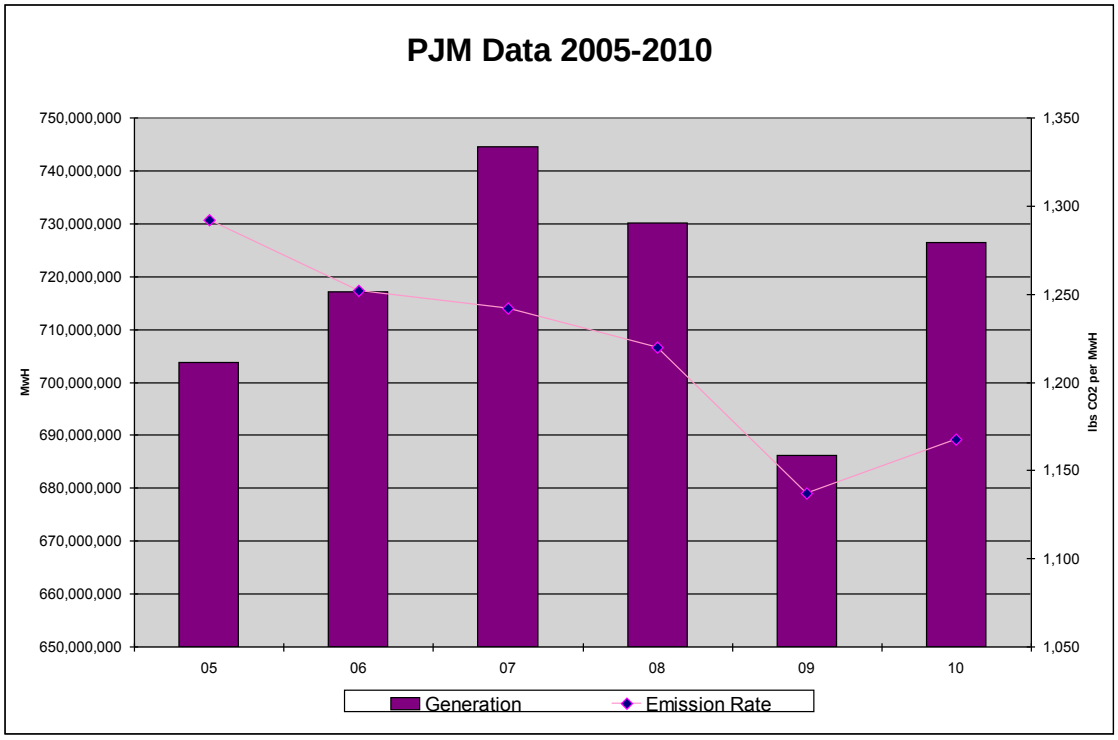
## Implementation

A generation performance standard portfolio would require that 100 percent of a load serving entity's energy portfolio emit an average of no more than a specified number of pounds of carbon dioxide per MWh. The generation performance standard could be modeled after Maryland's existing RPS with the exception that the standard may rely on a more diverse mix of replacements for coal-fired electricity than the RPS and would include conventional sources in the portfolio as well. This would encourage renewable energy sources. Any load serving entity selling energy to retail consumers in Maryland would be required to meet the generation performance standard.

The carbon intensity of electricity production measures the carbon emissions per unit of electricity generated, in a given year. The carbon dioxide from electricity generation combustion of all fossil fuel types is the sum of carbon emissions from electricity generation, combined heat and power generation, and heat plants. PJM Environmental Information Services provides an annual summary of environmental and emissions attributes reporting and tracking, including a full regional fuel mix and emissions factors for carbon dioxide and criteria pollutants through a General Attributes Tracking System database.

Since Maryland imports approximately 30 percent of electricity needed to meet demand, it is important to look at the full fuel mix of the PJM region when determining the carbon intensity of electricity consumption in Maryland. The PJM region is made up of 13 other states and the District of Columbia. Most of the states delivering electricity to the PJM region have a higher percentage of coal-fired generation than Maryland, which has the highest of the RGGI states. Even without the generation performance standard, the carbon dioxide emissions per MWh in the PJM area have declined over the past five years. Reasons for this reduction could include mild weather trends for certain years, the reduced cost of natural gas which resulted in fuel switching, a lessened demand for electricity due to a national economic recession, and modifications in the dispatch of electricity generators. As demonstrated in Figure C-5, Maryland is close to achieving the recommended generation performance standard from the 2008 Climate Action Plan without enacting a program and in the absence of a federal program. However, it is doubtful that the PJM region carbon intensity will continue to remain at the 2009 value as the nation recovers from a recession and experiences more typical weather trends.

**Figure C-5. Carbon Emissions and Intensity Compared to Total Megawatt-hours of Electricity Generation in the PJM region.**




## Supporting Laws and Regulations

- The Waxman-Markey bill, American Clean Energy and Security Act of 2009, House of Representatives 2454.

**New Legislation Needed**

The 2008 Climate Action Plan envisioned a Maryland generation performance standard to control imports of high-carbon intensity electricity from out-of-state. However, the benefits from this program are greatly reduced without effective federal legislation. A Maryland generation performance standard would apply stricter emissions standards to load serving entities that are serving Maryland consumers. The high up-front cost by the load serving entities to meet these standards for supplying electricity into Maryland would ultimately fall on Maryland ratepayers in the form of increased electricity rates. An overarching federal approach to reduce GHG emissions would level the playing field for competing sources of generation by applying the same standard to all electricity suppliers.

The Waxman-Markey bill (American Clean Energy and Security Act of 2009, House of Representatives 2454) had included a generation performance standard. The original bill set a limit of 1,100 pounds carbon dioxide per MWh for electricity generators permitted after January 1, 2009 going down to 800 pounds carbon dioxide per MWh for units

permitted after January 1, 2020. As amended during committee mark-up, the performance standard for coal-fired power plants was then based on a percentage carbon dioxide emission reduction requirement instead of pounds per MWh standard. This would have meant that any new coal plant permitted after 2009 would be required to undergo retrofits that capture and sequester at least 50 percent of their carbon dioxide emissions sometime between 2013 and 2025. After 2020, new coal plants would have been required to capture and sequester at least 65 percent of their carbon dioxide upon construction.

If and when climate legislation is enacted by Congress, a generation performance standard that emerges may be different from what was in the Waxman-Markey bill. In recognizing that such a standard is best done at the federal level to control leakage, MDE continues tracking federal climate change legislation and will defer implementation of a State generation performance standard pending final action on any national standard under consideration.

MDE will continue to monitor the carbon intensity of electricity production in Maryland over time. The carbon intensity of electricity production is one component of the carbon intensity of energy use as a whole. This indicator suggests the availability of fuel switching options in electricity production, i.e. switching from fossil fuels to non-fossil fuel sources in order to reduce GHG emissions. Electricity generation covers coal, oil, and gas (the fossil fuel sources of energy); hydropower and nuclear power generation, as well as geothermal, solar, wind, tide and wave energy, and that from combustible renewables and waste. The lower the carbon intensity, the more Maryland relies upon non-fossil fuel sources of energy for electricity generation.

## Links to Supporting Documentation

- PJM-EIS Generation Attributes Tracking System: http://www.pjm-eis.com/
- The Waxman-Markey bill, American Clean Energy and Security Act of 2009, H.R. 2454: http://www.epa.gov/climatechange/economics/economicanalyses.html#hr2454

# Energy-3: 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

**By 2020, the potential emission reductions from this program are estimated to be 4.84 MMt$CO_2$e.**

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

**Figure C-6. Low and High GHG Benefits for Energy-3**

| | | |
|---|---|---|
| Low Estimate | 3.22 MMt$CO_2$e | MDE Quantification Below |
| High Estimate | 4.84 MMt$CO_2$e | MDE Quantification Below |

**Low and High Estimates – MDE Quantification**

*Discussion of General Approach to Emissions and Cost Savings Estimates*

EPA will adopt new standards for fossil fuel power plants in July of 2011. Emissions reductions may result from fuel switching and /or more efficient power generation. Increases in efficiency will allow power plants to meet consumer demand while reducing

the amount of fuel burned. Fuel usage is the best basis for estimating the emissions and cost savings due to the upcoming regulation.

In order to provide accurate estimates of savings, power generation sources would need to provide data on historical fuel usage and provide estimates of fuel usage once efficiency is increased. That data could be used to estimate emissions and cost savings. Data obtained from the EPA Clean Air Markets database could be used to confirm carbon dioxide, nitrogen oxides and sulfur dioxide emissions savings. Cost savings and particulate matter emissions savings could be confirmed from actual fuel usage data and emission factors with control equipment efficiencies. In the absence of fuel usage data, the following calculations assume a straight 10 percent to 15 percent savings using historical data from Clean Air Markets. Each calculation will have additional assumptions. Calculations based on Clean Air Markets data include power generators capable of producing a minimum of 25 MW of power. There are additional sources that are not included in the Clean Air Markets data. These are smaller sources that typically run intermittently.

*Estimation of $CO_2$ Emissions Savings*

Scenario 1: July 2011 Regulation results in a reduction of carbon dioxide emissions by 10 percent from Power Generation Facilities which have a capacity of 25 MW or more.

Data Source: Clean Air Markets
Average Annual Emissions from 2007 to 2009 = 32,246,298 tons per year carbon dioxide

Assumed 10 percent reduction
Carbon Dioxide Emissions Savings = 0.1 x 32,246,298 tons per year = 3,224,630 tons per year

Scenario 2: July 2011 Regulation results in a reduction of carbon dioxide emissions by 15 percent from power generation facilities which have a capacity of 25 MW or more.

Data Source: Clean Air Markets
Average Annual Emissions from 2007 to 2009 = 32,246,298 tons per year carbon dioxide

Assumed 15 percent reduction
Carbon Dioxide Emissions Savings = 0.15 x 32,246,298 tons per year = 4,836,945 tons per year

***Estimation of Nitrogen Oxides Emissions Savings***

Calculation of Average Nitrogen Oxides Produced by Power Plants (Data Source: Clean Air Markets)

2009 Nitrogen Oxide Emissions = 20,831 tons per year (Note: The data from year 2009 was chosen as the basis for this calculation as it reflects emissions post Healthy Air Act

Assuming a 10 percent reduction in nitrogen oxides due to the July 2011 regulation:
Estimated. Emission Savings: 2083 tons per year

Assuming a 15 percent reduction in nitrogen oxides due to the July 2011 regulation:
Estimated. Emission Savings: 3125 tons per year

***Estimation of Sulfur Oxides Emissions Savings***

Calculation of Average Sulfur Dioxide Produced by Power Plants (Data Source: Clean Air Markets)

2010 Sulfur Dioxide Emissions = 28,670 tons per year (Note: The data from year 2010 was chosen as the basis for this calculation as it reflects emissions post Healthy Air Act)

Assuming a 10 percent reduction in Sulfur Dioxide due to the July 2011 regulation:
Estimated. Emission Savings: 2,867tons per year

Assuming a 15 percent reduction in nitrogen oxides due to the July 2011 regulation:
Estimated. Emission Savings: 4,300tons per year

***Estimation of Particulate Matter Emissions Savings***

Particulate matter emission savings are not estimated at this time. It is expected that particulate matter emissions had significant decreases in 2010 due to the Healthy Air Act. Sources implemented controls (scrubbers) to reduce particulate matter emissions. Available historical data will not reflect current or future particulate matter emissions.

***Estimation of Fuel and Cost Savings***

Note: All estimates of fuel usage are based on Clean Air Markets data. All fuel usage calculations assume that only the primary fuel was burned.

*Calculation of Fuel Usage for Coal:*

Total Coal Burned 2007, 2008 2009 = 804,462,421 mmBTU
Average Coal Burned = 268,154,140 mmBTU
Fuel Value of Coal ("The Engineering Toolbox") = 28 mmBTU per ton
Average Coal Burned = 9,576,934 Tons of Coal

Note: The price of Coal varied depending on the BTU value and sulfur content. (Figure C-6)

Assuming the price of coal is = $76.15 per short Ton
Cost of Average Coal Burned = $729,283,492.47

Assuming 10 percent less coal burned due to efficiencies resulting from July 2011 Regulation: **Savings = $72,928,349.25 per year**

**Figure C-7. Calculation of Fuel Usage: Coal[2]**

| Week Ended | Central Appalachia 12,500 Btu 1.2 Sulfur Dioxide | Northern Appalachia 13,000 Btu <3.0 SulfurDioxide | Illinois Basin 11,800 Btu 5.0 Sulfur Dioxide | Powder River Basin 8,800 Btu 0.8 Sulfur Dioxide | Uinta Basin 11,700 Btu 0.8 Sulfur Dioxide |
|---|---|---|---|---|---|
| 25-Feb-11 | $77.70 | $74.65 | $47.50 | $14.10 | $41.00 |
| 4-Mar-11 | $77.70 | $74.65 | $47.50 | $13.95 | $41.00 |
| 11-Mar-11 | $77.70 | $74.65 | $47.50 | $13.85 | $41.00 |
| 18-Mar-11 | $77.70 | $74.65 | $47.50 | $13.65 | $41.00 |
| 25-Mar-11 | $75.20 | $76.15 | $47.50 | $13.45 | $41.00 |
| 1-Apr-11 | $78.85 | $76.15 | $47.75 | $13.25 | $41.00 |
| 8-Apr-11 | $78.85 | $76.15 | $47.75 | $12.75 | $41.00 |

*Calculation of Fuel Usage for Oil:*

Total Oil Burned 2007, 2008 2009 = 31,832,205 mmBTU
Average Oil Burned = 10,610,735 mmBTU
Fuel Value of Oil ("The Engineering Toolbox") = 0.1524 mmBTU per gallon
Average Oil Burned = 69,624,245 Gallons of oil

Assuming the price of oil is = $2.00 per gallon
Cost of Average Oil Burned = $139,248,489.77

[2] http://www.eia.doe.gov/cneaf/coal/page/coalnews/coalmar.html

Assuming 10 percent less oil burned due to efficiencies resulting from July 2011 Regulation: **Savings = $ 13,924,848.98 per year**

*Calculation of Fuel Usage for Natural Gas:*

| | |
|---|---|
| Total Natural Gas Burned 2007, 2008 2009 | = 26,248,541 mmBTU |
| Average Natural Gas Burned | = 8,749,514 mmBTU |
| Fuel Value of Natural Gas ("The Engineering Toolbox") | = 0.001 mmBTU per cubic foot |
| Average Natural Gas Burned | = 8,749,514,000 cubic feet of Natural Gas |
| Assuming the price[3] of Natural Gas is | = $ 0.00555 per cubic foot |
| Cost of Average Natural Gas Burned, as of Jan 2011) | = $48,559,802.70 |

Assuming 10 percent less Natural Gas burned due to efficiencies resulting from July 2011 Regulation: **Savings = $4,855,980.27 per year**

Assuming 15 percent less Natural Gas burned due to efficiencies resulting from July 2011 Regulation: **Savings = $7,283,970.41 per year**

## Other Environmental Benefits

Any other environmental benefits from the GHG New Source Performance Standard will depend on the actual standards that EPA ends up adopting.

Estimates based on EPA's Clean Air Markets emissions data show potential emissions savings for nitrogen oxides and sulfur oxides. These estimates assume emissions reductions in the range of 10 percent to 15 percent with potential savings of 2,083 tons per year to 3,125 tons per year for nitrogen oxides; 2,867 tons per year to 4,300 tons per year for sulfur oxides.

## Economic Benefits, Job Creation and Job Protection

There may be economic benefits to contractors and consultants that will be hired to implement the new standards.

Power generation facilities may see cost savings due to reduced fuel usage costs. Estimates show the following potential savings:

- Reduced coal purchase, savings of $72,928,349 to $109,392,523 per year
- Reduced No. 6 fuel oil purchase, savings of $13,924,848 to $20,887,273 per year
- Reduced natural gas purchase, savings of $4,855,980 to $7,283,970 per year

[3] http://www.eia.doe.gov/dnav/ng/ng_pri_sum_dcu_nus_m.htm

Further analyses for the economic benefits, job creation and job protection in Maryland from this program is included in Chapter 7 of this plan.

## Implementation

Once EPA adopts the new GHG New Source Performance Standard, they will become effective on a date determined by EPA in the rule. MDE will then adopt the federal rules into Maryland State regulations. MDE's Air Quality Compliance Program will then ensure that the utilities comply with the requirements. Based on certified emissions reports, MDE will be able to determine the amount of GHG reductions achieved.

## Supporting Laws and Regulations

- The Clean Air Act.

# Energy-4: 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

**By 2020, the potential emission reductions from this program are estimated to be 0.10 $MMtCO_2e$.**

**Figure C-8. Low and High GHG Benefits for Energy-4**

| | | |
|---|---|---|
| Low Estimate | 0.02 $MMtCO_2e$ | MDE Quantification Below |
| High Estimate | 0.10 $MMtCO_2e$ | MDE Quantification Below |

**Low and High 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.[4] Actual emissions from this sector have been calculated as approximately 1.45 $MMtCO_2e$ per year if the affected boilers operate at average 15 percent capacity factor.[5] 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.

[4] 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.

[5] A 15 percent capacity factor chosen to approximate typical boiler based on COMAR 26.11.09.08F.

## 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. 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

## Economic Benefits, Job Creation and Job Protection

The Boiler MACT rule will create job opportunities for consultants and contractors to ensure that the boilers are in compliance.

There will be economic benefits to the consultants and contractors that are hired to ensure compliance. The 1 percent reductions in fuel consumption will lead to a savings of between $4 million when a 15 percent capacity factor is assumed to a maximum of $26 million for a 100 percent capacity factor.

Note: Economic benefit based on current fuel rates of $4.00 per gallon #2 fuel oil and 78 dollars per ton of coal.

Further analyses for the economic benefits, job creation and job protection in Maryland from this program in included in Chapter 7 of this plan.

## Implementation

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

## Supporting Laws and Regulations

- The Clean Air Act

# Energy-5: 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.

## Other Environmental Benefits

It is difficult to determine additional environmental benefits related to the Prevention of Significant Deterioration program since the benefits attributable to this program, as

discussed previously, are based upon the relevance of this program to policymaking, transparency issues and market efficiency.

## Economic Benefits, Job Creation and Job Protection

Analyses for the economic benefits, job creation and job protection in Maryland from this program is included in Chapter 7 of this plan.

## 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 $CO_2$-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 $CO_2$-equivalent or modifications to existing sources that increases net emission of $CO_2$-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 $CO_2$-equivalent and no modification resulting in net GHG increases of less than 50,000 tons per year $CO_2$-equivalent will be subject to this program's permitting before at least 6 years from now to April 30, 2016.

## Links to Supporting Documentation

No supporting laws or regulations were included in this version of the 2012 GGRA Plan.

# Energy-6: 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.[6] 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.[7] 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 will only be 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.
- *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.* This program offers homeowners rebates for home energy efficiency improvements. By combining a 35 percent rebate, and up

[6] 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.

[7] 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.

to $3,100 total, from MEA with a 15 percent rebate from the utility company, homeowners can save a total of 50 percent on home energy improvements. MEA encourages homeowners to upgrade the energy efficiency of their homes to ENERGY STAR standards. This program is federally-funded 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 are likely to increase their own rebate levels from 15 percent to a higher amount, such as 40 percent.

- *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 in 2009, 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 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. Replacing furnaces, heat pumps and air conditioners that are at least 10 years old is a primary focus, 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.[8]
- *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.
- *State Energy Efficient Appliance Rebate Program.* MEA worked with Maryland's five major utilities to enhance their existing appliance rebate programs for homeowners.[9] 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 are proposing to enhance their existing appliance rebate offerings in their 2012-2014 plans.

[8] 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.

[9] 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.

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 sectoral reach.[10]

- 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 efficiency in the residential sector and these programs are summarized in its September 2010 report.[11]
- 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.[12]
- MEA has 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.
    - 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.[13]

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[10] 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/Chapter4.pdf

[11] 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

[12] 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.

[13] 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.

- 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

**By 2020, the potential emission reductions from this program, combined with other EmPOWER programs, are estimated to be 7.27 MMt$CO_2$e.**

**Figure C-9. Low and High GHG Benefits for Energy-6**

| | | |
|---|---|---|
| Low Estimate | 5.40 MMt$CO_2$e | SAIC Quantification Appendix B, Pg. 68 |
| High Estimate | 7.27 MMt$CO_2$e | MEA Quantification Below |

**High Estimate – MEA Quantification**

## Figure C-10. Estimated GHG Benefits from EMPOWER Maryland

| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Population | **5,622,856** | 5,650,825 | 5,699,484 | 5,774,000 | 5,812,314 | 5,862,523 | 5,912,732 | 5,962,941 | 6,038,450 | 6,074,604 | 6,126,499 | 6,178,395 | 6,230,291 | 6,276,300 |
| EmPower Legislative Goals | 0.00% | 0.79% | 1.90% | 3.33% | **5.00%** | 7.50% | **10.00%** | 12.25% | **15.00%** | **16.00%** | **17.00%** | **18.00%** | **19.00%** | **20.00%** |
| | | | | | | | | | | | | | | |
| **Energy (GWh)** | **2007** | **2008** | **2009** | **2010** | **2011** | **2012** | **2013** | **2014** | **2015** | **2016** | **2017** | **2018** | **2019** | **2020** |
| Forecast Energy Use | 69,300 | 69,460 | 70,107 | 71,017 | 71,795 | 72,718 | 73,229 | 74,013 | 74,720 | 75,425 | 76,146 | 76,867 | 77,589 | 78,310 |
| Per Capita in GWh | 0.0123 | 0.0123 | 0.0123 | 0.0123 | 0.0124 | 0.0124 | 0.0124 | 0.0124 | 0.0124 | 0.0124 | 0.0124 | 0.0124 | 0.0125 | 0.0125 |
| 15% Less Per Capita | 0.0123 | 0.0122 | 0.0121 | 0.0119 | 0.0117 | 0.0115 | 0.0111 | 0.0109 | 0.0105 | 0.0104 | 0.0103 | 0.0102 | 0.0101 | 0.0100 |
| 15% Per Capita Reduction in Energy Use | 69,300 | 68,911 | 68,775 | 68,652 | 68,205 | 67,264 | 65,906 | 64,947 | 63,512 | 63,357 | 63,201 | 63,031 | 62,847 | 62,648 |
| Net Reduction | 0 | 549 | 1,332 | 2,365 | 3,590 | 5,454 | 7,323 | 9,067 | 11,208 | 12,068 | 12,945 | 13,836 | 14,742 | 15,662 |
| | | | | | | | | | | | | | | |
| | **GWh** | **MWh** | **mmtCO2** | | | | | | | | **MWh** | | | |
| Reduction of 15% by 2015 | 11,208 | 11,208,004 | **7.27** | | | PSC Estimated utility reduction goal for 2015 | | | | | 7,268,539 | | | |
| Reduction of 20% by 2020 | 15,662 | 15,662,059 | **8.8** | | | | | | | | | | | |

## Figure C-11. Summary of Demand Projections from EMPOWER Maryland

| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Population | 5,622,856 | 5,650,825 | 5,697,276 | 5,800,142 | 5,853,691 | 5,907,866 | 5,962,693 | 6,018,171 | 6,062,278 | 6,074,604 | 6,126,499 | 6,178,395 | 6,230,291 | 6,276,300 |
| EmPower Legislative Goals | 0 00% | 0.79% | 1.90% | 3.33% | **5.00 %** | 7 50% | **10.00 %** | 12.25 % | **15.00%** | **16.00%** | **17.00%** | **18.00 %** | **19.00 %** | **20.00%** |
| | | | | | | | | | | | | | | |
| **Demand (MW)** | **2007** | **2008** | **2009** | **2010** | **2011** | **2012** | **2013** | **2014** | **2015** | **2016** | **2017** | **2018** | **2019** | **2020** |
| Forecast Peak Demand | 14,387 | 14,569 | 14,788 | 14,988 | 15,150 | 15,313 | 15,519 | 15,698 | 15,870 | 16,068 | 16,253 | 16,438 | 16,623 | 16,808 |
| Per Capita in MWh | 0 0026 | 0 0026 | 0.0026 | 0.0026 | 0.0026 | 0.0026 | 0.0026 | 0.0026 | 0.0026 | 0.0026 | 0.0027 | 0.0027 | 0.0027 | 0.0027 |
| 15% Less Per Capita | 0 0026 | 0 0026 | 0.0025 | 0.0025 | 0.0025 | 0.0024 | 0.0023 | 0.0023 | 0.0022 | 0.0022 | 0.0022 | 0.0022 | 0.0022 | 0.0021 |
| 15% Per Capita Reduction in Energy Use | 14,387 | 14,454 | 14,507 | 14,488 | 14,393 | 14,164 | 13,967 | 13,775 | 13,489 | 13,497 | 13,490 | 13,479 | 13,465 | 13,447 |
| Net Reduction | 0 | 115 | 281 | 499 | 758 | 1,148 | 1,552 | 1,923 | 2,380 | 2,571 | 2,763 | 2,959 | 3,158 | 3,362 |

## Other Environmental Benefits

This initiative will help Maryland meet its Chesapeake Bay and air quality goals. Increasing energy efficiency in Maryland's residential sector reduces the need for power generation from fossil fuel sources. In addition to reducing GHG emissions, this will create reductions in nitrogen dioxide, sulfur dioxide and mercury.

- Nitrogen dioxide emission reductions will help Maryland reduce nitrogen pollution in the Chesapeake Bay. Approximately one-third of the Chesapeake Bay's nitrogen pollution comes from air pollution deposited into the Chesapeake Bay.
- The nitrogen oxide reductions will also help Maryland meet air quality standards for ground level ozone and fine particulate matter.
- Sulfur dioxide emission reductions will help Maryland further reduce fine particulates and also help achieve the visibility improvements required to comply with federal regional haze requirements.
- Mercury, a toxic pollutant, is primarily released by air pollution sources but ultimately affects water quality and bioaccumulates in fish tissue. Mercury reductions will help improve water quality in Maryland.

## Economic Benefits, Job Creation and Job Protection

Implementing energy efficiency in the residential sector will continue to create and retain thousands of good paying jobs in Maryland. A State-funded study by the Baltimore-based International Center for Sustainable Development found that by developing clean energy industries, Maryland could create between 144,000 and 326,000 jobs in the State over the

next 20 years.[14] Many of these jobs are in the field of energy efficiency, including appliance rebate and loan processing, sales and marketing, energy auditing, performance of energy efficiency, and training. Job creation and protection will be addressed in more detail in a study required under GGRA, which will be included in the draft and final GGRA Plans due in December of 2011 and 2012.

The International Center for Sustainable Development study found that clean industry jobs could contribute $5.7 billion in wages and salaries to Maryland citizens, boosting State and local tax revenues by $973 million and increasing gross State product by $16 billion.[15] Economic benefits will be addressed in a study required under GGRA, which will be included in the draft and final GGRA Plans.

Further analyses for the economic benefits, job creation and job protection in Maryland from this program is included in Chapter 7 of this plan.

## Implementation

Maryland's demand-side management programs are mandated and funded by Maryland law. The utilities are responsible for 10 percent of the 15 percent EmPOWER goal, and MEA and other State agencies are responsible for the remaining 5 percent. 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.[16] 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.[17]

## Supporting Laws and Regulations

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

[14] Economic Development Potential of Clean Energy Technology in Maryland and Feasibility Study for a Maryland Clean Energy Center, Spears, John W. and Van Rest, Andre W., International Center for Sustainable Development, December 31, 2006.
http://mdcleanenergy.org/sites/default/files/upload/pdf/MCECStudyReport2-28-07.pdf
[15] Ibid.
[16] EmPOWER Maryland Energy Efficiency Act of 2008, Md. Public Utility Companies Code § 7-211 (House Bill 374, General Assembly 2008).
[17] 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).

- Energy Independence and Security Act of 2007, H.R.6. 110th Cong., 1st Sess. (P.L. 110-140, H.R. 6).
- Maryland Energy Efficiency Standards Act, State Government Article, Section 9-2006, Annotated Code of Maryland (became law per Maryland Constitution, Chapter 2 of 2004 on January 20, 2004).
- Maryland Energy Efficiency Standards Act of 2007 (Senate Bill 674, General Assembly 2007), State Government Article, § 9-2006, Annotated Code of Maryland.

## Links to Supporting Documentation

- *EmPOWERing Maryland Clean Energy Programs FY11 Draft,* Maryland Energy Administration. energy.maryland.gov/documents/fy11programbook.pdf
- *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/Chapter4.pdf
- MEA Residential Programs: http://energy.maryland.gov/Residential/index.html.
- Maryland Clean Energy Center MHELP program**:** http://MCECloans.org
- *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. http://www.aceee.org/research-report/e106
- Efficiency Vermont (Public Benefit Fund) http://www.efficiencyvermont.com
- Economic Development Potential of Clean Energy Technology in Maryland and Feasibility Study for a Maryland Clean Energy Center, Spears, John W. and Van Rest, Andre W., International Center for Sustainable Development, December 31, 2006. http://mdcleanenergy.org/sites/default/files/upload/pdf/MCECStudyReport2-28-07.pdf
- EmPOWERing Maryland Clean Energy Programs FY11 Draft, Maryland Energy Administration. energy.maryland.gov/documents/fy11programbook.pdf
- 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/Chapter4.pdf
- MEA website: http://www.energy.state.md.us
- Utility rebate programs: http://www.alleghenypower.com/EngConserv/MD/ResEECMd.asp www.bgesmartenergy.com http://www.delmarva.com/home/ http://www.pepco.com http://www.smeco.coop/save/
- Maryland Clean Energy Center, MHELP program: http://MCECloans.org
- 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. http://www.aceee.org/research-report/e106

# Energy-7: 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.[18] 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.[19] Programs funded and administered through other State agencies also contribute to the EmPOWER goal.

Existing Progams. MEA administers a number of programs that target energy efficiency improvements in the commercial and industrial sectors, which represent approximately 33 percent of electricity consumption in Maryland.[20] 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:[21] 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.

[18] 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.

[19] 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 MEA and other state agencies, the law targets a 15 percent reduction in per capita and peak demand by 2015.

[20] EmPOWERing Maryland Clean Energy Programs FY11 Draft, MEA, p. 5. energy.maryland.gov/documents/fy11programbook.pdf

[21] 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.

- 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 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 will re-open the tax credit program until 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 which will be open until December 2011 will screen and select candidates for a total of $13 million 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 territory in 2011 in an attempt to collect quantitative information on the cost and benefits of the technology versus Empower Maryland goals.

- 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.[22]

## 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 Energy-6: EmPOWER: Energy Efficiency in the Residential Sector.

## Other Environmental Benefits

This initiative will also help Maryland meet its Chesapeake Bay and air quality goals. Increasing energy efficiency in Maryland's residential sector reduces the need for power generation from fossil fuel sources. In addition to reducing GHG emissions, this will create reductions in nitrogen dioxide, sulfur dioxide and mercury.

Nitrogen dioxide emission reductions will help Maryland reduce nitrogen pollution in the Chesapeake Bay. Approximately one-third of the Chesapeake Bay's nitrogen pollution comes from air pollution that deposits into the Chesapeake Bay. The nitrogen oxide reductions will also help Maryland meet air quality standards for ground level ozone and fine particulate matter.

Sulfur dioxide emission reductions will help Maryland further reduce fine particulates and also help achieve the visibility improvements required to comply with federal regional haze requirements.

Mercury, a toxic pollutant, is primarily released by air pollution sources but ultimately affects water quality and bio-accumulates in fish tissue. Mercury reductions will help improve water quality in Maryland.

## Economic Benefits, Job Creation and Job Protection

[22] 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

Implementing energy efficiency in the business community will continue to create and retain thousands of good paying jobs in Maryland. Businesses will be able to grow by reinvesting energy savings, keeping more employees on payroll. Other jobs include loan processing, sales and marketing, energy auditing, performance of energy efficiency upgrades, and training. A State-funded study by the Baltimore-based International Center for Sustainable Development found that by developing clean energy industries, Maryland could create between 144,000 and 326,000 jobs in the State over the next 20 years.[23] Job creation and protection will be addressed in more detail in a study required under GGRA, which will be included in the draft 2012 GGRA Plan.

The International Center for Sustainable Development study found that clean industry jobs could contribute $5.7 billion in wages and salaries to Maryland citizens, boosting State and local tax revenues by $973 million and increasing gross State product by $16 billion.[24] Economic benefits will be addressed in a study required under GGRA, which will be included in the draft 2012 GGRA Plan.

Further analyses for the economic benefits, job creation and job protection in Maryland from this program is included in Chapter 7 of this plan.

## Implementation

Maryland's demand-side management programs are mandated and funded by Maryland law. The utilities are responsible for 10 percent of the 15 percent EmPOWER goal, and MEA and other State agencies are responsible for the remaining 5 percent. 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.[25] 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.[26]

[23] Economic Development Potential of Clean Energy Technology in Maryland and Feasibility Study for a Maryland Clean Energy Center, Spears, John W. and Van Rest, Andre W., International Center for Sustainable Development, December 31, 2006.
http://mdcleanenergy.org/sites/default/files/upload/pdf/MCECStudyReport2-28-07.pdf
[24] Ibid.
[25] EmPOWER Maryland Energy Efficiency Act of 2008, Md. Public Utility Companies Code § 7-211 (House Bill 374, General Assembly 08).
[26] 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).

## Supporting Laws and Regulations

- EmPOWER Maryland Energy Efficiency Act of 2008, Md. Public Utility Companies Code § 7-211 (House Bill 374, General Assembly 2008).
- 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).
- "The Jane E. Lawton Loan Program" (Senate Bill 885/House Bill 1301, General Assembly 2008).

## Links to Supporting Documentation

- 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/Chapter4.pdf
- EmPOWERing Maryland Clean Energy Programs FY11 Draft, Maryland Energy Administration. energy.maryland.gov/documents/fy11programbook.pdf
- MEA Business Programs:
  http://www.energy.state.md.us/Business/farmAudit.html
  http://www.energy.state.md.us/SEN/Assessments.html
  University of Maryland Manufacturing Assistance Program (UMMAP)
  http://www.energy.state.md.us/SEN/Training.html
  http://www.energy.state.md.us/SEN/Tools_and_Resources.html
  http://www.energy.state.md.us/Govt/janeelawton.html
- 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. http://www.aceee.org/research-report/e106
- Economic Development Potential of Clean Energy Technology in Maryland and Feasibility Study for a Maryland Clean Energy Center, Spears, John W. and Van Rest, Andre W., International Center for Sustainable Development, December 31, 2006.
  http://mdcleanenergy.org/sites/default/files/upload/pdf/MCECStudyReport2-28-07.pdf

# Energy-8: EMPOWER: Energy Efficiency Appliances and Other Products

Lead Agency: MEA

## Program Description

As indicated in Energy-6: 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.[27] 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.[28]

Existing Progams. MEA administers several appliance and equipment rebate programs for homeowners. It also 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 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.[29] 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

[27] 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.

[28] 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.

[29] 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.

and the general Assembly to consider legislation establishing energy efficiency standards recommended by the Appliance Standard Awareness Program.[30]

- 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

In order to account for similarities across programs, all emission benefits and costs associated with this programs have been aggregated under Energy-6: EmPOWER: Energy Efficiency in the Residential Sector.

## Other Environmental Benefits

Increasing energy efficiency in appliances, equipment and lighting reduces the need for power generation from fossil fuel sources. In addition to reducing GHG emissions, this will create reductions in nitrogen dioxide, sulfur dioxide and mercury.

- Nitrogen dioxide emission reductions will help Maryland meet air quality standards for ground level ozone and fine particulate matter. The reductions will also significantly help Maryland reduce nitrogen pollution in the Chesapeake Bay.
- Sulfur dioxide emission reductions will help Maryland further reduce fine particulates and also help achieve the visibility improvements required to comply with federal regional haze requirements.
- Mercury, a toxic pollutant, is primarily released by air pollution sources but ultimately affects water quality and bioaccumulates in fish tissue. Mercury reductions will help improve water quality in Maryland.

## Economic Benefits, Job Creation and Job Protection

Implementing energy efficiency in appliances, equipment and lighting will continue to create and retain thousands of good paying jobs in Maryland. These jobs include appliance rebate processing, sales and marketing. This will be addressed in more detail in the jobs creation and protection study required under GGRA and will be included in the draft 2012 GGRA Plan.

[30] 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.

Analyses for the economic benefits, job creation and job protection in Maryland from this program is included in Chapter 7 of this plan.

## Implementation

Maryland's appliances, equipment and lighting efficiency programs are a mix of federal and State mandates, incentives and funding. MEA has primary responsibility for administering these programs. 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.[31] 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 dispursements; 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.[32]

## Supporting Laws and Regulations

- Energy Independence and Security Act of 2007, H.R.6. 110th Cong., 1st Sess. (P.L. 110-140, H.R. 6).
- Maryland Energy Efficiency Standards Act, State Government Article, Section 9-2006, Annotated Code of Maryland (became law per Maryland Constitution, Chapter 2 of 2004 on January 20, 2004).
- Maryland Energy Efficiency Standards Act of 2007 (Senate Bill 674, General Assembly 2007), State Government Article, § 9-2006, Annotated Code of Maryland.
- EmPOWER Maryland Energy Efficiency Act of 2008 (House Bill 374, General Assembly 2008), Public Utility Companies Article, § 7-211, Annotated Code of Maryland.
- Regional Greenhouse Gas Initiative – Maryland Strategic Energy Investment Program (Senate Bill 268/House Bill 368, General Assembly 2008), Public Utility Companies Article, § 7-701 et seq., Annotated Code of Maryland.

## Links to Supporting Documentation

- EmPOWERing Maryland Clean Energy Programs FY11 Draft, Maryland Energy Administration. energy.maryland.gov/documents/fy11programbook.pdf
- 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/Chapter4.pdf
- MEA website: http://www.energy.state.md.us

[31] EmPOWER Maryland Energy Efficiency Act of 2008, Md. Public Utility Companies Code § 7-211 (House Bill 374, General Assembly 2008).

[32] 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).

- Utility rebate programs:
  http://www.alleghenypower.com/EngConserv/MD/ResEECMd.asp
  www.bgesmartenergy.com
  http://www.delmarva.com/home/
  http://www.pepco.com
  http://www.smeco.coop/save/
- Maryland Clean Energy Center, MHELP program: http://MCECloans.org
- 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.
  http://www.aceee.org/research-report/e106

# Energy-9: Energy Efficiency in the Power Sector: General

Lead Agency: MDE

## Program Description

As part of the suite of EmPOWER programs, this program promotes the identification and pursuit of cost-effective GHG emissions reduction opportunities from existing generating units by improving operating efficiency or adding biomass. There are currently sixteen coal-fired facilities in Maryland that could be considered candidates for biomass co-firing. In time and with adequate evaluation, MEA could identify a portfolio of technological options for reducing emissions and allow Maryland utilities to share the opportunities they have identified.

Key implementation strategies would include: (a) requiring utilities to evaluate their existing generating units for opportunities to improve their GHG emissions profile through efficiency improvements or the addition of biomass. This evaluation would be part of an overall plan identifying cost-effective options for reducing system emissions on a short-term and long-term basis; b) requiring utilities to pursue cost-effective options identified above. The term "cost-effective" would be defined by some objective measure, such as cost per ton of carbon equivalent.

## 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 Energy-6: EmPOWER: Energy Efficiency in the Residential Sector.

## Other Environmental Benefits

Biomass fuels have little to no sulfur content and thus substituting biomass for coal reduces the amount of sulfur dioxide emitted. Co-firing biomass may also reduce ozone-creating nitrogen dioxide, although this environmental benefit is less certain than with sulfur dioxide. Facilities facing environmental compliance issues based on sulfur dioxide emissions may want to consider co-firing as an alternative to investing in emissions controls or switching to natural gas.

## Economic Benefits, Job Creation and Job Protection

The economic incentives from the sale of RECs available in Maryland and some of the surrounding states will help to make these projects more economically viable.

Analyses for the economic benefits, job creation and job protection in Maryland from this program is included in Chapter 7 of this report.

## Implementation

To determine the potential for biomass co-firing in Maryland, it is necessary to understand the various types of boilers and technologies in use at these facilities, as well as the capital costs to retrofit coal facilities, the availability of biomass resources, and the environmental benefits from co-firing. Test results indicate that the high alkali content of biomass fuels may interfere with the effectiveness of catalytic reduction systems designed to control for nitrogen oxides. Facilities which have invested in selective or non-selective catalytic reduction systems will likely not risk the effectiveness of the expensive emissions control technology in order to co-fire with biomass.

Another consideration is the availability of biomass resources within a 50-mile radius of a Maryland coal-fired facility, since beyond this area the transportation costs become excessive. It is estimated that the area has a total amount of 2.7 million dry tons of biomass resources and a potential to cultivate energy crops for an additional estimated 1 million tons of biomass resources.[33] Lacking a more mature market for biomass fuels, the resources are more expensive than coal, approximately $1.41 per million Btu (in 2006); whereas the most cost-competitive fuels are urban waste wood, $1.70 per million Btu; and, mill residues, $1.93 per million Btu.[34] Another consideration is the initial capital investment required for co-firing retrofits which varies depending upon the co-firing percentage of total heat input. Capital costs range from $150 per kilowatt to $400 per kilowatt of biomass capacity.[35] All things considered, the potential emission reductions of the criteria pollutants sulfur dioxide and nitrogen dioxide, from substituting biomass for coal, can improve facilities' compliance with air quality standards, as an

[33] Exeter Associates, Inc. The Potential for Biomass Cofiring in Maryland, Commissioned by the DNR, Power Plant Research Program, March 2006.
[34] Ibid.
[35] Ibid.

alternative to investing in emissions controls or switching to natural gas. Additionally, facilities which co-fire with biomass could qualify to sell renewable energy credits to Maryland and some of the surrounding states.

At this point in time, generation facilities can voluntarily implement efficiency improvements and/or co-fire with biomass. One generation facility in Maryland that is co-firing with biomass is Luke Mill. Luke Mill is a paper mill which generates electricity to use on site for making pulp and paper. In 2009, wood combustion and process improvement initiatives at NewPages's Luke Mill replaced over 17,000 tons of coal that would have been burned on site to produce electricity. The combustion of wood waste for electricity to displaces coal combustion and reduces GHG emissions. Also, Luke Mill installed a monitor in order to track and report carbon dioxide emissions of all three of its boilers. Luke Mill began a trial planting of switchgrass on mined lands to be used as biomass for renewable energy production. This activity, in coordination with West Virginia University's National Mine Land Reclamation Center, will produce renewable cellulosic ethanol and pelletized heating fuels while acting as a "sink" to sequester carbon dioxide in the atmosphere. In the northern Great Plains, an acre of switchgrass has been shown to sequester 4.5 tons of carbon in the soil each year.

MEA has advocated for federal climate legislation that would create a price on carbon which would in turn incentivize existing plants to operate more efficiently. MEA should track the development of regulations by EPA which would mandate new plants and certain existing plants to install technologies to reduce GHG emissions.

## Supporting Laws and Regulations

MDE developed regulations known as the Maryland $CO_2$ Budget Trading Program for participation in RGGI. This program includes set asides and other regulatory mechanisms that provide the opportunity for MDE to work with local industry to implement pollution reduction strategies that are economically feasible. The Limited Industrial Exemption Set-aside Account allows MDE to approve industrial generators, such as Luke Mill, for an exemption from acquiring $CO_2$ allowances. The industrial generator must: 1) request a permit condition to limit the commercial sale of its annual electricity output, 2) report its carbon dioxide emissions quarterly, and 3) comply with a MDE-approved climate action plan that addresses site reductions of GHG emissions through reasonably available reduction practices. The Maryland $CO_2$ Budget Trading Program also allows sources to deduct the carbon dioxide emissions generated from combustion of eligible biomass from their compliance demonstration.

### New Legislation Needed

New legislation could require existing and proposed coal-fired generating units to co-fire biomass at a maximum Statewide average rate of 8 percent of total energy input by 2020.

## Links to Supporting Documentation

- Exeter Associates, Inc. The Potential for Biomass Cofiring in Maryland, Commissioned by the Maryland Department of Natural Resources, Power Plant Research Program, March 2006. Available: http://esm.versar.com/pprp/bibliography/PPES_06_02/PPES_06_02.pdf
- The Maryland $CO_2$ Budget Trading Program Limited Industrial Exemption Set-aside Account, information available: http://www.mde.state.md.us/programs/Air/RGGI/Documents/www.mde.state.md.us/assets/document/air/RGGI/AQCAC_Fact_Sheet_for_COMAR_26_09_01_to_03_Amendment_1_October_2008.pdf

# Energy-10: EMPOWER: Utility Responsibility, including:

### 10.1 BGE
### 10.2 Pepco
### 10.3 SMECO
### 10.4 Potomac Edison
### 10.5 Delmarva Power and Light

Lead Agency: MEA

## Program Description

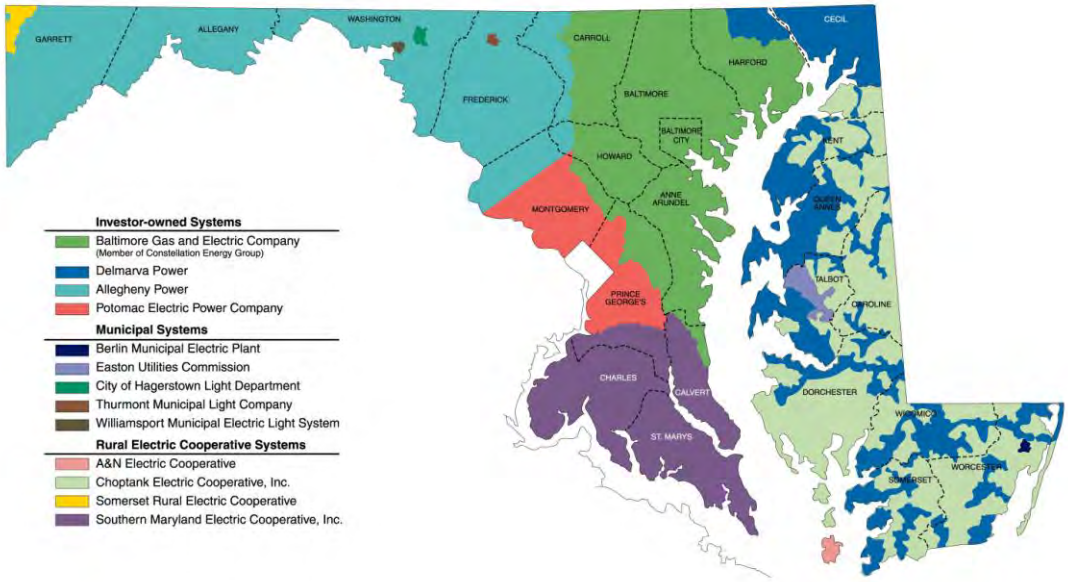
Enacted on April 24, 2008, EmPower Maryland Act calls for the State to reduce its energy consumption 15 percent by 2015, in order to reduce energy bills, protect our environment and reduce global warming pollution, while also creating new jobs and sources of clean, reliable energy. EmPower Maryland mandated 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.[36] Electric utilities are responsible for two thirds of the EmPOWER

[36] 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

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 zero net electricity consumption growth 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 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-12: 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

programs implemented by the MEA and other state agencies, the law targets a 15 percent reduction in per capita and peak demand by 2015.

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-13: 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 | **249,180** | **10.6%** |
| **BGE** | 1,108,503 | 117,633 | 5,345 | 0 | **1,231,481** | **52.5%** |
| **DPL** | 172,766 | 25,573 | 250 | 272 | **198,861** | **8.5%** |
| **PEPCO** | 472,874 | 46,756 | 11 | 102 | **519,743** | **22.2%** |
| **SMECO** | 133,560 | 13,204 | 5 | 267 | **147,036** | **6.3%** |
| **Total** | **2,106,364** | **230,505** | **8,446** | **986** | **2,346,301** | **100.0%** |

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 Energy-6: EmPOWER: Energy Efficiency in the Residential Sector.

## Other Environmental Benefits

Reducing the demand for electricity by increasing energy efficiency in appliances, equipment and lighting reduces the need for power generation from fossil fuel sources. In addition to reducing GHG emissions, this will create reductions in nitrogen dioxide, sulfur dioxide and mercury.

- Nitrogen dioxide emission reductions will help Maryland meet air quality standards for ground level ozone and fine particulate matter. The reductions will also significantly help Maryland reduce nitrogen pollution in the Chesapeake Bay.

- Sulfur dioxide emission reductions will help Maryland further reduce fine particulates and also help achieve the visibility improvements required to comply with federal regional haze requirements.
- Mercury, a toxic pollutant, is primarily released by air pollution sources but ultimately affects water quality and bioaccumulates in fish tissue. Mercury reductions will help improve water quality in Maryland.

## Economic Benefits, Job Creation and Job Protection

Analyses for the economic benefits, job creation and job protection in Maryland from this program is included in Chapter 7 of this plan.

## Implementation:

### Energy-10.1: 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,[37] 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.

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

[37] 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.

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:*[38]
*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.

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.

[38] 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 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-14. BGE Energy Efficiency & Conservation and Demand Response Reported Achievements***

| | 2010 Reduction | Percentage of 2010 Interim Target** | Program-to-Date Reduction | Percentage of 2011 Target |
|---|---|---|---|---|
| **BGE** | | | | |
| 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.

**Energy-10.2: 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,[39] 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,

[39] 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.

to incentives to purchase lighting and energy efficient HVAC and housing or building upgrades.

*Energy Efficiency and Conservation Programs*[40]
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.

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.

[40] 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 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, retrocomissioning, 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.[41] 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 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.

[41] 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.

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-15. Pepco Energy Efficiency & Conservation and Demand Response Reported Achievements***

| | 2010 Reduction | Percentage of 2010 Interim Target** | Program-to-Date Reduction | Percentage of 2011 Target |
|---|---|---|---|---|
| **Pepco** | | | | |
| 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.

**Energy-10.3: 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.[42] 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.

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.

[42] 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.

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-16. SMECO Energy Efficiency & Conservation and Demand Response Reported Achievements***

| | 2010 Reduction | Percentage of 2010 Interim Target** | Program-to-Date Reduction | Percentage of 2011 Target |
|---|---|---|---|---|
| **SMECO** | | | | |
| 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.

**Energy-10.4: 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.[43] 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 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.

[43]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.

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 (ie, 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-17. Potomac Energy's Energy Efficiency & Conservation and Demand Response Reported Achievements***

| | 2010 Reduction | Percentage of 2010 Interim Target** | Program-to-Date Reduction | Percentage of 2011 Target |
|---|---|---|---|---|
| **PE** | | | | |
| 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

**Energy 10.5 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,[44]

[44]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.

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 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, retrocomissioning, 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-18. Delmarva Power & Light Energy Efficiency & Conservation and Demand Response Reported Achievements***

| | 2010 Reduction | Percentage of 2010 Interim Target** | Program-to-Date Reduction | Percentage of 2011 Target |
|---|---|---|---|---|
| **DPL** | | | | |
| 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.

## Supporting Laws and Regulations

- *"EmPOWER Maryland Energy Efficiency Act of 2008" (House Bill 374/Senate Bill 205)* requires utilities to reduce per capita electricity consumption 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 under Senate Bill 268/House Bill 368, this legislation is intended to achieve a 15 percent reduction in per capita reductions by 2015.
- Annotated Code of Maryland, Public Utility Companies, under Title 7, Subtitle 2, Section 11: Energy Efficiency Programs.

## Links to Supporting Documentation

- Annotated Code of Maryland, Public Utility Companies, under Title 7, Subtitle 2, Section 11: Energy Efficiency Programs: http://michie.lexisnexis.com/maryland/lpext.dll?f=templates&fn=main-h.htm&cp
- Public Service Commission Case Number 9154: http://webapp.psc.state.md.us/Intranet/home.cfm

# Energy-11: 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.[45] Maryland's Tier 2 requirement remains constant at 2.5 percent through 2018, after which it sunsets. The

[45]"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.

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

**By 2020, the potential emission reductions from this program, combined with other RPS programs, are estimated to be 6.78 $MMtCO_2e$.**

**Figure C-19. Low and High GHG Benefits for Energy-11**

| | | |
|---|---|---|
| Low Estimate | 3.04 $MMtCO_2e$ | SAIC Quantification Appendix B, Pg. 86 |
| High Estimate | 6.78 $MMtCO_2e$ | MEA Quantification Below |

**High Estimate – 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 6.36 $MMtCO_2e$ to 6.78 $MMtCO_2e$. If the RPS program was expanded to 30 percent of electricity sales from renewable energy by 2020, the total GHG emissions avoided could increase to 11.33 $MMtCO_2e$.

One estimate was calculated using the electricity sales forecast from PSC and emission data from the PJM General Attributes Tracking System. The percentages of existing resources were held constant through the period and the avoided emissions are net of emissions from renewable energy resources.[46]

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. It the RPS target were increased to 30 percent of the energy supply from renewable energy sources by 2020, then 10,705 metric tons of nitrogen oxides and 77,574 metric tons of sulfur dioxides could be displaced.[47]

[46] Percentages of existing resources and capacity factors are based on the "2010 Inventory of Renewable Energy Generators Eligible for the Maryland Renewable Energy Portfolio Standard," PPRP (November 2010).

[47] Based upon the 2006 PJM fuel mix factor for nitrogen oxide and sulfur dioxide.

**Figure C-20. Current RPS Program**

| | Carbon Dioxide (metric ton) | Nitrogen Oxides (metric ton) | Sulfur Dioxides (metric ton) |
|---|---|---|---|
| Business As Usual 2020 PJM Emissions | 40,981,593 | 72,502 | 261,541 |
| Estimated 2020 PJM Fuel Mix MWh | 33,604,906 | 59,452 | 214,464 |
| Estimated 2020 Renewable Energy MWh | 592,053 | 6,750 | 543 |
| **Net Emissions Avoided** | **6,784,634** | **6,300** | **46,534** |

**Figure C-21. RPS Escalated to 30 percent by 2020**

| | Carbon Dioxide (metric ton) | Nitrogen Oxides (metric ton) | Sulfur Dioxides (metric ton) |
|---|---|---|---|
| BAU 2020 PJM Emissions | 40,981,593 | 72,502 | 261,541 |
| Estimated 2020 PJM Fuel Mix MWh | 28,687,115 | 50,752 | 183,079 |
| Estimated 2020 Renewable Energy MWh | 968,814 | 11,046 | 889 |
| **Net Emissions Avoided** | **11,325,664** | **10,705** | **77,574** |

## Other Environmental Benefits

Increasing the percentage of renewably generated electricity for the grid serving Maryland residents reduces the need for power generation from fossil fuel sources. In addition to reducing GHG emissions, this will create reductions in nitrogen dioxide, sulfur dioxide and mercury.

- Nitrogen dioxide 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.
- Sulfur dioxide emission reductions will help Maryland further reduce fine particulates and also help achieve the visibility improvements required to comply with federal regional haze requirements.
- Mercury, a toxic pollutant, is primarily released by air pollution sources but ultimately affects water quality and bioaccumulates in fish tissue. Mercury reductions t will help improve water quality in Maryland.

## Economic Benefits, Job Creation and Job Protection

Aside from the environmental benefits, the RPS will have demonstrable economic benefits for Maryland. Starting in 2012, all solar RECs must come from installations physically located in the State. By 2022, MEA estimates between 1,000 and 1,200 MW of solar capacity will be required to meet the solar carve out. Depending on the generation mix used for compliance purposes, thousands of MW of other technologies

such as land based wind, offshore wind, and biomass plants, will also have to be constructed to meet the remaining Tier 1 RPS obligation. In total, the RPS will require billions of dollars of investment and create thousands of jobs over the next decade.

Analyses for the economic benefits, job creation and job protection in Maryland from this program is included in Chapter 7 of this plan.

## 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.

## Supporting Laws and Regulations

The RPS was established in May 2004 by Senate Bill 869. In Case No. 9019, PSC considered certain threshold policy and administrative issues. With Case No. 9019 as a foundation, PSC Staff convened the RPS Working Group which was composed of representatives from electric utilities, electricity suppliers, renewable energy supplier, REC brokers, industry specialists, environmentalists, the Maryland Office of People's Counsel, and other stakeholders.

On April 13, 2005, the PSC staff filed recommended RPS regulations, and PSC opened Rulemaking 12. PSC received comments and held open meetings concerning the regulations. On May 25, 2005, PSC voted to publish the proposed RPS regulations as Section 20.61 of the Code of Maryland Regulations. Code of Maryland Regulations 20.61 was adopted and became effective November 24, 2005. RPS Statute is available in the Maryland Annotated Code, Public Utility Companies, under Title 7, Subtitle 7.

The first RPS compliance year began on January 1, 2006, and concluded on December 31, 2006. In addition to initiating the Tier 1 and Tier 2 REC requirements for retail electricity sales, the issuance of retroactive RECs concluded during the year and changes were made to the RPS regulations through Rulemaking 25.

On October 19, 2007, a Solar Technical Conference was held at PSC. The purpose of this conference was to convene a number of solar energy market participants to share information and ideas regarding a number of issues that may relate to the solar requirements. Topics discussed during the Solar Technical Conference included an overall background of the solar market, experiences from other state solar RPS programs, available REC trading platforms, and methods for metering and verifying renewable solar energy generation. Rulemaking 32 proposed regulations for Code of Maryland Regulations 20.61 to address issues created by the solar statutory changes. The regulations were adopted on September 4, 2008.

In 2008, Maryland enacted several changes to the RPS to increase the contribution of renewable energy to electricity supply: the RPS percentage requirements were accelerated (Senate Bill 209; Chapters 125 and 126 of 2008) and the geographic scope in which renewable resources can be obtained for compliance restricted. The effect is an increase in demand while reducing supply, thereby providing upward price pressure for RECs. Moreover, an increase in the Tier 1 compliance fees will take effect in 2011 to assist in fostering additional development and growth in the industry. Senate Bill 268 (Chapters 127 and 128 of 2008) established the Strategic Energy Investment Fund, as well as a Maryland Strategic Energy Investment Program administered by MEA. Senate Bill 348 (Chapters 135 and 136 of 2008) removed the incineration of poultry litter from the list of eligible Tier 2 renewable energy sources and added poultry litter-to-energy as a qualifying Tier 1 renewable energy source. Maryland's adoption of a Tier 1 solar requirement in 2008 (Senate Bill 595), in addition to Tier 1 and Tier 2 requirements, will support development of a wider variety of technologies as a result of RPS implementation. Initial year implementation and timing of the solar requirement resulted in significant payments into the Strategic Energy Investment Fund to support in-state Tier 1 resource development.

In 2010, Maryland enacted changes to the RPS to increase the contribution of solar renewable energy to electricity supply: the RPS percentage requirements for the solar set-aside were accelerated between years 2011 and 2016 and the alternative compliance payment for a shortfall in solar RPS requirements was increased between years 2011 and 2016 (Senate Bill 277). The change increased the potential value of a solar REC in the

early years of the solar carve-out. This modification was designed to stimulate demand and help establish a local solar industry that can scale up to meet the steeper increase in RPS compliance over the medium and long term. As the market matures, the interaction of supply and demand relative to an increasing compliance requirement will set the price for solar RECs. Additionally, increased alternative compliance penalties can be used to provide grants for additional solar installations, which can also cause downward pressure on the price of solar RECs.

**New Legislation Needed**

MEA is currently analyzing the Maryland and regional renewable markets to see if any changes in legislation or policy would be helpful to meet Maryland's RPS goals.

## Links to Supporting Documentation

- PSC RPS website: http://webapp.psc.state.md.us/intranet/ElectricInfo/home_new.cfm
- Annual RPS Report to the General Assembly: http://webapp.psc.state.md.us/Intranet/psc/Reports_new.cfm
- Annotated Code of Maryland, Public Utility Companies, under Title 7, Subtitle 7: http://www.michie.com/maryland/lpExt.dll?f=templates&eMail=Y&fn=main-h.htm&cp=mdcode/1ce2b
- Code of Maryland Regulations (COMAR): http://www.dsd.state.md.us/comar/comar.aspx

# Energy-12: 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.[48]

[48]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 2016), from 0.35 percent to 0.50 percent, while leaving unchanged the 2022 RPS goal of 2 percent for solar.

*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 heat pump 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 heat pump and wind turbine systems at their residence.

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.[49] 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.[50]

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 of Maryland's institutions over a 20-year period.[51] The awards were made to

[49]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.

[50]Telephone conversation with Hatim Jabaji, Office of Energy Projects and Convervation, DGS, May 12, 2009.

[51] 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.

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.

## Figure C-22. 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 (c/kWh) |
|---|---|---|---|---|---|---|---|---|---|
| US Windforce | Pinnacle | wind | WV | 552 | 173,542 | 0% | Dec 2011 | 20 | .082 |
| Synergic-SBR | Roth Rock Phase II | Wind | MD | 10 | 30,605 | 50% CPI | Dec 2011 | 20 | .120 |
| Constellation | St. Mary's Solar | Solar | MD | 13 | 22,291 | 0% | Jan 2013 | 20 | .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 9.1 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.[52]

*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.[53]

[52]"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

[53] 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

*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 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.

## 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 Energy-11: The Maryland Renewable Energy Portfolio Standard Program.

## Other Environmental Benefits

Increasing the percentage of renewably generated electricity for the grid serving Maryland residents reduces the need for power generation from fossil fuel sources. In addition to reducing GHG emissions, this will create reductions in nitrogen dioxide, sulfur dioxide and mercury.

- Nitrogen dioxide 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.
- Sulfur dioxide emission reductions will help Maryland further reduce fine particulates and also help achieve the visibility improvements required to comply with federal regional haze requirements.

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been extended by five years, to December 31, 2015.Maryland Clean Energy Incentive Act of 2010 (House Bill 464).

- Mercury, a toxic pollutant, is primarily released by air pollution sources but ultimately affects water quality and bioaccumulates in fish tissue. Mercury reductions t will help improve water quality in Maryland.

## Economic Benefits, Job Creation and Job Protection

Analyses for the economic benefits, job creation and job protection in Maryland from this program is included in Chapter 7 of this plan.

## Implementation

To promote all different types of renewables, MEA's staff includes; a program manager covering biomass, biofuels and transportation; a program manager dedicated to wind; and a program manager dedicated to solar. There is also a grant administrator dedicated to residential and commercial grant processing across all technologies, including geothermal. These program managers focus on providing support for the development and adoption of their respective technologies, and on fostering the economic development required for growth of their respective industries within Maryland.

## Supporting Laws and Regulations

2008 Legislation

- *"Solar and Geothermal Tax Incentive and Grant Program" (Senate Bill 207/House Bill 377)* increases grant awards and tax incentives for both solar and geothermal systems.
- *"Maryland Clean Energy Center" (House Bill 1337)* promotes and assists the development of clean energy jobs and industry in the State and establishes the Maryland Clean Energy Technology Incubator Program to: (1) advocate and promote clean energy industries and green jobs in Maryland; and (2) drive development of the State's energy efficiency and renewable energy resources.

2009 Legislation

- *"Greenhouse Gas Emissions Reduction Act of 2009" (House Bill 315/Senate Bill 278)* established a mandatory goal of reducing the State's GHG emissions 25 percent below 2006 levels by 2020. It found it to be in the State's best interest to act aggressively on the interim targets of 10 percent reduction by 2012 and a 15 percent reduction by 2015 but did not make these targets mandatory goals.
- *"Sales and Use and Property Tax – Exemptions – Solar Energy Equipment and Property"(Senate Bill 621)* expands the sales and property tax exemption for solar energy equipment and property to systems that sell electricity to the grid.
- *"Alternative Energy Tax Incentive Act of 2009" (House Bill 1171)* expands the sales and property tax exemption for alternative energy systems to residential wind energy systems, and expands the property tax exemption to solar systems used to provide hot water or electricity to structures (these were already exempt from sales tax).

2010 Legislation

- *"Maryland Clean Energy Incentive Act of 2010" (House Bill 464)* extends the existing clean energy incentive State income tax credit for 5 years, through December 31, 2015, for electricity generated by qualified Maryland facilities from renewable energy resources, such as such as solar, wind and geothermal.
- "*Net Metering - Payment for Accrued Generation Credit" (House Bill 701/ Senate Bill 355)* requires an electric company to pay customers who generate energy primarily for their own onsite use for any excess generation at the prevailing market price**.** The law repeals the one-year limitation for accrual of a customer-generator's generation credits. It also directs PSC to adopt implementing regulations after convening a technical advisory group on pricing and aggregation issues.
- *"Electricity - Net Energy Metering - Credits" (House Bill 801)* changes the accrual of credits for a customer-generator from a kilowatt-hour basis to a dollar basis.
- *"Net Energy Metering - Fuel Cell" (House Bill 821/Senate Bill 529)* adds fuel cells as a source of generation eligible for net energy metering.

2011 Legislation

- *"Net Metering" (House Bill 860/Senate Bill 380)* requires an electric company to pay a customer who generates electricity for credits from excess electricity generated. Payment for excess generation credits must be at the same retail electric rate the customer-generator pays for the consumption of electricity.
- *"Renewable Energy Portfolio Standard- Renewable Energy Credits- Solar Water Heating Systems (House Bill 933/Senate Bill 717)* establishes solar water heating systems as a Tier 1 renewable source eligible to meet the Tier 1 solar portion of Maryland's RPS.

## Links to Supporting Documentation

- Maryland 2008 Climate Action Plan: http://www.mde.state.md.us/assets/document/Air/ClimateChange/Introduction.pdf
- MEA website: http://energy.maryland.gov/
- Program links:
- Residential Clean Energy Grant Program
- Commercial Clean Energy Grant Program
- Zero Energy Home Project
- Mid-Sized Wind Energy Grant Program
- State Anemometer Loan Program
- Windswept Grant Program
- Small Wind Demonstration Projects
- Bioheat Tax Credit Program
- Renewable Fuels Production Credit Program
- Landfill Gas Feasibility
- Anaerobic Digestion & Gasification

# Energy-13: 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.[54] Research indicates that the potential power supply available from offshore wind substantially exceeds the region's current energy use.[55] 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,[56] according to researchers from the University of Delaware and Stanford.[57] 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.[58] 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.[59] 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.[60]

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

[54]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).

[55]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.

[56]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.

[57] Kempton et al., Large CO2 Reductions via Offshore Wind Power Matched to Inherent Storage in Energy End-Uses, GRL, Vol. 34 (2007).

[58] Musial, W.; Butterfield, S., "Future for Offshore Wind Energy in the United States." National Renewable Energy Lab Report No. CP-500-36-313, (2004).

[59] Ibid.

[60] Ibid. When the efficiency of the turbines, related fuel use, and leakage are considered.

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 supply renewable energy through at least the year 2044 and transmission lines through at least 2072.[61] 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 Energy-11: The Maryland Renewable Energy Portfolio Standard Program.

## Other Environmental Benefits

Displacing electricity generated from fossil fuels would provide air quality benefits by reducing criteria air pollutants that impact public health and the environment. Additional benefits would accrue from the displacement of water contamination effects caused by extraction and combustion of fossil fuels.

## Economic Benefits, Job Creation and Job Protection

Based on a recent report from the U.S. Department of Energy's National Renewable Energy Laboratory, MEA projects that a 500 MW project would create 2,000 manufacturing and construction jobs for 5 years and an additional 400 ongoing supply and operating and maintenance jobs thereafter.[62]

Based on a regional employment model analysis by DBED, the total economic impact of offshore wind over five years is more than $1.9 billion, 8,200 job-years and $14 million in State tax revenues, including direct and indirect effects.[63]

Analyses for the economic benefits, job creation and job protection in Maryland from this program is included in Chapter 7 of this plan.

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[61] 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

[62] US Department of Energy. National Renewable Energy Laboratory. Musial, W., Ram, B. (2010). Large-Scale Offshore Wind Power in the United States: Assessment of Opportunities and Barriers (September 2010. National Renewable Energy Lab/TP-500-40745) Available: http://www.nrel.gov/docs/fy10osti/40745.pdf

[63] DBED analysis (January 14, 2011). Assumptions: 2,000 manufacturing/construction/assembly jobs per year for 5 years; 2011-2016. 400 Operation & Maintenance jobs per year; 2013-2030

## Implementation

Beginning in 2009, MEA collaborated with DNR's Chesapeake and Coastal Program and other State agencies to develop an online interactive tool for marine spatial planning. Partnering with The Nature Conservancy and Towson University, DNR was able 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.

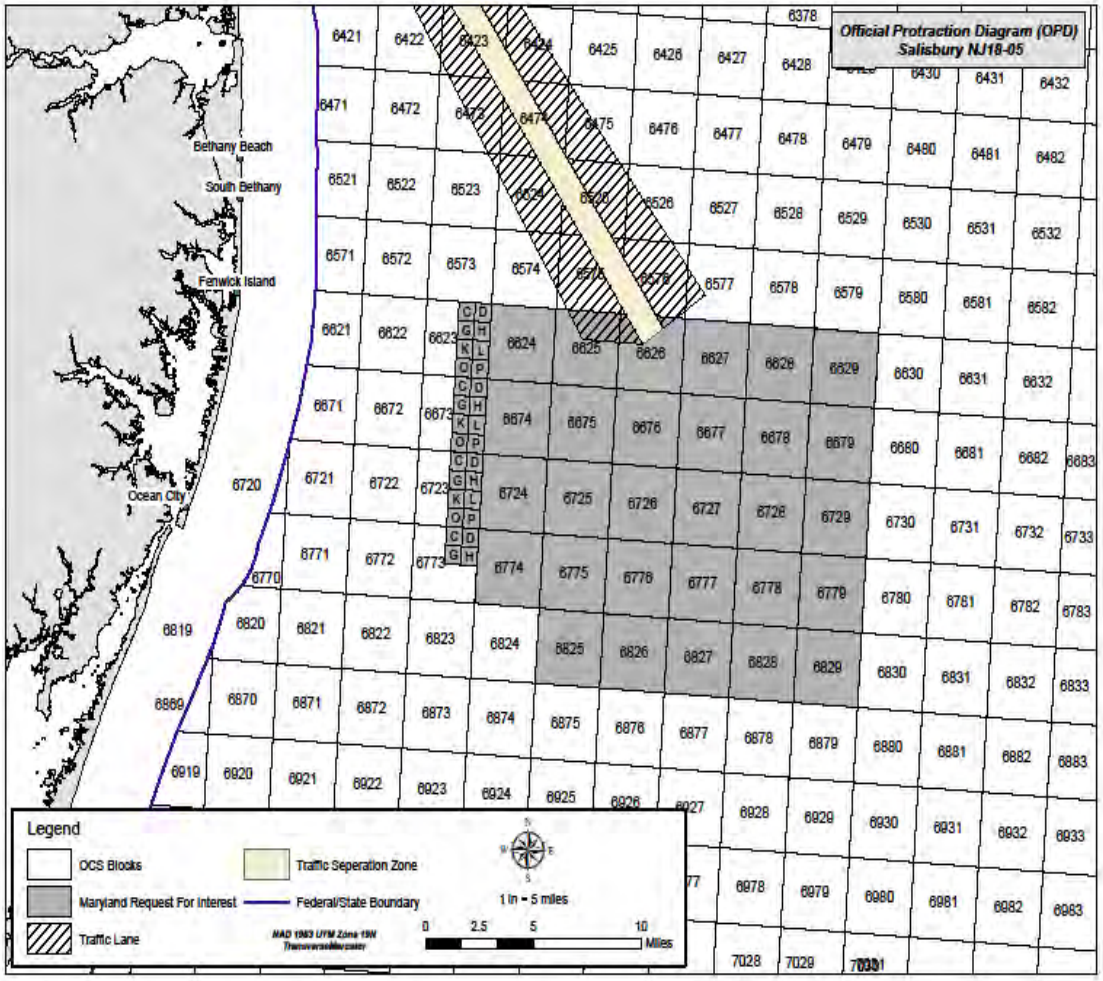
MEA contracted with AWS TruePower to develop maps and wind-roses detailing wind speed and power over the planning area. In partnership with MEA, the University of Maryland's Center for Integrative Environmental Research studied and provided data layers for both military uses of the offshore wind planning space as well as transmission and interconnection opportunities.

In April, 2010, DNR and MEA conducted two public open houses to allow citizens to ask questions and provide feedback at their own pace. Experts from both agencies and project partners were on hand to answer questions and provide information about ocean mapping and planning, offshore wind, project timelines, anticipated processes and opportunities for community response. In addition to the above open houses, MEA and DNR conducted comprehensive outreach to Ocean City and other affected coastal communities to gather community input on views and share information on planning processes. Information gathered at these events was also factored into the Coastal Atlas. Ultimately, this tool helped State agencies, offshore wind developers, and affected stakeholders to determine areas of potential conflict due to ecological, navigational, military, fisheries and other uses and provided the basis for the State level recommendation to the U.S. Department of the Interior.

At the request of Governor O'Malley in 2009, U.S. Department of the Interior's Bureau of Ocean Energy Management, Regulation and Enforcement created the Maryland State/Federal Offshore Wind Task Force. This task force, comprised of officials from state and federal agencies as well as elected officials from Maryland's coastal communities, developed siting recommendations for a Request for Interest to developers for offshore wind deployment proposals. The Bureau of Ocean Energy Management, Regulation and Enforcement accepted these recommendations, making Maryland the second state in the nation to have a Request for Interest issued for wind leases off its shores. Eight offshore wind developers responded with development proposals, and twelve stakeholders submitted comments.

Comments submitted to the Bureau of Ocean Energy Management, Regulation and Enforcement 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-23. Bureau of Ocean Energy Management, Regulation and Enforcement Maryland Request for Interest Area Map[64]




The Bureau of Ocean Energy Management, Regulation and Enforcement 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 information related to marine transportation, navigation, commerce and safety in order to provide a State level recommendation on boundaries of an area.

On May 11th, 2011, MEA held a stakeholder discussion with groups that had offered comments to the Bureau of Ocean Energy Management, Regulation and Enforcement Maryland Request for Interest regarding maritime safety and navigation. Additionally,

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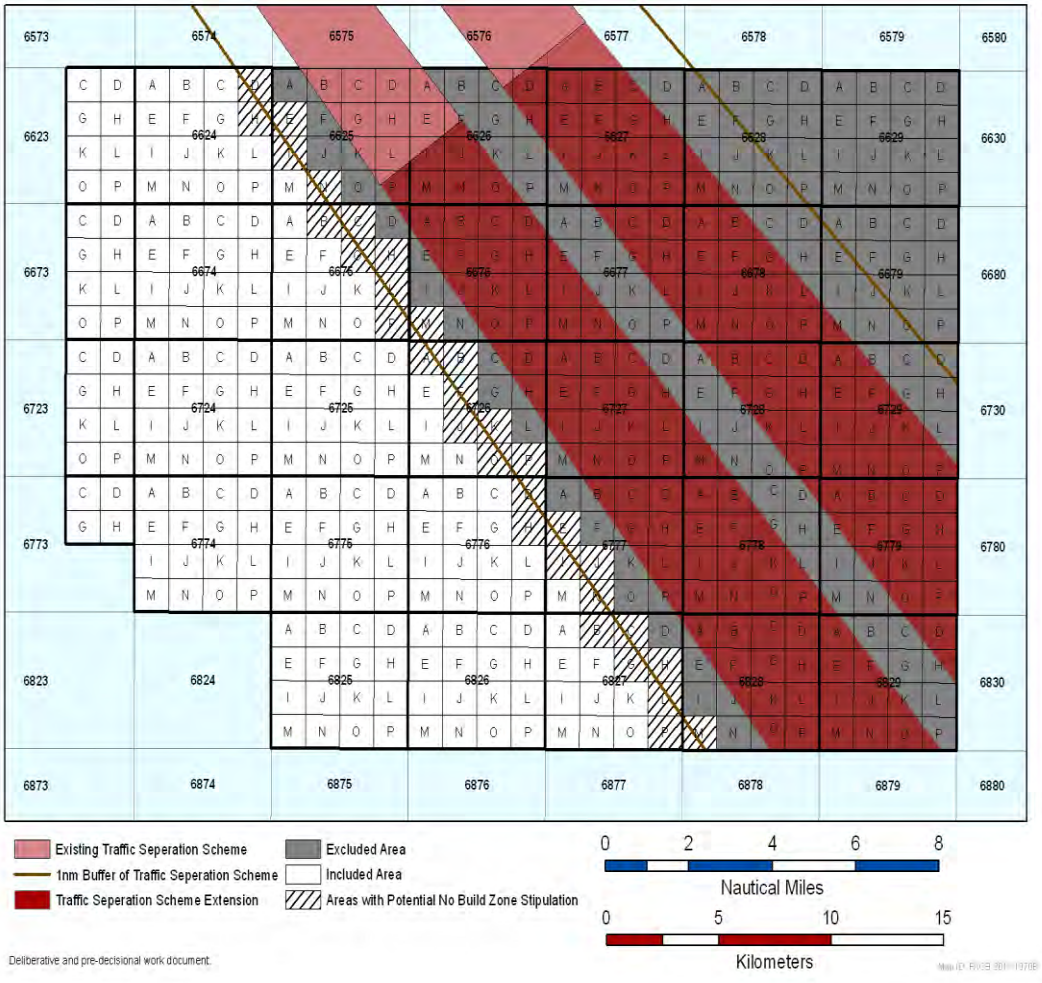
http://www.boemre.gov/offshore/RenewableEnergy/PDFs/stateactivities/MD_DEFiles/MarylandRFIMap_forBOEMREwebsitev2.pdf

the MEA staff has participated in stakeholder-led discussions on these issues. This stakeholder outreach informed the recommendation of State agencies to the Bureau of Ocean Energy Management, Regulation and Enforcement regarding the geographical area of interest. This recommendation largely resembled the final interest area agreed to at the fourth Task Force meeting, held on June 24th, 2011. (Figure C-24)

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




The General Assembly has spent the interim studying the various aspects of offshore wind in Maryland and Governor O'Malley has announced a continued push for legislation supporting offshore wind.

## Supporting Laws and Regulations

The Environmental Law Institute, in collaboration with DNR's Maryland Coastal Zone Management Program, has reviewed relevant laws, policies and programs, to identify opportunities and potential changes Maryland can anticipate with regard to offshore energy development. The resulting report, "Maryland Offshore Energy Framework" offered recommendations for modifying and clarifying existing statutes and policies to facilitate development of offshore wind energy.

In 1953, Congress enacted the Submerged Lands Act, which effectively transferred ownership of submerged lands and superjacent waters within the first three nautical miles and the right to exploit natural resources in that area to the adjacent state, subject to the federal government's retained rights to regulate those lands and waters for navigation, national security, commerce, and the like.[65] The Outer Continental Shelf Lands Act was also enacted in 1953, which grants the Secretary of the Interior jurisdiction to lease outer continental shelf lands for oil and gas exploration and development in the federal waters. The federal jurisdiction extends from 3 to at least 200 nautical miles.[66]

The federal Coastal Zone Management Act of 1972 encourages coastal states to prepare and gain federal agency approval of state coastal zone management plans. Furthermore, it allows a coastal state with an approved coastal program plan to review for consistency with that state's coastal zone management plan, federal projects, and applications for federal permits and licenses that "affect any land or water use or natural resource of the state coastal zone, regardless of location or activity".[67] Therefore, regardless of whether a state plans to develop offshore wind power or not, it could be advantageous to create a wind power development plan in order to coordinate with projects in federal waters which may impact the state. In Maryland, the DNR Chesapeake and Coastal Program has been delegated authority under the Coastal Zone Management Act and would have the responsibility to review any federal activities which might affect Maryland.

The Energy Policy Act of 2005 granted the U.S. Department of the Interior's Minerals Management Service jurisdiction to regulate offshore renewable energy and established a broad regulatory framework. Following the Programmatic Environmental Impact Statement released in November 2007, the Minerals Management Service released proposed rules for alternative energy in the outer continental shelf in July 2008. A Final Rule establishing a program to grant leases, easements, and rights-of-ways for renewable energy development activities such as the siting and construction of offshore wind farms on the outer continental shelf were promulgated in April 2009.[68] Under these rules, the Minerals Management Service was granted exclusive jurisdiction with regard to

[65] 43 USC §§1301-1315 Available: http://www mms.gov/aboutmms/pdffiles/submerged.pdf
[66] 43 USC §§1331-1356a. Available: http://www mms.gov/aboutmms/pdffiles/ocsla.pdf
[67] Office of Ocean Coastal Resource Management, National Oceanic and Atmospheric Administration, Available: http://coastalmanagement noaa.gov/consistency/media/fc_overview_022009.pdf (February 20, 2009).
[68] U.S. Department of the Interior, Minerals Management Service, Renewable Energy and Alternate Uses Existing Facilities on the Outer Continental Shelf, 74 Federal Register 19638-19871, Available: http://www.mms.gov/offshore/RenewableEnergy/PDF/FinalRenewableEnergyRule.pdf

production, transportation, or transmission of energy from non-hydrokinetic renewable energy projects, including wind and solar.

The Final Rule established timelines and procedures for performing regulatory review of project site assessment plans as well as construction and operations proposals. In 2010, the U.S. Department of Interior reorganized the Minerals Management Service, giving the new Bureau of Ocean Energy Management, Regulation and Enforcement jurisdiction over offshore wind permitting activities. In response to concerns that the process outlined in the 2009 Final Rule led to an overly long and redundant permitting timeline, Secretary of the Interior Salazar announced the "Smart from the Start" initiative.[69] "Smart from the Start" clarified and streamlined the process and identified four key Wind Energy Areas that represented areas considered most suitable for offshore wind energy development. Under this effort, the U.S. Department of the Interior initiated Environmental Assessments for the designated wind energy areas. If these Environmental Assessments result in findings of no significant impact on the environment, then project developers who are awarded leases can begin site assessment activities in these areas without further environmental review. Construction and Operations Plans will still require full Environmental Impact Statements, pursuant to the National Environmental Policy Act.[70]

**New Legislation Needed**

Federal law and regulation of offshore wind energy focuses largely on permitting areas of the Outer Continental Shelf for offshore wind development. At this time, no federal program or law reflects a direct effort to engage in, or assist with, the procurement of offshore wind energy or to incentivize the production of offshore wind power. However, several federal incentives designed to spur renewable energy production more broadly can be applied to offshore wind generation:

- Clean Energy Production Tax Credit (26 USC §45) – Offers a per kilowatt-hour federal corporate tax credit for production of energy from renewable resources
- Business Investment Tax Credit (26 USC §48) – Offers a 30 percent tax credit for qualifying renewable energy projects.
- US Department of Energy Loan Guarantee Program – (42 USC §16511 et seq.) Title XVII of EPAct 2005 authorized the U.S. Department of Energy to issue loan guarantees for projects that provide environmental benefits.

However, these incentives must be regularly reauthorized. Relative to other renewable energy technologies, offshore wind energy requires a longer planning timeline and therefore, greater regulatory and market certainty. Therefore, federal incentives for which funding are not guaranteed over a longer time may not provide adequate market

[69]US Department of the Interior, Press Release: "Salazar Launches 'Smart from the Start' Initiative to Speed Offshore Wind Energy Development off the Atlantic Coast", http://www.doi.gov/news/pressreleases/Salazar-Launches-Smart-from-the-Start-Initiative-to-Speed-Offshore-Wind-Energy-Development-off-the-Atlantic-Coast.cfm

[70]42 U.S.C. § 4321 et seq.

incentives to spur offshore wind projects. Therefore state governments have been the major driver in creating demand for offshore wind energy, through long-term power purchase requirements or mandates within state RPSs.

During the 2011 legislative session, Governor O'Malley introduced House Bill 1054, the Maryland Offshore Wind Energy Act of 2011, which requires Maryland utilities to enter into long-term contracts to purchase 400 to 600 MW of offshore wind energy, approximately ten nautical miles off of Maryland's coast. This would require the installation of between 80 and 200 wind turbines, depending on project scope and turbine capacity. Consideration of the bill has been postponed until next legislative session.

## Links to Supporting Documentation


- Cicin-Sain, B. et al. Toward a Vision for Maryland's Ocean, Gerard J. Mangone Center for Marine Policy, University of Delaware, Available: http://www.dnr.state.md.us/bay/czm/ocean/pdfs/Toward_Vision_for_MD_Ocean.pdf
- Coastal Atlas: *http://www.dnr.state.md.us/ccp/coastalatlas/ocean.asp*.
- Department of Energy, 20 percent Wind Energy by 2030, Increasing Wind Energy's Contribution to U.S. Electricity Supply, Available: http://www1.eere.energy.gov/windandhydro/pdfs/41869.pdf
- Environmental Law Institute, Virginia Offshore Energy Development Law and Policy Review and Recommendations, Available: http://www.elistore.org/reports_detail.asp?ID=11338
- Firestone, et. al. Maryland's Offshore Wind Power Potential, Abell Foundation and the University of Delaware, Feb. 2010.Available: http://offshorewind.net/Other_Pages/Links%20Library/MarylandsOffshorewindPowerPotential-feb2010.pdf
- Mid-Atlantic Regional Council on the Ocean, Mid-Atlantic Governors' Agreement on Ocean Conservation, Available: http://www.midatlanticocean.org/agreement.pdf
- 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
- US Department of Energy, "Wind Powering America," Available: http://www.windpoweringamerica.gov/
- Virginia General Assembly Legislative Information System, Senate Bill 1349 Mid-Atlantic Offshore Wind Energy Infrastructure Development Compact Available: http://leg1.state.va.us/cgi-bin/legp504.exe?091+sum+SB1349

# Energy-14: 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 this programs have been aggregated under Energy-6: EmPOWER: Energy Efficiency in the Residential Sector..

## Other Environmental Benefits

Under the EmPOWER umbrella, this initiative will help Maryland meet its Chesapeake Bay and air quality goals. Increasing energy efficiency in Maryland's residential sector reduces the need for power generation from fossil fuel sources. In addition to reducing GHG emissions, this will create reductions in nitrogen dioxide, sulfur dioxide and mercury.

- Nitrogen dioxide emission reductions will help Maryland reduce nitrogen pollution in the Chesapeake Bay. Approximately one-third of the Chesapeake Bay's nitrogen pollution comes from air pollution deposited into the Chesapeake Bay.
- The nitrogen oxide reductions will also help Maryland meet air quality standards for ground level ozone and fine particulate matter.
- Sulfur dioxide emission reductions will help Maryland further reduce fine particulates and also help achieve the visibility improvements required to comply with federal regional haze requirements.
- Mercury, a toxic pollutant, is primarily released by air pollution sources but ultimately affects water quality and bioaccumulates in fish tissue. Mercury reductions will help improve water quality in Maryland.

Biomass fuels have little to no sulfur content and thus substituting biomass for coal reduces the amount of sulfur dioxide emitted. Co-firing biomass for combined heat and power projects may also reduce ozone-creating nitrogen dioxide, although this environmental benefit is less certain than with sulfur dioxide. Facilities facing environmental compliance issues based on sulfur dioxide emissions may want to consider co-firing as an alternative to investing in emissions controls or switching to natural gas.

## Economic Benefits, Job Creation and Job Protection

Analyses for the economic benefits, job creation and job protection in Maryland from this program is included in Chapter 7 of this plan.

## 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.

## Supporting Laws and Regulations

There are no supporting laws or regulations for this program

**New Legislation Needed**
Combined heat and power can be promoted in Maryland 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 british thermal units generated from a qualifying facility; and, (3) feed-in tariffs.

## Links to Supporting Documentation

- MEA, Save Energy Now for Maryland Industry, CHP: http://energy.maryland.gov/SEN/CHP.html
- Jane E. Lawton Loan Program: http://www.energy.state.md.us/Govt/janeelawton.html
- US Department of Energy, Industrial Distributed Energy, CHP: http://www1.eere.energy.gov/industry/distributedenergy/index.html

# Energy-15: 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.[71]

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.[72] 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

[71] Kaplow, Stuart D. "Maryland is Poised to be the 1st State to adopt the International Green Construction Code." March, 2011. http://www.stuartkaplow.com/library3.cfm?article_id=185

[72] http://www.eecbg.energy.gov/

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 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

**By 2020, the potential emission reductions from this program are estimated to be 0.02 MMt$CO_2$e.**

**Figure C-25. Low and High GHG Benefits for Energy-15**

| | | |
|---|---|---|
| Low Estimate | 0.01 MMt$CO_2$e | MDE Quantification Below |
| High Estimate | 0.02 MMt$CO_2$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:

(Annual MMBtu/property)*(% reduction of upgrade type) = MMBtu reduction/upgrade

(350 MMBtu/commercial property)(15% reduction for HVAC) = 52.5 MMBtu/HVAC

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

(MMBtu reduction/upgrade)*(# of upgrades/year) = Total MMBtu reduction/ Year per upgrade type

(52.5 MMBtu/HVAC)(21 HVAC/year) = 1,125 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:

[MMBtu reduction/yr per upgrade type i] * [MMBtu reduction/yr per upgrade type ii] * [MMBtu reduction/yr per upgrade type iii] = Total reduction per year in MMBtu

1,125 MMBtu/year per HVAC * 3,111 MMBtu/year per windows/door * 3,150 MMBtu/year per insulation/lighting = 7,386

9. The MMBtu value is converted to million metric tons of $CO_2e$, 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-26. Energy-15 Low Estimate Summary**

| | $MMtCO_2e$ | | |
|---|---|---|---|
| Year | 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 |
| TOTAL | 0.0043 | 0.0064 | **0.0064** |

Figure C-27. Energy-15 High Estimate Summary

| | $MMtCO_2e$ | | |
|---|---|---|---|
| Year | 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 |
| TOTAL | 0.0043 | 0.0107 | **0.0214** |

## Other Environmental Benefits

Buildings are significant consumers of energy and other resources. In addition to reducing regional GHG emissions, green buildings can reduce waste output and water usage.

## Economic Benefits, Job Creation and Job Protection

The job creation and protection analysis is under development and is expected to be completed by May 2011. Governor O'Malley stated on April 21, 2010, that "this increased investment means the creation of up to 5,400 jobs to benefit Maryland's economy as well the significant impact of helping 4,000 families who own or rent homes."[73] For example, the construction of the University of Baltimore's new John and Frances Angelos Law Center is expected to generate 1,231 jobs.[74]

Economic analysis of this program by DHCD was completed by May of 2011. On April 21, 2010, Governor O'Malley also stated that "this initiative also assists small businesses and communities to save money and energy by improving energy efficiency in their workplaces. More importantly, this will stimulate private investment which will ensure the sustainability of these programs and help expand Maryland's burgeoning green workforce." [75] Construction of the University of Baltimore's new John and Frances Angelos Law Center is expected to provide $60 million in compensation and $7.2 million in State and local tax revenue. In all, the project will drive $174.2 million in economic activity.[76]

[73] DHCD. "Maryland to Receive $20 Million as Part of U.S. Department of Energy's Retrofit Ramp-Up Initiative." April 21, 2010.
http://www.dhcd.maryland.gov/Website/About/PublicInfo/NewsEvents/NewsDetail.aspx?newsID=264
[74] DGS. "Maryland Green Building Council 2010 Annual Report." November 1, 2010.
http://www.msa.md.gov/megafile/msa/speccol/sc5300/sc5339/000113/013000/013268/unrestricted/20110086e.pdf
[75] DHCD. "Maryland to Receive $20 Million as Part of U.S. Department of Energy's Retrofit Ramp-Up Initiative." April 21, 2010.
http://www.dhcd.maryland.gov/Website/About/PublicInfo/NewsEvents/NewsDetail.aspx?newsID=264
[76] DGS. "Maryland Green Building Council 2010 Annual Report." November 1, 2010.
http://www.msa.md.gov/megafile/msa/speccol/sc5300/sc5339/000113/013000/013268/unrestricted/20110086e.pdf

Further analyses for the economic benefits, job creation and job protection in Maryland from this program is included in Chapter 7 of this plan.

## 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.[77]

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.[78]

[77] "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/pressrealeases/100421.asp
[78] Ibid.

## Supporting Laws and Regulations

- Energy Independence and Security Act of 2007 Title III (Appliance and Lighting Efficiency) and Title IV (Energy Savings in Building and Industry)
- Smart, Green, and Growing - The Sustainable Communities Act of 2010 (House Bill 475)
- Greywater Recycling (House Bill 224)
- Maryland's Greenhouse Gas Emissions Reduction Act of 2009

### Suggested Laws and Regulations

Develop a Regional Blueprint Program to provide funds for voluntary regional sustainable growth planning efforts that emphasize transportation planning and scenario planning activities.[79]

## Links to Supporting Documentation

- Federal information on EECGB http://www1.eere.energy.gov/wip/eecbg.html
- http://www.mdhousing.org/website/programs/BeSmart/Default.aspx
- http://www.neighborhoodrevitalization.org/Programs/MainStreet/MainStreet.aspx
- http://www.mdhousing.org/website/documents/green_guide.pdf
- http://mdhousing.org/HousingConference/Default.aspx
- http://www.dhcd.state.md.us/Website/About/PublicInfo/NewsEvents/NewsDetail.aspx?newsID=292
- http://www.energy.gov/recovery/documents/Federal_Reporting_Recipient_Information.xls
- http://www.recovery.gov/Transparency/RecipientReportedData/pages/RecipientProjectSummary508.aspx?AwardIdSur=107012&AwardType=Grants
- http://www.recovery.gov/Pages/TextViewProjSummary.aspx?data=recipientAwardsList&State=MD&Agency=89&AwardType=CGL&DUNS=028492598&PageNumber=1
- http://www1.eere.energy.gov/buildings/betterbuildings/maryland.html
- http://webapp.psc.state.md.us/Intranet/CaseNum/NewIndex3_VOpenFile.cfm?filepath=%5C%5CColdfusion%5CEWorkingGroups%5CDRDG%5C%5CDHCD%20Weatherization%20psc%20full%20presentation%20novemebr%202010.ppt
- http://www.gov.state.md.us/pressreleases/100421.asp

[79] "DHCD Receives 2009 Environmental Excellence Award." September 29, 2009. http://www.hcd.ca.gov/USDOTAward.pdf

# Energy-16: 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.

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

**By 2020, the potential emission reductions from this program are estimated to be 0.04 $MMtCO_2e$.**

**Figure C-28. Low and High GHG Benefits for Energy-16**

| | | |
|---|---|---|
| Low Estimate | 0.03 $MMtCO_2e$ | MDE Quantification Below |
| High Estimate | 0.04 $MMtCO_2e$ | MDE Quantification Below |

**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-29. 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 |
| TOTAL | $56,267,796 | $9,565,525 | **$46,702,271** |

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 conversation 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

  (Total grant) / (cost per property) = Number of properties retrofitted

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

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

(Number of retrofits)*(current energy use/property)*(% reduction) = energy savings

(8,865 retrofits)*(87.1 MMBtu/property)*(32% reduction) = 247,093 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-30. 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 |
| **0.0311** | **million metric ton GHG saved/not emitted, 2020** |

| | 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 |
| **0.0383** | **million metric ton GHG saved/not emitted, 2020** |

## Other Environmental Benefits

Energy upgrades and sustainable development lead to an increase in air and water quality.

## Economic Benefits, Job Creation and Job Protection

The job creation and protection analysis is under development and is expected to be completed by May 2011. Governor O'Malley stated on April 21, 2010, that "this increased investment means the creation of up to 5,400 jobs to benefit Maryland's economy as well the significant impact of helping 4,000 families who own or rent homes."[80] For example, the construction of the University of Baltimore's new John and Frances Angelos Law Center is expected to generate 1,231 jobs.[81]

[80] DHCD. "Maryland to Receive $20 Million as Part of U.S. Department of Energy's Retrofit Ramp-Up Initiative." April 21, 2010. http://www.dhcd.maryland.gov/Website/About/PublicInfo/NewsEvents/NewsDetail.aspx?newsID=264

[81] DGS. "Maryland Green Building Council 2010 Annual Report." November 1, 2010. http://www.msa.md.gov/megafile/msa/speccol/sc5300/sc5339/000113/013000/013268/unrestricted/20110086e.pdf

The economic analysis is underway and expected to be complete in mid-2011. On April 21, 2010, Governor O'Malley also stated that "this initiative also assists small businesses and communities to save money and energy by improving energy efficiency in their workplaces. More importantly, this will stimulate private investment which will ensure the sustainability of these programs and help expand Maryland's burgeoning green workforce." [82]

Analyses for the economic benefits, job creation and job protection in Maryland from this program is included in Chapter 7 of this plan.

## 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. [83] 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.[84] 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

[82] DHCD. "Maryland to Receive $20 Million as Part of U.S. Department of Energy's Retrofit Ramp-Up Initiative." April 21, 2010.
http://www.dhcd.maryland.gov/Website/About/PublicInfo/NewsEvents/NewsDetail.aspx?newsID=264
[83] DHCD. "Rental Housing Preservation Program - MD-BRAC - Green Grant."
http://www.mdhousing.org/Website/programs/RHPP/Default.aspx.
[84] Ibid.

designed to streamline loan documents and underwriting procedures for affordable rental projects ($50,000).[85]

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 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.

## Supporting Laws and Regulations

- Energy Independence and Security Act of 2007 Title III (Appliance and Lighting Efficiency) and Title IV (Energy Savings in Building and Industry).
- The Sustainable Communities Act of 2010 (House Bill 475)
- Greywater Recycling (House Bill 224)
- Green Building Council (House Bill 154/Senate Bill 212)
- Baltimore City Building Code, Chapter 37 establishes a green building program

[85] 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

- Maryland's Greenhouse Gas Emissions Reduction Act of 2009

**Suggested Laws and Regulations**

Develop finance models for State public benefit fund programs to support energy efficiency improvements for new and existing construction. As part of this effort, focus on performance-based programs that provide incentives targeted to developers.

## Links to Supporting Documentation

- WAP http://www.dhcd.state.md.us/Website/programs/wap/Default.aspx
- LIHTC http://www.dhcd.state.md.us/Website/Housing/BuildDevelop.aspx
- MEEHA http://www.dhcd.state.md.us/Website/programs/MEEHA/Default.aspx
- Available information on the details of the WAP program: http://www.recovery.gov/Transparency/RecipientReportedData/pages/RecipientProjectSummary508.aspx?AwardIdSur=30595&AwardType=Grants
- US Department of Energy, WAP, ARRA 2009:
- http://www1.eere.energy.gov/wip/pdfs/wx_recovery_fact_sheet.pdf
- DHCD Presentation:
- http://webapp.psc.state.md.us/Intranet/CaseNum/NewIndex3_VOpenFile.cfm?filepath=%5C%5CColdfusion%5CEWorkingGroups%5CDRDG%5C%5CDHCD%20Weatherization%20psc%20full%20presentation%20novemebr%202010.ppt
- US Department of Energy, Source for $6,500/unit:
- http://www1.eere.energy.gov/wip/weatherization.html
- http://www.energy.gov/recovery/data.htm
- http://www.energy.gov/recovery/md.htm
- http://www.energy.gov/recovery/documents/Recovery_Act_Memo_Maryland.pdf
- http://www.dhcd.state.md.us/ARRA/WAP.aspx
- http://www1.eere.energy.gov/wip/wap.html

# Sub-Appendix C-2: Transportation Programs

## Transportation-1: 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:

Transportation-1: Maryland Clean Cars Program
Transportation-10: Transportation Technology Initiatives
Transportation-17: Renewable Fuel Standard
Transportation-18: Corporate Average Fuel Economy

For this reason, MDE aggregated the potential 2020 benefits from these programs under one emission benefit estimate. Refer to Transportation-10: 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.[86] To ensure that specific emission levels are achieved on a fleet-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.

[86] 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 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.

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.

## Economic Benefits, Job Creation and Job Protection

This program requires automobile manufacturers to produce cleaner, more fuel efficient vehicles. The clean vehicle technologies itself can create jobs in research and development and clean fuel auto and auto parts manufacturing sectors. Baum and Luria (2010) estimated that the supply of clean and fuel-efficient vehicles to the U.S. market alone would create as high as 190,000 jobs by 2020. The domestic job creations could vary from 50,000 to 150,000 jobs, depending on the assumptions on domestic manufacturing incentives. Also, according to this study, about 40 percent of the job creation will be in the auto sector, the remaining will be in service sectors and the broader manufacturing sectors in the supply chain. In the past, the requirement for new, federal motor vehicle standards has not resulted in the start-up of automobile production facilities in the State. However, this program may have minimal impact on job creation in the ancillary parts, components, and services areas in Maryland.

This program will promote and increase the availability of new, fuel efficient vehicles which in turn will lead to consumer savings due to lower fuel expenditures. Lower fuel expenditures provide consumers with additional income (which could increase if fuel prices increase) to spend in other areas of the economy. The Ceres Report (2011) shows that the gross economic output in the US, under a 5 percent scenario, will increase by $26.6 billion dollars, and create 603,000 jobs. The report also shows that personal income will increase by $17.6 billion dollars while tax revenues will increase by $15.8 billion dollars. Light-duty vehicle prices are expected to increase in the 5 percent scenario by about $2,184 per vehicle. However, the additional cost of the vehicles is less than the fuel saving generated by higher fuel economy. The re-spending of these savings will generate strong multiplier effects in the economy.

For Maryland, large proportion of the transportation fuel consumption is import-dependent. In contrast, the savings from fuel cost reductions tend to be spent on goods and services that are less import-dependent and have a larger share to be produced and provided within the State. The increased in-state spending shares will in turn create stronger multiplier effects compared with the spending on the conventional fossil fuel production and supply sectors.

According to the IMPLAN 2009 Maryland Input-Output data, $1 million in spending on transportation fuels (i.e., final demand increase in the Petroleum Product Manufacturing sector) would result in a total output impact of $1.36 million, or a multiplier effect of 1.36. The spending of this same amount on the typical bundle of goods and services

would result in a total output impact of $1.77 million, or a multiplier effect of 1.77. In other words, when $1 million of spending is shifted from transportation fuels to other goods and services, the net stimulus effect to the State is $0.41 million in terms of gross output.

There are discussions regarding the possible "rebound effect" in the energy efficiency literature, which refers to the increased energy consumption (or more driving) given the reduced cost of energy and increased income (Greening et al., 2000; Small and Dender, 2007). However, this effect appears to be modest in California--about 10 percent of the total reduced transportation fuel consumptions (Roland-Holst, 2011).

The major economic benefit stemming from fuel efficiency and clean car programs are the fuel cost savings to households and businesses. These savings will increase the purchasing power of households and reduce the production cost of business, and thus increase general spending and investment in other goods and services. Comparatively speaking, the fossil fuel supply sectors are among the least labor-intensive sectors in the economy.

For example, based on the 2009 IMPLAN Input-Output table of Maryland, the employment per $1 million of output of the Oil & Gas Extraction sector is 4.4 jobs, and of the Petroleum Product Mfg sector is 0.54 jobs, compared with an economy-wide labor-intensity of 7.4 jobs per million dollars of output. In addition, nearly 90 percent of the household spending in Maryland is in wholesale and retail trade, financial, and service sectors, which in aggregate have an employment-intensity of 8.3 jobs per million dollars of output.

Further analyses for the economic benefits, job creation and job protection in Maryland from this program is included in Chapter 7 of this plan.

## 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.

## Supporting Laws and Regulations

- Maryland Clean Cars Act of 2007

## Links to Supporting Documentation

- Baum, A. and Luria, D. 2010. *Driving Growth: How Clean Cars and Climate Policy Can Create Jobs*. Report for the Natural Resources Defense Council, and Center for American Progress. http://www.americanprogress.org/issues/2010/03/driving_growth.html.

- Greening, L.A., Greene, D.L., and Difiglio, C. 2000. "Energy Efficiency and Consumption—the Rebound Effect—a Survey," *Energy Policy* 28(6-7): 389-401.
- Roland-Holst, D. 2011. *Driving California's Economy: How Fuel Economy and Emissions Standards Will Impact Economic Growth and Job Creation*. Next 10 Report. http://www.next10.org/next10/publications/vehicle_efficiency.html.
- Small, K.A. and Dender, K.V. 2007. "Fuel Efficiency and Motor Vehicle Travel: The Declining Rebound Effect," *Energy Journal* 28(1): 25-52.
- Sullivan, M.R. 2009. *Dollars and Sense: The Economic Impacts of Bringing Clean Cars, Light-Duty Trucks & SUVs to Minnesota*. Environment Minnesota Research & Policy Center Report. http://www.environmentminnesota.org/reports/global-warming/global-warming/dollars--sense-the-economic-impacts-of-bringing-clean-cars-light-duty-trucks-and-suvs-to-minnesota.


# Transportation-2: 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**

**By 2020, the potential emission reductions from this program are estimated to be 0.88 MMt$CO_2$e.**

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 MMt$CO_2$e respectively.

**Figure C-31. Low and High GHG Benefits for Transportation-2**

| | | |
|---|---|---|
| Low Estimate | 0.63 $MMtCO_2e$ | MDE Quantification Below |
| High Estimate | 0.88 $MMtCO_2e$ | MDOT Quantification Appendix D |

**Low Estimate – MDE Quantification**

The methodology used to assess the benefits of this program relied on projected fuel sales as the primary basis for developing the GHG estimates. For the baseline future, total fuel sales were allocated to specific vehicle classes and model years using baseline fuel consumption estimates from EPA's MOBILE6.2 emission factor model in conjunction with fleet characterization data expressed as vehicle age distributions, vehicle sales fraction, vehicle mileage accumulation rates and vehicle class-specific VMT fractions, each developed locally for Maryland or derived from the MOBILE6.2 emission factor model (in the absence of local data). All locality specific data were provided by MDE. These same fleet characterization data in conjunction with the fuel consumption impacts estimated for this specific medium and heavy-duty program were used to estimate the overall change in GHG emissions. This "top down" fuel consumption approach is different than the "bottom-up" approach that relies on models such as MOBILE6.2 or MOVES. The full details of this analysis can be found in the supporting documentation which is available upon request.

**Other Environmental Benefits**

While this program specifically focuses on GHG emissions, the resulting fuel economy improvement will undoubtedly improve other mobile emissions from medium- and heavy-duty vehicles. It can be expected, but has not been quantified, that the decrease in fuel use will decrease the emissions of ozone precursor pollutants, nitrogen oxides and volatile organic carbons, as well particulate matter emissions.

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.

Volatile organic carbon compound emission reductions will help Maryland meet air quality standards for ground level ozone.

Particulate matter emission reductions will help Maryland meet air quality standards for fine particulate matter.

## Economic Benefits, Job Creation and Job Protection

The major economic benefit stemming from fuel efficiency and clean car programs are the fuel cost savings to households and businesses. These savings will increase the purchasing power of households and reduce the production cost of business, and thus

increase general spending and investment in other goods and services. Comparatively speaking, the fossil fuel supply sectors are among the least labor-intensive sectors in the economy. For example, based on the 2009 IMPLAN Input-Output table of Maryland, the employment per $1 million of output of the oil & gas extraction sector is 4.4 jobs, and of the petroleum product manufacturing sector is 0.54 jobs, compared with an economy-wide labor-intensity of 7.4 jobs per million dollars of output. In addition, nearly 90 percent of the household spending in Maryland goes to the wholesale and retail trade, financial, and service sectors, which in aggregate have an employment-intensity of 8.3 jobs per million dollars of output.

A study by MRG & Associates using the IMPLAN input-output model estimated that the net job gains of the *National Blueprint Heavy Duty Truck Transportation Scenario* by Union of Concerned Scientists (Cleetus et al., 2009) can reach 63,380 and 123,540 jobs in the Year 2020 and Year 2030, respectively (Goldberg, 2010). From a sectoral perspective, nearly half of the job increase takes place in the Services sector; another 20 percent occurs in the manufacturing and retail sectors. The major job losses take place in the Oil & Gas Extraction and Wholesale Trade sector.

This program requires affected vehicle manufacturers to produce cleaner, more fuel efficient vehicles across the U.S. not just in Maryland. In the past, the requirement for new, federal emissions standards for these types of vehicles has not resulted in the start-up of production facilities in the State. However, this program may have minimal impact on job creation in the ancillary parts, components, and services areas in Maryland.

This program will promote and increase the availability of new, fuel efficient vehicles which in turn will lead to consumer savings due to lower fuel expenditures. Lower fuel expenditures provide consumers with additional income (which could increase if fuel prices increase) to spend in other areas of the economy.

Based on the 2009 IMPLAN input-output data for Maryland, the output multiplier effects of consumer spending in typical bundle of goods and services are higher than multiplier effects of the spending in transportation fuels. In essential, when $1 million spending is shifted from transportation fuels to other goods and services, the net stimulus effect to the State is $0.41 million in terms of gross output.

Different from the light-duty vehicles, a large portion of the medium- and heavy-duty vehicles are owned by businesses. For the commercial and industrial sectors, the heavy-duty vehicle fuel cost savings will lead to production cost decrease. For example, for trucking companies, fuel cost savings will lead to reductions in the prices of trucking services. Consumer will then enjoy additional savings stemming from the decreased shipping costs of goods and commodities.

There are discussions in the energy efficiency literature with respect to the possible "rebound effect", which refers to the increased energy consumption (or more driving) given the reduced cost of energy and the price of trucking services (Greening et al., 2000; Small and Dender, 2007). A study focusing on single unit (Class 4-7) and Class 8 trucks

shows that the rebound effect ranges between 13 percent and 22 percent in the short run for the single unit at the national level. In the long run, this effect can increase to 28 percent to 45 percent for single unit. The long run rebound effect for the Class 8 trucks is estimated to be 12 percent to 14 percent. (EPA and National Highway Transportation Safety Administration, 2010).

The MRG & Associates study estimated that the national gross domestic product gains of the *National Blueprint Heavy Duty Truck Transportation Scenario* by Union of Concerned Scientists (Cleetus et al., 2009) can reach $4.2 billion and $10.4 billion in the Year 2020 and Year 2030, respectively (Goldberg, 2010). The economic impact results are sensitive to the assumptions on the incremental costs of the advanced and fuel-efficient trucks and technologies, as well as the price of fuels. From a sectoral perspective, the biggest gross domestic product increase takes place in the services, manufacturing, and insurance/real estate, and finance sectors. The oil & gas extraction sector will experience the largest negative impacts, followed by the wholesale trade sector.

Further analyses for the economic benefits, job creation and job protection in Maryland from this program is included in Chapter 7 of this plan.

## Implementation

The federal regulations for implementation of this program have not yet been adopted. EPA and the National Highway Transportation Safety Administration issued a proposed rulemaking on November 30th, 2010. A final rulemaking was published in the Federal Register on September 15, 2011. The program will be federally enforced jointly by EPA and the National Highway Transportation Safety Administration similar to the way the light-duty National GHG Emissions Standards will be enforced. MDE will not have to adopt regulations to implement this program.

## Supporting Laws and Regulations

- Clean Air Act
- Energy Independence and Security Act of 2007

## Links to Supporting Documentation

- http://www.epa.gov/oms/climate/regulations/420f10901.htm
- Cleetus, R., S. Clemmer, and D. Friedman. 2009. Climate 2030: A national blueprint for a clean energy economy. Cambridge, MA: Union of Concerned Scientists.
- EPA and National Highway Traffic Safety Administration. 2010. Draft Regulatory Impact Analysis: Proposed Rulemaking to Establish Greenhouse Gas Emissions Standards and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles (http://www.epa.gov/otaq/climate/regulations/420d10901.pdf).

- Goldberg, M. 2010. National Heavy Duty Truck Transportation Efficiency Macroeconomic Impact Analysis. MRG & Associates report prepared for the Union of Concerned Scientists.
- Motor Vehicle Greenhouse Gas Emissions, An Analysis of Emission Reductions Due to Greenhouse Gas and Corporate Average Fuel Economy (CAFE) Standards, Final Report, Meszler Engineering Services, May 27, 2011.


# Transportation-3: 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 PromoteClean 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

**By 2020, the potential emission reductions from this program are estimated to be 2.42 MMt$CO_2$e.**

The transportation sector accounts for one-third of total GHG emissions in the region. The predicted reduction in transportation-related GHG emissions of 5-9 percent from a regional Clean Fuels Standard (as identified in the regional economic analysis) could help states achieve their statutory obligations and other commitments to reduce GHG emissions.

Further analysis for GHG emissions reductions in Maryland from this program is under-development.

**Figure C-32. Low and High GHG Benefits for Transportation-3**

| | | |
|---|---|---|
| Low Estimate | 1.21 MMt$CO_2$e | MDOT Quantification Appendix D |
| High Estimate | 2.42 MMt$CO_2$e | MDOT Quantification Appendix D |

## Other Environmental Benefits

In addition to reducing regional GHG emissions, the Clean Fuel Standard program would provide opportunities for greater use of low-carbon fuels in the future. Alternative fuels that have the potential to reduce the carbon intensity of fuel include, but are not limited to, electricity (for plug-in hybrid and electric vehicles), natural gas, hydrogen and a variety of advanced biofuels, including those from non-food crops (such as cellulosic ethanol). These alternative fuels have the potential to reduce emissions of other criteria pollutants, including nitrogen dioxide, volatile organic compounds and particulate matter.

The recently released regional economic analysis indicates that a Clean Fuels Standard could result in a more diverse and lower carbon fuel mix that includes advanced biofuels, electricity and natural gas in addition to traditional fuel sources. Since the report assumes nearly all of the alternatives to gasoline and diesel are to be domestically produced, a Clean Fuels Standard could provide important energy security benefits in the northeast and mid-Atlantic region. When a 10 percent target is achieved, cleaner fuels could provide 13–27 percent of the energy needed to power the region's cars and trucks. Over the 10 year period analyzed, a Clean Fuels Standard could achieve a cumulative reduction in gasoline and diesel use in the region of 14 to 40 billion gallons. The analysis suggests that higher oil prices will result in a greater diversification of transportation fuels.

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.

Volatile organic compound emission reductions will help Maryland meet air quality standards for ground level ozone.

Particulate matter emission reductions will help Maryland meet air quality standards for fine particulate matter.

## Economic Benefits, Job Creation and Job Protection

The regional economic analysis conducted by Northeast States for Coordinated Air Use Management identified the following program costs and benefits, macroeconomic impacts, and industry sector impacts:

### Program Costs and Benefits

Published estimates suggest that the cost of many low carbon fuels would be less than that of the gasoline and diesel they replace. Modeling conducted as part of this analysis found that the cumulative net benefit to the region could be $22 to $41 billion over 10 years, not including the potential health benefits associated with improved air quality. Assuming low oil prices, a clean fuels program could have a small net benefit or small net cost, depending on the scenario analyzed.

Other costs and benefits:

- consumers could save money by purchasing lower carbon fuels, some of which are expected to be less expensive than gasoline and diesel (especially if oil prices are high);
- producers of low carbon fuels could increase revenues and profits through sales;
- regulated fuel providers would incur compliance and administration costs; and
- participating states would incur program implementation costs.

### Macroeconomic Impacts

The analysis suggests that a clean fuels standard could have a positive benefit on job growth, gross regional product, and disposable personal income. However, the percentage changes for any of the macroeconomic metrics are very small relative to the business as usual forecast of a $4.9 trillion regional economy in 2022. This analysis suggests that achieving a 10 percent carbon intensity reduction target could provide the following regional economic benefits:

| | **High Oil Prices** | **Low Oil Prices** |
|---|---|---|
| **Increased number of jobs** (year 10) | 20,000 – 50,000 | 9,000 – 40,000 |
| **Change-Gross Regional Product** (10 year total) | $17 – $29 billion | $7 – $20 billion |
| **Change-Disposable Personal Income** (10 year total) | $7 – $15 billion | $2 – $10 billion |

### Impact on Industry Sectors

The analysis suggests that a Clean Fuels Standard could have direct and indirect impacts on a range of industries. Utilities, construction, manufacturing, forestry, agriculture, and other sectors that supply the goods and services needed to produce and deliver alternative fuels benefit under all scenarios. Modeling suggests that the petroleum subsector could lose value and some jobs, but these losses represent under one-tenth to one-half of one

percent relative to current employment levels in that sub-sector. The health care and finance/insurance sectors accrue indirect benefits from a Clean Fuels Standard as households retain more income from reduced spending on transportation fuels and invested it elsewhere in the economy.

The Clean Fuels Standard program would lead to new infrastructure such as ethanol and biodiesel production plants, blending infrastructure, and the distribution and delivery systems of the alternative fuels (such as E-85 delivery system, compressed natural gas fueling stations, electric vehicle charging stations) (NESCAUM, 2010). These new infrastructure will create jobs for the construction sector and related service sectors. The installation and maintenance of the home chargers can also be labor-intensive.

The agriculture, forestry, and waste management sectors will see increased demand for energy crops, woody biomass, municipal solid waste, and livestock waste as feedstock for biofuel production. As a result, large employment increase can be expected from these sectors.

The employment impacts to the energy supply sectors are mixed. Demand in electricity and natural gas will increase because of the increasing use of electric and compressed natural gas vehicles, however, the traditional transportation fuel producing and supply sectors will be negatively affected by this program. Since the majority of gasoline and diesel consumed in Maryland is imported from outside of the State, the majority of this dampening effect will not be borne by Maryland.

Motor vehicle and auto parts manufacturing sectors, as well as the battery manufacturing sector will experience increased demand as a result of the needs to produce advanced vehicles that can use alternative fuels and the devices needed in the electric powered vehicles. However, the job creation potentials might be limited because currently the demand of goods and services from these sectors in Maryland are largely supplied by imports from outside of the State.

It is estimated that Oregon's proposed low carbon fuel standards would result in overall positive employment impacts (JFA, 2011). The study analyzed alternative scenarios in terms of penetration rate of electric vehicles, oil price, origin of biofuels, etc. The results show a wide range of impact on job creation, which is between 863 and 29,290 jobs by 2025. The most influential factor is the assumption on the in-state biomass availability. Analysis on the Clean Fuel Standard policy for New York State also indicated that the variation in the assumption on the in-state biomass supply availability can change the overall employment impacts from slightly negative to positive. According to the JFA (2011) study, the top sectors that are positively affected in terms of employment by this program are construction, farm, food processing, retail trade, finance, professional and technical services, and administrative and support services sectors.

No matter where the alternative fuels are produced, the development of delivery and distribution infrastructure and facilities will take place in Maryland, and will stimulate the State economy. If a large proportion of the new biofuel production capacity can also

be built within the State, additional economic growth will be expected from the program. Therefore, the relevant programs that encourage the introduction and penetration of the low-carbon fuel technologies and the development of alternative fuel producing capacities in Maryland would be important to enhance the potential economic gains to the State (JFA, 2011).

Further analyses for the economic benefits, job creation and job protection in Maryland from this program is included in Chapter 7 of this plan.

## Implementation

This program will eventually be implemented through regulations adopted by MDE into the Code of Maryland Regulations. The requirements would be fully enforceable, and MDE will enforce the regulations just as it enforces all its regulations.

## Supporting Laws and Regulations

- Greenhouse Gas Emissions Reduction Act of 2009

## Links to Supporting Documentation

- Northeast States for Coordinated Air Use Management, Low Carbon Fuel Standard website: www.nescaum.org/topics/low-carbon-fuels
- Jack Faucett Associates (JFA). 2011. Economic Impact Analysis of the Low-Carbon Fuel Standard Rule for the State of Oregon. http://www.deq.state.or.us/aq/committees/docs/lcfs/appendixDeconimpact.pdf.
- Miller, S., Wei, D., and Rose, A. 2010. The Macroeconomic Impact of the Michigan Climate Action Council Climate Action Plan on the State's Economy. Report to Michigan Department of Environmental Quality. http://www.climatestrategies.us/ewebeditpro/items/O25F22416.pdf.
- NESCAUM. 2010. Economic Analysis of the Northeast/Mid-Atlantic Low Carbon Fuel Standard: Draft Data and Assumptions, Parts I and II. http://www.nescaum.org/documents/draft-part-ii-data-and-assumptions-aug-6.pdf/

# Transportation-4: 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.[87], the energy, environment and transportation agency heads from the region convened a summit in Wilmington, Delaware in June 2010 to launch TCI.[88] On June 16, 2010 they 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.[89] 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."[90]

## Estimated Greenhouse Gas Emission Reductions in 2020

**By 2020, the potential emission reductions from this program are estimated to be 0.07 million metric tons of $CO_2$-equivalent.**

### Figure C-33. Low and High GHG Benefits for Transportation-4

| | | |
|---|---|---|
| Low Estimate | 0.03 $MMtCO_2$ | MDE Quantification Below |
| High Estimate | 0.07 $MMtCO_2$ | MDE Quantification Below |

**Low and High 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

[87] TCI Declaration of Intent, June 16, 2010. http://www.georgetownclimate.org/state/files/TCI-declaration.pdf

[88] 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.

[89] Declaration of Intent, fn. 1, supra.

[90] Ibid.

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.

This program has overlap with the Transportation-1: Maryland Clean Cars Program, Transportation-3: Clean Fuels Standard and Transportation-11: 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.

## Other Environmental Benefits

Increasing the percentage of renewably generated electricity for the grid serving Maryland residents reduces the need for power generation from fossil fuel sources. In addition to reducing GHG emissions, this will create reductions in nitrogen dioxide, sulfur dioxide and mercury.

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.

Sulfur dioxide emission reductions will help Maryland further reduce fine particulates and also help achieve the visibility improvements required to comply with federal regional haze requirements.

Mercury, a toxic pollutant, is primarily released by air pollution sources but ultimately affects water quality and bioaccumulates in fish tissue. The mercury reductions from displacing fossil fuel with renewable generation will help improve water quality in Maryland.

## Economic Benefits, Job Creation and Job Protection

Information on job creation is under development. There is potentially significant regional job creation. TCI's mission statement and work plan identify job creation and building the clean energy economy as core objectives.

TCI's work plan focus on a regional electric vehicle charging network and sustainable communities will provide jobs for Maryland citizens for research and development, manufacture, sale, installation and maintenance of plug-in vehicles and charging infrastructure, and new construction/adaptive reuse of buildings and infrastructure to support transit-oriented development and sustainable communities.

The economic development information is under development. There are potentially significant regional economic benefits, as well as greater energy security through reduced dependence on foreign oil.

TCI's mission statement and work plan identify regional economic development as a core objective. TCI initiatives are expected to support and advance a "critical mass" regional market and business climate that attracts and retains industries and businesses that innovate and operate in a low-carbon transportation sector. This can provide jobs, from entry-level to high-tech, and generate revenue within the State.

Analyses for the economic benefits, job creation and job protection in Maryland from this program is included in Chapter 7 of this plan. The economic and jobs analyses for this program will be a combination of Transportation-3: Clean Fuel Standard, Transportation-11: Electric Vehicles Initiative, and Smart Growth programs.

## 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.

## Links to Supporting Documentation

- http://www.georgetownclimate.org/transportation/index.php
- http://www.georgetownclimate.org/state/files/TCI-declaration.pdf

# Transportation-5: 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

**By 2020, the potential emission reductions from this program are estimated to be 1.97 MMt$CO_2$e.**

**Figure C-34. Low and High GHG Benefits for Transportation-5**

| | | |
|---|---|---|
| Low Estimate | 1.35 $MMtCO_2e$ | MDOT Quantification Appendix D |
| High Estimate | 1.97 $MMtCO_2e$ | MDOT Quantification Appendix D |

## Other Environmental Benefits

Replacing the use of single occupancy vehicles with use of mass transportation will result in other environmental benefits. It can be expected, but has not been quantified, that the decrease in fuel use will decrease the emissions of ozone precursor pollutants, nitrogen oxides and volatile organic carbons, as well particulate matter emissions.

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.

Volatile organic carbon compound emission reductions will help Maryland meet air quality standards for ground level ozone.

Particulate matter emission reductions will help Maryland meet air quality standards for fine particulate matter.

## Economic Benefits, Job Creation and Job Protection

Capital investment in the public transportation programs would lead to final demand increases and job creation in both the construction sector and the manufacturing sectors. For the construction sector, the stimulus effects stem from the investment to the construction or upgrade of busways, rail lines, as well as supporting facilities such as bus stations, rail terminals, pedestrian sidewalks, bike paths, park and ride lots, etc.

For the manufacturing sectors, the job creations stem from the capital investment in the purchases of transit vehicles such as buses, coaches, rail vehicles, and control equipment, fare collection equipment, etc. (APTA Fact Book, 2011). According to the IMPLAN 2009 Maryland Input-Output data, the construction sector has a very high (nearly 1.0) regional purchase coefficient, which means the investment in construction will mainly use goods and services produced in Maryland and hence stimulate the State economy rather than "leaking out" into other states. The vehicle manufacturing, railroad rolling stock manufacturing, and electric equipment manufacturing sectors have low regional purchase coefficients in Maryland, which will lead to flows of investment dollars to out-of-state producers.

The annual operation and maintenance of the public transportation systems will also stimulate the local economy and create jobs in the public transportation service sector, which is a very highly labor-intensive sector in the economy. The 2009 IMPLAN data

show that the labor-intensity of the transit & ground passengers sector in Maryland is as high as 23 jobs per $1 million output (compared with an economy-wide labor-intensity of 7.4).

The overall travel cost savings for households, from using public transit, will lead to increased spending on other goods and services, which will create jobs in these sectors stemming from both direct and indirect and induced effects. The reduced demand for transportation fuels, passenger vehicles, vehicle maintenance and other services will negatively affect those related sectors. However, since the majority of gasoline and diesel consumed in Maryland are imported from outside of the State, the majority of this dampening effect will not be borne by Maryland.

Capital investment in the public transportation programs would increase the demand for goods and services from both the construction sector and the manufacturing sectors. The demand increase for the construction sector stems from the investment to the building or upgrade of busways, rail lines, as well as supporting facilities such as bus stations, rail terminals, pedestrian sidewalks, bike paths, park and ride lots, etc. The other part of the capital investment pertains to the purchases of buses, coaches, rail vehicles, control equipment, fare collection equipment, etc. (APTA Fact Book, 2011).

The capital investment of public transportation largely comes from the federal, state, and local governments (APTA Fact Book, 2011). The proportion of funds that can be obtained from the federal government to support the public transportation programs in Maryland would affect the economic performance of this program. This is because if higher State government budget needs to be spent on public transportation development, it has to be offset by reduced spending in other general government expenditure areas. A higher proportion of federal government funding would reduce such (negative) offsetting effects in the State.

The total investment and spending impacts of one billion dollars of sustained national investment in public transportation are estimated to be $3.5 billion in Weisbrod and Reno (2009) study. Other benefits associated with the development of public transportation include reduced delay and congestion cost, higher business productivities (through, e.g., improved labor market access, lower delivery cost), property value increase (Weisbrod and Reno, 2009).

The jobs and economic impact of this program also includes components of smart growth and more efficient land use. Please reference Land Use-3: Land Use Planning for GHG Benefits for an in-depth analysis of the job impact.

Further analyses for the economic benefits, job creation and job protection in Maryland from this program is included in Chapter 7 of this plan.

## 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

## Supporting Laws and Regulations (including new legislation needed)

- Reauthorization of Safe Accountable Flexible Efficient Transportation Equity Act: A Legacy for Users
- Increased federal funding opportunities for commuter rail

## Links to Supporting Documentation

- Maryland Climate Action Plan and Appendix, MDOT Draft 2012 Implementation Plan Report, April 11, 2011 (including appendices)
- Maryland Climate Action Plan, Appendix D-4, Transportation & Land Use, August 2008
- MDOT Draft 2012 Implementation Plan http://www.mdot.maryland.gov/Planning/Environmental_Planning.html
- Washington DC region transportation & land use- http://www.mwcog.org/store/item.asp?PUBLICATION_ID=353, http://www.mwcog.org/uploads/pub-documents/zFZeVg20090522125642.pdf
- Charm City Circulator- http://www.yournameyourride.com/
- University of MD Green Transportation, Shuttle and Carpool info- http://www.sustainability.umd.edu/content/campus/transportation.php
- JARC info- http://mta.maryland.gov/projects/
- Zipcar DC- http://www.zipcar.com/webdc/?gclid=CKKY5Yv65KcCFQJN4AodpRXc9w
- MTA Green Initiatives- http://www.mtagogreen.com/
- Carbon Savings Calculator for transit use-http://publictransportation.org/tools/carbon-savings.asp
- MDOT 2010 Environmental Stewardship report- www.mdot.maryland.gov/.../2010AttainmentreportEnvironmentalStewardship.pdf
- MDOT TOD Website- http://www.mdot.maryland.gov/Planning/TOD/Index.html
- Baltimore Metropolitan Council Commuter Options - http://www.baltometro.org/commuter-options/commuter-options
- Commuter Choice Website- http://www.commuterchoicemaryland.com/
- Kent Street Transit Plaza-http://www.baltometro.org/transportation-planning/2011-2014-tip-amendment-kent-street-transit-plaza-ccc-buses
- PlanMaryland - http://plan.maryland.gov/draftPlan/draftPlan.shtml
- Transit Oriented Development Case Studies- http://www.iedconline.org/downloads/smart_growth.pdf
- Live Near Your Work Maryland- http://www.livebaltimore.com/resources/incentives/employerprograms/livenearyourwork/
- Live Near Your Work-Washington DC- http://www.mwcog.org/commuter2/LNYW/housing-options.html
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# Transportation-6: Initiatives to Double Transit Ridership by 2020

Lead Agency: MDOT

## Program Description

This program is designed to help Maryland meet a goal set by the O'Malley-Brown Administration of doubling transit ridership by 2020, and continue that same growth rate beyond 2020. In order to achieve this growth, actions to increase the attractiveness and

convenience of public transportation, improve the operational efficiency of the system, and increase system capacity are required. Supportive actions with regard to land use planning and policy, pricing (disincentives to auto use), and bike and pedestrian access improvements are also necessary to attain the ridership goal and are all addressed in Transportation-5: Public Transportation Initiatives.

**MARC East Baltimore Station**
A new station is planned for east Baltimore City in 2015. There is a potential tie-in with Baltimore City's proposed Greektown pedestrian and transit center project.

**Expand Transit (Purple Line, Corridor Cities Transitway, Red Line)**
Major projects planned for opening by 2020 in the Washington region include the Purple Line which runs from Bethesda Metro station to New Carrolton Metro station and the Corridor Cities Transitway which runs from Shady Grove Metro station to COMSAT. A major project in the Baltimore region is the Red line. It will facilitate travel between the Social Security Administration in Woodlawn to the Bayview Medical Center in East Baltimore.

**MARC Growth and Investment Plan**
Consistent with the desire to expand and improve transit throughout Maryland, the O'Malley/Brown Administration's MARC Growth and Investment Plan is a multi-phased, multi-year plan to triple the capacity of MARC, Maryland's commuter rail system. MARC is a key component of Maryland's commuter network providing rail service for more than 30,000 commuters a day traveling between Washington's Union Station and northern, central and western Maryland. The MARC Growth and Investment plan establishes a series of improvement milestones for 2008, 2010, 2015, 2020 and 2035.

## 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 Transportation-5: Public Transportation Initiatives.

## Other Environmental Benefits

Replacing the use of single occupancy vehicles with use of mass transportation will result in other environmental benefits. It can be expected, but has not been quantified, that the decrease in fuel use will decrease the emissions of ozone precursor pollutants, nitrogen oxides and volatile organic carbons, as well particulate matter emissions.

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.

Volatile organic carbon compound emission reductions will help Maryland meet air quality standards for ground level ozone.

Particulate matter emission reductions will help Maryland meet air quality standards for fine particulate matter.

## Economic Benefits, Job Creation and Job Protection

Capital investment in transit programs would lead to final demand increases and job creation in both the construction sector and the manufacturing sectors. For the construction sector, the stimulus effects stem from the investment to the construction or upgrade of busways, rail lines, as well as supporting facilities such as bus stations, rail terminals, park and ride lots, etc. For the manufacturing sectors, the job creations stem from the capital investment in the purchases of transit vehicles such as buses, coaches, rail vehicles, and control equipment, fare collection equipment, etc. (APTA Fact Book, 2011). However, comparatively speaking, the job creations in the construction sector will be more prominent than in the manufacturing sectors.

According to the IMPLAN 2009 Maryland Input-Output data, the construction sector has a very high (nearly 1.0) regional purchase coefficient, which means the investment in construction will mainly use goods and services produced in Maryland and hence stimulate the State economy rather than "leaking out" into other states. In contrast, the vehicle manufacturing, railroad rolling stock manufacturing, and electric equipment manufacturing sectors have low regional purchase coefficients in Maryland, which will lead to flows of investment dollars to out-of-state producers.

The annual operation and maintenance of the public transportation systems will also stimulate the local economy and create jobs in the public transportation service sector, which is a very highly labor-intensive sector in the economy. The 2009 IMPLAN data show that the labor-intensity of the transit & ground passengers sector in Maryland is as high as 23 jobs per $1 million of output (compared with an economy-wide labor-intensity of 7.4).

The overall travel cost savings for households, from using public transit, will lead to increased spending on other goods and services, which will create jobs in these sectors stemming from both direct and indirect and induced effects. The reduced demand for transportation fuels, passenger vehicles, vehicle maintenance and other services will negatively affect those related sectors. However, since a large share of gasoline and diesel consumed in Maryland are imported from outside of the State, the majority of this dampening effect will not be borne by Maryland.

Capital investment in the transit programs would increase the demand for goods and services from both the construction sector and the manufacturing sectors. The demand increase for the construction sector stems from the investment to the building or upgrade of busways, rail lines, as well as supporting facilities such as bus stations, rail terminals, pedestrian sidewalks, bike paths, park and ride lots, etc. The other part of the capital

investment pertains to the purchases of buses, coaches, rail vehicles, control equipment, fare collection equipment, etc. (APTA Fact Book, 2011).

In addition to the stimulus effects generated by the up-front capital investment, the annual operation and maintenance of the public transportation systems will also stimulate the local economy. The total investment and spending impacts of one billion dollars of sustained national investment in public transportation are estimated to be $3.5 billion in a Weisbrod and Reno (2009) study.

Other benefits associated with the development of public transportation include reduced delay and congestion cost, higher business productivities (through, e.g., improved labor market access, lower delivery cost), property value increase (Weisbrod and Reno, 2009).

Further analyses for the economic benefits, job creation and job protection in Maryland from this program is included in Chapter 7 of this plan.

## 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 the initiative to double transit ridership by 2020 include all Maryland Transit Administration and Washington Metropolitan Area Transit Authority capital projects dedicated to the expansion and increased level of service of public transportation services in Maryland. These projects include infrastructure expansion, vehicle purchase and replacement, transit operations and transit support facilities in the 2011-2016 Consolidated Transportation Program. Example projects include:

- MARC Growth and Investment Plan implementation
- Completion of the Silver Spring transit center
- Locally operated transit systems' capital procurement projects
- Washington Metropolitan Area Transit Authority Capital Improvement Program
- Matching funds to Washington Metropolitan Area Transit Authority for the Passenger Rail Investment and Improvement Act

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

- Purple Line (Bethesda to New Carrolton)
- Corridor Cities Transitway (Shady Grove to COMSAT)
- Red Line (Social Security Administration to Bayview Medical Center)

Additionally, strategies to address the expected gap in meeting the transit ridership goal have been identified. The intent is for these strategies to complement and support funded Maryland Transit Administration and Washington Metropolitan Area Transit Authority plans and programs identified for implementation by 2020 in the 2011-2016 Consolidated

Transportation Program and the metropolitan planning organizations transportation improvement programs and long-range plans as discussed above. The general strategies are as follows:

- Additional Capacity on Existing Transit Routes
- Increase Frequencies of Transit Services Statewide/Expanded Park and Ride Capacity
- Increase Coverage of Transit Services – New Commuter / Intercity Bus Routes
- Increase Coverage of Transit Services – New Local Bus Routes

In addition to the above projects and strategies, other entities will:

- Increase public/private commuter shuttles to transit stops
- Examine "First and Last Mile" programs

## Supporting Laws and Regulations (including new legislation needed)

- Reauthorization of Safe Accountable Flexible Efficient Transportation Equity Act: A Legacy for Users
- Increased Federal match for transit new starts projects
- Increased Federal funding for transit including commuter rail
- Federal and State support for density bonuses, transit-oriented development, first and last mile access to transit, etc.

## Links to Supporting Documentation

- Maryland Climate Action Plan and Appendix, MDOT Draft 2012 Implementation Plan Report, April 11, 2011 (including appendices)
- Maryland Climate Action Plan, Appendix D-4, Transportation & Land Use, August 2008
- MDOT Draft 2012 Implementation Plan - http://www.mdot.maryland.gov/Planning/Environmental_Planning.html
- Maryland efforts to double transit riders by 2020- http://www.gov.state.md.us/statestat/GDUtransit.asp
- DC Commuter Connections- http://www.mwcog.org/commuter2/
- Baltimore Ride Share- http://www.baltimorecity.gov/Government/AgenciesDepartments/Transportation/Planning/RideshareProgram.aspx
- EPA guidance on land use impacts on transportation patterns- http://www.epa.gov/otaq/stateresources/policy/pag_transp.htm#lu
- Baltimore Metropolitan Council Commuter Options - http://www.baltometro.org/commuter-options/commuter-options
- Commuter Choice Website- http://www.commuterchoicemaryland.com/
- Charm City Circulator- http://www.charmcitycirculator.com/
- Maryland Transit Administration-Purple Line-http://www.purplelinemd.com/
- Corridor Cities Transitway-http://www.i270multimodalstudy.com/corridor-cities-transitway

- The Baltimore Red Line- http://www.baltimoreredline.com/
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# Transportation-7: 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

**By 2020, the potential emission reductions from this program are estimated to be 0.76 MMt$CO_2$e.**

**Figure C-35. Low and High GHG Benefits for Transportation-7**

| | | |
|---|---|---|
| Low Estimate | 0.65 MMt$CO_2$e | MDOT Quantification Appendix D |
| High Estimate | 0.76 MMt$CO_2$e | MDOT Quantification Appendix D |

## Other Environmental Benefits

This program will result in other environmental benefits. It can be expected, but has not been quantified, that the decrease in fuel use will decrease the emissions of ozone

precursor pollutants, nitrogen oxides and volatile organic carbons, as well particulate matter emissions.

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.

Volatile organic carbon compound emission reductions will help Maryland meet air quality standards for ground level ozone.

Particulate matter emission reductions will help Maryland meet air quality standards for fine particulate matter.

## Economic Benefits, Job Creation and Job Protection

Capital investment in the intercity transportation programs would lead to final demand increase and job creation in the construction sector. The stimulus effect stems from the investment to the construction of new busways for rapid transit lines, rail lines, as well as supporting facilities such as pedestrian bridge, high level platforms, and parking garages and decks at the stations. The increased needs of overhauling and retrofitting of the locomotives and rail cars will increase jobs in the repair and maintenance sectors of these rolling stocks. Both of the construction sector and the support activities for rail and road transportation sector are labor-intensive sectors.

The annual operation and maintenance of the intercity transportation systems will also stimulate the local economy and create jobs in the public transportation service sector, which is a very highly labor-intensive sector in the economy. The 2009 IMPLAN data show that the labor-intensity of the transit & ground passengers sector in Maryland is as high as 23 employment per $1 million output (compared with an economy-wide average of 7.4 employment per $1 million output).

The intercity transportation programs will also lead to fuel cost savings and vehicle operating and owning cost savings for the passengers. These savings for the households will lead to increased spending on other goods and services. However, reduced demand for transportation fuels, passenger vehicles, and vehicle repair and maintenance will negatively affect those related sectors. Comparatively speaking, the fossil fuel supply sectors and vehicle manufacturing sectors are less labor-intensive in the economy. In addition, since most of the gasoline and diesel, as well as vehicles consumed in Maryland are imported from outside of the State, the majority of the dampening effect stemming from the reduced passenger car travel will not be borne by Maryland.

The intercity transportation programs would lead to increased economic activities in the construction sector and transportation activity support sectors. The capital investment to build new busways for rapid transit lines, rail lines, as well as the supporting facilities such as pedestrian bridge, high level platforms, and parking garages and decks at the stations will increase the demand for goods and services from the construction sector.

The increased needs of overhauling and retrofitting of the locomotives and rail cars will increase the demand for goods and services from the repair and maintenance sectors of these rolling stocks. Both the construction sector and the support activities for rail transportation sector have high proportion of demand that can be met by in-state production and services.

According to the 2009 IMPLAN data, the construction sector in Maryland has a nearly 1.0 regional purchase coefficient, which means almost 100 percent of the investment to the construction sector will boost the State economy. The support activities for rail and road transportation sector in Maryland has an regional purchase coefficient of about 0.67, which means about two thirds of the investment in repair, maintenance and overhauling will stay inside of the State and generate multiplier effects to the State economy. The annual operation and maintenance of the intercity transportation systems will also stimulate the demand for goods and services from the public transportation service sector, which has a relatively high regional purchase coefficient of 0.77.

The intercity transportation programs and the improved efficiency of the multi-mode transportation system in the State will also lead to fuel cost savings and vehicle operating and owning cost savings of the passengers. These savings for the households will lead to increased spending on other goods and services. However, reduced demand for transportation fuels, passenger vehicles, vehicle maintenance and other services will negatively affect those related sectors. However, in Maryland, both gasoline and diesel, vehicles are largely imported from outside of the State. Therefore, the dampening effects stemming from the reduced demand of petroleum transportation fuels and vehicles will mostly not affect the State economy. In contrast, consumer savings on transportation fuels and vehicles can increase the spending on more domestically produced goods and services and stimulate the State economy. Other benefits of this program would include time savings and reduced congestion cost of the passengers.

Further analyses for the economic benefits, job creation and job protection in Maryland from this program is included in Chapter 7 of this plan.

## 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.

## Supporting Laws and Regulations (including new legislation needed)

- Sustainability tax or tax incentives for sustainable development including rail
- Money saved from ending oil depletion allowance directed to high speed rail service development

## Links to Supporting Documentation

- Maryland Climate Action Plan and Appendix, MDOT Draft 2012 Implementation Plan Report, April 11, 2011 (including appendices)
- Maryland Climate Action Plan, Appendix D-4, Transportation & Land Use, August 2008
- MDOT Draft 2012 Implementation Plan - http://www.mdot.maryland.gov/Planning/Environmental_Planning.html
- MTA MARC- http://mta.maryland.gov/services/marc/
- Federal Rail Administration high speed rail- http://www.fra.dot.gov/
- EPA guidance on Transportation Control Measures- http://www.epa.gov/otaq/stateresources/policy/pag_transp.htm#tcm
- MTA- MARC, MAGLEV- http://mta.maryland.gov/
- FTA- High speed rail- http://fastlane.dot.gov/2009/03/highspeed-rail-an-engine-of-growth.html
- Amtrak Acela- http://www.amtrak.com/servlet/ContentServer?c=AM_Route_C&pagename=am%2FLayout&cid=1241245664867
- Maryland High Speed Rail update- http://www.hsrupdates.com/statebystate/details/Maryland-HighSpeed-Rail-Plans--41

# Transportation-8: 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

**By 2020, the potential emission reductions from this program are estimated to be 0.41 MMt$CO_2$e.**

**Figure C-36. Low and High GHG Benefits for Transportation-8**

| | | |
|---|---|---|
| Low Estimate | 0.25 MMt$CO_2$e | MDOT Quantification Appendix D |
| High Estimate | 0.41 MMt$CO_2$e | MDOT Quantification Appendix D |

## Other Environmental Benefits

Provision of bike and pedestrian network to places of business, commerce, and recreation reduces the need for people to make short car trips, which are more polluting per mile than longer trips (due to cold starts, hot soaks), to visit local attractions.

This program will result in other environmental benefits. It can be expected, but has not been quantified, that the decrease in fuel use will decrease the emissions of ozone precursor pollutants, nitrogen oxides and volatile organic carbons, as well particulate matter emissions.

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.

Volatile organic carbon compound emission reductions will help Maryland meet air quality standards for ground level ozone.

Particulate matter emission reductions will help Maryland meet air quality standards for fine particulate matter.

## Economic Benefits, Job Creation and Job Protection

This program will result in major capital investment in the building and expansion of bicycle lanes and pedestrian sidewalks in urban areas of the State. Job creations will be expected in the construction sector. According to the IMPLAN 2009 Maryland Input-Output data, the construction sector has a very high (nearly 1.0) regional purchase coefficient, which means the investment in construction will mainly use goods and services produced in Maryland and hence stimulate the State economy rather than "leaking out" into other states. In addition, the successive rounds of the upper-stream supply sectors of the construction sector (such as utility, asphalt mfg, metal products mfg, machinery mfg sectors) will also be stimulated through the ripple (or multiplier) effects. Based on the Maryland Input-Output data, $1 million investment in the construction sector will create 7.5 jobs. The economy-wide effects will be an increase of 13.8 jobs.

There will also be jobs created in city planning, bicycle and pedestrian facility design, bike rental services, and other related services as a result of this program.

The major benefits to the households would be the transportation cost savings, which include both transportation fuel cost savings and vehicle operating and maintenance cost savings. These savings for the households will lead to increased spending on other goods and services, which will create jobs in these sectors stemming from both direct and indirect and induced effects. The reduced demand for transportation fuels, passenger vehicles, vehicle maintenance and other services will negatively affect those related sectors. However, since a large share of gasoline and diesel consumed in Maryland are imported from outside of the State, the majority of this dampening effect will not be borne by Maryland.

This program will result in major capital investment in the building and expansion of bicycle lanes and pedestrian sidewalks in urban areas of the State. Based on the Maryland Input-Output data, $1 million investment in the construction sector will generate a total output impact of $1.8 million to the State economy, or a multiplier effect of 1.8.

A recent Victoria Transport Policy Institute study shows that the benefits of the shifting from driving to non-motorized travel can be $1.43 per mile (Litman, 2011). These savings to the households will lead to increased spending on other goods and services, which, compared with vehicles and fuels, would have higher regional economic values.

The increased bike paths, trails, and bicycle facilities, especially in scenic areas will also boost the tourism industry and stimulate the economy. A report by North Carolina Department of Transportation indicated that after the one-time government investment of $6.7 million on building the bicycle paths and facilities in the northern Outer Banks, an annual economic gain of $60 million will be generated from the expenditures made by the cyclists (Lawrie et al., 2004). The major positively affected sectors will be tourism and retail trade.

Other possible economic benefits of improved bicycle and pedestrian access and facilities include increased property value, reduced health costs, and increased labor productivity (through improved access to work and education) (Litman, 2011). The negative economic impacts stemming from the shifted and reduced spending in other general government expenditure areas should be taken into consideration.

Further analyses for the economic benefits, job creation and job protection in Maryland from this program is included in Chapter 7 of this plan.

## 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

## Supporting Laws and Regulations (including new legislation needed)

- Full implementation of Maryland Bike and Pedestrian Access 2001- The Bicycle and Pedestrian Access 2001 Bill established:
  - A Director of Bicycle and Pedestrian Access
  - Requires the Director to develop a 20 year Statewide Bicycle-Pedestrian Master Plan to provide models to counties in enhancing bicycling and walking and help them fund them
  - Ensures best and most modern engineering practices be used by the State
  - Expands the focus of the State Bicycle Advisory Committee to include pedestrians
- In 2010 six significant Bike/Ped/Transportation bills passed and on May 20th the Governor signed these bills into law:
  - Senate Bill 624 - Shoulder Rule bill
  - Senate Bill 51 - 3 Foot bill
  - House Bill 1155 - Transportation Transparency bill
  - House Bill 282 - Funding for Bike/Ped Access bill
  - Senate Bill 229/ House Bill 710 - Blue Ribbon Commission on Maryland Transportation Funding
  - House Bill 786 - Funding Priority to Sidewalk or Bicycle Pathway Construction
- Increased Federal support for bicycle enhancements

## Links to Supporting Documentation

- Maryland Climate Action Plan and Appendix, MDOT Draft 2012 Implementation Plan Report, April 11, 2011 (including appendices)
- Maryland Climate Action Plan, Appendix D-4, Transportation & Land Use, August 2008
- MDOT Draft 2012 Implementation Plan - http://www.mdot.maryland.gov/Planning/Environmental_Planning.html
- Maryland Bicycle and Pedestrian Advisory Committee (MPBAC)- http://www.mdot.maryland.gov/planning/Bicycle/MBPAC.html
- One Less Car- http://www.onelesscar.org/page.php?id=152
- Bicycles on MTA- http://mta.maryland.gov/resources/bikesonmta/Bicycle_Text_Information_08.cfm?&printer=1

- Maryland MTA bike racks on buses- mta.maryland.gov/resources/bikesonmta/MTA_Bicycles_Brochure.pdf
- East Coast greenway- http://www.greenway.org/
- Baltimore 2001 bike/ped plan- www.baltometro.org/BRTP2001/BikePedGreenPlan.pdf
- MDOT bicycle plans- http://www.mdot.maryland.gov/Planning/Bicycle/BikePed_Index.html
- Bikestation info- http://home.bikestation.com/
- National Complete Streets Coalition- http://www.completestreets.org/tag/usdot/
- Baltimore bicycle level of service task report, June 2004- www.baltometro.org/reports/BikePedLOS.pdf
- Baltimore Metropolitan Council Commuter Options - http://www.baltometro.org/commuter-options/commuter-options
- Commuter Choice Website- http://www.commuterchoicemaryland.com/
- Lawrie, J., Guenther, J., Cook, T., Meletiou, M.P., and O'Brien, S.W. 2004. The Economic Impact of Investments in Bicycle Facilities: A Case Study of the Northern Outer Banks. Report for the North Carolina Department of Transportation. http://www.ncdot.org/bikeped/download/bikeped_research_EIAfulltechreport.pdf.
- Litman, T. 2011. Evaluating Non-Motorized Transportation Benefits and Costs. Victoria Transport Policy Institute, June 8, 2011. http://www.vtpi.org/nmt-tdm.pdf.


# Transportation-9: 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

**By 2020, the potential emission reductions from this program are estimated to be 2.21 MMt$CO_2$e.**

**Figure C-37. Low and High GHG Benefits for Transportation-9**

| | | |
|---|---|---|
| Low Estimate | 0.20 $MMtCO_2e$ | MDOT Quantification Appendix D |
| High Estimate | 2.21 $MMtCO_2e$ | MDOT Quantification Appendix D |

## Other Environmental Benefits

This program will result in other environmental benefits. It can be expected, but has not been quantified, that the decrease in fuel use will decrease the emissions of ozone precursor pollutants, nitrogen oxides and volatile organic carbons, as well particulate matter emissions.

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.

Volatile organic carbon compound emission reductions will help Maryland meet air quality standards for ground level ozone.

Particulate matter emission reductions will help Maryland meet air quality standards for fine particulate matter.

## Economic Benefits, Job Creation and Job Protection

The major job creation potentials of the transportation pricing policies stem from the re-investment of government revenues that are collected from VMT taxes, congestion fees, toll fees, etc. These revenues can be invested to improve transportation infrastructure and increase transit facilities in the most affected areas of the pricing policies. All of this investment will create jobs in the construction sector, public transportation sector, and related transportation activity supporting sectors. All of these sectors are labor intensive in Maryland.

Implementation and administration of the pricing mechanisms will also create jobs. For example, compared with transportation fuel taxes, toll collection demands more labor inputs. Even with increased use of electronic toll collection systems, back office work such as verifying the readings of license plate, network management, traffic violation processing, etc. will increase (Cambridge Systematics, Inc., 2009).

The government incentives to promote the employer commute programs can encourage non-motorized commuting such as walking and biking, or use of public transportation, carpooling/vanpooling, or telecommuting. Benefits can be expected to both the employers and employees. For the employers, short-term benefits include tax savings. Long-term benefits may include savings in parking facilities and office spaces (Herzog and Grant, 2007). For the employees, savings would mainly come from reduced

expenses on transportation fuels and vehicle operation and maintenance. All of these potential savings can bring positive job growth to the State.

The major stimulus effects of the transportation pricing policies will stem from the re-investment of government revenues that are collected from VMT taxes, congestion fees, toll fees, etc. These revenues can be invested to improve transportation infrastructure and increase transit facilities in the most affected areas of the pricing program. All of this investment will increase demand on goods and services from construction sector, public transportation sector, and related transportation activity supporting sectors. All of these sectors can lead to relatively high multiplier effects in the economy, meaning that the direct spending in these sectors would generate relatively higher positive ripple or chain effects in the economy.

In Safirova et al. (2006), the long-term economic and land-use effects of congestion pricing were evaluated using the computable general equilibrium model. The policy analyzed in this study is a cordon toll implemented in a small core area of downtown Washington, DC during the morning rush hours. The modeling results indicated a modest economic gain of about 0.05 percent increase of annual income. In this study, the collected government revenues from the tolls are assumed to be redistributed back to the households through lump-sum transfers. The equity implication (i.e., how the welfare gains are distributed among different income groups) is thus likely to be progressive, because equal lump sum transfers across the population represent a higher proportion of base income of lower income groups.

Further analyses for the economic benefits, job creation and job protection in Maryland from this program is included in Chapter 7 of this plan.

## 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.

## Supporting Laws and Regulations (including new legislation needed)

- "Safe Accountable Flexible Efficient Transportation Equity Act: A Legacy for Users" needs to be re-authorized to allow for funding of multimodal strategies and VMT options

## Links to Supporting Documentation

- Maryland Climate Action Plan and Appendix, MDOT Draft 2012 Implementation Plan Report, April 11, 2011 (including appendices)
- Maryland Climate Action Plan, Appendix D-4, Transportation & Land Use, August 2008
- MDOT Draft 2012 Implementation Plan - http://www.mdot.maryland.gov/Planning/Environmental_Planning.html
- MdTA web page- http://www.mdta.maryland.gov/
- FHWA report on Innovative Traffic Control Practices in Europe (1999) - http://www.fhwa.dot.gov/publications/publicroads/99septoct/trafscan.cfm
- VMT fees- http://www.planetizen.com/node/25269
- EPA guidance on transportation pricing- http://www.epa.gov/otaq/stateresources/policy/pag_transp.htm#tp
- Commuter Choice Website- http://www.commuterchoicemaryland.com/
- CBO Alternative Approaches to Funding Highways- http://www.cbo.gov/doc.cfm?index=12101
- Virginia Hot Lanes-Capital Beltway-http://virginiahotlanes.com/
- Cato-High Occupancy Toll Lanes Benefit All- http://www.cato.org/pubs/regulation/regv23n1/poole.pdf

- A Domestic Scan of Congestion Pricing and Managed Lanes-FHWA-http://ops.fhwa.dot.gov/publications/fhwahep09044/fhwahep09044.pdf
- Congestion Pricing and Managed Lanes in Metropolitan Transportation Planning-http://westernite.org/2010/consideration-of-congestion-pricing-and-managed-lanes-in-metropolitan-transportation-planning/
- Regional Parking Strategies for Climate Protection-California-http://www.mtc.ca.gov/planning/smart_growth/parking/MTC_Parking_Strategies.pdf
- Cambridge Systematics, Inc. 2009. Assessing the Economic Effects of Congestion Pricing. Final Report Prepared for Oregon Department of Transportation.
- Herzog, E. and Grant M. 2007. "Commuter Choice Benefits Calculator: Web-Based Tool for Estimating Costs and Benefits of Commuter Programs," Transportation Research Record 1781: p32-39.
- Safirova, E., Houde, Sebastien, Lipman, D.A., Harrington, W., and Baglino, A. 2006. Congestion Pricing: Long-Term Economic and Land-Use Effects. Resources for the Future Discussion Paper. http://www.rff.org/rff/documents/rff-dp-06-37.pdf.


# Transportation-10: Transportation Technology Initiatives

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.

**By 2020, the potential emission reductions from this program combined with the Maryland Clean Cars Program are estimated to be 9.48 MMt$CO_2$e.**

**Figure C-38. Low and High GHG Benefits for Transportation-10**

| | | |
|---|---|---|
| Low Estimate | 6.03 MMt$CO_2$e | MDOT Quantification Appendix D |
| High Estimate | 9.48 MMt$CO_2$e | MDOT Quantification Appendix D |

The emission reductions from this measure have been combined with the federal fuel efficiency (or Corporate Average Fuel Éfficiency) 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:

Transportation-1: Maryland Clean Cars Program
Transportation-10: Transportation Technology Initiatives
Transportation-17: Renewable Fuel Standard

Transportation-18: Corporate Average Fuel Economy

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

The Transportation-1: Maryland Clean Cars Program quantification identifies a 2020 potential benefit of 8.67 $MMtCO_2e$ in 2020:

**Figure C-39. Breakout of GHG Benefits from State-driven fuel efficiency programs**

| Program Name | 2020 $MMtCO_2e$ reduced |
|---|---|
| 2008 -2011 CAFÉ Standards | 3.09 |
| 2012-2016 CAFÉ Standards | 4.26 |
| 2017-2025 Clean Cars | 1.32 |
| sum | 8.67 |

The Transportation-10: Transportation Technology Initiatives and Transportation-17: Renewable Fuel Standards quantification later in this section identifies the following reductions in 2020:

**Figure C-40. Breakout of Additional GHG Benefits from fuel efficiency programs not captured under the Maryland Clean Cars Program**

| Program Name | 2020 $MMtCO_2e$ reduced |
|---|---|
| 2008 -2011 CAFÉ Standards | 2.27 |
| 2012-2016 CAFÉ Standards | 3.19 |
| Renewable Fuel Standard | 0.24 |
| Plans/ Programs/ TERMS - Funded | 0.33 |
| Plans/ Programs/ TERMS - Unfunded | 0.24 |
| sum | 6.27 |

Combining these programs under one emission reduction estimate to avoid double counting (or "overlap") produces a new estimate of reductions:

**Figure C-41. Combined GHG Benefits from State and federal fuel efficiency programs**

| Program Name | 2020 $MMtCO_2e$ reduced |
|---|---|
| 2008 -2011 CAFÉ Standards | 3.09 |
| 2012-2016 CAFÉ Standards | 4.26 |
| 2017-2025 Clean Cars | 1.32 |
| Renewable Fuel Standard | 0.24 |
| Plans/ Programs/ TERMS - Funded | 0.33 |

| | |
|---|---|
| Plans/ Programs/ TERMS - Unfunded | 0.24 |
| sum | 9.48 |

**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 $MMtCO_2e$.

## Other Environmental Benefits

This program will result in other environmental benefits. It can be expected, but has not been quantified, that the decrease in fuel use will decrease the emissions of ozone precursor pollutants, nitrogen oxides and volatile organic carbons, as well particulate matter emissions.

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.

Volatile organic carbon compound emission reductions will help Maryland meet air quality standards for ground level ozone.

Particulate matter emission reductions will help Maryland meet air quality standards for fine particulate matter.

## Economic Benefits, Job Creation and Job Protection

All of the initiatives above will result in jobs created to produce the needed infrastructure and equipment to fulfill the program. Installation, operation, and maintenance of these equipments will also create job opportunities.

Reduced fuel consumption and maintenance will provide a cost savings for the trucking industry as well as consumers. This savings will help increase the purchasing power of households and reduce the production and shipping cost of businesses, which will all turn into economic gains, including job creation.

Studies show that home-based telework will bring benefits to both employers and employees (Van Horn and Storen, 2000; Doherty et al., 2000; Morgan, 2004; Telework Research Network, 2010). The benefits to employees would include savings on gasoline, parking, tolls, and other work related expenses (such as clothing and food), as well as time savings. Benefits to the employers include improved productivities of the employees, electricity and office space savings, as well as other work space related savings such as maintenance, security, sanitation, etc.

For all of the above transportation technologies, a full macro assessment should also include the consideration regarding the source of program funding, and which sectors will ultimately bear the incremental cost of adopting these technologies. For example, if most of the cost of these programs would be covered by the State government funds, the negative impacts stemming from the shifted and reduced spending in other general government expenditure areas should be taken into consideration.

For job and economic impacts of other vehicle technologies, please refer to Transportation-1: Maryland Clean Car Program, Transportation-3: Clean Fuel Standard, Transportation-14: Airport Initiatives, and Transportation-15: Port Initiatives.

This program will increase the demand of goods and services from the sectors that produce equipment needed to fulfill these programs. Economic activities will also increase in operating and maintaining of these equipment and systems.

Shutting off the diesel engine at the truck stops that provide electrification equipment will reduce diesel consumption but will increase grid electricity consumption. Since almost two-thirds of electricity consumption in Maryland is supplied by in-state generation, while a very large proportion of diesel is imported, this shift of energy use will result in more in-state spending and related multiplier effects.

Reduced fuel consumption and maintenance will provide a cost savings for the trucking industry as well as consumers. This savings will help increase the purchasing power of households and reduce the production and shipping cost of businesses, which will all turn into economic gains.

A recent study by Telework Coalition indicates that if 50 people in a company with telework compatible jobs can work from home half of the time, the total savings can reach $789,810 (Telework Research Network, 2010). Re-spending of all these savings in other goods and services will generate both direct and indirect stimulus effects to the State economy.

For all of the above transportation technologies, a full macro assessment should also include the consideration regarding the source of program funding, and which sectors will ultimately bear the incremental cost of adopting these technologies. For example, if most of the cost of these programs would be covered by the State government funds, the

negative impacts stemming from the shifted and reduced spending in other general government expenditure areas should be taken into consideration.

Further analyses for the economic benefits, job creation and job protection in Maryland from this program is included in Chapter 7 of this plan.

## 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 Trasnportation-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 Trasnportation-11: Electric Vehicle Initiatives and Transportation-12: Low Emission Vehicle Initiatives).

## Supporting Laws and Regulations (including new legislation needed)

Though none were identified in this version of the Plan, future versions of this Plan may identify any laws and regulations pertinent to this program.

## Links to Supporting Documentation

- CHART – http://chart.maryland.gov/default.asp
- Maryland Climate Action Plan and Appendix, MDOT Draft 2012 Implementation Plan Report, April 11, 2011 (including appendices)
- Maryland Climate Action Plan, Appendix D-4, Transportation & Land Use, August 2008
- MDOT Draft 2012 Implementation Plan - http://www.mdot.maryland.gov/Planning/Environmental_Planning.html
- "Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards; Final Rule" (EPA-HQ-OAR-2009-0472-11424:http://www.regulations.gov/#!documentDetail;D=EPA-HQ-OAR-2009-0472-11424).
- FHWA report on Innovative Traffic Control Practices in Europe (1999) - http://www.fhwa.dot.gov/publications/publicroads/99septoct/trafscan.cfm
- Intelligent Transportation Society of Maryland- http://www.itsmd.org/index.php?page_id=3
- Variable message signs- http://en.wikipedia.org/wiki/Variable-message_sign
- Carbon offsets- http://www.terrapass.com/about/how-carbon-offsets-work.html
- LEED certification- http://www.usgbc.org/DisplayPage.aspx?CMSPageID=222
- EPA Guidance on Intelligent Transportation Systems Management- http://www.epa.gov/otaq/stateresources/policy/pag_transp.htm#itsm
- Shorepower Truck Stop Electrification- http://www.shorepower.com/

- Baltimore Metropolitan Council Telework website- http://www.baltometro.org/commuter-options/telework
- CAFE standards- http://www.nhtsa.gov/fuel-economy
- EPA Renewable Fuels Standard- http://www.epa.gov/otaq/fuels/renewablefuels/regulations.htm
- Doherty, S. T., Andrey, J. C., and Johnson, L. C., "The Economic and Social Impacts of Telework," paper prepared for U.S. Department of Labor Symposium "Telework and the New Workplace of the 21st Century," New Orleans, LA, October 16, 2000.
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- Telework Research Network. 2010. Workshifting Benefits: The Bottom Line. http://www.workshifting.com/downloads/downloads/Workshifting%20Benefits-The%20Bottom%20Line.pdf.
- Van Horn, C.E. and Storen, D. "Telework: Coming of Age? Evaluating the Potential Benefits of Telework," paper prepared for U.S. Department of Labor Symposium "Telework and the New Workplace of the 21st Century," New Orleans, LA, October 16, 2000. http://www.naswa.org/sections/pdf/2001/p1_1.pdf


# Transportation-11: 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.

**Vehicle-to-Grid**

MDOT, MEA, and MDE continue to evaluate and consider vehicle to grid opportunities in Maryland. Vehicle to grid presents a mechanism to meet key requirements of the electric power system, using electric vehicles when they are parked and underutilized. While vehicle to grid is expected to have several applications, the most economic entry for this green innovation is the market for ancillary services. The highest value ancillary service is frequency regulation. In Maryland's deregulated electricity market, frequency regulation can have average values of $30-$45 per MW per hour, with hourly rates fluctuating widely around that average.

A second market of interest is spinning reserves, or synchronous reserves, with values in the range of $10 per MW per hour, but much less frequent dispatch. The primary revenue in both of these markets is for electricity capacity rather than energy, and both markets are well suited for using the electric vehicle batteries as a storage resource because they require quick response times yet low total energy demand. Additionally, use of vehicle to grid can provide electricity distribution system support when there is a concentration of parked vehicle to grid cars, along overload elements in the distribution system.

A later application, when parked vehicle to grid-capable cars are connected and aggregated in large numbers, would be to use them as dispersed energy storage for intermittent but renewable resources such as wind and solar. The results of the study show that vehicle to grid, in addition to providing valuable grid services, could also prove to be a prominent application in the global transition to the emerging green and sustainable energy economy. Solar panels in parking lots would shade the vehicles (lower evaporative emissions/less energy needed to cool car interiors) and generate mostly green electrons to feed plug-in hybrid electric vehicles.

*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 *S*ubcommittee 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 Transportation-10: Transportation Technologies.

## Other Environmental Benefits

It is estimated that there will be less power plant emissions if V2G can return power to grid which would assist electricity generators from supplying generation capacity.

This program will result in other environmental benefits. It can be expected, but has not been quantified, that the decrease in fuel use will decrease the emissions of ozone precursor pollutants, nitrogen oxides and volatile organic carbons, as well particulate matter emissions.

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.

Volatile organic carbon compound emission reductions will help Maryland meet air quality standards for ground level ozone.

Particulate matter emission reductions will help Maryland meet air quality standards for fine particulate matter.

## Economic Benefits, Job Creation and Job Protection

The impacts to the energy supply sector are mixed. With the substitution of the electric vehicles for internal combustion engine vehicles, the demand for electricity generation will increase while the demand for gasoline and diesel will decrease accordingly. In Maryland, two-thirds of electricity demand is supplied by in-state generation, while in contrast, nearly 90 percent of the petroleum fuels (including gasoline and diesel) are imported from out-of-state (MIG, 2011). Therefore, most of the dampening effect from reduced gasoline and diesel consumption will take place outside of the State

This program would also stimulate the manufacturing sector of the electric vehicles. In addition, large-scale use of electric vehicles would also increase the demand of storage battery and other ancillary parts production. According to the 2009 IMPLAN data, both the automobile manufacturing and storage battery manufacturing sectors have very low regional purchase coefficients (0.006 for the former and 0.07 for the latter). Therefore, complementary policies that provide incentives to the electric vehicle and parts technologies and manufacturing can help bring new firms and job opportunities to the State.

The supporting infrastructure development is also important for the large-scale adoption of electric vehicles. Necessary infrastructure would include public charging stations, installation of home chargers, integrated communications, and electronic control systems (EPRI, 2009). New jobs will be created in the construction sector and electronic equipment mfg sectors. Increased economic activities are expected as a result of these infrastructure developments.

Job creation can also take place in Scientific Research and Development sector since technology progress in electric vehicles and its energy storage systems will be required for the large-scale market penetration of the technology (EPRI, 2009).

The macroeconomic impact analysis results show that the employment gains will reach 1.9 million jobs by 2030 as a result of the policies in the 2009 Electrification Roadmap. The top sectors that would experience job increase include: 106,000 in motor vehicle mfg sector, 112,000 in electric and electronic component mfg sector, 560,000 in other manufacturing sector, 73,000 in professional services sector, 276,000 in travel and tourism sector (EC, 2010).

This program would stimulate the vehicle production plants that produce the electric vehicles. In addition, large-scale use of electric vehicles would also increase the demand of storage battery and other ancillary parts production.

The overall cost impact to the households, and thus their purchasing power would be reliant on the magnitude of increased vehicle costs and home chargers relative to the net fuel cost savings (gasoline expenditure savings minus electricity expenditure increase). If in the long-run, the energy savings from using the electric vehicles can offset the increased cost on the vehicles and the electricity charging and storage devices, the re-

spending of these savings in other goods and services will generate positive multiplier effects to the State economy.

The 2010 Electrification Coalition report indicated that the gross domestic product gains from the 2009 Electrification Roadmap policy initiatives can reach $281 billion (EC, 2010).

Further analyses for the economic benefits, job creation and job protection in Maryland from this program is included in Chapter 7 of this plan.

## 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

## Supporting Laws and Regulations (including new legislation needed)

- Power companies required to accept vehicle to grid return power
- Plug-in requirements in zoning for parking lots for stores, offices, hotels/motels, and government buildings
- Allow for plug-ins at U.S. Interstate toll plazas
- US Department of Transportation's Clean Cities Program

## Links to Supporting Documentation

- Maryland Climate Action Plan and Appendix, MDOT Draft 2012 Implementation Plan Report, April 11, 2011 (including appendices)
- Maryland Climate Action Plan, Appendix D-4, Transportation & Land Use, August 2008
- MDOT Draft 2012 Implementation Plan - http://www.mdot.maryland.gov/Planning/Environmental_Planning.html
- MEA Electric Vehicle Initiative: http://www.bmoremedia.com/innovationnews/meaelectricvehicleinitiative030910.aspx
- PJM website: http://www.pjm.com/committees-and-groups/stakeholder-meetings/symposiums-forums/phev.aspx
- Link to PHEV-V2G summit at PJM HQ on Jan. 26, 2009, and papers delivered: http://www.pjm.com/committees-and-groups/stakeholder-meetings/symposiums-forums/phev.aspx

- List of companies that provide smart-grid related services: http://money.cnn.com/news/newsfeeds/gigaom/green/2009_01_26_faq_smart_grid.html
- Mid-Atlantic Grid Interactive Cars Consortium (MAGICC): http://www.magicconsortium.org/
- 10 V2G projects across the country: http://dsc.discovery.com/technology/tech-10/top-10-v2g-projects.html
- University of Maryland School of Engineering, Department of Mechanical Engineering: http://www.mcart.umd.edu/index.htm
- US Department of Energy – Smart Grid home page: http://www.oe.energy.gov/smartgrid.htm
- University of Delaware V2G program: http://www.udel.edu/V2G/
- Electric vehicles, general: http://en.wikipedia.org/wiki/Electric_vehicle
- Electric Power Research Institute (EPRI). 2009. Regional Economic Impacts of Electric Drive Vehicles and Technologies: Case Study of the Greater Cleveland Area. http://www.clevelandfoundation.org/uploadedFiles/Pressroom/PressReleases/1018578%20-%20Task%204%20Final%20APPROVED.pdf.
- Electrification Coalition (EC). 2010. Economic Impact of the Electrification Roadmap. http://www.electrificationcoalition.org/sites/default/files/SAF_1249_EC_ImpactReport_v06_proof.pdf.
- Minnesota IMPLAN Group (MIG). 2011. 2009 Maryland Input-Output Data.

# Transportation-12: 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 Transportation-10: Transportation Technologies.

## Other Environmental Benefits

This program will result in other environmental benefits. It can be expected, but has not been quantified, that the decrease in fuel use will decrease the emissions of ozone precursor pollutants, nitrogen oxides and volatile organic carbons, as well particulate matter emissions.

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.

Volatile organic carbon compound emission reductions will help Maryland meet air quality standards for ground level ozone.

Particulate matter emission reductions will help Maryland meet air quality standards for fine particulate matter.

## Economic Benefits, Job Creation and Job Protection

Similar to the electric vehicle program, increasing adoption of other low-emitting vehicles, such as plug-in hybrid electric vehicles, will also increase demand and create jobs in the vehicle and vehicle parts (battery, motor/controller, engine/transmission, charger, and devices that reduce particulate matter and nitrogen dioxide emissions) manufacturing sectors that produce these advanced and low carbon-emitting vehicles and ancillary parts and components. However, how much of the job creation in the vehicle manufacturing sectors can be captured by Maryland depends on the availability of incentive policies that attract new automobile production facilities to the State.

Construction jobs will be increased as more public charging stations are built for the electric vehicles and plug-in hybrid electric vehicles and as a result of the increased demand for facilitated infrastructure systems of electric vehicles and hybrid electric vehicles.

Dampening impacts will be seen in the gasoline and diesel producing and supply sectors. However, since most of the petroleum transportation fuels consumed in Maryland are imported, the Maryland economy will generally not be affected by these dampening effects.

Job creation can also take place in scientific research and development sectors since continued technological progress in the advanced low carbon emitting vehicles will be needed to reduce their costs and improve their market competitiveness with respect to the conventional vehicle counterparts (EPRI, 2009).

Increasing economic activities are expected in the vehicle and vehicle parts manufacturing sectors due to the large-scale demand and production of the more advanced, but costly low carbon emitting vehicles. However, according to the current regional purchase coefficients of the relevant manufacturing sectors in Maryland, nearly 90 percent of the increased demand will be supplied by imports. Therefore, the level of economic gains stemming from the increased demand of advanced low carbon emitting vehicles can be captured by Maryland depends on the availability of incentive policies that attract new automobile production facilities to the State.

Negative impacts will occur in the petroleum transportation fuel producing sectors. However, since most of the gasoline and diesels consumed in Maryland are imported, most of the negative impacts will take place outside of the State. There will be increased demand for electricity due to the more widely use of plug-in hybrid electric vehicles. In contrast to petroleum transportation fuel production, electricity demand is mostly supplied by in-state generation.

The overall cost impact to households, and thus the impact on their purchasing power, would be reliant on the magnitude of increased vehicle costs relative to the net fuel cost savings. The availability and level of the government financial incentives to the purchases of low carbon emitting cars would greatly affect the net cost to the consumers. For plug-in hybrid electric vehicles, study shows that even with the maximum level of tax

credit, the fuel savings over the entire life of the vehicle can only marginally offset the increased vehicle cost (EC, 2010).

Further analyses for the economic benefits, job creation and job protection in Maryland from this program is included in Chapter 7 of this plan.

## 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.

## Supporting Laws and Regulations (including new legislation needed)

- US Department of Transportation's Clean Cities Program
- MEA's incentives for low-emitting vehicle programs
- Tax incentives for hybrid vehicle purchases
- Insurance incentives for hybrid vehicle purchases
- Zoning regulations for hybrid preference in parking

## Links to Supporting Documentation

- Maryland Climate Action Plan and Appendix, MDOT Draft 2012 Implementation Plan Report, April 11, 2011 (including appendices)
- Maryland Climate Action Plan, Appendix D-4, Transportation & Land Use, August 2008
- MDOT Draft 2012 Implementation Plan - http://www.mdot.maryland.gov/Planning/Environmental_Planning.html
- USDOE Clean Cities Program- http://www1.eere.energy.gov/cleancities/
- MEA programs- http://energy.maryland.gov/
- CMAQ Funding- http://www.baltometro.org/transportation-planning/request-for-project-applications-fy2011-cmaq-funding
- Guaranteed Ride Home Program- http://www.baltometro.org/commuter-options/rideshare
- Zip Car Car sharing - http://www.zipcar.com/webbal?gclid=CI_ygqforqoCFQp75Qodv0xAZQ
- Baltimore City Parking Authority-Car Sharing - http://www.baltimorecity.gov/Government/QuasiAgencies/ParkingAuthority/CarSharing.aspx
- Electric Car Sharing in Baltimore - http://www.altcar.org/
- Baltimore Metropolitan Council-Baltimore Region Hybrid Bus Tour - http://www.baltometro.org/reports/HybridBus.pdf
- New York Times-Transit Systems are Turning to Hybrid Buses - http://www.nytimes.com/2009/10/22/automobiles/autospecial2/22BUS.html
- Smart Park at BWI- http://www.csc-ansc.com/stories/smartpark.asp
- Eco Driving - http://www.ecodrivingusa.com/
- Intelligent Transportation Systems-Northern Virginia - http://www.virginiadot.org/travel/smart-traffic-center-nova.asp
- Electric Power Research Institute. 2009. Regional Economic Impacts of Electric Drive Vehicles and Technologies: Case Study of the Greater Cleveland Area. http://www.clevelandfoundation.org/uploadedFiles/Pressroom/PressReleases/1018578%20-%20Task%204%20Final%20APPROVED.pdf.
- Electrification Coalition. 2010. Economic Impact of the Electrification Roadmap. http://www.electrificationcoalition.org/sites/default/files/SAF_1249_EC_ImpactReport_v06_proof.pdf.

# Transportation-13: 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.

## Other Environmental Benefits

As stated above, other environmental benefits from this program are assumed to contribute to overall reductions of pollution from the transportation sector. It can be expected, but has not been quantified, that the decrease in fuel use will decrease the emissions of ozone precursor pollutants, nitrogen oxides and volatile organic carbons, as well particulate matter emissions.

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.

Volatile organic carbon compound emission reductions will help Maryland meet air quality standards for ground level ozone.

Particulate matter emission reductions will help Maryland meet air quality standards for fine particulate matter.

## Economic Benefits, Job Creation and Job Protection

This program demands manpower and resources to undertake both qualitative and quantitative assessments of the effects of major transportation projects on GHG emission reductions. Job creation will be associated with the evaluation of the transportation projects/programs (including the development and design of proper methodologies, interagency collaboration and consultation, analytical work, technical report writing, etc.), as well as the planning, administration, and management of the evaluation programs. Entities that would be directly affected by this program include State and local government, management, scientific, and technical consulting services, as well as other scientific and research institutions.

This program would increase the demand on policy design and analytical assessments (including both qualitative and quantitative assessments) of the effects of major transportation projects on GHG emissions. Associated work includes the evaluation of the transportation projects/programs (including the development and design of proper methodologies, interagency collaboration and consultation, analytical work, technical report writing, etc.), as well as the planning, administration, and management of the evaluation programs. There will be direct, indirect and induced effects to the economy stemming from the increased demand of the evaluation efforts for the transportation projects/programs.

Economic and job benefits from the implementation of the transportation policy options are not counted towards this program. The associated impacts of individual policies are evaluated in their respective documentation.

Analyses for the economic benefits, job creation and job protection in Maryland from this program is included in Chapter 7 of this plan.

## 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 or an Environmental Assessment. 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.

## Supporting Laws and Regulations (including new legislation needed)

- Transportation Conformity regulations
- Reauthorization of Safe Accountable Flexible Efficient Transportation Equity Act: A Legacy for Users
- EPA, the U.S. Department of Transportation, the U.S. Department of Housing and Urban Development, six Federal livability principles- should be in all long range plans

## Links to Supporting Documentation

- Maryland Climate Action Plan and Appendix, MDOT Draft 2012 Implementation Plan Report, April 11, 2011 (including appendices)
- Maryland Climate Action Plan, Appendix D-4, Transportation & Land Use, August 2008
- MDOT Draft 2012 Implementation Plan - http://www.mdot.maryland.gov/Planning/Environmental_Planning.html
- Integrating climate change into the transportation planning process: www.fhwa.dot.gov/hep/climatechange/climatechange.pdf
- MDOT implementation process: www.mdot.maryland.gov/Planning/Plans...Reports/.../Climate_Change.pdf
- EPA Transportation Conformity web page- http://www.epa.gov/otaq/stateresources/transconf/index.htm
- The Clean Air Act- http://www.epa.gov/air/caa/
- American Planning Association-California Chapter –SB375- http://www.calapa.org/en/cms/?2841
- California Air Resources Board – Sustainable Communities website- http://www.arb.ca.gov/cc/sb375/sb375.htm
- Maryland Climate Action Plan and Appendix, MDOT Draft 2012 Implementation Plan Report, April 11, 2011 (including appendices)
- Maryland Climate Action Plan, Appendix D-4, Transportation & Land Use, August 2008

# Transportation-14: 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 Transportation-10: Transportation Technologies.

## Other Environmental Benefits

As stated above, other environmental benefits from this program are assumed to contribute to overall reductions of pollution from the transportation sector. It can be expected, but has not been quantified, that the decrease in fuel use will decrease the emissions of ozone precursor pollutants, nitrogen oxides and volatile organic carbons, as well particulate matter emissions.

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.

Volatile organic carbon compound emission reductions will help Maryland meet air quality standards for ground level ozone.

Particulate matter emission reductions will help Maryland meet air quality standards for fine particulate matter.

## Economic Benefits, Job Creation and Job Protection

Increasing use of alternative fuel or biofuel vehicles in the fleet for ground passenger transportation or airport maintenance will increase the demand for alternative fuels (biofuels and natural gas) and advanced vehicles, and hence create jobs in the associated producing sectors. In Maryland, most of the diesel consumption is supplied by imports. Therefore, the dampening effects of reduced diesel consumption to the diesel producing sectors will mostly take place outside of the State. The proportion of the investment on alternative fuel or biofuel vehicles that can stimulate the State economy and create local jobs depends on whether the State can attract new production facilities of low-carbon fuels and vehicles.

Increased labor inputs are needed when the Maryland Aviation Administration conducts energy audits at BWI and develops utility master plan for the airport.

Energy efficiency improvement measures such as replacing the lighting and upgrading the heating, ventilation and cooling systems at the BWI airport would result in electricity consumption reductions. These measures will increase the demand for goods and services from the lighting and HVAC manufacturing sectors, but reduce the demand for electricity generation. Although all of these directly affected sectors are not labor-intensive, compared with the electricity generation sector, the lighting and HVAC manufacturing sectors are relatively more labor-intensive. If the savings resulting from fuel use reduction exceed the costs spent on energy efficient lighting and HVAC system, the operation cost of the airport will decrease. Re-investment of those savings can benefit the economy and create jobs.

Promoting of transit access to BWI airport will increase the demand for goods and services from the transit and ground passengers sector, which according to IMPLAN 2009 Maryland Input-Output data, is very labor-intensive (the labor-intensity of the transit and ground passengers sector in Maryland is as high as 23 jobs per $1 million of output, compared with an economy-wide labor-intensity of 7.4)

As mentioned above the increasing use of alternative fuel or biofuel vehicles in the fleet for ground passenger transportation or airport maintenance will increase the demand for alternative fuels (biofuels and natural gas) and advanced vehicles. The proportion of the investment on alternative fuel or biofuel vehicles that can stimulate the State economy rather than "leaking out" into other States depends on whether Maryland can attract new production facilities of low-carbon fuels and vehicles.

Energy efficiency improvement measures such as replacing the lighting and upgrading the heating, ventilation and cooling systems at the BWI airport would result in electricity consumption reductions. These measures will increase the demand for goods and services from the lighting and HVAC manufacturing sectors, but reduce the demand for electricity generation. According to IMPLAN 2009 Maryland Input-Output data, investment in the lighting and HVAC mfg sectors can lead to relatively higher output multiplier effects (at about 1.5 to 1.7) than the multiplier effects stemming from the investment in electricity generation (at about 1.4). In addition, if the savings resulting from fuel use reduction exceed the costs spent on energy efficient lighting and HVAC systems, the operation cost of the airport will decrease. Re-investment of those savings can stimulate the economy as well. In sum, the stimulus effects stemming from the energy efficiency measures are very likely to more than offset the dampening effects of the measures.

Promoting of transit access to BWI airport will increase the demand for goods and services from the Transit and Ground Passengers sector. According to IMPLAN 2009 Maryland data, $1 million of investment in this sector would result in a total output impact of $1.78 million, or a multiplier effect of 1.78.

The proportion of funds that can be obtained from the federal government to support the measures specified in the airport initiatives will affect the overall economic performance of these measures. This is because if more State government funds need to be spent on

these measures, they have to be offset by reduced spending in other general government expenditure areas. A higher proportion of federal government funding would reduce such (negative) offsetting effects in the State.

Further analyses for the economic benefits, job creation and job protection in Maryland from this program is included in Chapter 7 of this plan.

## 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

## Supporting Laws and Regulations

- Federal Aviation Administration requirements for aircraft engines and aircraft operations with focus on GHG emission reductions and retirement of older, more-polluting aircraft engines
- EPA's General Conformity regulations

## Links to Supporting Documentation

- Maryland Climate Action Plan and Appendix, MDOT Draft 2012 Implementation Plan Report, April 11, 2011 (including appendices)
- Maryland Climate Action Plan, Appendix D-4, Transportation & Land Use, August 2008
- MDOT Draft 2012 Implementation Plan - http://www.mdot.maryland.gov/Planning/Environmental_Planning.html
- Maryland Aviation Administration - http://www.marylandaviation.com/
- Maryland Aviation Administration Environmental Planning (link to New Horizons Environmental Overview Report for BWI, January 2004)- http://www.marylandaviation.com/content/environmental/environmentaldocs.html
- BWI Airport- http://www.bwiairport.com/en
- Federal Aviation Administration - http://www.faa.gov/
- EPA SmartWay program- http://www.epa.gov/smartwaylogistics/
- Carbon footprint- http://www.whatsmycarbonfootprint.com/faq.htm
- Carbon offsets- http://www.terrapass.com/about/how-carbon-offsets-work.html
- LEED buildings- http://www.usgbc.org/DisplayPage.aspx?CMSPageID=1988
- MDOT 2010 Environmental Stewardship report- www.mdot.maryland.gov/.../2010AttainmentreportEnvironmentalStewardship.pdf
- BWI air quality mgmt plan and GHG inventory- http://www.kbenv.com/projects.html
- EPA Guidance on Airport Emissions and Emission Reductions- http://www.epa.gov/otaq/stateresources/policy/pag_transp.htm#a

# Transportation-15: 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 Transportation-10: Transportation Technologies.

## Other Environmental Benefits

As stated above, other environmental benefits from this program are assumed to contribute to overall reductions of pollution from the transportation sector. It can be expected, but has not been quantified, that the decrease in fuel use will decrease the emissions of ozone precursor pollutants, nitrogen oxides and volatile organic carbons, as well particulate matter emissions.

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.

Volatile organic carbon compound emission reductions will help Maryland meet air quality standards for ground level ozone.

Particulate matter emission reductions will help Maryland meet air quality standards for fine particulate matter.

## Economic Benefits, Job Creation and Job Protection

The Port of Baltimore Initiatives mainly include GHG mitigation measures associated with the vehicles and equipment used for land-side operation at the port, which include the cargo handling equipment, fleet vehicles of the port, and trucks and other vehicles visiting the port.

Substantial fuel cost savings can be achieved through idling time reduction for heavy-duty trucks. For example, the Optical Character Recognition system installed at the Seagirt Marine Terminal helped reduce the truck processing time of more than 50 percent. A study showed that for every hour of engine idling reduction, about one gallon of diesel fuel can be saved (Ross & Associates, 2009). Although the reduced diesel consumption would result in negative impacts to the transportation fuel producing sectors, since a large portion of diesel consumed in Maryland is imported from outside of the State, most of the dampening impacts will not be borne by Maryland. On the other hand, the diesel savings will lead to production cost saving to the truck transportation sector, which will lead to positive multiplier effects (in terms of both value-added and jobs) to the economy.

The port initiatives also include measures that increase the proportion of alternative fuel vehicles in the Maryland Port Authority fleet, retrofitting the cranes with diesel oxidation catalysts, as well as using cleaner cargo handling equipment. All of these measures will increase the demand for goods and services from the manufacturing sectors that produce these advanced vehicles, emission reduction devices for cranes and trucks, and cleaner cargo handling equipment, and hence lead to job increases in both the directly and indirectly affected sectors as well as generate associated stimulating multiplier effects in the economy. However, the share of the investment that can stimulate the State economy depends on the proportion of the clean and advanced technologies and equipment can be supplied by in-state producers. In addition, the effect on the economy will depend on the proportion of the increased demand that can be supplied by in-state producers.

The port related initiatives mainly include GHG mitigation measures associated with the vehicles and equipment used for land-side operation at the port, which include the cargo handling equipment, the port fleet vehicles, and trucks and other vehicles visiting the port.

The amount of funding that can be obtained from the federal government to support these measures will affect their overall economic performance. Funding from out-of-state sources will result in a more positive stimulus effect to Maryland compared with the use of State government funding. This is because the latter has to be offset by reduced spending in other general government expenditure areas, the negative impacts of which need to be counted in a full macroeconomic impact assessment of the measures.

Further analyses for the economic benefits, job creation and job protection in Maryland from this program is included in Chapter 7 of this plan.

## 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

## Links to Supporting Documentation

- Maryland Climate Action Plan and Appendix, MDOT Draft 2012 Implementation Plan Report, April 11, 2011 (including appendices)
- Maryland Climate Action Plan, Appendix D-4, Transportation & Land Use, August 2008
- MDOT Draft 2012 Implementation Plan - http://www.mdot.maryland.gov/Planning/Environmental_Planning.html
- Maryland Port Administration- http://mpa.maryland.gov/
- EPA regulations for ocean vessels and large ships- http://www.epa.gov/oms/oceanvessels.htm#regs
- EPA SmartWay program- http://www.epa.gov/smartwaylogistics/
- Carbon footprint- http://www.whatsmycarbonfootprint.com/faq.htm
- Carbon offsets- http://www.terrapass.com/about/how-carbon-offsets-work.html
- BMC Commuter Choice Website- http://www.baltometro.org/commuter-options/commuter-options
- Port of Baltimore Green Port Initiative- http://www.portcompliance.org/pdfs/Port%20of%20Baltimore%20Green%20Ports.pdf

- Repower of McAllister Tugboat- http://pobdirectory.com/news/2011/03/30/marchapril-issue-of-the-port-of-baltimore-magazine/
- Port of Virginia Drayage Truck Initiative- http://www.portofvirginia.com/corporate/environment/go-program.aspx
- Baltimore/Mid-Atlantic Drayage Truck Initiative- http://www.efc.umd.edu/pdf/Marama/FAQs_for_GO_Program%5B1%5D.pdf
- Port of Baltimore's Clean Diesel Program- http://mpa.maryland.gov/content/air-quality.php
- Maryland Port Administration. 2010. Port of Baltimore GreenPort Initiatives. Harbors, Navigation & Environment Seminar and Green Port Americas 2010. http://www.portcompliance.org/pdfs/Port%20of%20Baltimore%20Green%20Ports.pdf.
- Ross & Associates. 2009. Truck Stop Electrification and Anti-Idling as a Diesel Emissions Reduction Strategy at US-Mexico Ports of Energy. Report Prepared for the U.S. EPA. http://www.epa.gov/region9/climatechange/border.html.

# Transportation-16: 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 Transportation-10: Transportation Technologies or Transportation-7: Intercity Transportation.

## Other Environmental Benefits

As stated above, other environmental benefits from this program are assumed to contribute to overall reductions of pollution from the transportation sector. It can be expected, but has not been quantified, that the decrease in fuel use will decrease the emissions of ozone precursor pollutants, nitrogen oxides and volatile organic carbons, as well particulate matter emissions.

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.

Volatile organic carbon compound emission reductions will help Maryland meet air quality standards for ground level ozone.

Particulate matter emission reductions will help Maryland meet air quality standards for fine particulate matter.

## Economic Benefits, Job Creation and Job Protection

The initiatives of freight transportation development will result in increased capital investment in both the construction sector and the manufacturing sectors. Construction jobs will be created for the expansion of the major truck and rail corridors and construction and improvement of the intermodal connections and terminals. For the manufacturing sectors, the job creations will stem from the capital investment in rolling stocks, including new hybrid locomotives, as well as anti-idling equipment on locomotives and trucks.

Job creation in the construction sector will be more prominent than in the manufacturing sectors. There are two reasons for this: First, investment in construction will mainly use goods and services produced in Maryland, which will stimulate the State economy rather than "leaking out" into other states.[91] In contrast, the manufacturing sectors for railroad rolling stock, motors and generators, and relay and industrial controls have low effect in Maryland, which will lead to flows of investment dollars to out-of-state producers.

[91] According to the IMPLAN 2009 Maryland Input-Output data, the construction sector has a very high (nearly 1.0) value to indicate in-state use.

Second, the construction sector is much more labor-intensive than the manufacturing sectors.

The annual operation and maintenance of the freight transportation system will also create jobs in the rail transportation and truck transportation sectors.

Macroeconomic impact analysis performed by the Center for Climate Strategies on state climate action plans indicates overall positive job impacts of several freight transportation related policy options selected by the states. For example, Florida's GHG policy option of increasing freight movement efficiencies will create nearly 2,300 jobs by 2025.[92] The policy option of cutting emissions from freight transportation in Pennsylvania's Climate Action Plan will create about 2,100 jobs by 2020.[93] The primary driver for job creation from these policies is the substantial diesel savings.

The initiatives of freight transportation development will result in increased capital investment in both the construction sector and the manufacturing sectors. The economic activity in the construction sector will increase due to the expansion of the major truck and rail corridors, construction and improvement of the intermodal connections and terminals. Capital investment will also increase in the purchases of rolling stocks, including new hybrid locomotives, as well as ant-idling equipment on locomotives and trucks. As noted above, the results in the construction sector indicate the investment in construction will mainly use goods and services produced in Maryland. In contrast, most investments dollars in the manufacturing sectors for railroad rolling stock, motors and generators, and relay and industrial control will flow to out-of-state producers.

The annual operation and maintenance of the freight transportation system will also increase economic activities in the rail transportation and truck transportation sectors.

Fuel cost savings will be achieved through the usage of anti-idling equipment and other fuel saving and emission cutting equipment on locomotives and trucks. Additional rail lines and freight capacities will reduce congestion costs for both passengers and freight. All of these savings will lead to stimulus effects to the State economy.

Macroeconomic impact analysis on State climate action plans indicates overall positive economic gains of several freight transportation related policy options selected by the states. For example, the Florida's policy option of increasing freight movement efficiencies will result in an increase in gross state product of $0.25 billion in 2025. The net present value of the gross state product gains over the entire period of study (2009-2025) will be $0.81 billion.[94] Pennsylvania's policy option of cutting emissions from freight transportation will lead to a gross state product increase of $0.27 billion in 2020. The net present value of the gross state product gains over the entire planning period

[92] Rose, A. and Wei, D. 2009a. The Economic Impact of the Florida Energy and Climate Change Action Plan on the State's Economy. Report to the Governor Office of the State of Florida.
[93] Rose, A. and Wei, D. 2009b. "Macroeconomic Assessment," Pennsylvania Climate Action Plan, Chapter 11. http://www.elibrary.dep.state.pa.us/dsweb/View/Collection-10677
[94] Supra, fn. 2.

(2009-2020) will be $0.65 billion.[95] The major economic gains of these policies stem from the substantial diesel savings.

Further analyses for the economic benefits, job creation and job protection in Maryland from this program is included in Chapter 7 of this plan.

## 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):

[95] Supra, fn. 3.

- 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)

## Supporting Laws and Regulations (including new legislation needed)

- Rail incentives for funding equality with commercial trucking
- Zoning incentives for truck stops
- Incentivize connections between rail and product distribution centers
- Promote zoning at the local level that considers the need for freight movement, which could help to alleviate congestion and inappropriate land uses such as residential abutting freight facilities.

## Links to Supporting Documentation

- Maryland Climate Action Plan and Appendix, MDOT Draft 2012 Implementation Plan Report, April 11, 2011 (including appendices)
- Maryland Climate Action Plan, Appendix D-4, Transportation & Land Use, August 2008
- MDOT Draft 2012 Implementation Plan - http://www.mdot.maryland.gov/Planning/Environmental_Planning.html
- Auxiliary power unit information- www1.eere.energy.gov/vehiclesandfuels/pdfs/idling_2004/stewart.pdf
- EPA Locomotive Rule- http://www.epa.gov/oms/locomotives.htm
- EPA guidance on locomotive idling- http://www.epa.gov/otaq/stateresources/policy/pag_transp.htm#i
- National Gateway- http://www.nationalgateway.org/

- CSX Intermodal Container Facility-Baltimore- http://www.mdot.maryland.gov/Planning/ICTF/Home.html#Description
- High Speed Rail-Susquehanna Bridge Replacement- http://www.daggerpress.com/2011/05/09/22-million-federal-project-will-replace-105-year-old-penn-line-bridge-over-susquehanna-river-additional-bridges-may-be-coming-over-bush-and-gunpowder-rivers/
- Norfolk Southern Crescent Corridor- http://www.nscorp.com/nscportal/nscorp/
- CSX Genset Locomotives in Baltimore- http://www.csx.com/index.cfm/media/press-releases/major-public-private-partnership-brings-cleaner-air-to-maryland/
- Rose, A. and Wei, D. 2009a. The Economic Impact of the Florida Energy and Climate Change Action Plan on the State's Economy. Report to the Governor Office of the State of Florida.
- Rose, A. and Wei, D. 2009b. "Macroeconomic Assessment," Pennsylvania Climate Action Plan, Chapter 11.
- Rose, A. and Wei, D. 2009b. "Macroeconomic Assessment,"
- Pennsylvania Climate Action Plan, Chapter 11. http://www.elibrary.dep.state.pa.us/dsweb/View/Collection-10677


# Transportation-17: 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

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

Transportation-1: Maryland Clean Cars Program
Transportation-10: Transportation Technology Initiatives
Transportation-17: Renewable Fuels Standard
Transportation-18: Corporate Average Fuel Economy

For this reason, MDE aggregated the potential 2020 benefits from these programs under one emission benefit estimate. Refer to Transportation-10: Transportation Technology Initiatives for the description and data regarding the methodologies used to quantify these four programs.

## Other Environmental Benefits

The Renewable Fuels Standard is expected to reduce emissions of carbon monoxide and benzene. The program will not directly enforce any emission reductions from the transportation sector; it only regulates the volume of renewable fuels used each year.

Carbon monoxide emission reductions will help Maryland meet air quality standards for ground level ozone.

Benzene is a human carcinogen and highly toxic. The reduction in emissions of benzene will provide health benefits to people across the country.

## Economic Benefits, Job Creation and Job Protection

This program is designed to increase the production and use of renewable fuels in the nation's transportation fuels. It will result in an increase of jobs related to the production of the renewable fuels needed to comply with this federal requirement. It also has the potential to increase jobs related to the research and development of the advanced biofuels. It is unknown how this program will impact job creation in Maryland.

According to EPA, this program will promote and increase the availability of renewable fuels which will reduce the amount of oil the U.S. imports. The expanded market for products such as corn and soybeans is expected to increase annual net farm income by $13 billion. By 2022 the increased use of renewable fuels is expected to decrease the price of gasoline by $.024 per gallon and the price of diesel by $.121 per gallon, producing a combined annual savings of nearly $12 billion. The Renewable Fuels Standard is expected to displace some 13.6 billion gallons of petroleum-based gas and diesel fuel by 2022, about 7 percent of expected annual U.S. transportation consumption. This will help reduce the US's dependence on foreign oil.

Further analyses for the economic benefits, job creation and job protection in Maryland from this program is included in Chapter 7 of this plan.

## Implementation

This program has been implemented through regulations adopted by EPA. The requirements are fully enforceable, and EPA is enforcing these regulations just as it enforces all its regulations.

## Supporting Laws and Regulations

- Energy Policy Act of 2005
- Energy Independence and Security Act of 2007

## Links to Supporting Documentation

- Energy Policy Act of 2005- http://doi.net/iepa/EnergyPolicyActof2005.pdf
- Energy Independence and Security Act of 2007-Summary- http://energy.senate.gov/public/_files/RL342941.pdf
- EPA Regulations and Standards- http://www.epa.gov/otaq/fuels/renewablefuels/regulations.htm
- Renewable Fuel Standard Overview by CBO- http://www.nationalaglawcenter.org/assets/crs/R40155.pdf
- Renewable Fuels Standard Implementation-Frequently Asked Questions- http://www.epa.gov/oms/renewablefuels/420f07062.htm
- Maryland Climate Action Plan and Appendix, MDOT Draft 2012 Implementation Plan Report, April 11, 2011 (including appendices)
- Maryland Climate Action Plan, Appendix D-4, Transportation & Land Use, August 2008
- MDOT Draft 2012 Implementation Plan - http://www.mdot.maryland.gov/Planning/Environmental_Planning.html
- Renewable Fuels Association - http://ethanolrfa.org/
- Growth Energy-Ethanol- http://www.growthenergy.org/
- National Biodiesel Board- http://www.biodiesel.org/

# Transportation-18: 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.

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:

Transportation-1: Maryland Clean Cars Program
Transportation-10: Transportation Technology Initiatives
Transportation-17: Renewable Fuels Standard
Transportation-18: Corporate Average Fuel Economy

For this reason, MDE aggregated the potential 2020 benefits from these programs under one emission benefit estimate. Refer to Transportation-10: Transportation Technology Initiatives for the description and data regarding the methodologies used to quantify these four programs.

## Other Environmental Benefits

While this program's mainly focus is improving fuel economy, which also reduces GHG emissions, the resulting reduced fuel consumption will reduce other emissions from passenger cars and light-duty trucks. It can be expected, but has not been quantified, that the decrease in fuel use will decrease the emissions of ozone precursor pollutants, nitrogen oxides and volatile organic carbons as well as particulate matter emissions.

Nitrogen dioxide 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.

Volatile organic compound emission reductions will help Maryland meet air quality standards for ground level ozone.

Particulate matter emission reductions will help Maryland meet air quality standards for fine particulate matter.

## Economic Benefits, Job Creation and Job Protection

This program required automobile manufacturers to produce cleaner, more fuel efficient vehicles beginning with model year 2008 vehicles and continuing through model year 2011. In the past, the requirement for new, federal motor vehicle standards has not resulted in the start-up of automobile production facilities in the State. However, this program may have minimal impact on job creation in the ancillary parts, components, and services areas.

This program promoted and increased the availability of new, fuel efficient vehicles which in turn lead to consumer savings due to lower fuel expenditures. Lower fuel expenditures provide consumers with additional income (which could increase if fuel prices increase) to spend in other areas of the economy.

Analyses for the economic benefits, job creation and job protection in Maryland from this program is included in Chapter 7 of this plan.

## 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.

## Supporting Laws and Regulations

- Clean Air Act
- Energy Independence and Security Act of 2007

## Links to Supporting Documentation

- CAFE Overview- http://www.nhtsa.gov/cars/rules/cafe/overview.htm

- CAFE Standards Website- http://www.nhtsa.gov/fuel-economy
- Effectiveness and Impact of CAFE Standards- http://www.nhtsa.gov/cars/rules/CAFE/docs/162944_web.pdf
- Maryland Climate Action Plan and Appendix, MDOT Draft 2012 Implementation Plan Report, April 11, 2011 (including appendices)
- Maryland Climate Action Plan, Appendix D-4, Transportation & Land Use, August 2008
- MDOT Draft 2012 Implementation Plan - http://www.mdot.maryland.gov/Planning/Environmental_Planning.html

# Transportation-19: Promoting Hybrid and Electric Vehicles

Lead Agency: MEA

## Program Description

Maryland's transportation infrastructure plays a vital role in the movement of people and goods throughout the region, for Maryland residents and also for the larger network of U.S. highways and distribution channels along the East Coast. Maryland's highways and mass transportation systems serve State, regional and national transportation and freight movement interests, and also serve as a key element of transportation around the Nation's capital.

The transportation sector is responsible for 32 percent of Maryland's GHG emissions according to the Maryland Climate Change Commission. Reducing emissions from this sector is critical to achieving reduction in GHG emissions. Existing and new technologies will allow us to meet our transportation needs with fewer carbon dioxide emissions, and with reduced reliance on petroleum imports. The reduction in diesel and petroleum-based fuel consumption has many clean air benefits in addition to reduced emissions of black carbon and nitrous oxide, both GHGs.

Existing Programs: Electric Vehicle Infrastructure Program

MEA created the Electric Vehicle Infrastructure Program in early 2010 to aid the installation of electric vehicle recharging stations. MEA issued two grants under this program totaling $594,000 to install a total of eighty one (81) public stations across the State.

In June of 2010, MEA used federal stimulus funds to award $503,000 in competitive matching grants for the installation of 64 electric vehicle charging stations around the State. In June 2011, MEA expanded the Electric Vehicle Infrastructure Program by $94,000, increasing by 14 stations.

Two Electric Vehicle Infrastructure Program grants were awarded for electric vehicle charging stations:

- *Baltimore Electric Vehicle Initiative:* $461,500 was awarded to the Baltimore Electric Vehicle Initiative, a non-profit organization promoting electric vehicles and electric vehicle infrastructure in Maryland, for the installation of 69 electric vehicle re-charging stations around the State and the I-95 corridor, including Harford, Cecil, Baltimore City, Baltimore, Montgomery, Anne Arundel, Charles, Frederick and Prince George's counties.
- *Baltimore City:* $134,500 was awarded to Baltimore City for the installation of electric vehicle re-charging stations in various parking garages throughout the city. Project partners include Baltimore City Department of General Services, Baltimore City Parking Authority and Baltimore Gas & Electric.

MEA, MDE and MDOT are working with Baltimore City and the Baltimore Electric Vehicle Initiative to ensure that Maryland's in-state electric vehicle charging station network is aligned with the regional planning goals of TCI for electric charging infrastructure, particularly along the I-95 corridor and its interface with urban and rural charging networks in Maryland.[96]

By the end of summer 2011, electric vehicle owners will be able to charge using one of 78 public charging stations at approximately 36 different locations in Maryland. Maryland stations will reach from Charles to Frederick counties. MEA has posted a map and list online of electric vehicle stations that will be operational in Maryland and Washington, D.C., by the end of summer 2011. The proactive construction of charging infrastructure will better position Maryland to meet demand for publicly accessible charging stations as major vehicle manufacturers begin to release plug-in vehicles for sale to general consumers beginning in 2011 and 2012.

The electric vehicle funding complements several recently enacted laws and a PSC initiative promoting electric vehicles and electric vehicle infrastructure in Maryland. These are summarized below.

Maryland Hybrid Truck Goods Movement Initiative

MEA partnered with Maryland Clean Cities and several of the most prominent and progressive fleets in the U.S. to expeditiously implement the nation's largest deployment of heavy-duty hybrid trucks in goods movement applications through the Maryland Hybrid Truck Goods Movement Initiative. This initiative will provide financial and technical assistance to the high profile fleets of companies like ARAMARK, Efficiency Enterprises, Nestle Waters of North America, Sysco Corporation and United Parcel Service to facilitate the implementation of the largest collaborative hybrid truck project in the nation. MEA received a $5.9 million U.S. Department of Energy grant to assist in purchasing and deploying 143 heavy duty hybrid vehicles.

[96] TCI is a regional collaboration of Maryland and ten other Northeast and Mid-Atlantic states and the District of Columbia to reduce GHG emissions in the region's transportation sector. Planning and deploying a regional electric vehicle charging network is a key priority of TCI. *See* policy Transportation-4: The Transportation and Climate Initiative for details on this program.

Electric Vehicle Tax Credit (House Bill 490 2010 Session)
In 2010 the legislature passed a credit against the motor vehicle excise tax for certain qualified plug–in electric drive vehicles. This is a 3 year program and each vehicle is eligible for up to $2,000. This program is administered by MDOT and paid for by MEA utilizing money from the Strategic Energy Investment Fund.

Electric Vehicle Charging Station Tax Credit (House Bill 163 2011 Session)
This statute allows a State income tax credit for tax years 2011, 2012, and 2013, for 20 percent of the cost of qualified electric vehicle recharging equipment placed in service by a taxpayer during a taxable year up to $400. This program is administered and paid for by MEA utilizing money from the Strategic Energy Investment Fund.

Electric Vehicle Council
The Maryland Electric Vehicle Infrastructure Council was created in the 2011 legislative session. The council will develop an action plan to facilitate the successful integration of electric vehicles within Maryland's transportation sector. The council must submit an interim report on or before January 1, 2012, and a final report on or before December 1, 2012.

Electric Vehicle Pilot Program
The Electric Vehicle Pilot Program requires PSC to establish a pilot program for charging electric vehicles by June 30, 2013. This program allows utilities to participate and requires that they include incentives for residential, commercial, and governmental customers to recharge electric vehicles in ways that will accomplish specified goals namely modifying behavior so that recharging occurs during off peak hours. PSC must report to the governor and the General Assembly on the program by February 1, 2015.

Programs under Consideration

MEA continues to analyze new transportation initiatives to help Maryland meet the GHG emission reduction goals established under GGRA. Some initiatives under consideration include:

- MEA will continue to coordinate with relevant State agencies and stakeholders to develop a strategic plan for building a Statewide electric vehicle charging infrastructure, with the goal of enabling drivers of plug-in vehicles to drive anywhere in Maryland and be within range of a charging station, with connectivity to a regional charging infrastructure.[97]
- MEA will work with the Governor and General Assembly and will pursue federal grants to obtain funding to strategically expand alternative fueling infrastructure throughout the State.

[97] MEA's Director is a member of the Maryland Electric Vehicle Infrastructure Council created by the General Assembly in the 2011 Session. *See* Supporting Laws and Regulations, below, for detail on this legislation.

- MEA will analyze the economics, feasibility and advisability of using abandoned Idle Air truck stop electrification infrastructure for electric vehicle fast charging on Maryland interstates.
- MEA will analyze the economics, feasibility and advisability of developing incentives for trucks to install auxiliary power units to promote anti-idling.
- MEA will work with both public and private stakeholders to reduce GHG emissions in the transportation sector.

## 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 Transportation-4: The Transportation Climate Initiative.

## Other Environmental Benefits

These initiatives will also help Maryland meet its Chesapeake Bay and air quality goals. Replacing petroleum-based mobile fuels with alternatives will reduce emissions of the major air pollutants from tailpipe exhaust: carbon-containing compounds including, nitrogen oxides which contribute significantly to Chesapeake Bay pollution and combine with hydrocarbons to create smog, hydrocarbons, particulate matter which are tiny particles of solid matter that lodge in the lungs and deposit on buildings, carbon monoxide which is a colorless, odorless, poisonous gas, and formaldehyde which is a lung irritant and carcinogen.

Nitrogen dioxide emission reductions will help Maryland meet air quality standards for ground level ozone and fine particulate matter. The reductions will also significantly help Maryland reduce nitrogen pollution in the Chesapeake Bay.

Sulfur dioxide emission reductions will help Maryland further reduce fine particulates and also help achieve the visibility improvements required to comply with federal regional haze requirements.

Mercury, a toxic pollutant, is primarily released by air pollution sources but ultimately affects water quality and bioaccumulates in fish tissue. Mercury reductions will help improve water quality in Maryland.

## Economic Benefits, Job Creation and Job Protection

The potential for job creation is significant. Expanding the alternative fuels market, especially by building an electric vehicle ecosystem in the State will provide jobs for Maryland citizens throughout the supply chain, from research and manufacture to the sale, installation and maintenance of plug-in vehicles and charging infrastructure.

The economic benefits of expanding the alternative fuels market and building an electric vehicle system in Maryland have already begun and are expected to grow significantly.[98] For example, MEA estimates a cumulative projection of 21,000 to 25,000 electric vehicles sold in Maryland by 2017. By conditioning the State's markets and regulatory climate Maryland will continue to attract vendors throughout the alternative fuels supply chain. Economic benefits will be addressed in more detail in a study required under GGRA, which will be included in the draft and final 2012 GGRA Plans.

The increased building and installation of electric vehicle charging stations will create jobs in the construction sector. Investment in construction will mainly use goods and services produced in Maryland, which will stimulate the State's economy rather than "leaking out" into other states.[99] In addition, successive rounds of the upper-stream supply sectors of the construction sector (such as the utility, asphalt, metal products, and machinery manufacturing sectors) will be stimulated through the ripple (or multiplier) effects. Based on the Maryland Input-Output tables of the 2009 IMPLAN modeling, $1 million investment in the construction sector will create 7.5 jobs. The economy-wide effects will be an increase of 13.8 jobs.

Other economic and job impacts of the widespread incorporation of electric vehicles are presented in Transportation-11: Electric Vehicle Initiatives. The job impacts of truck stop electrification are discussed in Transportation-10: Transportation Technology Initiatives.

Installation of auxiliary power units on trucks to eliminate engine idling has great potential for diesel savings. For every hour of engine idling reduction, about one gallon of diesel fuel can be saved.[100] Even taking into consideration the cost of the auxiliary power devices, the truck anti-idling technology can be very cost-effective.[101] The macroeconomic impact analysis of these power units and other anti-idling policies indicates that the employment increase can reach 985 jobs by 2025.[102] A scale-up analysis of the macro effects of anti-idling policies at the national level shows an increase in employment of 16.7 thousand jobs in 2020.[103]

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[98] General Motors re-tooled and re-opened its White Marsh plant in 2010 to manufacture hybrid transmissions and has plans to expand. The state's electric vehicle infrastructure build-out is also supporting the steady growth of two Maryland-based electric vehicle charging station vendors, Semaconnect (Annapolis) and Timber Rock Energy Solutions (Frederick), and their suppliers.

[99] According to the IMPLAN 2009 Maryland Input-Output data, the construction sector has a very high (nearly 1.0) RPC.

[100] Ross & Associates. 2009. Truck Stop Electrification and Anti-Idling as a Diesel Emissions Reduction Strategy at US-Mexico Ports of Energy. Report Prepared for the U.S. EPA. http://www.epa.gov/region9/climatechange/border.html.

[101] The per ton GHG mitigation cost of the transportation policy option "Anti-Idling Technologies and Practices" recommended in the Michigan Climate Action Plan is -$48/tCO2e. The negative sign here means net cost savings.

[102] Miller, S., Wei, D., and Rose, A. 2010. The Macroeconomic Impact of the Michigan Climate Action Council Climate Action Plan on the State's Economy. Report to Michigan Department of Environmental Quality. http://www.climatestrategies.us/ewebeditpro/items/O25F22416.pdf.

[103] Center for Climate Strategies. 2010. Impacts of Comprehensive Climate and Energy Policies on the U.S. Economy. Johns Hopkins University, Baltimore, MD. http://www.climatestrategies.us/ewebeditpro/items/O25F23386.PDF

As noted above, the increased building and installation of electric vehicle charging stations will create jobs in the construction sector. Based on the Maryland Input-Output tables of the 2009 IMPLAN modeling, $1 million investment in the construction sector will generate a total output impact of $1.8 million to the State economy, or a multiplier effect of 1.8.

Macroeconomic impact analysis of anti-idling policies indicates that the gross State product increase can reach $0.12 billion by 2025. The net present value of the gross State product gains over the entire study period (2009-2025) is $0.55 billion.[104] A scale-up analysis of the macro effects of anti-idling policies at the national level shows an increase in gross domestic product of $1.62 billion in 2020. The net present value of the gross domestic product gains between 2010 and 2020 are $2.49 billion.[105]

Detailed analyses for the economic benefits, job creation and job protection in Maryland from this program under-development.

## Implementation

MEA has primary responsibility for administering the Electric Vehicle Infrastructure Program, the Maryland Hybrid Truck Goods Movement Initiative Program, and the Electric Vehicle Charging Station Tax Credit Program. MDOT has primary responsibility for administering the Electric Vehicle Tax Credit Program.

## Supporting Laws and Regulations

- *Motor Vehicle Excise Tax - Tax Credit for Electric Vehicles* (House Bill 469).[106] Introduced by the Administration, this legislation creates a 3-year vehicle excise tax exemption, from Oct. 1, 2010 to June 30, 2013, for the purchase of plug-in electric vehicles, capped at $2,000 per vehicle. Exemptions are limited to one per individual and 10 per business entity.
- *High Occupancy Vehicle Lanes - Use by Plug-In Vehicles* (Senate Bill 602).[107] This legislation permits plug-in vehicles, both hybrid and all-electric, to use high occupancy vehicle lanes, without restrictions on the number of passengers required to be in the vehicle.
- *Income Tax – Tax Credit for Electric Vehicle Recharging Equipment* (House Bill 163).[108] This law allows a State income tax credit for 20 percent of the cost of qualified electric vehicle recharging equipment placed in service in tax years 2011, 2012, and 2013, limited to $400 for each system.

[104] Miller et al. (2010).
[105] Center for Climate Strategies (2010)
[106] Chapter 490, Acts of 2010; codified in Transportation §13-815, Md. Code Ann.
[107] Chapter 492, Acts of 2010; codified in Transportation §§11–167, 21–201(a)(1) and 25-108 Md. Code Ann.
[108] Chapter 402, Acts of 2011; codification pending.

- *Pilot Program for Charging Electric Vehicles* (Senate Bill 179/House Bill 164).[109] This law requires PSC to establish a pilot program for electric customers to charge electric vehicles during off-peak hours and to report the results by February 1, 2015.
- *Maryland Electric Vehicle Infrastructure Council* (Senate Bill 176/House Bill 167).[110] This law established the Council to develop a plan and report to the Governor and the General Assembly by December 1, 2012 regarding integration of electric vehicles into the State's transportation network.
- *The State Vehicle Fleet- Use of Biofuels* (Senate Bill 959). This law amends an existing statute by broadening eligible fuels to include advanced biofuels. The change provides end markets for advanced biofuel producers, helps to create competition and allows the State to purchase fuels in a more competitive market.
- *PSC Case No. 9261*. On petition of its Staff, PSC initiated a proceeding in March 2011 to consider the regulatory treatment to be applied to the owner/operators of electric vehicle charging stations as well as persons involved in provisioning, arranging or billing these charging services.[111]

## Links to Supporting Documentation

- The Next Generation of Hybrid Cars: Plug-in Hybrids Can Help Reduce Global Warming and Slash Oil Dependency, Electric Power Research Institute and the Natural Resources Defense Council, July 19, 2007.http://www.nrdc.org/energy/plugin.pdf
- Maryland Energy Administration Electric Vehicle Infrastructure Program http://www.energy.state.md.us/Transportation/index.html
- Transportation and Climate Initiative http://www.georgetownclimate.org/transportation/index.php
- PSC Case No. 9261: In the Matter of the Investigation into the Regulatory Treatment of Providers of Electric Vehicle Charging Stations and Related Services. http://www.psc.state.md.us/
- Maryland Hybrid Truck Goods Movement Initiative http://www.marylandhti.com/
- Center for Climate Strategies (CCS). 2010. Impacts of Comprehensive Climate and Energy Policies on the US Economy. Johns Hopkins University, Baltimore, MD. http://www.climatestrategies.us/ewebeditpro/items/O25F23386.PDF
- Miller, S., Wei, D., and Rose, A. 2010. The Macroeconomic Impact of the Michigan Climate Action Council Climate Action Plan on the State's Economy. Report to Michigan Department of Environmental Quality. http://www.climatestrategies.us/ewebeditpro/items/O25F22416.pdf.
- Ross & Associates. 2009. Truck Stop Electrification and Anti-Idling as a Diesel Emissions Reduction Strategy at US-Mexico Ports of Energy. Report Prepared for the EPA. http://www.epa.gov/region9/climatechange/border.html.

[109]Chapters 403 and 404, Acts of 2011; codification pending.
[110]Chapters 400 and 401, Acts of 2011; codification pending.
[111] PSC Case No. 9261: In the Matter of the Investigation into the Regulatory Treatment of Providers of Electric Vehicle Charging Stations and Related Services. http://www.psc.state.md.us/

# Transportation-20: Pay-As-You-Drive®[112] Insurance in Maryland

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.[113]

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

[112] Pay-As-You-Drive is a registered trademark of Progressive Casualty Insurance Company.
[113] Consumers receive discounts off of their insurance premiums for participating in most use-based programs.

Maryland[114]. Some carriers are offering programs or pilot programs similar to Pay-As-You-Drive® in other states.[115]

## Estimated GHG Emission Reductions in 2020

**By 2020, the potential emission reductions from this program are estimated to be 0.09 $MMtCO_2e$.**

**Figure C-42. Low and High GHG Benefits for Transportation-20**

| | | |
|---|---|---|
| Low Estimate | 0.03 $MMtCO_2e$ | SAIC Quantification Appendix B, Pg. 217 |
| High Estimate | 0.09 $MMtCO_2e$ | MDE Quantification Below |

**High Estimate – MDE Quantification**

The GHG emission reductions associated with this program are estimated between 0.03 and 0.09 $MMtCO_2e$. A GHG reduction quantification of 0.09 $MMtCO_2e$ is for aggressive implementation of Pay as You Drive insurance. Automobiles account for more than 25 percent of GHG emissions in the U.S. Research expects widespread adoption of Pay As You Drive policies to reduce driving by 10-20 percent, resulting in significant decreases in GHG emissions.[116]

An adoption rate of 10 percent by 2020 for voluntary and private sector efforts to promote Pay As You Drive is considered. An effectiveness rate of 5 percent is assumed. (For semi-agnostic consumer influenced only by the doubling of effort through the two programs in the absence of any survey data.) The applicable VMT (i.e., 53578 million) and GHG factor is (i.e., 321 g/mi).

[114] 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.

[115] 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 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.

[116] Funderburg, Keri, Michael Grant, and Ed Coe. "Changing Insurance One Mile at a Time." *Contingencies*. November / December 2003. 17 March 2004

**Figure C-43. Estimate of potential GHG reductions**

| | % 2020 (Participation Rate) | Change in Annual VMT (Effectiveness Rate) | Annual VMT Reduction (million VMT) | GHG Reduction ($MMtCO_2e$) |
|---|---|---|---|---|
| Low Projection | 5% | 4% | 107 | 0.03 |
| High Projection* | 10% | 5% | 268 | 0.09 |

* Combination of Voluntary Efforts To Promote Pay As You Drive and Private Sector efforts To Promote Pay As You Drive

## Other Environmental Benefits

The Brookings Institution estimates that if all motorists paid for accident insurance based on their actual motor vehicle use, driving would decline by 8 percent nationwide,[117] netting society the equivalent of about $50 billion to $60 billion a year by reducing driving-related harms.[118] A decrease in annual miles driven results in the reduction of nitrogen oxides, sulfur dioxide, particulate matter and mercury emissions.

## Economic Benefits, Job Creation and Job Protection

The reduced use of personal vehicles and decreased expenditures on transportation fuels, plus reduced insurance costs, may increase the purchasing power of consumers. Since in Maryland petroleum fuels and vehicles are largely supplied by imports, consumer savings on transportation fuels and vehicles can increase spending on more domestically produced goods and services and thus spur the State economy. In addition, the fossil fuel supply sectors are among the least labor-intensive sectors in the economy. Moreover, the public transportation sector is among the most labor-intensive sectors. The labor-intensity of the transit & ground passengers sector in Maryland is 23 jobs per $1 million output. That means jobs created through the increased usage of mass transit and increased spending on other general consumption categories can more than offset the negative job impacts in the transportation fuel supply sectors and vehicle manufacturing sectors.

Less driving would also lead to congestion cost savings and reduced accident costs to households. The re-spending of these savings in other goods and services will generate both direct and indirect stimulus effects to the State economy and create jobs. A study by the Brookings Institution indicated that the gross savings of adopting Pay As You Drive insurance policy in California can reach $414 per vehicle, of which a large portion will come from congestion and accident cost savings (Bordoff and Noel, 2008a). At the

117 The Brookings Institution divided the per-gallon retail price of fuel by the fuel economy of each vehicle to get per-mile fuel cost for that vehicle. Combining the initial mileage for each vehicle, the driving response to per-mile premiums from Parry (2005), the per-mile premiums and the per-mile fuel cost, driving reductions can be estimated for each vehicle in the sample.

118 Bordoff, J., & Noel, P. (2008). Pay-As-You-Drive Auto Insurance: A Simple Way to Reduce Driving-Related Harms and Increase Equity. Washington, DC: The Brookings Institution. Retrieved from http://www.brookings.edu/papers/2008/07_payd_bordoffnoel.aspx.

national level, the estimated annual savings are $257 per vehicle (Bordoff and Noel, 2008b).

Further analyses for the economic benefits, job creation and job protection in Maryland from this program is included in Chapter 7 of this plan.

## Implementation

In January of 2009, MIA led a workgroup with MDE, MDOT, the insurance industry, consumer advocacy groups and other stakeholders to review the opportunities and barriers to expanding the Pay-As-You-Drive® program to other companies. An analysis of Pay-As-You-Drive® insurance was conducted by the group and a *Review of Pay-As-You-Drive® Programs in Maryland* was issued in September 2009.[119] The *Review of Pay-As-You-Drive® Programs in Maryland* concluded:

> Even though it is unclear to what extent the Pay-As-You-Drive® Program will reduce GHG production, it is beneficial to encourage the expansion of these programs in the State in that they offer more options to consumers. Based on this, it is recommended that meetings be held with insurance carriers to discuss whether they would consider offering Pay-As-You-Drive® programs in the State.

In keeping with that recommendation, MIA conducted a survey of the major carriers writing private passenger automobile insurance in the State to determine whether they offer or intend to offer use-based insurance in Maryland in the future. These carriers wrote polices for approximately 74 percent of the premiums in calendar year 2009.

Survey results were published on September 22, 2010 an MIA report entitled *2010 Carrier Survey Results for Pay-As-You-Drive*.[120] While a number of the carriers where considering use-based programs in Maryland, survey participants indicated that did not intend to offer such programs any sooner than 2012. Carriers who were *not* considering offering use-based programs in Maryland cited the cost of developing the product and the regulatory environment as the reason.[121] MIA will continue to work with carriers interested in offering such products in Maryland on a long-term or pilot basis.

## Supporting Laws and Regulations

- Maryland Greenhouse Gas Emissions Reduction Act of 2009

[119] Maryland Insurance Administration. (2009). Review of Pay-As-You-Drive® Programs in Maryland. Baltimore, MD: Author. Retrieved July 18, 2011 from http://www.mdinsurance.state md.us/sa/documents/PayAsYouDriveFinal9.29.09.pdf.
[120] Ibid
[121] MIA. (2010). 2010 Carrier Survey Results for Pay-As-You-Drive. Baltimore, MD: Author. Retrieved July 18, 2011 from http://www.mdinsurance.state.md.us/sa/documents/PAYDSurveyReport09-22-10.pdf.

- 72nd Oregon Legislative Assembly--2003 Regular Session, Enrolled House Bill 2043
- Proposed Amendments to Title 10, California Code of Regulations, Chapter 5, Subchapter 4.7, Section 2632.5

## Links to Supporting Documentation


- Bordoff, J., & Noel, P. (2008). "Pay-As-You-Drive Auto Insurance: A Simple Way to Reduce Driving-Related Harms and Increase Equity." Washington, DC: The Brookings Institution. Retrieved July 18, 2011 from http://www.brookings.edu/papers/2008/07_payd_bordoffnoel.aspx.
- Maryland Insurance Administration. (2010). 2010 Carrier Survey Results for Pay-As-You-Drive. Baltimore, MD: Author. Retrieved July 18, 2011 from http://www.mdinsurance.state.md.us/sa/documents/PAYDSurveyReport09-22-10.pdf.
- Maryland Insurance Administration. (2009). Review of Pay-As-You-Drive® Programs in Maryland. Baltimore, MD: Author. Retrieved July 18, 2011 from http://www.mdinsurance.state.md.us/sa/documents/PayAsYouDriveFinal9.29.09.pdf.
- Pay-As-You-Drive Vehicle Insurance: Converting Vehicle Insurance Premiums Into Use-Based Charges. (2011). In Transit Demand Management Encyclopedia. Retrieved July 18, 2011 from http://www.vtpi.org/tdm/tdm79.htm.
- Bordoff, J. E. and Noel, P. J. 2008a. The Impact of Pay-As-You-Drive Auto Insurance in California. The Brookings Institution.
- Bordoff, J. E. and Noel, P. J. 2008b. Pay-As-You-Drive Auto Insurance: A Simple Way to Reduce Driving-Related Harms and Increase Equity. The Brookings Institution.
- Litman, T. 2011a. Pay-As-You-Drive Insurance: Recommendations for Implementation. Victoria Transport Policy Institute.
- Litman, T. 2011b. Win-Win Transportation Solutions: Mobility Management Strategies That Provide Economic, Social and Environmental Benefits. Victoria Transport Policy Institute.

# Sub-Appendix C-3: Ag and Forestry Programs

## Ag and Forestry-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.[122]

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 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

[122] See existing biomass gudelines established for North East U.S. http://www.forestguild.org/publications/research/2010/FG_Biomass_Guidelines_NE.pdf

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

**By 2020, the potential emission reductions from this program are estimated to be 2.70 MMt$CO_2$e.**

**Figure C-44. Low and High GHG Benefits for Ag and Forestry-1**

| | | |
|---|---|---|
| Low Estimate | 0.21 MMt$CO_2$e | DNR Quantification Below |
| High Estimate | 2.70 MMt$CO_2$e | MDE Quantification Below |

**Low 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 $CO_2$-equivalent attenuation benefits resulting from forestry activities. Debate still exists within the scientific community about whether to acknowledge certain forest practices (e.g., avoided deforestation) as creditable for carbon attenuation. Likewise, some practices which are readily acknowledged as contributing to carbon sequestration are nevertheless subjected to debate regarding the degree to which those practices contribute. As the Maryland Forest Service and U.S. Forestry Service progress in their discovery process, these questions will become narrower and the confidence of reported results will increase.

Current data collection resources do not provide the detailed information required to make exact inventories of carbon sequestration attributable to enhancements in forest management implementation; however, we can make defensible estimations suitable for early planning. These estimations draw upon many assumptions, and we anticipate these numbers to fluctuate, possibly significantly, as information improves and narrows the assumptions.

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 improve as well.

**Analysis of the best available data preliminarily indicates that 28.54 MMt$CO_2$e should be sequestered on a cumulative basis by 2020 through enhanced management of Maryland's privately owned forests.** It is imperative to understand that this estimate is very rough – it is based on the best data available and uses algorithms derived from national and regional datasets to predict future forest conditions. Since potential exists for the preliminary estimates to over-state the actual sequestration rates,

we suggest reducing our estimate by a factor of 25 percent to provide a margin of error if needed. Refinements to forest measurements as well as the calculation protocols will alter the results either positively or negatively.

**Figure C-45. Potential for Cumulative Carbon Sequestration**

| Forest Carbon Calculation | | | | |
|---|---|---|---|---|
| (based on Table 1 of Maryland Carbon On Line Estimator carbon report): | | | | |
| | | | | |
| | **FS Impact** | **Annual** | **Cumulative** | |
| **Year** | **acres[123],[124]** | **MMT $CO_2e$[125]** | **MMT $CO_2e$[126]** | |
| 2006 | 34,914 | 0.24 | 3.60 | |
| 2007 | 29,407 | 0.20 | 3.32 | |
| 2008 | 46,218 | 0.32 | 3.20 | |
| 2009 | 40,008 | 0.28 | 2.92 | |
| 2010 | 33,845 | 0.23 | 2.63 | |
| 2011 | 30,000 | 0.21 | 2.37 | * est.[127] |
| 2012 | 30,000 | 0.21 | 2.13 | * |
| 2013 | 30,000 | 0.21 | 1.89 | * |
| 2014 | 30,000 | 0.21 | 1.65 | * |
| 2015 | 30,000 | 0.21 | 1.41 | * |
| 2016 | 30,000 | 0.21 | 1.17 | * |
| 2017 | 30,000 | 0.21 | 0.93 | * |
| 2018 | 30,000 | 0.21 | 0.69 | * |
| 2019 | 30,000 | 0.21 | 0.45 | * |
| 2020 | 30,000 | 0.21 | 0.21 | * |
| | | | **28.54** | **MMT $CO_2e$** |

The formula for computing this estimate is basic, and requires drawing broad assumptions both for the data inputs and for how the forest will respond to management activities. Input data was provided by Maryland Forestry Service records of data collected for other purposes. Predictions for carbon response 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 U.S. Forest Service http://www.ncasi2.org/ .

It is important to understand the fundamental basis for the Maryland Forest Service's strategy to increase forest carbon is to continue are present mission of providing technical and financial assistance to private landowners and managing State-owned forests for

[123] Years 2011 forward estimated. Source: Maryland Forest Service PMAS
[124] Impacts include forest management planning, timber stand improvements, habitat work and area of timber harvest planning
[125] Assumes 1.5 tonnes CO2-equivalent per acre for unmanaged forest versus 8.4 tonnes CO2-equivalent per acre for managed forest. (R Birdsey, U.S. Forest Service-NES, March 11, 2011.
[126] Estimated from median value of annual increment of 0.24 $MMtCO_2e$ per year for years 2006 through 2010.
[127] Estimated from trend observed 2006 through 2010.

maximum public benefit. Our challenge, therefore, is to ensure that gains in carbon stocks are retained. In the case of public lands this is ensured through management policy. The case of private lands is quite different, since decisions of the disposition of forests are made by the individual private landowner, and thus the collective decisions of these landowners will determine the fate of forest carbon stocks. However, recent data indicate that 98 percent of landowners engaging the services of MD Forest Service implement the management recommendations and, as importantly, tend to retain their forests long-term. For these reasons, we are optimistic that continued investment in providing professional forestry assistance will yield positive gains in forest carbon stocks.

Note that all of the estimated quantifications provided are an estimated tally from private lands alone. Estimates for forest carbon stocks attributable to management policy of public lands is not quantified herein. Estimations for State-owned forests will be provided following the receipt of third-party certification of our proposed sustainability plans by the two certification agencies recognized as being the most stringent (i.e., Forest Sustainability Council and Sustainable Forestry Initiative). These dual certifications are expected in late 2011.

Data Assumptions

- Private landowners will continue to embrace forest management and implement forestry recommendations.
- The presence of a Forest Stewardship Plan on private lands serves as a proxy indicator for enhanced forest management actions occurring. This is a highly generalized assumption. First, the mere presence of a Forest stewardship Plan does not necessarily equate to on-the-ground actions actually occurring on the ground. Secondly, management activities vary widely and forest response to those activities also varies widely. However, experience demonstrates that 98 percent of landowners receiving management assistance implement the recommendations, and thus the forests improve in condition and productivity. Gains in carbon stocks resulting from management assistance are thus assumed to parallel those predicted by the algorithms developed by the U.S. Forest Service for similar forest types (USDA GTR 343).
- Trends in future management activity will remain constant. This is obviously not accurate, but for computational purposes we assumed that past history indicates expected rates of participation.
- Forest stand 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.)
- Planning timber harvests (i.e., preparation of permits for timber harvest) results in the timber harvest actually occurring, and further assume this in turn results in forest management planning.

- Acres of harvest planned equals acres of harvest occurring.
- Acres of timber harvest planning are exclusive of acres of Forest Stewardship Planning.
- Acres of timber harvest planning are exclusive of forest stand improvements acreage.

Computational Assumptions

- Average annual C increment, unmanaged forest = 1.5 tonnes $CO_2$-equivalent per acre (average increment from age 50 – 90).
- Average annual C increment, managed forest = 8.4 tonnes $CO_2$-equivalent per acre (average increment from age 10 – 50).
- Additional annual C increment because of management = 6.9 tonnes $CO_2$-equivalent per acre.
- Acreage of forest lost or gained is ignored.

Recognizing that this analysis is just an initial attempt to quantify forest carbon stocks, we hope to attain the resources necessary to conduct a much more detailed analysis utilizing recently developed statistical methodologies which model forest vegetation growth response to management activities. Developed by the U.S. Forest Service, the Forest Vegetation Simulator is a robust modeling software program designed to provide forest managers with predictions of future results of current management decisions.

**High Estimate – MDE Quantification**

A. Estimated GHG Reductions

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 $CO_2$-equivalent for the practices. The result is 2.70 $MMtCO_2e$ estimated to be sequestered in 2020.

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 then 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 $MMtCO_2e$; this is calculated by adding the Private Forest Stewardship Impact 2.15 $MMtCO_2e$ to the State Forest 0.55 $MMtCO_2e$. 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 $CO_2$-equivalent per acre and divided 1,000,000 conversion factor to get 0.13 annual $MMtCO_2e$, then added to the previous 20 years of private land improvements sequestration to get 2.15 $MMtCO_2e$ sequestration credit plus adding the State lands of 62,500 acres multiplied times the carbon rate of 0.98 tonnes $CO_2$-equivalent per acre and divided 1,000,000 conversion factor to get 0.06 annual $MMtCO_2e$, then added to the previous 20 years of State land improvements sequestration to get 0.55 $MMtCO_2e$ sequestration credit, for a total of 2.70 $MMtCO_2e$ sequestration credit.

C. Calculations

Total $MMtCO_2e$ = Private + State

The Yearly Private FS Impact $MMtCO_2e$ = (FS acres * 4.43 tonnes $CO_2$-equivalent per acre / 1,000,000) + previous years credit (up to 20 years prior)

The Yearly State Forest $MMTCO_2e$ = (State acres * 0.98 tonnes $CO_2$-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 $CO_2$-equivalent per acre from – 1.5 tonnes $CO_2$-equivalent per acre for unmanaged forest vs. 8.4 tonnes $CO_2$-equivalent per acre for managed forest, therefore a total of 6.9 tonnes $CO_2$-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 $CO_2$-equivalent per acre for each acre improved in a year. This is the average between DNR 6.9 tonnes $CO_2$-equivalent per acre and 1.96 tonnes $CO_2$-equivalent per acre from the Maryland D-GORCAM model report for public forest improvements.

[3] Annual $MMtCO_2e$ = Private Forest Service Impact acres times carbon rate

[4] Yearly $MMtCO_2e$ = 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 $CO_2$-equivalent per acre vs. 4.46 tonnes $CO_2$-equivalent per acre = 1.99 tonnes $CO_2$-equivalent per acre
- For Red Maple 1.47 tonnes $CO_2$-equivalent per acre vs. 3.40 tonnes $CO_2$-equivalent per acre = 1.93 tonnes $CO_2$-equivalent per acre
- Average of the two tree types was assumed =1.96 tonnes $CO_2$-equivalent per acre

The Rate used was 0.98 tonnes $CO_2$-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 $CO_2$-equivalent per acre.

[7] Annual $MMtCO_2e$ = State Forest acres times carbon rate

[8] Yearly $MMtCO_2e$ = 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-46. Carbon Sequestration Potential for State and Private Lands**

| Year | Private Forest Service Impact Acres[1] | Carbon Rate tons $CO_2$-equivalent per acre [2] | Annual $MMtCO_2e$ [3] | Yearly $MMtCO_2e$ (Stack credit from previous year) [4] | State Forest dual-certified 500,000 acres [5] | Carbon Rate tons $CO_2$-equivalent per acre [6] | Annual $MMtCO_2e$ [7] | Yearly $MMtCO_2e$ (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 |
| **2020** | **30,000** | 4.43 | **0.13** | **2.15** | **62,500** | 0.98 | **0.06** | **0.55** |
| | 484,392 | | 2.15 | | 562,500 | | 0.55 | |

**TOTAL 2.70 $MMtCO_2e$**

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 $CO_2$-equivalent per acre and 1.96 tonnes $CO_2$-equivalent per acre from Maryland-GORCAM report = 4.43 tonnes $CO_2$-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 $CO_2$-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 $CO_2$-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.

## Other Environmental Benefits

Sustainably managing Maryland's forests will result in many ancillary benefits in addition to sequestering carbon. Maintaining healthy and viable forests will provide a bastion for endangered and threatened species of plants and animals, as well as improve Maryland's waterways and the Chesapeake Bay through the valuable ecosystem services provided by healthy forests.

Forest management planning, required by Maryland law, is much more comprehensive than just improving product yields. Each plan is prepared to meet the unique goals of the owner, yet each Forest Stewardship Plan purposefully addresses the full suite of forest related environmental and social issues. For example, water quality is protected (and more likely actually improves) as a result of implementing a Forest Stewardship Plan. Similar improvements can be clearly noted for wildlife habitats and populations. Especially noteworthy is the identification, protection and enhancement of habitats for rare, threatened or endangered species. Soil erosion is minimized through planning and soil condition improves as forest condition improves. Owners of forestland who can appreciate the full suite of benefits they derive from their forests tend to keep their lands forested, as opposed to converting them to other uses, and the presence of a Forest Stewardship Plan enhances the landowner's appreciation for their forests.

## Economic Benefits, Job Creation and Job Protection

Sustainably managing Maryland's forests to capture carbon will ensure that logging and other wood biomass-related jobs remain in Maryland. Additionally, the resulting increase in habitat for wildlife that will be created will assist the hunting and fishing industry within Maryland by providing fertile forests for fish, birds, deer, and other mammals.

Including direct and induced employment derived from forest management and the industries that rely on the products derived from healthy, well-managed forests total approximately 29,000 jobs.[128]

[128] BEACON, Salisbury State University, 2009. The Impact of Resource Based Industries on the Maryland Economy.

The economic benefits of sustainably managing Maryland's forests for capture are two-fold. First, biomass can be harvested and sold by landowners throughout the State, where a market already exists for wood biomass resources. Second, by managing forests across the State to increase the amount of carbon captured, the possibility for participation in various offsets programs becomes more likely.

The National Woodland Owners Association commissioned the forest economic consulting firm Forest2Market to investigate the economic contribution of forests to the American economy. The investigation generated State specific results, which are presented here. For details, see: The Economic Impact of Privately-Owned Forests, Forest2Market, 2009.

**Figure C-47. Gross Domestic Product Contributions from Forests**

| | |
|---|---|
| *Direct, Indirect and Induced Employment per 1000 Acres* | *15.6* |
| Direct, Indirect and Induced Payroll Contribution per Acre | $ 560 |
| State Tax Contribution per Acre | $ 14.63 |
| Annual Sales per Acre | $ 1,644 |
| Contribution to Gross Domestic Product per Acre | **$ 478** |

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Further analyses for the economic benefits, job creation and job protection in Maryland from this program is included in Chapter 7 of this plan.

## Implementation

From July 1, 2010 through March 31, 2011, DNR prepared 10,394 acres of forest management plans on private forest land and implemented 2,224 acres of forest improvements. In 2009, DNR implemented a Carbon Sequestration Pilot project to assess forest planting and management techniques for approximately 174 acres of Maryland forests. Additionally, meetings of the National Resource Conservation Service State Technical Committee, Forestry Sub-committee are occurring on a regular basis.

The impact of the Emerald Ash Borer (*Agrilus 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

## Supporting Laws and Regulations

- 2008 Farm Bill
  http://www.usda.gov/wps/portal/usda/farmbill2008?navid=FARMBILL2008
- Woodland Incentive Fund, Natural Resources Article §5-304
  http://www.dnr.state.md.us/forests/programapps/wood.html
- Sustainable Forestry Act of 2009
  http://mlis.state.md.us/2009rs/bills/sb/sb0549t.pdf

## Links to Supporting Documentation

- Statewide Forest Assessment
  http://www.dnr.state.md.us/forests/sas.asp
- LandServer
  http://www.landserver.org/
- The Bay Bank
  http://www.thebaybank.org/marketplace/results
- Tools for Carbon Inventory, Management, and Reporting
  http://nrs.fs.fed.us/carbon/tools/
- Measurement Guidelines for the Sequestration of Forest Carbon
  http://nrs.fs.fed.us/pubs/gtr/gtr_nrs18.pdf
- Standard Tables of Forest Ecosystem and Harvested Wood Carbon
  http://nrs.fs.fed.us/pubs/gtr/ne_gtr343.pdf
- Carbon OnLine Estimator: Web-based Tool for Forest Carbon Analysis
  http://www.ncasi2.org/COLE/
- The Economic Impact of Privately-Owned Forests
  http://www.marbidco.org/Economic-Impact-of-Working-Forests.pdf
- The Potential for Sustainable Wood-Based Bioenergy in Maryland
  http://www.pinchot.org/pubs/325
- Forest Stewardship Planning
  http://www.dnr.state.md.us/forests/programapps/stewcon.asp

- Woodland Incentive Fund, Natural Resource Article §5-304
- Sustainable Forestry Act of 2009
- 2008 Farm Bill

# Ag and Forestry-2: 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 consists of representatives from State agencies, the private sector, and a non-profit organization. As part of this process, DNR is currently reviewing its existing programs to determine which practices and programs could play a role in promoting private sector involvement and developing ecosystem markets. DNR will undergo a policy analysis of the role public lands might play in promoting market-based approaches to GHG reductions; including generating ecosystem credits. As such, the potential of ecosystem markets as a GHG reduction measure is still being evaluated. If DNR and the Ecosystem Services Working Group determine that certain markets should be fostered and that this would advance our natural resource goals, then 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 being 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. This is an issue that the Ecosystem Services Workgroup is evaluating.

*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 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.

*Carbon: RGGI and Maryland $CO_2$ Budget Trading Program Offsets*

Started in 2009, the Maryland $CO_2$ 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 $CO_2$ offset allowances. $CO_2$ offset allowances are traded through a public access website called the $CO_2$ Allowance Tracking System located on RGGI's website. At this point, the

regulations for the offsets program under the Maryland $CO_2$ 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. A public and private stakeholder advisory process, started in November 2009, initially assessed mitigation activities, determined a menu of eligible practices, and developed draft policies and guidelines that could be used to implement a complementary carbon trading program.

*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.

While there have been no transactions to date from this voluntary market due to a preliminary lack of demand, there is considerable interest and potential for developing programs in Maryland under GGRA, such as a carbon market.

*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

**By 2020, the potential emission reductions from this program are estimated to be 0.82 $MMtCO_2e$.**

**Figure C-48. Low and High GHG Benefits for Ag and Forestry-2**

| | | |
|---|---|---|
| Low Estimate | 0.16 $MMtCO_2e$ | MDE Quantification Below |
| High Estimate | 0.82 $MMtCO_2e$ | 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 the estimated carbon credit calculation of 0.822 $MMtCO_2e$ of sequestration.

Ecosystem Markets Evaluated:

- 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.
- 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 the Maryland Department of Natural Resources.

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 $MMtCO_2e$ in 2020.

## Other Environmental Benefits

The establishment of ecosystem markets would serve to protect and conserve nearly all components of any associated ecosystems. The types of environmental benefits will vary based on the design and focus of the market. If ecosystem markets incentives do grow and are properly structured to provide disincentives for unchecked loss or incomplete replacement of ecosystem services, then both conservation of existing high value resource lands and waters and restoration of degraded resources would accelerate.

## Economic Benefits, Job Creation and Job Protection

If the State were to explore and foster private sector involvement in assisting in mitigation and restoration projects, such efforts would have job creation and retention possibilities. Specific to forest mitigation, current observations show that many local jurisdictions do not support the development of privately owned mitigation banks or have not set up the program structure to take advantage of this option. If private companies were to implement reforestation activities, job creation and retention would be viable in the long-term. The estimated number of jobs that this program will create and protect is currently under development.

Similar to job creation and retention, the economic benefits would be enjoyed by private companies that would be contracted to implement mitigation requirements. This would include nurseries, restoration equipment suppliers, site design and installation contractors, maintenance companies and third-party verifiers to ensure credit requirements are met. Such companies would enjoy increased work, thereby spurring job creation and retention and regional economic development. The estimated economic benefits of this program are currently under development. Indirect economic benefits potentially exist as well. The creation of additional income opportunities for private landowners has the potential to reduce the conversion of valuable land and resources to a lesser use. When the approach of environmental mitigation is targeted through sound science, this approach has the potential to decrease the cost of services provided by the community.

Further analyses for the economic benefits, job creation and job protection in Maryland from this program is included in Chapter 7 of this plan.

## 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 address 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. As the next step in this process, 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.

As of July 2010, 319 acres wetlands have been restored. LandServer was officially introduced to the public by DNR and key non-profit partners, including the Pinchot Institute for Conservation, Forestry for the Bay, and the Alliance for the Bay. Additionally, DNR continues supporting the development of the BayBank program.

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.

## Supporting Laws and Regulations

- Greenhouse Gas Emissions Reduction Act of 2009
  http://mlis.state.md.us/2009rs/bills/sb/sb0278e.pdf
- Forest Conservation Act (1991)
  http://www.dnr.state.md.us/forests/programapps/newFCA.asp
- Critical Area Commission
  http://www.dnr.state.md.us/criticalarea/
- Wetlands and Waterways Program
  http://www.mde.state.md.us/programs/Water/WetlandsandWaterways/Pages/Programs/WaterPrograms/wetlands_waterways/index.aspx

## Links to Supporting Documentation

- Ecosystem Services Homepage - www.dnr.state.md.us/es
- DNR Ecosystem Services Workgroup 2010 Report http://www.dnr.maryland.gov/download/ESWG-InterimReport-Dec2010.pdf
- Multiple Ecosystem Markets in Maryland, Quantifying the Carbon Benefits Associated with Nutrient Trading, CIER in collaboration with WRI, December 2010. Available: http://www.cier.umd.edu/publications.htm
- http://www.thebaybank.org/
- http://www.mdnutrienttrading.org/
- Clean Water Act 404, Rivers and Harbors Act Section 10
- Endangered Species Act
- Annotated Code of Maryland, Environment Article, § 1-404, 5-501-514
- Annotated Code of Maryland, Environment Article, § 5-901 to 911 (Nontidal)
- Annotated Code of Maryland, Environment Article, § 16-101 to 503 (Tidal)
- Code of Maryland Regulations, Title 26 Department of the Environment, Subtitle 17 Water Management
- Code of Maryland Regulations, Title 26 Department of the Environment, Subtitle 23 Nontidal Wetlands
- Code of Maryland Regulations, Title 26 Department of the Environment, Subtitle 24 Tidal Wetlands
- Maryland Forest Conservation Act: COMAR 8.19)
- Critical Area Forest Mitigation: COMAR 27.01.02.04.C(2) and 27.01.02.05.C(7)
- Critical Area Habitat Mitigation: COMAR 27.01.09.04
- Critical Area Buffer Mitigation: COMAR 27.01.09.01
- Critical Area 10 Percent Pollutant Removal: COMAR 27.01.02.03.D(3)
- Maryland Nongame and Endangered Species Conservation Act (Annotated Code of Maryland 10-2A-01); which is supported by regulations (Code of Maryland Regulations 08.03.08) containing the State's Threatened and Endangered Species list
- DNR's Fisheries Service maintains an official list of game and commercial fish species that are designated as threatened or endangered in Maryland (Code of Maryland Regulations 08.02.12)

# Ag and Forestry-3: 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-49. 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 |
|---|---|---|---|---|---|---|
| **Allegany (total 8 places)** | | | | N | | |
| -- Cumberland | Complete | 10/1/2008 | 48% | TBD | | |
| **Anne Arundel (total 32 places)** | Complete | 2/19/2010 | 58% | TBD | | |
| -- Annapolis | Complete | 6/1/2006 | 41% | Y | 50% | 2036 |
| **Baltimore (total 30 places)** | Complete | 4/1/2009 | 49% | TBD | | |
| Baltimore City | Complete | 1/1/2006 | 20% | Y | 46% | 2036 |
| **Dorchester (total 11 places)** | | | | N | | |
| -- Vienna | None | n/a | | Y | TBD | |
| -- Cambridge | None | n/a | | Y | TBD | |
| **Frederick (total 22 places)** | | | | 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 | | | | | |
| **Howard (total 5 places)** | Complete | 12/1/2009 | 50% | TBD | | |
| **Kent (total 5 places)** | | | | N | | |
| -- Rock Hall | Underway | | | | | |
| -- Millington | Underway | | | | | |
| -- Chestertown | Complete | 4/1/2009 | 25% | Y | 40% | 2020 |
| -- Betterton | Underway | | | TBD | | |
| **Montgomery (total 48 places)** | Complete | | | TBD | TBD | |
| -- Rockville | Complete | 5/1/2009 | 44% | N | | |
| -- Takoma Park | Complete | 12/3/2010 | 59% | | | |
| **Prince George's (total 27 places)** | 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 | | |
| **Washington (total 25 places)** | | | | 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, 68,771 trees have been planted and registered.

By 2020, the implementation goal is to establish urban canopy goals for 50 percent (74 communities) of the area developed primarily before stormwater management regulations (pre-1984), with the overall goal of achieving a 10 percent cumulative increase in urban tree canopy throughout Maryland.

## Estimated GHG Emission Reductions in 2020

**By 2020, the potential emission reductions from this program are estimated to be 1.32 $MMtCO_2e$.**

**Figure C-50. Low and High GHG Benefits for Ag and Forestry-3**

| | | |
|---|---|---|
| Low Estimate | 0.03 $MMtCO_2e$ | DNR Quantification Below |
| High Estimate | 1.32 $MMtCO_2e$ | SAIC Quantification Appendix B, Pg. 113 |

**Low Estimate – DNR Quantification**

GHG Emissions Reductions

**Figure C-51. Urban Forest Carbon Calculation**

| | **Forest Conservation Act and NRA 5-103(h) Tree Planting** | **TreeMendous Maryland & Marylanders Plant Trees Programs** | |
|---|---|---|---|
| Year | Number of Trees Planted | Number of Trees Planted | $MMtCO_2e$ |
| 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 |
| | **12,556,050** | **317,058** | **0.16 $MMtCO_2e$** |

**Note:** 2020 estimates reflect values for trees planted in 2020 (if grown to 2021), so trees planted in 2019 will collect 0.0262 $MMtCO_2e$ 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-52: GHG Emission Reductions Resulting from 2008 Climate Action Plan Policy AFW-2.**

| **Emissions Category** | **GHG Reductions ($MMtCO_2e$)** | | |
|---|---|---|---|
| | **2012** | **2015** | **2020** |
| 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 | *De minimis* | | |

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-53. Carbon Benefits from Planted Trees**

| | **Forest Conservation Act and NRA 5-103(h) Tree Planting** | **TreeMendous Maryland & Marylanders Plant Trees Programs** | | |
|---|---|---|---|---|
| Planted Year | Number of Trees Planted | Number of Trees Planted | $MMtCO_2e$/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 | * |
| | **12,556,050** | **317,058** | **0.16** | |

Step 4: Determine Total GHG Reductions from Sequestration:

## Figure C-54. 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

| | Trees Planted | | | | | | | | | | | | | | | | | Convert to | TOTAL | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | TOTAL lbs. C | Metric Tonne | MTCO2e | MMTCO2e |
| 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 | 234,536 | 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

| | Trees Planted | | | | | | | | | | | | | | | | | Convert to | TOTAL | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | TOTAL lbs. C | Metric Tonne | $MTCO_2e$ | $MMTCO_2e$ |
| 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 | 4,397 | 15,920 | 15,920 | 15,920 | 15,920 | 15,920 | 108,120 | 49 | 180 | 0.00018 |
| 2008 | | | 2,160 | 582 | 582 | 582 | 582 | 1,568 | 1,568 | 1,568 | 1,568 | 1,568 | 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 | 8,453 | 8,453 | 8,453 | 8,453 | 8,453 | 54,820 | 25 | 91 | 0.00009 |
| 2013 | | | | | | | | 11,643 | 3,139 | 3,139 | 3,139 | 3,139 | 8,453 | 8,453 | 8,453 | 8,453 | 46,367 | 21 | 77 | 0.00008 |
| 2014 | | | | | | | | | 11,643 | 3,139 | 3,139 | 3,139 | 3,139 | 8,453 | 8,453 | 8,453 | 37,914 | 17 | 63 | 0.00006 |
| 2015 | | | | | | | | | | 11,643 | 3,139 | 3,139 | 3,139 | 3,139 | 8,453 | 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 | | |
| | MMTCO2e/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 |

## Other Environmental Benefits

While climate change mitigation will have long lasting effects within the next 100 years, climate science shows that our past actions will expose us to rising temperatures in the coming decades. The urban areas are particularly at risk from increasing heat and stormwater runoff as they already have a high percent of impervious area. Strategic planting of trees, especially around public buildings, nursing homes, and parks will allow communities to adapt to increasing temperatures.

In addition to increasing carbon sequestration, tree canopies provides essential habitat for birds and small mammals living within urban areas. Urban trees also provide humidity balancing and reduce the intensity of stormwater runoff, improving stream and Bay quality. Trees and other green space have a direct and positive connection to reduced crime, graffiti, noise, litter, and risk of skin cancer (due to shade). Additionally, green environments have also been shown to increase self-discipline and reduce attention deficit disorders in children, as well as promote stronger ties among neighbors and greater sense of safety for urban residents.

Trees and other green space have a direct and positive connection to:

- Reduced crime, graffiti, noise and litter
- Increased self-discipline and reduced attention deficit disorders in children
- Reduced risk of skin cancer (due to shade); and
- Stronger ties among neighbors, with a greater sense of safety for urban residents

Healthy urban forests create a multitude of positive economic benefits in our towns and cities. They include:

- Extending the life of street surfaces through shade
- Providing an alternative to landfills for 'green' waste streams via mulching
- Reducing soil erosion, polluted storm water run-off and thus the need for expensive mechanical water control
- Producing positive consumer responses to retail and business locations
- Greater productivity and work satisfaction for desk workers with views of green; and
- Increased rental rates for commercial[129]

## Economic Benefits, Job Creation and Job Protection

Increasing urban tree canopies will help maintain current jobs by improving the welfare of community members where increases in canopy growth occur. The potential for new jobs exist in relation to the potential for an urban wood waste market that may develop in response to increased urban biomass.

[129] Trees: A Prospectus: A Solid Green Investment, National Tree Trust June 2006

Per a study on the economic impacts for the U.S. Green Industry in 2002, the economic impacts of the U.S. Urban Forestry Tree Sales and Tree Care Services in Maryland, the total tree sales and services output (which includes nursery and greenhouse sector tree sales and landscaping services tree care) were $375 million. Of the nursery and greenhouse sector tree sales ($90 million) 27.2 percent were urban forestry trees sales. The employment impact or jobs associated with these sectors is 7,407 with labor income impacts of $321 million and indirect business tax impact of $17 million[130]. This also contributes to the training of underprivileged youth in urban areas, providing them with necessary training for green jobs by enhancing education opportunities and skill sets.

Healthy urban forests create a multitude of positive economic benefits in our towns and cities. Urban forests help to extend the life of street surfaces through shade, provide an alternative to landfills for "green" waste streams via mulching, reduce soil erosion, polluted storm water run-off and thus the need for expensive mechanical water control, produce positive consumer responses to retail and business locations, increase productivity and work satisfaction for desk workers with views of green trees, and increase rental rates for commercial businesses[131].

A potential market exists in the harvesting of urban tree wood waste for sale as biofuel and is currently being explored. Furthermore, improving Bay quality through decreased stormwater runoff will reduce costs associated with Bay cleanup.

The following forest attribute are estimated for the urban or community land in Maryland. These are rough estimates and more detailed information is necessary for more precise estimates. With 82.6 million trees:

- 15.8 million metric tons of carbon stored ($360.2 million value)
- 520,000 metric tons/year of carbon sequestered ($11.9 million value)
- 16,200 metric tons/year total pollution removal ($133.4 million value
    - 263 metric tons/year of carbon monoxide removed ($370,500 value)
    - 3,187 metric tons/year of nitrogen dioxides removed ($31.6 million value)
    - 7,465 metric tons/year of ozone removed ($74 million value)
    - 1,780 metric tons/year of sulfur dioxide removed ($4.3 million value)
    - 3,505 metric tons/year of particulate matter-10 removed ($23.2 million value) [132]

The Wharton School of Business recently conducted a study of housing prices in Philadelphia that found that improvements to streetscapes (street tree plantings, container plantings, small pocket parks, parking lot screens and median plantings) can add more than 25 percent to the value of a nearby home. The study also determined that

[130] Hall, Hodges, and Haydu. Revised June 3, 2005. Economic Impacts of the Green Industry in the United States – Final Report to the National Urban and Community Forestry Advisory Committee.
[131] Trees: A Prospectus: A Solid Green Investment, National Tree Trust June 2006
[132] Nowak, David J.; Greenfield, Eric J. 2009. Urban and community forests of the Southern Atlantic region: Delaware, District of Columbia, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia, West Virginia. Gen. Tech. Rep. NRS-50. Newtown Square, PA. U.S. Department of Agriculture, Forest Service, Northern Research Station. 85 p.

neighborhood commercial corridors in "excellent" condition are correlated with a more than 20 percent net rise in value for homes within ¼ mile of the corridor and 10 percent net rise for those within ½ mile, and homes located in "business improvement districts"— neighborhood-based organizations that provide special services like trash removal and greening, such as University City District and Frankford Special Services District—are valued 30 percent higher than comparable homes not located in business improvement districts. Additionally, while proximity to a neglected vacant lot subtracts 20 percent from the base value of an adjacent home, adjacency to a stabilized lot—one that has been improved through cleaning and greening—increases the home's base value by approximately 15 percent.[133]

Further analyses for the economic benefits, job creation and job protection in Maryland from this program is included in Chapter 7 of this plan.

## 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 68,771 trees have been planted and registered as of February 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.

[133] Public Investment Strategies: How They Matter for Neighborhoods in Philadelphia (2006), Dr. Susan Wachter, Professor of Real Estate, Finance, and City and Regional Planning at the Wharton School of Business, University of Pennsylvania

Tree planting assistance for local governments and citizens is also provided through the TreeMendous MD 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.

## Supporting Laws and Regulations

- Cooperative Forestry Assistance Act of 1978
  http://ag.senate.gov/FinalTitles/WEI07B38_xml.pdf
- Maryland Forest Service Urban and Community Forestry Program
  http://www.dnr.state.md.us/forests/programs/urban/
- Marylanders Plant Trees Initiatives
  http://www.trees.maryland.gov/
- Chesapeake Executive Council Riparian Forest Buffer Directive No. 03-01
- Forest Conservation Act and Regulations, NRA §5-1601—1613 and COMAR 08.19
- Roadside Tree Law and Regulations, NRA §5-406 and COMAR 08.07 Chapter 02
- Tree Experts Law and Regulations, NRA §5-415—5-423 and COMAR 08.07 Chapter 07

**New Legislation:**

- New legislation, as follows, may be needed to fully implement this program:
  - New legislation to allow tree planting on private property utilizing State funding.
  - New funding to promote and educate public on current and expanded programs.
  - New legislation that furthers the implementation of the No New Loss of Forest Task Force and the future Sustainable Forest Council recommendation.
  - New legislation incentivizing communities to increase their urban tree canopy.

## Links to Supporting Documentation

- Maryland Commission on Climate Change - http://www.mdclimatechange.us/
- Tree-Mendous Maryland - http://www.dnr.state.md.us/forests/treemendous/
- Chesapeake Bay Program - http://www.chesapeakebay.net/
- Tools for Carbon Inventory, Management, and Reporting
  http://nrs.fs.fed.us/carbon/tools/
- Measurement Guidelines for the Sequestration of Forest Carbon
  http://nrs.fs.fed.us/pubs/gtr/gtr_nrs18.pdf
- Standard Tables of Forest Ecosystem and Harvested Wood Carbon
  http://nrs.fs.fed.us/pubs/gtr/ne_gtr343.pdf
- COLE (Carbon OnLine Estimator): Web-based Tool for Forest Carbon Analysis
  http://www.ncasi2.org/COLE/
- i-Tree: Identify, Understand, and Manage Urban Tree Populations
  http://itreetools.org/
- Nowak, David J.; Greenfield, Eric J. 2009. Urban and community forests of the Southern Atlantic region: Delaware, District of Columbia, Florida, Georgia,

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# Ag and Forestry-4: 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.

Between 2009 and 2011, 319 acres of wetlands were restored under DNR's public land restoration program. Future targets for on-the ground wetland restoration are currently being established under Maryland's Phase II Watershed Implementation Plan (WIP) for the Chesapeake Bay TMDL. The Proposed Strategy (Draft, January 25, 2012) sets forth a target of 11,141 acres of wetland restoration by 2025. 223 of these wetland restoration acres will be restored on public lands between 2012 and 2013 by DNR with the additional acreage to be on private lands through the Conservation Reserve Enhancement Program administered by MDA. Goals beyond 2013 for wetland restoration on public lands have not yet been established. It is DNR's intent to align its Chesapeake Bay TMDL wetland restoration goals with proposed 2020 carbon sequestration targets and will be working with MDE and MDA to finalize its targets in the coming months.

DNR and MDE are working together to promote wetland carbon sequestration. Estuarine wetlands are known to be very efficient at sequestering carbon[134]. 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 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[135] 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.

[134]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.
[135] D. Strebel, "Wetland Restoration Potential for Carbon Sequestration", report to PPRP (2010)

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/coastalatlas/index.asp).

## Estimated GHG Emission Reductions in 2020

**By 2020, the potential emission reductions from this program are estimated to be 0.65 MMt$CO_2$e.**

### Figure C-55. Low and High GHG Benefits for Ag and Forestry-4

| | | |
|---|---|---|
| Low Estimate | 0.05 MMt$CO_2$e | SAIC Quantification Appendix B, Pg. 133 |
| High Estimate | 0.65 MMt$CO_2$e | DNR Quantification Below |

**High Estimate – DNR Quantification**

Estimated GHG Reductions

#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 MMt$CO_2$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 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-56. Estimated Carbon Sequestration from Dorchester County wetland restoration projects.**

| Project Type | Total Area (Hectares) | Sequestration Rate (milligrams carbon per hectare per year) | Estimated Sequestration ($MMtCO_2e$ 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.

## Other Environmental Benefits

Sustainably managing Maryland's wetlands has significant adaptation co-benefits, since wetland protection is one of the best ways to protect communities and prevent property damage from storm surge and flooding in the coastal zone. Riparian wetlands would be protected under this program by the acquisition of riparian buffers and wetland transition zones throughout the State. Maintaining healthy and viable wetland ecosystems will provide a bastion for endangered and threatened species of plants and animals, as well as improve Maryland's waterways and the Chesapeake Bay through the valuable ecosystem services provided by these ecosystems.

## Economic Benefits, Job Creation and Job Protection

Projects developed under this program would comprise both private and public sector initiatives. Restoration projects will involve a large cross section of jobs with the bulk expected to be in construction. There will also be ongoing employment in the management and assessment of the projects to ensure their continued function and account for carbon sequestered and other ecosystem services. The estimated number of jobs that this program will create and protect is currently under evaluation.

The principal near term economic benefit will come from shoreline protection however this value has not been monetized as a part of the ongoing research. When a comprehensive national climate change policy evolves, there will be a potential revenue stream associated with the sale of GHG offsets. At this time it is not possible to price these offsets, but the economic benefits of this program are under evaluation.

Analyses for the economic benefits, job creation and job protection in Maryland from this program is included in Chapter 7 of this plan.

## Implementation

This program is being implemented through a suite of programs and strategies including on-the-ground wetland restoration efforts through DNR's Coastal Wetlands Initiative, 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. For the purposes of the Final GGRA Plan, DNR's intent to align its Chesapeake Bay TMDL wetland restoration goals with proposed 2020 carbon sequestration targets and will be working with MDE and MDA to finalize its targets in the coming months.
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.

## Supporting Laws and Regulations

- Wetlands and Waterways Program
  http://www.mde.state.md.us/programs/Water/WetlandsandWaterways/Pages/Programs/WaterPrograms/wetlands_waterways/index.aspx
- Water Quality Financing Program
  http://www.mde.state.md.us/programs/Water/QualityFinancing/Pages/Programs/WaterPrograms/water_quality_finance/index.aspx
- Maryland's Phase I and II Watershed Implementation Plan for the Chesapeake Bay TMDL

## Links to Supporting Documentation

- Reservoir Watershed Management Program

http://www.baltometro.org/environmental-planning/reservoir-watershed-management-program-details
- The Bay Bank - http://www.thebaybank.org/marketplace/results
- LandServer - http://www.landserver.org/
- Terrestrial Sequestration of Carbon Dioxide http://www.netl.doe.gov/technologies/carbon_seq/refshelf/BPM_Terrestrial.pdf
- Information about Maryland's Efforts to conserve coastal wetlands as sea levels rises http://csc.noaa.gov/digitalcoast/wetlands/_pdf/Habitat_Conservation_for_Climate_Adaptation.pdf
- http://www.mde.state.md.us/programs/Water/TMDL/TMDLImplementation/Documents/DRAFT_PhaseII_Report_Docs/DRAFT%20PHASE%20II%20WIP%20REPORT%20DOCUMENT_012512.pdf

# Ag and Forestry-5: Geological opportunities to store carbon

Lead Agency: DNR

## Program Description

Natural geologic reservoirs have held oil, natural gas, water, and even carbon dioxide, for millions of years with no or minimal leakage. Therefore, these same natural geologic systems are thought to offer both near-term opportunities and longer-term possibilities for future management of man-made carbon dioxide emissions. However, given the growing amount of emissions from carbon dioxide, it is necessary to understand the extent of the geologic reservoirs that would be available to receive and capture these emissions. The principal geologic reservoirs of interest are played out gas fields, un-mineable coal seams, and deep saline aquifers, all of which are present in Maryland. This program is designed to identify the location and extent of these reservoirs in Maryland and then to determine their integrity through a series of test injections and finally develop an appropriate regulatory environment for safe deployment.

The U.S. Department of Energy has a carbon sequestration partnership program that is set up to develop regionally appropriate approaches to carbon sequestration. The principal approach is geologic sequestration although there are also a number of terrestrial sequestration projects being developed. The Midwest Regional Carbon Sequestration Partnership, of which Maryland is a member, is analyzing potential geological carbon sequestration.

Ultimately, test injections of carbon dioxide in target geologic formations will be monitored for migration of the injected gas, geochemical alterations in the subsurface and the containment integrity. Regulations relating to underground injection will need to be developed prior to these techniques coming into routine use. To manage costs associated

with geologic sequestration, particularly in the near term, developing a beneficial use program for the stored carbon dioxide will be important. One option in Maryland may be the use of carbon dioxide in enhanced oil and gas recovery and particularly shale gas.

## Estimated GHG Emission Reductions in 2020

Due to the uncertainty of how much carbon sequestration could occur under this new technology, this program has not been quantified for potential GHG emissions reductions as of yet. As the science behind carbon capture and storage technology becomes further refined and Maryland identifies project locations within its borders, DNR will revisit quantifying the potential of carbon sequestration from these activities.

## Other Environmental Benefits

Utilizing geological sources to store carbon is both permanent and non-disruptive to the surrounding environment. Furthermore, protection of these sources will likely result in an umbrella effect for adjacent areas, protecting valuable wildlife habitat and water resources. Other environmental benefits are currently under assessment.

## Economic Benefits, Job Creation and Job Protection

Geologic carbon sequestration is a new endeavor with unknown consequences. Consequently, more detailed geologic and hydrologic data and modeling must be done before further classifying carbon dioxide injection wells. In the initial stages the job creation would center on the use of relatively highly paid researchers and technicians with appropriate background in engineering, geology, physics, chemistry and similar areas of expertise to develop the methodologies and monitoring components required to evaluate successful geologic carbon sequestration projects.

Analyses for the economic benefits, job creation and job protection in Maryland from this program is included in Chapter 7 of this plan.

## Implementation

Pursuit of geological sequestration projects is not presently underway in Maryland or in any other eastern states. Geologic carbon sequestration should be considered in the near term as a possibility which requires further analysis, research and engineering development. Due to the costs involved geologic sequestration may require cooperative studies, partnerships, and funding at the federal level and with industry.

Phase 1 of the Midwest Regional Carbon Sequestration Partnership's program has been completed, which involved compiling information on potential reservoir characteristics and mapping their extent in the region. Extensive reservoirs were identified including in the western counties and areas of the Delmarva Peninsula in Maryland. Because of their location in the subsurface, the geologic opportunities for sequestration span state and administrative boundaries. Subsequent work has developed information on factors that

will control the functionality of the reservoirs, and this work is continuing, with particular focus currently on the integrity of the reservoir seals. The extent of potential geologic sequestration reservoirs offshore in the mid-Atlantic area is also being investigated with available data.

Phase I of the Midwest Regional Carbon Sequestration Partnership estimated the following geologic sequestration potentials for Maryland:

Waste Gate Formation – located in the Lower Eastern: 4.4 gigatonnes
Needmore Shale – located Western Maryland: 0.010 gigatonnes
Oriskany Sandstone – located in Western Maryland: 0.981 gigatonnes
Medina Sandstone – located in Western Maryland: 3.382 gigatonnes

Ultimately, test injections of carbon dioxide in target geologic formations will be monitored for migration of the injected gas, geochemical alterations in the subsurface and the containment integrity. Regulations relating to underground injection will need to be developed prior to these techniques coming into routine use. To manage costs associated with geologic sequestration, particularly in the near term, developing a beneficial use program for the stored carbon dioxide will be important. One option in Maryland may be the use of carbon dioxide in enhanced oil and gas recovery and particularly shale gas. Fracturing of shale gas containing rocks with carbon dioxide in lieu of water (e.g. hydrofracking) is another option.

## Supporting Laws and Regulations

Supporting laws and regulations would need to be developed to support geologic sequestration. Currently, MDE has permitting authority for extraction of natural gas, but the applicability of that authority to carbon storage would need to be evaluated. Potential conflicts exist with regard to underground mineral rights and underground natural gas storage operations, particularly in the Accident Dome area of Garrett County.

## Links to Supporting Documentation

- US Department of Energy Carbon Sequestration Partnership Program
  http://fossil.energy.gov/sequestration/partnerships/index.html
- Midwest Regional Carbon Sequestration Partnership
  http://216.109.210.162/
- US Department of Energy – Carbon Sequestration:
  http://www.energy.gov/sciencetech/carbonsequestration.htm
- National Energy Technology Laboratory (NETL):
  http://www.netl.doe.gov/technologies/carbon_seq/index.html

# Ag and Forestry-6: 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 Landserver 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

**By 2020, the potential emission reductions from this program are estimated to be 0.62 $MMtCO_2e$.**

## Figure C-57. Low and High GHG Benefits for Ag and Forestry-6

| | | |
|---|---|---|
| Low Estimate | 0.12 $MMtCO_2e$ | DNR Quantification |
| High Estimate | 0.62 $MMtCO_2e$ | SAIC Quantification Appendix B, Pg. 126 |

**Low 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 $CO_2$-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-58. Potential Carbon Sequestration from Reforestation

| **$MMtCO_2e$ Reforestation** | | | | | | |
|---|---|---|---|---|---|---|
| | **Private Lands** | | **Public Lands** | | | |
| | Loblolly | Mixed Upland | Loblolly | Mixed Upland | | |
| | Pine[136,137,138,1394] | Hardwood[133,134,136,140] | Pine[133,134,135,136] | Hardwood[133,134,136,141] | Total | |
| Year | (Acres) | (Acres) | (Acres) | (Acres) | ($MMTCO_2e$) | |
| 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. |

[136] Includes soil carbon estimate of 34.51 tonnes per acre
[137] Assumes constant rate of reforestation annually, based on median acreage planted years 2006-2010.
[138] From Carbon On Line Estimator report for Maryland
[139] U.S. Dept of Agriculture Forest Service-NRS GTR NE-343
[140] Assumes 90 percent reforestation post-harvest is pine. See Figure above
[141] Assumes 90 percent reforestation post-harvest is pine. See Figure above

| | | | | | | |
|---|---|---|---|---|---|---|
| 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. |
| **Total** | 33,283 | 3,698 | 2,489 | 9,978 | **1.95** | **MMt$CO_2e$** |

## Figure C-59 Potential Carbon Sequestration from Afforestation

| $MMtCO_2e$ Afforestation | | | | |
|---|---|---|---|---|
| | Loblolly | Mixed Upland | | |
| | Pine[142,143,144,145] | Hardwood[146,140,142,147] | Total | |
| Year | (tons $CO_2$-equivalent) | (tons $CO_2$-equivalent) | (tons $CO_2$-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 | |
| 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** | **$MMtCO_2e$** |

## Other Environmental Benefits

Sustainably managing Maryland's forests will result in many ancillary benefits in addition to sequestering carbon. Maintaining healthy and viable forests will provide a bastion for endangered and threatened species of plants and animals, as well as improve Maryland's waterways and the Chesapeake Bay through the valuable ecosystem services provided by healthy forests. Reforestation ensures that forests harvested shall regenerate and continue to provide watershed protection, wildlife habitats, soil retention and improvement, air quality remediation, and preserve open space. Afforestation raises the environmental benefits (i.e., water, soil, air, habitat and open space qualities) beyond the levels provided by the land use which it replaces. For example, converting a landscape dominated by fescue to forest will capture and treat much more stormwater runoff, provide diverse habitats for wildlife, and capture airborne pollutants.

An important area to consider is that tree planting requires a capital investment from the landowner, and most landowners will therefore perceive a financial incentive to retain

[142] Includes soil carbon average of 26.17 tonnes per acre per year.
[143] Assumes constant rate of afforestation annually, as based on median acreage planted years 2006-2010
[144] From Table 4, Carbon On Line Estimator report for Maryland. Based on U.S. Dept of Agriculture Forest Service-NRS GTR NE-343
[145] Assumes 80 percent of all afforestation is mixed hardwood.
[146] Includes soil carbon average of 17.93 tonnes per acre per year.
[147] From Figure above.

their investment in the forest for long-term periods and be reluctant to convert the forest to another non-forest land use. Most tree plantings are therefore maintained in the overall landscape for very long periods, which allows the environmental benefits to accrue and mature over time.

## Economic Benefits, Job Creation and Job Protection

36,400 acres (all pine planting + hardwood afforestation) * 600 seedlings per acre * ½ minute per seedling per 60 minutes per 2,000 hours = 91 person years. However, planting usually occurs over a 3 or 4 month period. So, to get 91 person years into a 4 month window would require 274 people. If tree tubes are included (25 percent of 11,320 hardwood afforestation acres @100 tubes per acre) per 12 trees per hour per 2,000 hours yields approximately 12 person years. This also occurs in a 4 month window, requiring 35 people.

| | |
|---|---|
| Cost per acre to plant ($100/acre) * 36,400 = | $3,640,000 |
| Cost of seedlings ($80/thousand) * 600/trees per acre * 36,400 = | $1,747,200 |
| Cost of tree tubes – ($8/tube) * 11,320 acres * 100/tubes per acre* 25% = | $2,264,000 |
| | $7,651,200 |

Analyses for the economic benefits, job creation and job protection in Maryland from this program is included in Chapter 7 of this plan.

## Implementation

As of June 2011, the Forest Brigade has met its goal of planting one million trees, and as reported on the Bay Stat website, 301 acres of forested buffers have been planted. LandServer was officially introduced to the public by DNR and key non-profit partners, including the Pinchot Institute for Conservation, Forestry for the Bay, and the Alliance for the Bay. 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)

The Sustainable Forestry Act of 2009 established the Sustainable Forestry Council as an advisory body for DNR relative to the restoration, management and protections of the State's tree and forest resources. The council's first charge is to make recommendations to the DNR Secretary on the following by December 31, 2011:

- Define what is meant by "No Net Loss"
- Suggest a base year and a method and/or metrics to track net forest cover
- Suggest strategies and incentives for obtaining No Net Loss of forests by building on the previous work of the No Net Loss Taskforce
- Seed Tree Law

The council's recommendations will become part of Maryland's Watershed Implementation Plan upon review and adoption by DNR's Office of the Secretary.

## Supporting Laws and Regulations

- The Sustainable Forestry Act of 2009 established the Sustainable Forestry Council as an advisory body for MDE relative to the restoration, management and protections of the State's tree and forest resources. The Sustainable Forestry Council's first charge is to make recommendations to the Secretary on the following by December 31, 2011:
  - http://mlis.state.md.us/2009rs/billfile/sb0549.htm
  - Define what is meant by "No Net Loss"
  - Suggest a base year and a method and/or metrics to track net forest cover
  - Suggest strategies and incentives for obtaining No Net Loss of forests by building on the previous work of the No Net Loss Taskforce
  - Seed Tree Law
- Senate Bill 0431: Task Force to Study A No Net Loss of Forest Policy
  - http://mlis.state.md.us/2011rs/bills/sb/sb0431t.pdf
- The Sustainable Forestry Council's recommendations will become part of Maryland's Watershed Implementation Plan upon review and adoption by the Office of the Secretary. Many, if not all of the Sustainable Forestry Council's recommendations, would be $CO_2$-equivalent positive initiatives.

## Links to Supporting Documentation

- The Bay Bank - http://www.thebaybank.org/marketplace/results
- LandServer - http://www.landserver.org/
- No Net Loss of Forest Task Force 2009 Report http://www.dnr.state.md.us/dnrnews/pdfs/NNLTFFINALREPORT1.pdf
- Tools for Carbon Inventory, Management, and Reporting http://nrs.fs.fed.us/carbon/tools/
- Measurement Guidelines for the Sequestration of Forest Carbon http://nrs.fs.fed.us/pubs/gtr/gtr_nrs18.pdf
- Standard Tables of Forest Ecosystem and Harvested Wood Carbon http://nrs.fs.fed.us/pubs/gtr/ne_gtr343.pdf

- COLE (Carbon OnLine Estimator): Web-based Tool for Forest Carbon Analysis http://www.ncasi2.org/COLE/

# Ag and Forestry-7: Expanded Use of Forest and Feedstocks 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

**By 2020, the potential emission reductions from this program are estimated to be 3.07 MMt$CO_2$e.**

**Figure C-60. Low and High GHG Benefits for Ag and Forestry-7**

| | | |
|---|---|---|
| Low Estimate | 0.50 MMt$CO_2$e | SAIC Quantification Appendix B, Pg. 150 |
| High Estimate | 3.07 MMt$CO_2$e | DNR Quantification Below |

**High Estimate – DNR Quantification**

Estimated GHG Reductions

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 MMt$CO_2$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 MMt$CO_2$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 $CO_2$-equivalent.

Assuming three systems installed per year beginning in 2015, the potential displacement of $CO_2$-equivalent is displayed in Figure C-61.

**Figure C-61. Potential $CO_2$-equivalent displacement from 3 wood-firing systems.**

| | Total No. | Annual | Cumulative | |
|---|---|---|---|---|
| | Sytems | 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 | |
| | | | | |
| | | **4.33** | **MMt$CO_2$e** | |

## 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:

- an improved energy situation,
- extracting greater value from our urban and rural forests,
- maintaining a healthy and clean environment, and
- improving our 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. This is a tremendous squandering of a valuable renewable resource. Unfortunately, it is also typical of most urban areas throughout the nation.

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.

## Economic Benefits, Job Creation and Job Protection

Maryland has not yet calculated job creation and protection figures for this program but it is generally assumed that the effort would both protect and create new jobs in the forestry, as well as other sectors. The engineering and construction phases of conversion projects would create jobs and continued operation of wood to energy operations will maintain or create new jobs for loggers, truckers and wood pellet manufacturers[148].

[148] State of Maine, Department of Conservation Maine Forest Service. October 29, 2009 Request for Applications: Public Building Wood to Energy Program (http://www maine.gov/tools/whatsnew/attach.php?id=84347&an=1)

Assuming a modest growth of just 3 moderately sized wood energy systems per year (beginning in 2015), could result in a cumulative savings of $800 million by 2020. If, for example, a school campus with multiple buildings were to invest in a system of this size, it should expect the central heating/cooling plant to realize significantly reduced maintenance and operational costs. Fuels savings alone are typically reduced by 50 percent. Payback of capital costs would likely be 5 years or less. The fuel savings could be applied towards other unmet needs of the school system, and the fuel expenditures would remain in the local community since all of the fuel would be locally supplied.

**Figure C-62. Cost Saving Attributed to Wood Energy**

| ***Assumptions:*** | | | |
|---|---|---|---|
| | #2 fuel oil: | $2.50 | Per gallon |
| | Wood fuel: | $30.00 | Per ton |
| | Wood fuel consumed: | 3,515 | Tons |
| | Total wood fuel cost: | $105,450 | |
| | Labor (1 hour per day): | $30.00 | Per hour |
| | | | |
| | Oil displaced: | 181,440 | Gallons |
| | Dollars not spent on fuel oil: | $453,600 | |
| | Net fuel savings: | $348,150 | |
| | Less labor cost: | $8,250 | |
| | Net Savings After Labor: | $339,900 | Annually |

| Year | Total No. Systems Installed | Annual Savings ($/year) | Cumulative Savings ($) |
|---|---|---|---|
| 2015 | 3 | $1,019,700 | $1,019,700 |
| 2016 | 6 | $2,039,400 | $4,078,800 |
| 2017 | 9 | $3,059,100 | $14,275,800 |
| 2018 | 12 | $4,078,800 | $48,945,600 |
| 2019 | 15 | $5,098,500 | $167,230,800 |
| 2020 | 18 | $6,118,200 | $571,032,000 |
| | 18 | $21,413,700 | **$806,582,700** |

Further analyses for the economic benefits, job creation and job protection in Maryland from this program is included in Chapter 7 of this plan.

## Implementation

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:

- Educate State agency leadership of the numerous benefits of wood energy and catalog solutions for removing barriers to implementation.
- Develop 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.
- Modify State energy policies to specifically recognize wood as a preferred renewable energy source on par with solar, geothermal, and wind.
- Expand 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 helps 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/

**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.
- A wood energy "white paper" for use by State agency leadership discussing policy options addressing barriers and opportunities is scheduled to be released in mid 2011.
- Baltimore County contracted with Maryland Environmental Service to identify County-owned facilities that could utilize wood as energy source. This investigation should be fully complete in June 2011.
- The current productivity of this program cannot be attained if there is a future reduction in staff and funding.

## Supporting Laws and Regulations

- Various grants, loans, and cost-share programs offered by MEA, MDE, and other agencies.
- Amend Renewable Fuels Standard to accommodate renewable thermal energy.
- Recognize modern emission control technologies utilized by wood energy systems in air quality permitting regulation.
- Specifically include wood energy systems as option for HVAC design in State buildings.

## Links to Supporting Documentation

- EPA AP-42 Emission factors by fuel source - http://www.epa.gov/ttnchie1/ap42/
- US Energy Information Administration -- provides policy-independent data, forecasts, and analyses to promote sound policy-making, efficient markets, and public understanding regarding energy and its interaction with the economy and the environment. - http://www.eia.gov/
- Energy and Environmental Analysis, Inc. -- air permitting info http://www.eea-inc.com/rrdb/DGRegProject/States/MD.html
- USFS Fuel Value Calculator (5th Edition) -- a tool that can be used to compare typical unit costs of various fuels. http://www.fpl.fs.fed.us/documnts/techline/fuel-value-calculator.pdf
- US 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 helps 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/
- State of Maine, Department of Conservation Maine Forest Service. October 29, 2009 Request for Applications: Public Building Wood to Energy Program http://www.maine.gov/tools/whatsnew/attach.php?id=84347&an=1

# Ag and Forestry-8: 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 safeguasrd 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

**By 2020, the potential emission reductions from this program are estimated to be 0.28 MMt$CO_2$e.**

**Figure C-63. Low and High GHG Benefits for Ag and Forestry-8**

| | | |
|---|---|---|
| Low Estimate | 0.28 MMt$CO_2$e | SAIC Quantification Appendix B, Pg. 133 |
| High Estimate | 0.28 MMt$CO_2$e | 2008 Climate Action Plan, Appendix D [149] Pg. 31 of 341) |

## 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

## Economic Benefits, Job Creation and Job Protection

Over 2,000,000 acres, almost one-third of Maryland's land, is farmed, and agriculture remains the State's largest industry. The purchase of easements through the Maryland Agricultural Land Preservation Foundation guarantees that the land will permanently preserved for agricultural use and helps to keep Maryland's agricultural base intact. Currently Maryland landowners participating in the Conservation Reserve Enhancement

[149] http://www.mde.state.md.us/programs/Air/ClimateChange/Documents/www mde.state.md.us/assets/document/Air/ClimateChange/Appendix_D_Mitigation.pdf

Program can receive five types of payments that incentivize the installation and maintenance of eligible conservation practices.

Analyses for the economic benefits, job creation and job protection in Maryland from this program is included in Chapter 7 of this plan.

## 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

## Supporting Laws and Regulations

- Conservation Reserve Enhancement Program
  http://www.fsa.usda.gov/FSA/webapp?area=home&subject=copr&topic=cep

Senate Bill 297 creating the Maryland Agricultural Land Preservation Foundation in its present form was enacted and signed into law in 1977. Since the Maryland Agricultural Land Preservation Foundation is closely tied to State statute, different aspects of the program are subject to review and revision every legislative session. As a national initiative, the Conservation Reserve Enhancement Program receives its authorization pursuant to the 1996 Federal Agriculture Improvement and Reform Act. Memoranda of Agreement incorporating the Conservation Reserve Enhancement Program proposals and renewals are signed by the U.S. Secretary of Agriculture and the governor of each participating state.

## Links to Supporting Documentation

- Maryland Agricultural Land Preservation Foundation - http://www.malpf.info
- Conservation Reserve Enhancement Program financing opportunities:
  www.mda.state.md.us/resource_conservation/financial_assistance/crep.

# Ag and Forestry-9: 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

**By 2020, the potential emission reductions from this program are estimated to be 0.05 $MMtCO_2e$.**

**Figure C-64. Low and High GHG Benefits for Ag and Forestry-9**

| | | |
|---|---|---|
| Low Estimate | 0.03 $MMtCO_2e$ | SAIC Quantification Appendix B, Pg. 142 |
| High Estimate | 0.05 $MMtCO_2e$ | MDE Quantification Below |

**High Estimate – MDE Quantification**

In U.S., the majority of the vegetables in grocery stores are brought in from other states by conventional tractor trailers. There is a small share of grocery products sold via farmers markets, in which the transportation is done by small trucks. The conventional tractor trucks not only consume more fuel but leave a larger carbon footprint compared with the small trucks. The total annual estimated benefits of buy local program in GHG emission reductions is 49,034 metric tons carbon dioxide emissions or 0.0490 $MMtCO_2e$ emissions from 2010 – 2020.

*Information*

Population data from the 2010 U.S. Census:
Iowa Population - 3,046,355
Maryland Population - 5,773,552

Fuel consumption figures based on Iowa State University study (available at: http://www.leopold.iastate.edu):
Fuel Consumption for Iowa Conventional Tractor Trailer – 368,102 gallon per year
Fuel Consumption for CSA Farmers Market Small Truck – 49,359 gallon per year

*Assumptions*

From the given information, the fuel consumption and carbon dioxide emissions were calculated for Iowa State. These data were extrapolated to estimate the fuel consumption and carbon dioxide emissions for Maryland based on annual population projections.

The following assumptions were considered for calculating the carbon dioxide emissions.

**Figure C-65. Assumptions for Maryland using the Iowa study.**

| | | Iowa | Maryland |
|---|---|---|---|
| Population Growth (from 2010 to 2020) | | +2.9% | +11.5% |
| Fuel Consumption (high estimate model) | Conventional tractor | -3% per year | -3% per year |
| | Small Truck | +1.8% per year | +1.8% per year |
| Carbon dioxide emissions (high estimate model) | Conventional tractor | -5% per year | -5% per year |
| | Small Truck | +3% per year | +3% per year |

Other assumptions include:

- Data inputs used for Iowa analysis which include transport distance and variety of crops grown were the same for the Maryland analysis.
- Emissions associated with storage, processing, packaging, and distributions were not included in this analysis.
- Agricultural products grown in states neighboring Maryland were not considered "local" and were not included in this analysis.

*Calculations*

- Iowa:

Calculated population growth in Iowa using 2010 U.S. census data, and assumed a population growth of 2.9 percent from 2010 – 2020 based on population growth data from the 2000 – 2010 U.S. census data.

Calculated fuel consumption for conventional tractor trailers and CSA small market farm trucks in Iowa using fuel consumption numbers from the Iowa State University study conducted by the Leopold Center for Sustainable Agriculture and assuming decreases and increases in annual fuel consumption.

Calculated carbon dioxide emissions for conventional tractor trailers and CSA small market farm trucks in Iowa using fuel consumption numbers from the Iowa State University study conducted by the Leopold Center for Sustainable Agriculture and assuming decreases and increases in annual carbon dioxide emissions.

**Figure C-66. – Fuel Consumption and emissions for Iowa**

| Year | Iowa Population | Iowa Conventional Tractor Trailer | | Iowa CSA Farmers Market Small Truck | |
|---|---|---|---|---|---|
| | | Fuel Consumption | Carbon Dioxide Emissions (metric tons per year) | Fuel Consumption | Carbon Dioxide Emissions (metric tons per year) |
| 2010 | 3,046,355 | 368,102 | 3,807 | 49,359 | 439 |
| 2011 | 3,054,580 | 357,059 | 3,617 | 50,247 | 452 |
| 2012 | 3,062,805 | 346,016 | 3,426 | 51,136 | 465 |
| 2013 | 3,071,030 | 334,973 | 3,236 | 52,024 | 479 |
| 2014 | 3,079,256 | 323,930 | 3,046 | 52,913 | 492 |
| 2015 | 3,087,481 | 312,887 | 2,855 | 53,801 | 505 |
| 2016 | 3,095,706 | 301,844 | 2,665 | 54,690 | 518 |
| 2017 | 3,103,931 | 290,801 | 2,475 | 55,578 | 531 |
| 2018 | 3,112,156 | 279,758 | 2,284 | 56,467 | 544 |
| 2019 | 3,120,381 | 268,714 | 2,094 | 57,355 | 558 |
| 2020 | 3,128,607 | 257,671 | 1,904 | 58,244 | 571 |

Maryland:

Calculated population growth in Maryland using 2010 U.S. census data, and assumed a population growth of 11.5 percent from 2010 – 2020 based on population growth data from the 2000 – 2010 U.S. census data.

Fuel consumption for conventional tractor trailers and CSA small market farm trucks in Maryland was calculated by using population data for Iowa and Maryland and fuel consumption from Iowa in 2010 to calculate the values for Maryland in 2010. Values for fuel consumption from conventional tractor trailers and CSA small market farm trucks in Maryland in each preceding year were calculated based on stated assumptions.

Carbon dioxide emissions for conventional tractor trailers and CSA small market farm trucks in Maryland was calculated by using population data for Iowa and Maryland and carbon dioxide emissions Iowa in 2010 to calculate the values for Maryland in 2010. Values for carbon dioxide emissions from conventional tractor trailers and CSA small market farm trucks in Maryland in each preceding year were calculated based on stated assumptions.

**Figure C-67. – Fuel Consumption and Emissions for Maryland**

| Year | Maryland Population | Maryland Conventional Tractor Trailer | | Maryland CSA Farmers Market Small Truck | |
|---|---|---|---|---|---|
| | | Fuel Consumption | Carbon Dioxide Emissions (metric tons per year) | Fuel Consumption | Carbon Dioxide Emissions (metric tons per year) |
| 2010 | 5,777,552 | 698,122 | 7,220 | 93,612 | 833 |
| 2011 | 5,837,927 | 677,179 | 6,859 | 95,297 | 858 |
| 2012 | 5,898,303 | 656,235 | 6,498 | 96,982 | 883 |
| 2013 | 5,958,678 | 635,291 | 6,137 | 98,667 | 908 |
| 2014 | 6,019,054 | 614,348 | 5,776 | 100,352 | 932 |
| 2015 | 6,079,429 | 593,404 | 5,415 | 102,037 | 957 |
| 2016 | 6,139,805 | 572,460 | 5,054 | 103,722 | 982 |
| 2017 | 6,200,180 | 551,517 | 4,693 | 105,407 | 1,007 |
| 2018 | 6,260,555 | 530,573 | 4,332 | 107,092 | 1,032 |
| 2019 | 6,320,931 | 509,629 | 3,971 | 108,777 | 1,057 |
| 2020 | 6,381,306 | 488,686 | 3,610 | 110,462 | 1,082 |

*Estimated GHG Emission Reductions*

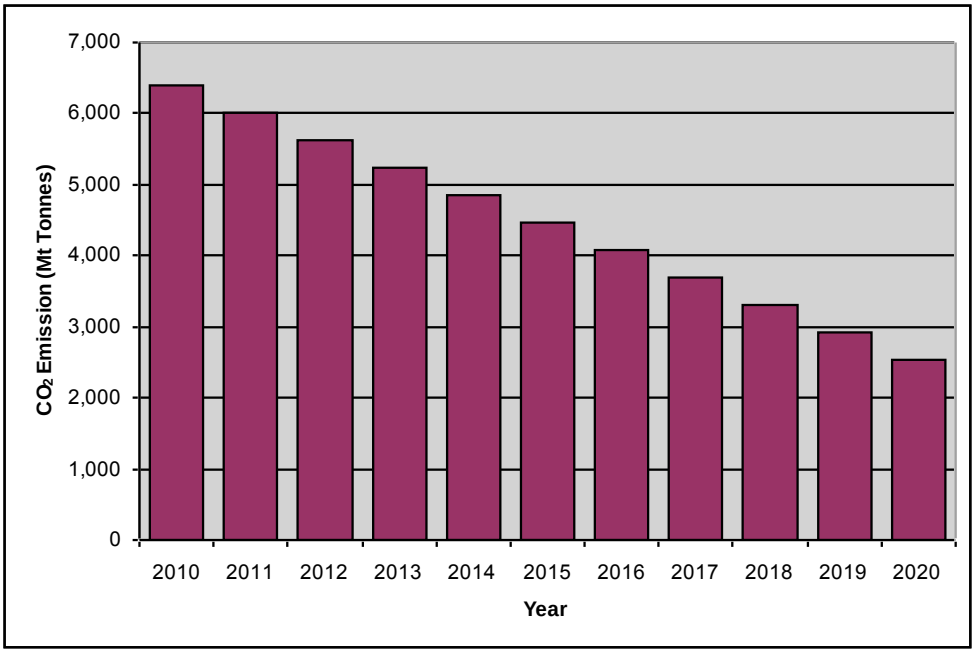
The annual emissions reductions were calculated subtracting the difference between the annual carbon dioxide emissions from conventional tractor trailers and CSA small market farm trucks in Maryland for each year from 2010 – 2020.

**Figure C-68. – Annual Estimated GHG Benefits for Maryland from Buy Local Program**

| Year | Annual Estimated Benefits of Buy Local GHG Emission Reductions (metric tons carbon dioxide) |
|---|---|
| 2010 | 6,388 |
| 2011 | 6,002 |
| 2012 | 5,616 |
| 2013 | 5,230 |
| 2014 | 4,844 |
| 2015 | 4,458 |
| 2016 | 4,072 |
| 2017 | 3,686 |
| 2018 | 3,300 |
| 2019 | 2,914 |
| 2020 | 2,528 |

TOTAL = 49,034 metric tons total carbon dioxide emissions

**Figure C-69. High Estimate model for annual carbon dioxide emissions**



## Other Environmental Benefits

"Buy Local" programs result in the increased sustainable management of Maryland's agricultural lands. Increased production of local agricultural products increases the implementation of MDA approved best management practices on farmlands, which possess numerous inherent environmental benefits such as improved water quality, creation of wildlife habitat, and decreased soil nutrient consumption. In addition to energy savings and possible GHG reductions resulting from decreased transportation emissions, greater demand for local products preserves the agricultural landscape, supports agro-biodiversity, and encourages conservation practices.

## Economic Benefits, Job Creation and Job Protection

Programs that promote the sale of locally grown food products obviously help to maintain farming as an enterprise and provide income to sustain the agricultural community. A survey to assist in the compilation and measurement of direct sales data is being developed, and adoption of the Sticky Economic Evaluation Device, an online tool to assess the impact of farmers markets on the local economy, is under consideration. The economic benefits of this program are currently being evaluated.

Analyses for the economic benefits, job creation and job protection in Maryland from this program is included in Chapter 7 of this plan.

## 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.

## Supporting Laws and Regulations

- Because of ongoing confusion about the meaning of the terms "local" and "locally grown," the 2010 Maryland General Assembly gave MDA the authority to put parameters on the use of these terms in advertising. (House Bill 421 Advertising or Identifying Agricultural Products as Locally Grown)
- The Farm to School Program (Senate Bill 158 Farm-to-School Program - Activities and Promotional Events) was created during the 2008 session of the Maryland General Assembly to bring more Maryland-grown products to school lunches and help educate students about the sources of their food, how it is produced, and the benefits of a healthy diet.
- 2008 "Buy Local" Program.

## Links to Supporting Documentation

- MDA Marketing Department – assistance in the sale of Maryland products www.mda.state.md.us/md_products/md-products/php
- Maryland's Best - http://www.marylandsbest.net/
- U.S. Census – http://www.census.gov
- Iowa State University – Leopold Center for Sustainable Agriculture- http://www.leopold.iastate.edu/
- MDA - http://www.mda.state.md.us/
- Maryland's Best - http://www.marylandsbest.net/

# Ag and Forestry-10: 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 use 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

**By 2020, the potential emission reductions from this program are estimated to be 0.21 $MMtCO_2e$.**

### Figure C-70. Low and High GHG Benefits for Ag and Forestry-10

| | | |
|---|---|---|
| Low Estimate | 0.14 $MMtCO_2e$ | SAIC Quantification Appendix B, Pg. 166 |
| High Estimate | 0.21 $MMtCO_2e$ | MDE Quantification Below |

**High Estimate – MDE Quantification**

Based on analysis and calculations, the total annual estimated benefits of the nutrient trading program for GHG emission reductions is 0.213 $MMtCO_2e$ emissions in 2020 for the high estimate model.

*Assumptions*

- Target fertilizer reductions are assumed from agricultural use only.
- Initial target fertilizer reductions were assumed to be small, based on participation and amount of GHG credits available.
- In the baseline model, assumed 10 percent participation which equals 20 percent of policy target efficiency improvements from 2008-2020.
- In high estimate model, 20 percent participation was assumed which equals 40 percent of policy target efficiency improvements from 2008-2020.

- In the baseline model, 1507 metric tons of fertilizer was used as basis for target fertilizer reduction.
- In the high estimate model, 3014 metric tons of fertilizer was used as basis for target fertilizer reduction.

*Calculations*

Calculations for the high estimate (Figure C-71) are based upon an estimated 20 percent participation from point and non-point sources in a nutrient trading program resulting in estimated policy target efficiency improvements from 2008-2020 of 40 percent. Avoided GHG Emissions were calculated by multiplying target fertilizer reduction per given year by the $CO_2$-equivalent emission factor for GHG emissions from fertilizer and dividing that by 1,000,000 to get values in $MMtCO_2e$.

$CO_2$-equivalent Emission Factor for GHG Emissions from Fertilizer (nitrogen) = 0.778 tons $CO_2$-equivalent per ton Nitrogen

Avoided GHG Emissions = (Target Fertilizer Reduction × $CO_2$-equivalent Emission Factor for GHG Emissions from Fertilizer) ÷ 1,000,000 = $MMtCO_2e$

Where,

Target Fertilizer Reduction = annual reduction in fertilizers used based on percentage of policy target efficiency improvements.

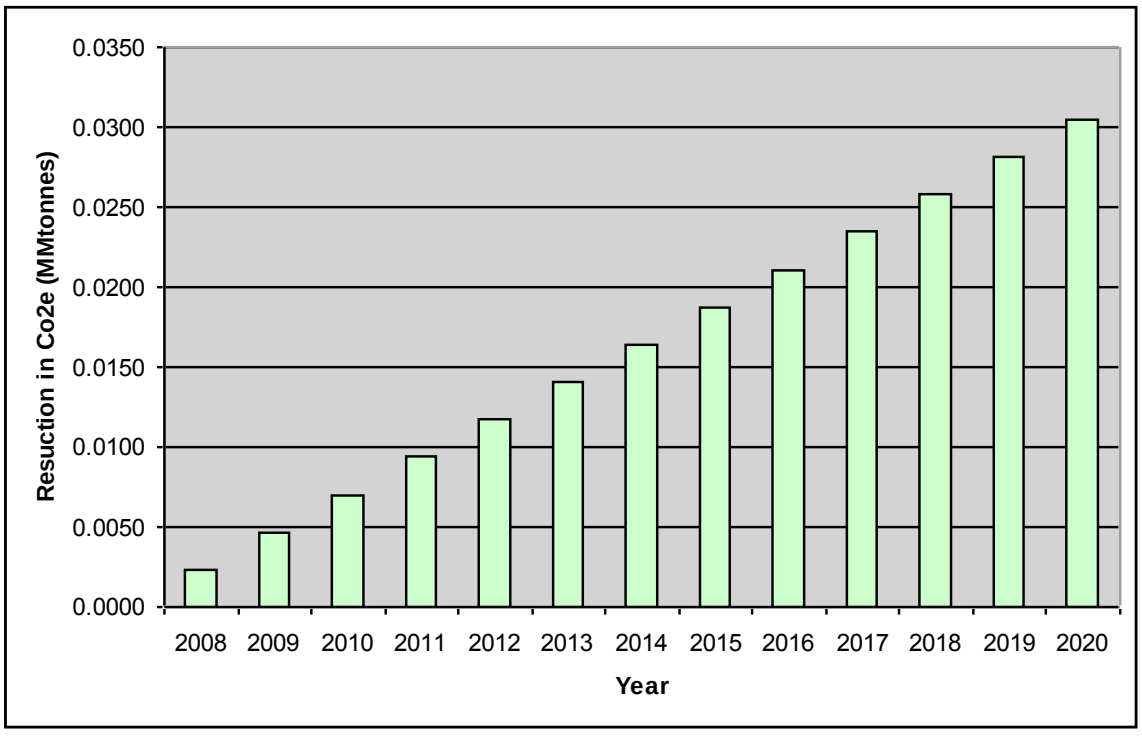
$CO_2$-equivalent Emission Factor for GHG Emissions from Fertilizer (nitrogen) = 0.778 tons $CO_2$-equivalent per ton of Nitrogen

**Figure C-71. – Fertilizer reduction and GHG benefits for high estimate**

| Year | Policy Target Efficiency Improvements (%) | Target Fertilizer Reduction (metric ton) | Avoided GHG Emissions (million metric ton) |
|---|---|---|---|
| 2008 | 4% | 3014 | 0.0023 |
| 2009 | 6% | 6028 | 0.0047 |
| 2010 | 10% | 9042 | 0.0070 |
| 2011 | 12% | 12056 | 0.0094 |
| 2012 | 16% | 15070 | 0.0117 |
| 2013 | 18% | 18084 | 0.0141 |
| 2014 | 22% | 21098 | 0.0164 |
| 2015 | 24% | 24112 | 0.0188 |
| 2016 | 28% | 27126 | 0.0211 |
| 2017 | 30% | 30140 | 0.0234 |
| 2018 | 34% | 33154 | 0.0258 |
| 2019 | 36% | 36168 | 0.0281 |
| 2020 | 40% | 39182 | 0.0305 |

Total Avoided GHG Emissions = 0.213 $MMtCO_2e$

**Figure C-72. Reductions in $CO_2$-equivalent per Year**



## Other Environmental Benefits

Nutrient trading encourages improved efficiency of fertilizer use and other nitrogen-based soil amendments through best management practices and advanced technologies. Advanced technologies, such as global positioning system technology and GreenSeeker, can help with precision application of nitrogen on crops.

Many of the best management practices that would be incentivized under the nutrient trading program would also result in significant GHG reductions, such as no-till and conservation tillage, improved irrigation management, conservation buffers, grassland plantings, green infrastructure, afforestation, reforestation, and restoration wetlands. There are a host of best management practices that would be accepted. Implementation of this program would also result in riparian buffer planting wetlands restoration.

Encouraging trades between nonpoint sources, such as agricultural operations, and point sources, such as wastewater treatment plants, industrial facilities, and development projects, would create new possibilities for GHG reductions while also improving water quality, reducing fertilizer use and soil erosion, restoring wetlands and wildlife habitat, and promoting SmartGrowth goals by preserving agricultural and forested lands. Agricultural producers may qualify, too, for voluntary early reduction credits under the provisions of the GGRA when those market options are clarified.

## Economic Benefits, Job Creation and Job Protection

Besides maintaining and creating jobs in the agricultural sector, the development of a public marketplace for nutrient and carbon trading creates new employment opportunities for individuals and companies offering services to support an emerging industry. While numbers are impossible to quantify at this point, the assessment and verification of credits, annual inspections, the design and installation of structures and systems, as well as the acquisition, management, and re-sale of credits, are expected to be sources of revenue for consultants, technical advisors, engineers, contractors, aggregators, and brokers. The estimated number of jobs that this program will create and protect is currently under evaluation.

Nutrient trading with carbon benefits is a means to provide private funding for the implementation of a wide variety of agronomic, land use, and structural practices. Just like the nutrient market upon which it will be based, carbon trading gives entities under regulatory requirements a potentially more cost-effective means to meet their obligations while offering farmers and landowners the opportunity to receive compensation and generate supplemental income for the adoption and maintenance of conservation practices. Since nutrient trading is only in its infancy and the carbon component has not yet been added, it is impossible at present to quantify the economic potential of these new markets. Also, the concept of markets for multiple ecosystem services is still relatively new and its promise is just beginning to be explored. The economic benefits of this program are currently being evaluated.

Analyses for the economic benefits, job creation and job protection in Maryland from this program is included in Chapter 7 of this plan.

## Implementation

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 Trading 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 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. These goals will serve as a model for basin-wide trading programs in other parts of the country.

## Supporting Laws and Regulations

- Maryland Nutrient Trading Program - http://www.mda.state.md.us/nutrad/
- Maryland Smart Growth Initiative http://www.mdp.state.md.us/OurWork/smartGrowth.shtml

House Bill 974 (*Nutrient Trading – Voluntary Agricultural Nutrient Credit Certification Program*), effective June 1, 2010, gives MDA the authority to implement a nutrient credit

trading program by verifying and certifying tradable agricultural credits, reviewing technical elements and approving those practices subject to additional procedures, and facilitating transactions between participating parties by reviewing contracts and establishing a web-based registry to post trades, track credits, and assist users in the management of their accounts.

GGRA contains specific clauses for 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 language in GGRA, offset credits would be generated by alternative compliance mechanisms executed within the State, including carbon sequestration projects. Among the policy actions incorporated in both the 2008 Climate Action Plan and the draft 2012 Plan is the charge to add or "stack" both carbon and enhanced nutrient credits onto the existing Maryland Nutrient Trading Program.

## Links to Supporting Documentation

- NutrientNet - http://www.nutrientnet.org/
- USDA National Resources Conservation Service - http://www.nrcs.usda.gov/
- University of Maryland Center for Integrative Environmental Research Report, "Multiple Ecosystem Markets in Maryland: Quantifying the Carbon Benefits Associated with Nutrient Trading," August 2010, www.cier.umd.edu/documents/Multiple_Ecosystem_Markets_MD.pdf
- Climate Action Reserve Agricultural Project Protocols Development Process, www.climateactionreserve.org.
- Technical Working Group on Agricultural Greenhouse Gases (T-AGG) Reports, "Assessing Greenhouse Gas Mitigation Opportunities and Implementation Options for Agricultural Land Management in the United States" and "Greenhouse Gas Mitigation Potential of Agricultural Land Management in the United States" www.nicholas.duke.edu/institute/t-agg
- Carbon Markets: Expanding Opportunities/Valuing Co-Benefits, Workshop organized by the National Wildlife Federation and the Soil and Water Conservation Society, July 21, 2010, St. Louis Missouri - www.swcs.org/carbonworkshop
- Maryland Nutrient Trading Program - http://www.mdnutrienttrading.org
- MDA - http://www.mda.state.md.us/
- World Resources Institute - http://www.wri.org/

# Sub-Appendix C-4: Recycling Programs

## Recycling-1: Recycling and Source Reduction

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.

MDE strives to reduce the amount of waste generated (waste generated is 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 main waste generation goal is to maintain a maximum 1.36 tons per person per year waste generation by increasing the source reduction credit rate achieved from 3.55 percent in 2006 to 3.98 percent in 2012 to 4.20 percent in 2015 and 4.56 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 3.75 percent by 2012, 7.22 percent by 2015, and 13.81 percent by 2020. MDE also works to increase the recycling rate achieved from 41.16 percent in 2006 to 47.16 percent in 2012 to 50.16 percent in 2015 to 55.17 percent in 2020.

This program will reduce the volume of waste from residential, commercial, and government sectors through programs that reduce the generation of wastes, expand recycling and upcycling (adding value to the re-manufactured product), and enhance reuse of product components and manufacturers' lifetime product responsibility. Increased recycling and reduced waste disposal would limit GHG emissions at landfills as well as in upstream production (*i.e.*, energy used to extract and process raw materials and produce value-added commodities). This program will result in reduced landfill methane emissions by reducing and recycling the biodegradable fraction of landfill waste.

Without additional enabling legislation, MDE will not have the authority to require additional recycling or waste reduction activities by local or State agencies or the business sector.

## Estimated Greenhouse Gas (GHG) Emission Reductions

**By 2020, the potential emission reductions from this program are estimated to be 2.32 MMtCO$_2$e.**

**Figure C-73. Low and High GHG Benefits for Recycling-1**

| | | |
|---|---|---|
| Low Estimate | 2.00 MMtCO$_2$e | MDE Quantification Below |
| High Estimate | 2.32 MMtCO$_2$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$_2$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-74. Per Ton Energy Use (British Thermal Unit (BTU)^)**

| 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 ** |

^ 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 ÷ 0.5) cubic yards of landfill space saved by recycling and composting in 2009.

## Economic Benefits, Job Creation and Job Protection

According to The Impact of Recycling on Jobs in North Carolina report, recycling is a job creator, creating 100 new jobs for every 13 lost in the solid waste disposal or virgin material extraction industries.

RRR Technologies reports that incinerating 10,000 tons of plastic waste creates 1 job, landfilling the same amount creates 6 jobs, while recycling the same 10,000 tons creates 36 jobs.

According to the 2001 U.S. Recycling Economic Information Study Prepared for The National Recycling Coalition by R. W. Beck, the recycling and reuse industry consists of

approximately 56,000 establishments that employ over 1.1 million people, generate an annual payroll of nearly $37 billion, and gross over $236 billion in annual revenues.

Additionally, local recycling and reuse activities spur "downstream" economic impacts. The impact of recycling also adds jobs to recycling support industries, such as accounting firms and office supply companies. Including these support industries, a total of 1.4 million jobs are supported by the recycling and reuse industry. These jobs have a payroll of $52 billion and produce $173 billion in receipts.

Spending by employees of the recycling and reuse industry also contributes indirectly and adds another 1.5 million jobs with a payroll of $41 billion and produces receipts of $146 billion. In 1997, the recycling and reuse industry also generated roughly $12.9 billion in federal, State, and local tax revenues, with 80 percent going to federal and State government.

Additional studies would be needed to determine what jobs and economic benefits may be created or saved in Maryland as a result of increased recycling and source reduction activities.

Further analyses for the economic benefits, job creation and job protection in Maryland from this program is included in Chapter 7 of this plan.

## Implementation

- State government is required to reduce by recycling the amount of the solid waste stream generated for disposal by at least 20 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 10 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.
- 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 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.

- 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 in Product Stewardship and 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 scrap cars and trucks 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.
- Each county recycling plan must address the collection, processing, marketing, and disposition of recyclable materials from county public schools.
- 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 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.

## Supporting Laws and Regulations

- Jurisdictions with populations greater than 150,000 are required to recycle 20 percent or more of their waste and jurisdictions with populations less than 150,000 are required to recycle 15 percent or more of their waste. In no case is the recycling rate to be less than 10 percent.
- State government must reduce by recycling the amount of the solid waste stream generated for disposal by at least 20 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 10 percent.
- Telephone directories distributed in the State must have a recycled content, by weight, of 40 percent.
- Newsprint distributed in the State must have a 3-year rolling average recycled content, by weight, of 40 percent.
- Scrap tires are banned from disposal in a landfill.
- Private natural wood waste recycling facilities must be permitted.
- Counties must address the feasibility of composting mixed solid waste when developing their 10-year solid waste management plans.
- Separately collected yard waste is banned from disposal at solid waste acceptance facilities.
- Mercuric oxide battery manufacturers are responsible for the collection, transportation, and recycling or disposal of these batteries sold or offered for promotional purposes in the State.
- State law requires a program or system for the collection, recycling, or disposal of each cell, rechargeable battery or rechargeable product sold in the State.
- The State has a voluntary, Statewide waste diversion goal of 40 percent, consisting of a 35 percent Maryland Recycling Act recycling rate plus up to 5 percent credit for source reduction activities.
- Electronics manufacturers of an average of more than 1,000 computers and video display devices in the previous three years who sell or offer for sale their product in Maryland must register and pay a fee to MDE. Fees may be used to provide grants to counties and municipalities for computer and video display device recycling activities.
- Electronics manufacturers are encouraged to implement takeback programs for reuse and recycling of electronic products.
- Motor vehicle manufacturers are required to develop and submit to MDE a mercury minimization plan that includes information on mercury switch removal from motor vehicles.
- A county's recycling plan is required to address the collection, processing, marketing, and disposition of recyclable materials from county public schools; a county is required to submit a revised recycling plan to MDE.
- Composting in the calculation of the recycling rate (1992).
- The sale of mercury thermostats and mercury thermometers has been prohibited in Maryland.

## Links to Supporting Documentation

- Conservatree.com - www.conservatree.com
- eNotes.com - www.enotes.com/science-fact-finder/environment/what-natural-resources-saved-by-recycling-one-ton, Gale Book of Averages, p. 428
- EPA Waste Reduction Model (WARM) www.epa.gov/climatechange/wycd/waste/calculators/Warm_home.html
- EPA Measuring Recycling: A Guide for State and Local Governments www.epa.gov/wastes/conserve/tools/recmeas/docs/guide.pdf
- The Impact of Recycling on Jobs in North Carolina

www.p2pays.org/ref/01/00366.pdf
- RRR Technologies - http://rrrtech.netfirms.com/facts.html
- US Recycling Economic Information Project www.epa.gov/epawaste/conserve/rrr/rmd/rei-rw/index.htm
- Maryland Department of the Environment - www.mde.state.md.us/recycling
- University of Massachusetts Amherst, Reynolds Metal Company www.umass.edu/recycle/recycling_benefits.shtml

# Sub-Appendix C-5: Multi-Sector Programs

## Multi-Sector-1: GHG Emissions Inventory Development

Lead Agency: MDE

### Program Description

As a starting point for developing a plan to reduce GHG emissions, Maryland must first become aware of what its total GHG emissions are as of a starting date and from where the emissions come. The State needs to identify all sources that emit GHGs and determine the total annual amount of GHG emissions. GGRA chose 2006 as a base year for Maryland's process, and as the year for the first inventory. It requires Maryland to include GHG emissions from electricity consumed by its citizens in the 2006 baseline. This is appropriate since historically 30 percent of electricity consumed by Marylanders is generated in a neighboring State. The baseline inventory is important in the GHG reduction planning process, since it will identify the percentages by which sectors, such as electricity generation and transportation, contribute to Maryland's GHG emissions profile. In addition to identifying Maryland's GHG sources, MDE will include a 2006 assessment of Maryland's forests for carbon confinement and a 2020 forecast based on forest land loss or gain.

On June 1, 2011, MDE published an inventory of Statewide GHG emissions for calendar year 2006 and, based on 2005 GHG control measures, a projected "business as usual" inventory for calendar year 2020. The 2020 projection includes all GHG emissions control measures implemented in Maryland prior to 2006. MDE must review and publish an updated Statewide GHG emissions inventory for calendar year 2011, and again every third calendar year thereafter. Impacts of GHG reduction programs implemented after 2006 will show up in the 2011 calendar year inventory.

The Center for Climate Strategies provided critical technical support and planning activities for the Department during the commission process. Specifically, the Center for Climate Strategies developed a comprehensive top-down 2006 GHG inventory and 2020 forecast for Maryland's GHG emissions. This is included in Appendix B of the 2008 Climate Action Plan.

In addition, the emission inventory created by the Center for Climate Strategies was a "top-down" inventory, meaning much of the data was based on national averages and not Maryland-specific data. This should not minimize the original inventory in any way, but it should not be considered a compliance level inventory. The process for creating a

consumption-based emission inventory is complex and new to Maryland. Between many of the implemented mitigation programs, there is overlap for the projected emission reductions. Though the Center for Climate Strategies performed an analysis to minimize GHG reduction overlap between policies in the 2008 Climate Action Plan, the lack of transparency of this review has added to the uncertainty of the final emission reduction estimates.

Prior to the release of the 2008 Climate Action Plan, the Maryland Commission on Climate Change discussed the uncertainty issues and expressed concerns over the clarity of the emission reduction calculations. The Center for Climate Strategies' technical team, which conducted the overlap analysis, evaluated different approaches for communicating this uncertainty. After lengthy discussion, the technical team concluded that an explicit, quantitative estimate of the uncertainty was beyond the scope of the effort in 2008; however, there was an agreement by the Maryland Commission on Climate Change to communicate the uncertainty associated with the aggregated reductions (of all mitigation strategies) using a range. The range uses 80 percent of the estimate for the lower bound and 100 percent for the upper bound.

While a "top-down" inventory was developed for the 2008 Climate Action Plan, GGRA requires that a more State-specific "bottom-up" inventory be used to develop the 2006 inventory and 2020 forecast. MDE created a consumption-based, "bottom-up" inventory specific to Maryland's source based emissions. MDE incorporated the technical work from the 2008 Climate Action Plan as a starting point in its development of a bottom-up inventory required by GGRA.

## Estimated GHG Emission Reductions in 2020

Although no emissions reductions can be attributed directly to this program, development of a Statewide inventory and forecast will allow for a more thorough refinement and development of existing and future programs, potentially increasing their total reductions.

## Other Environmental Benefits

Developing an inventory and forecast for Maryland will help direct focus on reducing GHG emissions and other harmful environmental substances within Maryland. Areas subject to greater emissions can be labeled as priority areas and measures such as improving water quality, forest health, and restricting development can be taken to help improve the overall environmental health of the area.

## Economic Benefits, Job Creation and Job Protection

Analyses for the economic benefits, job creation and job protection in Maryland from this program is included in Chapter 7 of this plan.

## Implementation

The Center for Climate Strategies developed a top-down 2006 GHG inventory and forecast for Maryland's GHG emissions and MDE has finalized a consumption-based, "bottom-up" inventory specific to Maryland's source based emissions. MDE incorporated the technical work from the 2008 Climate Action Plan as a starting point in its development of a bottom-up inventory required under GGRA.

On June 1, 2011, MDE published an inventory of Statewide GHG emissions for calendar year 2006 and, based on 2005 GHG control measures, a projected "business as usual" inventory for calendar year 2020. This 2020 projection will include all GHG emissions control measures implemented in Maryland prior to 2006.

## Supporting Laws and Regulations

- Greenhouse Gas Emissions Reduction Act of 2009
  http://mlis.state.md.us/2009rs/bills/sb/sb0278e.pdf

## Links to Supporting Documentation

- 2008 Climate Action Plan - http://www.mdclimatechange.us/
- Center for Climate Strategies 2006 Maryland Inventory and Forecast
  http://www.mdclimatechange.us/ewebeditpro/items/O40F14745.pdf

# Multi-Sector-2: Program Analysis, Goals and Overall Implementation

Lead Agency: MDE

## Program Description

Relative to its size, Maryland has a large and growing carbon footprint. Maryland GHG emissions have increased by about 18 percent since 1990, a faster rate of growth than the U.S. as a whole.[150] Per capita GHG emissions by Maryland citizens also grew between 1990 and 2005, a period when per capita GHG emissions for the U.S. as a whole decreased. This program identified the need for Statewide goals and targets to address Maryland's growth in GHG emissions.

On April 20, 2007 Governor O'Malley signed an Executive Order that established the Maryland Commission on Climate Change. The Executive Order directed the Maryland Commission on Climate Change to appoint members representing diverse stakeholder

[150] MDE. "PLAN FOR REDUCING MARYLAND'S GREENHOUSE GAS EMISSIONS BY 25% BY 2020. April 2010. http://www.statestat.maryland.gov/GDU/11ClimateDeliveryPlan.pdf

interests to develop GHG emissions reduction Statewide goals and targets. The members made recommendations based on the findings of the Intergovernmental Panel on Climate Change.

According to these international findings, industrialized societies must achieve certain GHG emissions reduction targets if global concentrations of GHGs are to remain below the 450 parts per million threshold. The Intergovernmental Panel on Climate Change found that industrialized nations should achieve rapid reductions of between 25 percent to 40 percent below 2000 levels by 2020, and 80 percent to 95 percent below 2000 levels by 2050 to avoid the most dangerous anthropogenic changes to the earth's climate.[151]

Through a science-based, consensus-building stakeholder process, the Statewide goals and targets were developed for consideration by the Maryland Commission on Climate Change, which were then recommended in its 2007 Interim Report and included as a core element of the 2008 Climate Action Plan.[152] The Maryland Commission on Climate change suggested the following goals for Maryland: (1) 25 percent to 50 percent below 2006 levels by 2020, 25 percent being a minimum, regulatory driver and 50 percent an aspirational goal to reward deeper, market-based cuts; (2) 90 percent below 2006 levels by 2050, a non-regulatory goal to drive climate neutral technology innovations; (3) interim targets of 10 percent reductions by 2012 and 15 percent by 2015 to spur early actions; and (4) a science-based review of the goals every four years. Maryland then adopted the 2020 GHG emissions reduction goal as part of the GGRA.

## Estimated GHG Emissions Reductions in 2020

Although no emissions reductions can be attributed directly to the development of this program, passage of a legislative goal to reduce Statewide GHG emissions will ensure that climate change programs will be developed and implemented.

## Other Environmental Benefits

GHG reduction programs in Maryland have many benefits. From managing forests to nutrient trading, these programs reduce air and water pollutants in addition to GHGs. Managing forests for enhanced carbon sequestration promotes forest health, increases water quality and reduces soil erosion. Transit-oriented development programs reduce air pollution, highway congestion and public expenditures driven by sprawl. Agricultural nutrient trading programs protect the Chesapeake Bay by reducing nitrogen and phosphorus loads from fertilizer run-off.

[151] MDE. "Climate Action Plan Interim Report to the Governor and the Maryland General Assembly." January 14, 2008. http://www.mdclimatechange.us/ewebeditpro/items/O40F14798.pdf
[152] Ibid.

## Implementation

Under the Maryland Commission on Climate Change, the Statewide goals were designed to reduce Maryland's GHG emissions by 25 percent to 50 percent below 2006 levels by 2020 and 90 percent below 2006 levels by 2050. The goals include interim reduction targets of 10 percent reductions by 2012 and 15 percent reductions by 2015, again using the 2006 baseline. The quantified policy options in the 2008 Climate Action Plan are projected to achieve these levels of reductions.[153] The first update report to be issued to the public to summarize Maryland's programs and progress in meeting Statewide goals and targets occurred in January of 2010.[154]

In 2009, GGRA was signed into law officially establishing a GHG emissions reduction Statewide goal of 25 percent by 2020, from a 2006 baseline. Since then, MDE has led numerous stakeholder and interagency meetings. Currently, MDE, under direction by GGRA, is developing a draft plan for submission to the General Assembly and Governor on or before December 31, 2011. MDE is also evaluating early action options and drafting regulations to provide credits for voluntary early actions, if appropriate.

One of the key challenges facing Maryland and other states is the lack of clear federal climate change goals, policies, and programs. The enactment of the Federal Energy Independence and Security Act of 2007 provided some national direction on auto mileage; however, energy efficiency facets of climate change are still waiting for federal policy to become more apparent. In the meantime, Maryland's participation in important regional ventures such as RGGI offers the State the clear opportunity to help develop regional and collaborative initiatives that will have broader applicability than just within Maryland borders. The State has begun to implement a number of activities recognized in the Lead-by-Example program and will need to build on these efforts, taking such initiatives to the next level. Additionally, the State must continue to organize efforts across State agency boundaries in order to realize some of the reductions anticipated from State government. While the aggregated policy recommendations in the 2008 Climate Action Plan were projected to result in a net cost savings to Maryland, implementation of some of the individual policies may entail additional costs to State government that the State will need to determine how to finance. Determining how to finance implementation in the 2012 Plan will remain an ongoing challenge.

While Maryland has already participated in important regional ventures such as RGGI, there are many initiatives still to be implemented. This program provides Maryland with Statewide goals and targets necessary to do its part in avoiding the International Panel on Climate Change's predicted forecasts. Specific targets for reduction by 2012 and 2015 are essential to provide a framework for Maryland's reduction efforts.

[153] Ibid.
[154] Ibid.

## Supporting Laws and Regulations

- Maryland Greenhouse Gas Emissions Reduction Act of 2009

## Supporting Links

- Executive Order 01.01.2007.07 http://www.gov.state.md.us/executiveorders/01.07.07ClimateChange.pdf
- Maryland Commission on Climate Change http://www.mdclimatechange.us/

# Multi-Sector-3: 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

**By 2020, the potential emission reductions from this program are estimated to be 0.05 $MMtCO_2e$.**

**Figure C-75. Low and High GHG Benefits for Multi-Sector-3**

| | | |
|---|---|---|
| Low Estimate | 0.00 $MMtCO_2e$ | MDE Quantification Below |
| High Estimate | 0.05 $MMtCO_2e$ | MDE Quantification Below |

**Low and High 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 $MMtCO_2e$ reduction is calculated to illustrate GHG reductions potential as participation in the programs increase.

**Figure C-76. High Range GHG Benefits ($MMtCO_2e$)**

| 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-77. Middle Range GHG Reductions ($MMtCO_2e$)**

| 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 $MMtCO_2e$ emissions avoided.

**Figure C-78. Bike to Work Benefits**

| Year | People | GHG emissions avoided (pounds) | GHG emissions avoided (Metric Tons) | GHG emissions avoided ($MMtCO_2e$) |
|---|---|---|---|---|
| 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 |

## Other Environmental Benefits

No other environmental benefits were identified for this version of the draft 2012 GGRA Plan but will be included in future iterations.

## Economic Benefits, Job Creation and Job Protection

Analyses for the economic benefits, job creation and job protection in Maryland from this program is included in Chapter 7 of this plan.

## 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.[155] 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

[155] National Science Foundation award information available at: http://www.nsf.gov/awardsearch/showAward.do?AwardNumber=1043262.

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 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,[156] 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 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

[156] Curriculum information available: http://www.marylandpublicschools.org/MSDE/programs/environment/?WBCMODE=PresentationUnpubli%25%3E%25

climate on you and society and your influence on climate".[157] Moreover, a climatically literate person:

- 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/.

## Links to Supporting Documentation

- National Science Foundation award information available at: http://www.nsf.gov/awardsearch/showAward.do?AwardNumber=1043262
- The Governor's Regional Environmental Education Network forum is available online: http://mdinformee.ning.com
- Maryland State Department of Education's Environmental Education curriculum information available: http://www.marylandpublicschools.org/MSDE/programs/environment/?WBCMODE=PresentationUnpubli%25%3E%25

[157] Climate Literacy: Essential Principles and Fundamental Concepts, 2007, NOAA, AAAS Project 2061.

# Sub-Appendix C-6: Buildings Programs

## Buildings-1: Green Buildings

Lead Agency: DGS

### Program Description

The Maryland Green Building Council (the Council) was authorized in June 2007, and is designed to evaluate current high performance building technologies. The Maryland Green Building Council provides recommendations for cost-effective green building technologies the State could require in the construction of State facilities and, additionally, compiles a list of building categories in which green building technologies should not be used. DGS is the lead State agency for the Maryland Green Building Council.

Each year the Maryland Green Building Council releases an annual report which recommends an implementation plan for a State higher performance building program. In 2007 Maryland passed the High Performance Building Act which established green building requirements and identified the LEED, designed by the U.S. Green Building Council, as the certification option. LEED is an internationally recognized green building certification system, providing third-party verification that a building or community was designed and built using strategies intended to improve performance in metrics such as energy savings, water efficiency, carbon dioxide emissions reduction, improved indoor environmental quality, and stewardship of resources and sensitivity to their impacts. The High Performance Building Act of 2007, which requires certain building renovation projects or new schools receiving State public school construction funds to comply with high performance building standards. Under this law, the State is required to pay a certain amount of local costs related to the construction of schools that qualify as high performance buildings.

DGS is lead agency to implement Maryland's green building program and upgrade existing State government buildings to increase energy efficiency and reduce energy consumption. Buildings are significant consumers of energy and other resources. In addition to reducing regional GHG emissions, green buildings can reduce waste output and water usage. DGS ensures State government buildings receiving upgrades/retrofits to lighting systems, water source heat pump replacements, building envelope infiltration reductions, window replacements, steam traps, occupancy controls, and automated energy management systems meet the High Performance Building standards.

By the end of 2011, DGS hopes to develop and publish environmental footprints for all State government agencies.

### Estimated GHG Emission Reductions in 2020

This program references a specific Governor's Initiative and the quantification of potential GHG reductions is aggregated in the quantification of Innovative Initiatives-5: State of Maryland Initiative to Lead by Example.

## Other Environmental Benefits

Increasing energy efficiency in Maryland State government's facilities operations and purchasing practices reduces the need for power generation from fossil fuel sources. In addition to reducing GHG emissions, this will create reductions in nitrogen dioxide, sulfur dioxide and mercury.

- Nitrogen dioxide emission reductions will help Maryland meet air quality standards for ground level ozone and fine particulate matter. The reductions will also significantly help Maryland reduce nitrogen pollution in the Chesapeake Bay.
- Sulfur dioxide emission reductions will help Maryland further reduce fine particulates and also help achieve the visibility improvements required to comply with federal regional haze requirements.
- Mercury, a toxic pollutant, is primarily released by air pollution sources but ultimately affects water quality and bioaccumulates in fish tissue. Mercury reductions will help improve water quality in Maryland.

## Economic Benefits, Job Creation and Job Protection

Analyses for the economic benefits, job creation and job protection in Maryland from this program is included in Chapter 7 of this plan.

## Implementation

The Maryland Green Building Council continues to pursue projects qualified to be designed as High Performance Green Buildings. This includes State capital projects, such as renovations to the Low House of Delegates Building in Annapolis and educational facilities such as the new School of Business Complex proposed by Morgan State University. A complete list of all projects involved with the High Performance Green Building program can be found in the Green Building Council's 2010 annual report:
http://www.msa.md.gov/megafile/msa/speccol/sc5300/sc5339/000113/013000/013268/unrestricted/20110086e.pdf

## Supporting Laws and Regulations

- Energy Independence and Security Act of 2007 Title III (Appliance and Lighting Efficiency) and Title IV (Energy Savings in Building and Industry)
- Smart, Green, and Growing - The Sustainable Communities Act of 2010 (House Bill 475)
- Greywater Recycling (House Bill 224)

- Green Building Council (House Bill154/Senate Bill 212)
- Maryland's Greenhouse Gas Emissions Reduction Act of 2009
- Baltimore City Building Code, Chapter 37 establishes a green building program
- High Performance Buildings Act of 2008 (Senate Bill 208) http://mlis.state.md.us/2008rs/bills/sb/sb0208t.pdf
- High Performance Buildings Act - Applicable to Community College Capital Projects (Senate Bill 234/House Bill 1044)

## Links to Supporting Documentation

- US Green Building Council Maryland Chapter - http://usgbcmd.org/
- Maryland Green Building Council.- http://www.dgs.maryland.gov/reports/index.html

# Buildings-2: Building and Trade Codes in Maryland

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.[158] 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. Except for energy conservation standards, DHCD may not adopt provisions that are more stringent than what is contained in either international code.

[158] Annotated Code of Maryland, Public Safety, Title §12–503 Maryland Building Performance Standards.

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

**By 2020, the potential emission reductions from this program are estimated to be 5.40 MMt$CO_2$e.**

**Figure C-79. Low and High GHG Benefits for Buildings-2**

| | | |
|---|---|---|
| Low Estimate | 2.40 MMt$CO_2$e | 2008 Climate Action Plan, Appendix D,[159] pg. 170 of 341 |
| High Estimate | 5.40 MMt$CO_2$e | SAIC Quantification Appendix B, Pg. 31 |

## Other Environmental Benefits

DHCD held public stakeholder event(s) to solicit input on enhanced building codes, particularly for coastal communities subject to flooding and sea-level rise. Information was published in a report to the Governor and General Assembly. The report is entitled: "A Review of Current Statewide Building Codes and Recommendations for Enhancement in Coastal Regions of Maryland," dated October 2010 and available on DHCD Web site

## Economic Benefits, Job Creation and Job Protection

The job creation and protection analysis is under development and is expected to be completed by May 2011. DHCD will continue to provide training on the new version of the Maryland Building Performance Standards to local jurisdictions, architects, engineers, green building professionals, and other stakeholders.

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http://www.mde.state.md.us/programs/Air/ClimateChange/Documents/www.mde.state.md.us/assets/document/Air/ClimateChange/Appendix_D_Mitigation.pdf

The regional economic analysis is underway and expected to be completed by May 2011. DHCD will continue to identify opportunities to improve and expand training on building codes, especially those that will continue to be developed relating to energy efficiency and other green building standards.

Analyses for the economic benefits, job creation and job protection in Maryland from this program is included in Chapter 7 of this plan.

## 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.

## Supporting Laws and Regulations

- Energy Independence and Security Act of 2007 Title III (Appliance and Lighting Efficiency) and Title IV (Energy Savings in Building and Industry).
- The Sustainable Communities Act of 2010 (House Bill 475)
- The Green Building Council (House Bill 154/Senate Bill 212)
- Baltimore City Building Code, Chapter 37 establishes a green building program
- Maryland's Greenhouse Gas Emissions Reduction Act of 2009

### Suggested Laws and Regulations

Funding for DHCD training programs to ensure that suitable training remains available Statewide to local code authorities and other stakeholders.

## Links to Supporting Documentation

- Building codes training is offered Statewide. http://www.dhcd.state.md.us/Website/SmartCodes/SmartCodesTrainings.aspx
- DHCD published in October of 2010 "A Report to the Governor and the Maryland General Assembly: A Review of Current Statewide Building Codes and Recommendations for Enhancement in Coastal Regions of Maryland." http://www.dhcd.state.md.us/Website/About/PublicInfo/Publications/Default.aspx
- Maryland General Assembly – 2010 legislation: http://mlis.state.md.us/

# Sub-Appendix C-7: Land Use Programs

## Land Use-1: Reducing GHG Emissions from the Transportation Sector through Land Use and Location Efficiency

Lead Agency: MDP

### Program Description

MDP will work with sister agencies and the Sustainable Growth Commission to reduce Marylanders' dependence on motor vehicle travel, especially single-occupant vehicles, by developing incentives and requirements for development projects and regional land use patterns that achieve land use and location efficiency with regard to transportation. Specifically, development projects and regional land use patterns will result in shorter trip lengths, less need for automobile and truck travel, and greater use of alternative transportation modes to reach employment, shopping, recreation, education, religious and commercial destinations. The purpose is to reduce VMT and the use of fossil fuels, which generate GHGs.

Smart growth, which includes redevelopment and infill, growth in designated areas, and rural conservation zoning, results in compact development. This development pattern, together with land use/location efficiency, results in shorter trip lengths, less need for automobile and truck travel, and greater use, makes the establishment and use of alternative transportation modes much more likely. Why? When trip lengths are shorter between origins and destinations (e.g., homes and shopping), people are more willing to walk, bike, or make use of bus, transit and rail options. In addition, smart growth results in a greater number of people within a smaller area, which means more customers for alternative transportation networks, making financing of such systems more feasible.

To achieve land use and location efficiency, smart growth efforts must always focus on reducing the need for motor vehicle travel. A compact development of homes located far away from jobs and alternative transportation systems still results in a high amount of VMTs and fuel use. To maximize land use and location efficiency, development projects and regional land use patterns should also have additional characteristics:

- Proximity between homes and jobs, which often means affordable housing options near jobs. Example: Miller's Court, Baltimore City: http://www.millerscourt.com/
- Mixed-use development, which decreases distances between origins and destinations. Example: Easton Market Square, Easton. http://www.talbotcountymd.gov/index.php?page=Town_of_Easton
- Transit-oriented development, which increases the accessibility of alternative transportation modes to residents, and the accessibility of shopping and other destinations to commuters. Example: Wheaton Metrorail Station, Wheaton -

http://www.wmata.com/business/joint_development_opportunities/tod/project.cfm?I=20

- Availability of more than one transportation option
- Centrally located public facilities including schools, libraries and parks
- Greenway/trail linkages connecting neighborhoods and activity centers
- Fewer development centers in more compact settings along a corridor, which results in quicker travel for those living along the route

Despite the increase in use of more fuel-efficient vehicles and lower carbon-based fuels, transportation GHG emissions are forecasted to grow over the long-term as population continues to grow in Maryland. From 1990 to 2009, VMT and transportation GHG emissions increased by 37 percent, while population only increased by 19 percent.[160] The trend of VMT outpacing population growth is expected to continue through 2030.

Between 2009 and 2030, VMT is expected to increase by 42 percent while population is expected to grow by 19 percent.[161] This development trend is primarily the result of dispersed land use patterns in Maryland, which have sprawled over the past five decades.

The only method to ensure a reduction in overall transportation emissions over time is to sharply reduce the rate of growth in VMT, which will require a significant adjustment of land use patterns away from automobile-oriented development.[162] County and municipal governments in Maryland use their land use planning and zoning authority to meet community needs.

The role of MDP and other State agencies is to ensure that State-level programs, procedures and funds are constructed and used to support development projects and regional land use patterns that support the land use and location efficiency program. Two significant initiatives that will inform State-level program effort include:

- **Maryland Sustainable Growth Commission.** The Maryland Sustainable Growth Commission was established by Senate Bill 278 from the 2010 session. The bill transformed the 2007-2010's Task Force on the Future for Growth and Development into a permanent commission to advise on growth and development issues in the State.
- **PlanMaryland.** MDP is working with other State agencies, local governments and stakeholders to develop PlanMaryland. PlanMaryland is the State's first comprehensive plan for sustainable growth and development. The Maryland legislature created the authority for such a plan in the 1970s, but a broader recognition of the many costs of unsustainable growth and development patterns in many parts of the State have grown in recent years. This new Statewide planning process commenced with listening sessions held by MDP in 2008 and will culminate with a draft plan in 2011. PlanMaryland will include

[160] MDP. Transportation Planning. http://www.mdp.state md.us/OurWork/transportationPlanning.shtml
[161] Ibid.
[162] Ewing, Reid, Bartholomew, Keith, etc. "Growing Cooler – The Evidence on Urban Development and Climate Change." The Urban Land Institute. October, 2007.

recommendations for additional programs and policies, many in support of this program.

## Estimated GHG Emission Reductions in 2020

**By 2020, the potential emission reductions from this program are estimated to be 1.01 MMt$CO_2$e.**

**Figure C-80. Low and High GHG Benefits for Land Use-1**

| | | |
|---|---|---|
| Low Estimate | 0.96 MMt$CO_2$e | MDP Quantification below |
| High Estimate | 1.01 MMt$CO_2$e | MDP Quantification below |

**Low and High Estimate – MDP Quantification**

Estimated GHG Reductions

The estimated GHG emission reductions for the Land Use programs assumes that as a result of Land Use-1, Land Use-2, Land Use-3, and Land Use-4, 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 sub-goals:

- 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)

In addition to reducing GHG emissions, achieving this goal will help Maryland implement Senate Bill 276, one of the Smart, Green and Growing bills passed in the 2009 Maryland legislative session, which sets a Statewide land use goal of increasing the current percentage of growth in Priority Funding Areas and decreasing the current percentage of growth outside of these areas.

MDP felt most comfortable with a 5 percent margin of error to obtain an upper range for the TLU-2 GHG emission reduction estimate.

The reason is that an increase of 5 percent is roughly equivalent to the GHG reductions achieved from 80 percent compact development in 2020, which the MDP feels is very optimistic (and beyond our 75 percent compact development in 2020 goal).

So overall, the range of GHG emission reductions from the Land Use programs would be 0.96 – 1.01 MMt$CO_2$e.

## Other Environmental Benefits

Reducing our dependence on automobiles for transportation will lead to emissions reduction of nitrogen oxides, sulfur oxides, particulate matter and mercury. Nitrogen oxides contribute to airborne deposition of nitrogen within the Chesapeake Bay watershed.[163] In addition, the development patterns that support land use and location efficiency prevent nutrient and sediment pollution to our water bodies by limiting new septic tanks and stormwater runoff, and protect our forests and other green infrastructure by limiting land consumption.

## Economic Benefits, Job Creation and Job Protection

There is a potential for significant regional job creation and economic benefits from reducing GHG emissions in the transportation sector. American Recovery and Reinvestment Act investments in public transportation created almost twice as many jobs per billion dollars invested as highway projects – 16,419 vs. 8,781 job-months. Often, pedestrian and bicycle facility improvement projects create more jobs than road construction and repair projects. A study of eleven cities nationwide shows that for each $1 million spent, the bicycle and pedestrian projects create an average of 8.4 to 11.4 jobs within the State where the project is located while roadway projects create 7.8 jobs. Political Economy Research Institute, University of Massachusetts, Amherst, June 2011, Heidi Garrett-Peltier: "Pedestrian and Bicycle Infrastructure: A National Study of Employment Impacts."
http://www.peri.umass.edu/fileadmin/pdf/published_study/PERI_ABikes_June2011.pdf

Analyses for the economic benefits, job creation and job protection in Maryland from this program is included in Chapter 7 of this plan. The jobs and economic benefits will be a combination of two other programs in this plan: Transportation-6: Initiatives to Double Transit Ridership by 2020; and Transportation-3: GHG Benefits from Smart Growth.

## Implementation

MDP and sister agencies will make use of existing programs and policies as well as several new programs and policies enacted by Governor O'Malley and the General Assembly. Some examples include the Sustainable Communities Act of 2010, transit-oriented development efforts, and improvement of sidewalks, bikeways and other alternative transportation programs.

MDP will work with other State agencies to implement new or modified programs and policies recommended by PlanMaryland and the Sustainable Growth Commission on the reduction of transportation emissions through sustainable development and land use/location efficiency.

[163] See http://www.chesapeakebay net/airdeposition.aspx?menuitem=14746 for more information on airborne deposition impacts to the Chesapeake Bay.

MDP along with other State agencies will investigate the feasibility in Maryland of implementing Rule 9510 of the San Joaquin Valley Air Pollution Control District - http://www.valleyair.org/ISR/Documents/ISR%20FAQs%201-22-08.pdf. This rule would require mitigation for the growth in air emissions, which encourages strategies to reduce the growth in those emissions, such as locating new development near transit stations or incorporating pedestrian-friendly design.

MDP and sister agencies will carry out a VMT Fee Pilot Project Study in Maryland. The study will examine the use of variable VMT pricing as an alternative funding mechanism for State transportation needs. Variable VMT pricing also can reduce VMT and support smart growth land use patterns. Through the pilot project, the study will identify technical, political, and economic challenges and will propose strategies for overcoming the challenges. To address equity concerns, the study will identify appropriate pricing and revenue distribution methods to support affordable housing and alternative transportation options.

In addition to compact development, recent research shows that additional outcomes should be pursued to implement land use and location efficiency. A recent analysis of nearly 50 published studies on the subject of land use and travel behavior found VMT to be most strongly related to measures of destination accessibility (e.g., distance to jobs downtown) and street network design, while population and job densities were the factors most weakly associated with travel behavior[164].

MDP proposes to establish additional desired outcomes (see below) beyond compact development and quantitative goals for each outcome. To set these goals, MDP will work with sister agencies, metropolitan planning organizations, the University of Maryland, and the National Center for Smart Growth Research and Education to develop and use a transportation model, specific to Maryland, that is able to take into account the GHG reduction benefits of land use/location efficiency factors. Leaders in the climate change mitigation field recognize the necessity of this task. For example, California is undertaking updates to municipal planning organizations' transportation models to ensure jurisdictions obtain adequate GHG reduction credit for land use/location efficiency factors not currently factored into existing transportation models.[165] MDP and sister agencies will investigate the feasibility in Maryland of implementing California's Senate Bill 375 bill and will develop sustainability criteria (e.g., a decrease or no net increase in VMTs) that local transportation plans and projects must achieve in order to receive State transportation funds. Conventional transportation models have focused on speed, distance, and the number of vehicles accommodated, but to measure GHG reductions

[164] Reid Ewing and Robert Cervero, "Travel and the Built Environment: A Meta-Analysis", Journal of the American Planning Association, 1939-0130, Volume 76, Issue 3, First published 2010, Pages 265 – 294.
[165] Merced County Association of Governments, California Senate Bill 375 Model Improvement, http://www.mcagov.org/programs/trans/1672.html

from land use/location efficiency, transportation models must also emphasize access, proximity and VMT.[166]

Until an updated transportation model is in place that can adequately take into account the GHG reduction benefits of land use/location efficiency factors, MDP recommends measurement of additional metrics to determine progress in implementing the land use and location efficiency program. Some examples include:

- Number of people and businesses within a certain distance from transit stations and bus stops
- Average distance to work by census block
- Share of land use within Maryland that is supportive of alternative transportation modes
- Share of developed acres that achieve a certain walkability index score

What are the desired outcomes of the land use and location efficiency program?

- **Geographic and spatial relationships between origins and destinations.** Residences, job centers, retail and commercial development and educational and recreational opportunities are very close to each other and are connected through convenient and easy access roadway networks, efficient mass transit options and sidewalks and bikeways. Residents can access most of their daily life needs within reasonable and short travel distances and timeframes and/or by using alternative transportation. Residences comprise a balanced supply of diverse but relatively dense housing, including affordable work force housing.

- **Governance of transportation, land use and development.** The ways in which land use, development and transportation are planned, managed, and regulated by the State, metropolitan planning organizations, and local government guide and enable public and private sector investments to achieve the described geographic and spatial relationships between origins and destinations. Transportation and land use are integrated at every planning and related investment level.

- **Functional and social integration of transportation modes.** It is generally convenient, safe and relatively easy to walk or use bicycles and in conjunction with convenient and efficient mass transit to move between most origins and destinations. In addition to work trips, this integration of transportation modes must help to accommodate the 80 percent of household trips associated with non-work travel. Integration of transportation modes limits reliance on automobiles to relatively few and short routine trips for many parts of the population, with the exception of those employed in rural-resource based businesses, or living in small rural towns or villages relatively distant from employment centers, larger metropolitan areas, and areas transitional between metro and rural.

[166] The data problem that holds back climate action and smart growth, Philip Langdon, New Urban Network, http://newurbannetwork.com/article/data-problem-holds-back-climate-action-and-smart-growth-13218)

• **Mass transit efficiency and affordability.** Efficient mass transit between origins and destinations, with convenient walk access on both ends, is widespread and affordable to the vast majority of the population, with the exception of those employed in rural-resource based businesses or living in small rural towns or villages relatively distant from employment centers, larger metropolitan areas, and areas transitional between metro and rural.

## Supporting Laws and Regulations

- The Sustainable Communities Act of 2010 (House Bill 475)
- Maryland Sustainable Growth Commission (Senate Bill 278/House Bill 474)
- Planning Visions (House Bill 294/Senate Bill 273)
- Smart Growth Goals, Measures and Indicators and Implementation of Planning Visions (House Bill 295/Senate Bill 276)
- Smart and Sustainable Growth Act of 2009 (House Bill 297/Senate Bill 280)
- Evaluation and Selection of Proposed Capital Projects (House Bill 1155)
- Transit–Oriented Development (House Bill 373/Senate Bill 204)
- Transit Oriented Development- Tax Increment Financing" (House Bill 300)
- Maryland's Greenhouse Gas Emissions Reduction Act of 2009

### Suggested Laws and Regulations

Emission caps for the transportation sector, implemented through development or adjustment of regional and local land use, transit, and affordable housing plans, and other transportation and land use strategies, would ensure that transportation GHG emissions do not increase as population increases. This suggested law would ensure long-term success at maintaining the State's 2020 GHG emission reduction goal.

Additional statutory or regulatory authority, along with new State policies, will be needed to implement some of the above recommendations. New programs will include a mix of incentives and requirements.

## Links to Supporting Documentation

- 2009 Smart, Green and Growing legislation, including the 12 Planning Visions - http://planning.maryland.gov/OurWork/2009Legislation.shtml
- MDP: http://planning.maryland.gov
- Plan Maryland: http://plan.maryland.gov/home.shtml
- The Sustainable Growth Commission: http://planning.maryland.gov/YourPart/773/sustainableGrowthComm.shtml
- The Sustainable Communities Act of 2010: http://planning.maryland.gov/PDF/YourPart/SustainableCommunities/SustainableCommunitiesAct2010.pdf

# Land Use-2: Transportation GHG Targets for Local Governments and Metropolitan Planning Organizations

Lead Agency: MDP

## Program Description

Many local governments are implementing land use policies that support compact, transit-oriented development in suburban cores while protecting rural agricultural areas. By their very nature, these approaches mitigate against climate change by reducing VMT, preserving natural areas that serve to sequester carbon, and creating more compact, energy-efficient buildings. Establishing transportation GHG targets for local governments and metropolitan planning organizations will facilitate the development and implementation of local land use policies and plans that ensure achievement and long-term maintenance of Maryland's climate change mitigation goals.

County and municipal governments in Maryland use their land use planning and zoning authority to meet community needs. The role of MDP and other State agencies is to ensure that State-level programs, procedures and funds are constructed and used to support development projects and regional land use patterns that support the land use and location efficiency program (see Land Use-1). In addition, MDP provides technical assistance to Maryland's counties and municipalities in support of local comprehensive plans, zoning and land use policies, revitalization, and land preservation. MDP reviews comprehensive plans for consistency with the State's Smart Growth and growth management policies and laws, specifically, Article 66B, Economic Growth Resource Protection and Planning Act of 1992, the 1997 Priority Funding Areas Act, and the requirements of House Bill 1141 and House Bill 2 from the 2006 Maryland General Assembly. MDP's review and comment on local plans are provided to counties and municipalities as guidance to ensure local plans reflect land management policies and practices that meet community needs and support State programs. MDP's comments are posted on their website prior to the draft plan's scheduled public hearing. The public is invited to participate in crafting the vision, goals and priorities for their community.

Maryland entrusts local jurisdictions with land use planning authority through Article 66B, 25A, and 28 of the Maryland Annotated Code. Article 66B enables local government to guide growth and development; outlines the responsibilities, roles, and functions of the planning commission; and sets the "ground rules" for operations. Many sections of Article 66B apply to all jurisdictions in the State that exercise planning and zoning powers. This statute delegates planning and land use regulatory authority to all non-charter counties and all incorporated municipalities outside of Montgomery and Prince George's counties, as well as specifically identified towns within these two jurisdictions (Barnesville, Brookeville, Gaithersburg, Laytonsville, Poolesville, Rockville, Washington Grove, and Laurel).[167] Article 25A delegates planning and land

[167] Ibid.

use powers to six charter counties (Anne Arundel, Baltimore, Harford, Howard, Talbot, and Wicomico).[168] Article 28 applies to Montgomery and Prince George's Counties and to all incorporated towns within those two counties not covered by Article 66B.

## 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)

## Other Environmental Benefits

Compact, transit-oriented, bicycle-friendly land use, with neighborhood schools, walkable streets, mixed-use development and a wide range of housing choices conserves valuable natural resources through the efficient use of land, water, and air and promotes public health.

## Economic Benefits, Job Creation and Job Protection

Transportation GHG targets for local governments and metropolitan planning organizations will support dense, transit-oriented, and sustainable development in local and municipal core growth areas. Capital investment using State funding on the construction of roads, water and sewer facilities, public transportation systems, and other economic development needs in these development core areas will create jobs in the construction sector and transit vehicle manufacturing sectors directly. The upstream supply sectors of those directly affected sectors will also have increased demand and employment through the demand-side multiplier effects.

For example, the Leonardtown Wharf Project, located at the end of Jefferson Street in Leonardtown, is a 5.5 acre waterfront redevelopment that includes a park, restaurant, and a mix of stores, office space and loft apartments. At build-out, this development will

[168] Ibid.

provide approximately 168 full-time jobs, and is a redevelopment effort consistent with Maryland's Smart Growth policies.[169]

A major stimulus effect of smart growth over sprawl stems from the reduced use of personal vehicles and decreased expenditures on conventional transportation modes (using transit and other alternative transportation and driving shorter distances and less often). In Maryland, petroleum fuels and vehicles are largely supplied by imports. Consumer savings on transportation fuels and vehicles and by riding transit can increase spending on more in-state produced goods and services and thus spur the State economy. The American Public Transportation Association recently estimated the monthly savings from riding transit for twenty top cities with highest transit ridership in the U.S. The analysis shows that riding transit with one less car can save on average, $9,900 annually and $825 monthly. As the second largest expenditure for American households, transportation costs can be significantly different depending on location. "Housing + Transportation Affordability in Washington DC," a 2011 Study by The Center For Neighborhood Technology and the District of Columbia's Office of Planning, shows that transportation costs for households near major transit lines and close to urban cores and job centers are much less than those in outer suburbs and areas further away from job centers, shopping, and other community amenities, and where driving is the only transportation means. For instance, the monthly transportation costs for the Area Median Income households along the Metro Redline corridor in Montgomery County ranged from $920 to $1,177 while the households in Urbana and the Western Montgomery County spend $1,500 to $1,770 per month on transportation. Accounting for about 15 percent of a household's expenditure, lower transportation costs can make a significant impact on housing affordability in certain locations. The Center For Neighborhood Technology Study shows that housing in many outer suburbs was previously considered affordable, but once transportation costs are factored in, outer suburb housing actually is less unaffordable. Counting the real cost and savings in smart growth areas encourages economic growth since the investment in these areas creates better cost-benefit outcomes for consumers and investors.

Another economic effect of smart growth comes from the increased ridership of public transportation. The increased use of mass transportation will stimulate the demand for services from the public transportation sector and its supporting activity sectors. These sectors are very labor-intensive. For example, the labor-intensity of the transit and ground passengers sector is as high as 23 jobs per $1 million of output. That means a $1 million investment in the public transportation sector can create 23 direct jobs. The economy-wide job creation potential will be an increase of 29 jobs.

The preservation of green lands, natural resources, as well as the investment in park areas, can also help boost the local tourism industry and create jobs in tourism supporting and facilitating sectors.

[169] MDP. "Growing Smarter." June, 2007.
http://www.mdp.state.md.us/PDF/OurProducts/Publications/OtherPublications/growing_smarter.pdf

Smart growth development patterns can save public expenditures with reduced government outlays on new infrastructure (such as streets, highways, sewers, water lines, utility distribution systems) and maintenance as well as the cost of delivering public services (such as road maintenance, waste and trash collection, fire and police emergency services). The study by Burchell et al. (2005) shows that if 25 percent of sprawl growth nationally can be replaced by more compact development, $110 billion in government spending on road construction and $2.6 billion on water and sewer infrastructure can be saved. In addition, $420 billion can be saved since the average cost of building a house/home will be $16,000 lower. The same economic modeling is also applied to the top 20 sprawling economic areas in the U.S. For the Washington/Baltimore area, the per capita savings can reach $6,069 if 25 percent of the low-density development can be shifted to high-density development.

Smart growth can also be beneficial to the overall local/regional economy. Smart growth may result in positive effects on housing property value productivity gains from more mixed-use and concentrated growth, and substantial private investments in public revitalization and redevelopment. For instance, many studies on cost-benefits of transit-oriented development demonstrate that areas near transit stations have higher land value, generate significant private investments, and, over time, developments are attracted to major transit-way corridors. A study on transit-oriented development in the U.S. indicates that the percent price premium for housing in transit station areas in some major metropolitan areas is 6 percent to 45 percent higher than those in non-station areas (Robert Cervero, et al, "Transit-Oriented Development in the United States: Experiences, Challenges, and Prospects, TCRP 102, Transportation Research Board, 2004).

A case study on private investment trends in transportation-oriented development by Smart Growth America shows that from 1976 to 2006, after the Washington DC Metro Line opened to serve the Rosslyn-Ballston Corridor, including five station areas, over 13,000 housing units and 18 million square feet of commercial space was developed. These developments generate $14.5 billion of taxable real estate value ("The Best Stimulus for the Money," Smart Growth America, Metropolitan Research Center, University of Utah, A. Nelson, T. Sanchez, K. Bartholomew, R. Ewing, P. Perlich, J. Anderson, 2009). The MDP's recent transportation-oriented development capacity analysis indicates that the areas within ½ mile radius of the existing transit stations could accommodate 83 percent of the total projected metropolitan Maryland residential growth by 2030.

Further analyses for the economic benefits, job creation and job protection in Maryland from this program is included in Chapter 7 of this plan.

## Implementation

Desiring a higher quality of life, citizens and policy makers in communities across Maryland are adopting Smart Growth principles in their local development and land use decisions. Examples of these principles can be found in the counties of Montgomery, Frederick, Baltimore, Talbot, and Prince George. In addition, MDP is working with

counties and municipalities in Maryland on implementing 2009 Smart, Green, and Growing legislation and on developing PlanMaryland.

Montgomery County is regarded as a national model for Smart Growth with pioneering policies on affordable housing, transit-oriented development and traditional "New Urbanist" subdivisions. With its population of 980,000 expected to increase by 200,000 during the next twenty-five years, the county will need to accommodate growth with denser pedestrian friendly redevelopment. Montgomery County has a long history of innovative land use, from its 1960s policy of concentrating development along transportation corridors between wedges of open space, to its designated Rural Zone in the western and northern areas, to its use of Transferable Development Rights that have helped preserve about 90 percent of the farmland in the county, or more than 70,000 acres.

Frederick County is a model for innovative "Smart Growth" in Maryland. Strong rural zoning has channeled development into Frederick County's municipalities and designated growth areas.[170] Innovative programs, such as the Vacant Commercial Tax Credit Program for both Frederick County and the city of Frederick have breathed new life into vacant properties. Nearly $6.5 million in State tax credits have been used to rehabilitate historic commercial and residential properties. The city of Frederick's aesthetic Carroll Creek redevelopment project has become a destination draw. Carroll Creek was recognized nationally by the American Planning Association as its Project of the Year in 2007. Next steps in Smart Growth may include East Frederick Rising, which is envisioned as a redevelopment area of nearly 1,800 acres where residents can live, work and play in the same proximity.

Baltimore County uses a multi-faceted approach to preserve open space, farmland, natural beauty, and environmental resources.[171] A steadfast urban-rural demarcation line, which limits the extension of urban services, helps concentrate development into the county's planned urban and suburban areas. Outside this area, a variety of "Resource Conservation" zoning districts allows development designed to preserve landscape and resources. On land previously used for farming, development is limited to two-acre lots, plus one for each fifty acres above one hundred acres. On watershed protection lands, one lot per five acres is allowed, lots must be clustered, and environmentally sensitive areas must be protected. Baltimore County acquires conservation easements through numerous purchases of development rights programs, local land trusts, and five designated Rural Legacy Areas. It also leads Maryland in acres of easements donated to the Maryland Environmental Trust.

[170] MDP. "Frederick Maryland Smart Growth Successes." September, 2009. http://planning maryland.gov/PDF/OurProducts/Publications/OtherPublications/SG_Success_FRED.pdf
[171] MDP. "Baltimore County Smart Growth Successes." May, 2010. http://www.mdp.state.md.us/PDF/OurProducts/Publications/OtherPublications/SG_Successes_BACO.pdf

Talbot County is creating a passive use park with public water access to the Tuckahoe River and Norwich Creek.[172] It will feature walking trails, non-motorized boat launches, restored meadowlands, and a forty-acre organic best practices farm. The park will be an example for how local governments can improve quality of life, promote resource conservation and provide special places for residents to enjoy year-round.

Also in Talbot County, the Town of Easton has encouraged infill development and the rehabilitation and redevelopment of existing buildings and has provided affordable housing for the community. The Genova project is an infill and rehabilitation project undertaken by local developers at the site of a former gas station. It houses multiple use units and includes office space, reasonably priced apartments, retail and restaurants. Milestone is Habitat for Humanity Choptank's first multi-unit project and, when complete, will include four moderate income homes and six low-income homes. These examples showcase local commitment to re-use land within the Town boundary for projects that will benefit the community. Both projects received awards from the Eastern Shore Land Conservancy for promoting infill and growth in appropriate areas.

Prince George's County has focused several transit-oriented development projects around Metro and MARC stations to encourage more people to travel to and from work without relying on their cars.[173] The Hyattsville Arts District and the Port Towns are examples of other sustainable growth projects directed at reducing dependency on automobiles, at promoting pedestrian-friendly development and at supporting infill and redevelopment in underutilized communities.

MDP will continue to work with local governments to implement the measures in the 2008 and 2009 Smart, Green, and Growing legislation, including incorporation of the twelve new planning visions in local comprehensive plans, development of local land use goals, and submittal of local annual reports.

MDP will also work with other State agencies to support existing local programs and policies that support GHG reductions as well as community planning efforts that link GHG reductions, land use changes, smart transportation investments, and efficient energy management/distribution systems.

## Supporting Laws and Regulations

- The Sustainable Communities Act of 2010 (House Bill 475)
- Maryland Sustainable Growth Commission (Senate Bill 278/House Bill 474)
- Planning Visions (House Bill 294/Senate Bill 273)
- Smart Growth Goals, Measures and Indicators and Implementation of Planning Visions (House Bill 295/Senate Bill276)
- Smart and Sustainable Growth Act of 2009 (House Bill 297/Senate Bill 280)

[172] MDP. "Talbot County Smart Growth Successes." August, 2010. http://www.mdp.state.md.us/PDF/OurProducts/Publications/OtherPublications/SG_Successes_Talbot.pdf
[173] MDP. "Prince George's County Smart Growth Sucesses." October, 2009. http://planning maryland.gov/PDF/OurProducts/Publications/OtherPublications/SG_Success_PG.pdf

- Evaluation and Selection of Proposed Capital Projects (House Bill 1155)
- Transit–Oriented Development (House Bill 373/Senate Bill 204)
- Transit Oriented Development- Tax Increment Financing (House Bill 300)
- Maryland's Greenhouse Gas Emissions Reduction Act of 2009

**Suggested Laws and Regulations**

Emission caps for the transportation sector, implemented through development or adjustment of regional and local land use, transit and affordable housing plans, and other transportation and land use strategies, would ensure transportation GHG emissions do not increase as population increases. MDP and sister agencies will begin by investigating the feasibility in Maryland of implementing California's Senate Bill 375 bill. The California bill establishes regional transportation emission caps and requires municipal planning organizations to develop strategies to achieve the caps, focusing on adjusting local plans for land use, transit and affordable housing. California, through the establishment of regional transportation emission caps via Senate Bill 375, expects a reduction of Statewide transportation emissions by 5 million metric tons of $CO_2$-equivalent in 2020 which will increase to 30 million metric tons of $CO_2$-equivalent in 2050.[174] MDP, MDOT and MDE will study possible methods for establishing regional transportation emission caps in Maryland and how regional and local land use, transit, and affordable housing plans, and transportation and land use strategies could be developed or adjusted to achieve the caps.

The State will develop sustainability criteria (e.g., a decrease or no net increase in VMTs) that local transportation plans and projects must achieve in order to receive State transportation funds. The State will investigate legal authority to require sustainability criteria for use of State funds, federal funds, or a subset, and make adjustments to ensure existing metropolitan planning organization processes do not preclude compliance with this requirement.

Even though local governments are implementing land use policies that support compact, transit-oriented development, more can be done to encourage smart growth in Maryland. It was recommended by a member of the Sustainable Growth Commission that Maryland should review the reports of local jurisdictions on adequate public facilities development restrictions required by Article 66B, § 10.01 of the code.[175] Upon review, Maryland could assess whether and to what extent adequate public facilities ordinances have a detrimental effect on smart growth and affect the achievement of the goals of the State economic growth, resource protection, and planning policy. In addition, it was recommended that Maryland develop clear metrics for determining progress toward smart growth. Tools are needed to support communities in Maryland as they develop their own climate protection strategies, and demonstrate the important role of land use in reducing GHG emissions. For example, Montgomery County requested assistance through EPA's Smart Growth Implementation Assistance program to estimate the GHG reduction

[174] AB32 Scoping Plan, California Air Resources Board, see http://www.arb.ca.gov/cc/scopingplan/document/scopingplandocument.htm.
[175] Maryland Sustainable Growth Commission. "2010 Annual Report." December 3, 2010.

impacts of various land use alternatives, thereby supporting local decision makers' ability to approve projects that contribute to the community's climate protection goals.[176]

## Links to Supporting Documentation

- Article 66B http://www.mdp.state.md.us/PDF/OurWork/CompPlans/Article_66B.pdf
- Plan Maryland Draft Plan - http://plan.maryland.gov/PDF/draftPlan/pmddraft_April.pdf
- Basu, A. 2005. Smart Growth Towards Economic Performance. Urban & Regional Planning Economic Development Handbook. Taubman College of Architecture and Urban Planning, University of Michigan. http://www.umich.edu/~econdev/smartgrowth/index.html
- Buchell, R.W., Downs, A., McCann, B., and Mukherji, S. 2005. Sprawl Costs: Economic Impacts of Unchecked Development. Washington, DC: Island Press.
- Carlino, G. 2001. "Knowledge Spillovers: Cities' Role in the New Economy," Business Review Q4**:** 17-24.
- Ciccone, A. and Hall, R.E. 1996. "Productivity and the Density of Economic Activity," American Economic Review 86(1): 54-70.
- Glaeser, E.L. and Gyourko, J. 2002. "The Impact of Zoning on Housing Affordability," Cambridge: Harvard Institute of Economic Research Discussion Paper Number 1948.
- International Economic Development Council (IEDC). 2006. Economic Development and Smart Growth: 8 Case Studies on the Connections Between Smart Growth Development and Jobs, Wealth, and Quality of Life in Communities.
- Muro, M. and Puentes, R. 2004. Investing in a Better Future: A Review of the Fiscal and Competitive Advantages of Smarter Growth Development Patterns. The Brookings Institution Center on Urban and Metropolitan Policy.
- Nelson, A. C. 2000. Effects of Urban Containment on Housing Prices and Landowner Behavior. Cambridge, MA, Lincoln Institute of Land Policy.
- Nelson, A. C. and Peterman, D. 2000. "Does Growth Management Matter: The Effect of Growth Management on Economic Performance," Journal of Planning Education and Research 19: 277-285.

# Land Use-3: Funding Mechanisms for Smart Growth

Lead Agency: MDP

## Program Description

Growth increasingly produces traffic congestion, greater demand on resources, loss of green spaces, and other undesirable consequences. By properly managing growth, communities can reduce the negative effects of expansion and reduce GHG emissions. Smart growth is

[176] EPA. "Smart Growth – Project Summaries." http://www.epa.gov/smartgrowth/sgia_communities.htm

characterized by compact, transit-oriented, bicycle-friendly land use, with neighborhood schools, walkable streets, mixed-use development and a wide range of housing choices.[177]

Smart growth concentrates new development and redevelopment in areas that have existing or planned infrastructure to avoid sprawl. Sprawl is generally defined as the increased development of land in suburban and rural areas outside of their respective urban centers. This increased development of real estate in the outskirts of towns, villages and metropolitan areas is quite often accompanied by a lack of development, redevelopment or reuse of land within the urban centers themselves and an increase in GHG emissions.

According to MDP, Smart Growth has four straightforward goals:[178]

- Support existing communities by targeting resources to support development in areas where infrastructure exists;
- Save our most valuable natural resources before they are forever lost;
- Save taxpayers from the high cost of building infrastructure to serve development that has spread far from our traditional population centers; and
- Provide Marylanders with a high quality of life, whether they choose to live in a rural community, suburb, small town, or city.

Since 1992 Maryland has adopted a variety of Smart Growth laws and policies. Many of these laws and policies have been administered by the MDP, such as the 1992 Planning Act, the 1997 Priority Funding Act, House Bill 1141 and House Bill 2 from the 2006 Maryland General Assembly, and Planning legislation enacted in the 2009 session of the Maryland General Assembly. The State provides funds in support of smart growth within Priority Funding Areas. This includes funding programs such as the Sustainable Communities Act of 2010.

## 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)

[177] MDP. Smart Growth. http://www.mdp.state.md.us/OurWork/smartGrowth.shtml
[178] Ibid.

- Similar or higher share of future nonresidential development in compact form (nonresidential development mostly follows population)

## Other Environmental Benefits

Many studies show the environmental benefits of smart growth. Development guided by smart growth principles can minimize air and water pollution, encourage brownfields clean-up and reuse, and preserve natural lands.

## Economic Benefits, Job Creation and Job Protection

One of the major benefits of smart growth programs comes from the reduced use of personal vehicles and decreased expenditures on transportation fuels because of the increased usage of public transportation. Since in Maryland petroleum fuels and vehicles are largely supplied by imports, consumer savings on transportation fuels and vehicles can increase spending on more domestically produced goods and services and thus spur the State economy. The fossil fuel supply sectors are among the least labor-intensive sectors in the economy, particularly in comparison with the transit and ground passengers sector.[179]

There is a potential for significant regional job creation from smart growth programs. The Sustainable Communities Act of 2010 is expected to create an estimated 740 jobs in the construction industry during its first year of implementation.[180] There may be an overall reduced demand in construction work since, compared with sprawl development, smart growth can reduce the need for government investments in new infrastructure (such as streets, highways, sewers, water lines, utility distribution systems). However, this can enable a shift to spending in other areas, where additional jobs can be created.

More compact, mixed-use, and transit-oriented development strategies can save taxpayer dollars by reducing government expenditures on building and maintaining new infrastructure and delivering public services (e.g. waste and trash collection, fire and police emergency services). According to one study, replacing 25 percent of sprawl growth with more compact development nationwide from 2000 to 2025 can save $110 billion in government spending on road construction and $2.6 billion on water and sewer infrastructure.[181] An additional savings of $420 billion can be realized since the average cost of building a house/home will be $16,000 lower. For the Washington/Baltimore area, the per capita savings can reach $6,069 if 25 percent of the low-density development can be shifted to high-density development.

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[179] Based on the 2009 IMPLAN data of Maryland, the employment intensity (i.e., employment per $1 million output) of the Oil & Gas Extraction sector and the Petroleum Product manufacturing sector is 4.4 and 0.54, respectively, compared with an economy-wide labor-intensity of 7.4 employment per million dollars of output. In contrast, the labor-intensity of the Transit & Ground Passengers sector is as high as 23 employment per $1 million output.

[180] MDP. Sustainable Communities. http://www mdp.state md.us/YourPart/SustainableCommunities.shtml

[181] Buchell, R.W., Downs, A., McCann, B., and Mukherji, S. 2005. Sprawl Costs: Economic Impacts of Unchecked Development. Washington, DC: Island Press.

Smart growth also improves the overall local/regional economic performance through:

- Increase in residential property values due to increased living convenience, adjacency to public transit and other facilities, and reduced service costs.[182]
- Corresponding increase in property tax revenues.
- Productivity gains from shorter commute times to work[183] and agglomeration of suppliers, customers, and regional skilled labor market.[184] [185]

Smarter growth also reduces the use of personal vehicles and increases ridership on public transportation. As noted above, the consumer savings on imported petroleum fuels and vehicles can increase spending on more domestically produced goods and services and stimulate the State economy.

Smart growth may also result in some negative impacts to the local economy. There are studies indicating that more compact and high-density development would bring challenges in providing affordable housing to the general population.[186] However, the Center for Neighborhood Technology's Housing + Transportation Affordability in Washington DC Study, discussed in a previous section, indicates that if quality transit services are provided and developments are close to job centers and community amenities, e.g., shopping, recreational uses, and services, that reduced transportation costs could offset the cost of housing. The more concentrated development may also increase traffic congestion, which leads to congestion delays and increased fuel costs, although the latter would be more than offset by investing in transit and encouraging the use of transit and other alternative transportation means, managing single-occupancy-vehicle travel, and continuing the Statewide smart growth patterns to reduce distances between travel destinations and the overall decreased vehicle miles traveled.

Reduced infrastructure investment from smart growth could affect the construction sector in the short term, by shifting supply/demand away from Greenfield areas. Over time, with a changing market and more incentives, the building industry could benefit from

[182]Nelson, A. C. 2000. Effects of Urban Containment on Housing Prices and Landowner Behavior. Cambridge, MA, Lincoln Institute of Land Policy; Glaeser, E.L. and Gyourko, J. 2002. "The Impact of Zoning on Housing Affordability," Cambridge: Harvard Institute of Economic Research Discussion Paper Number 1948.

[183] Basu, A. 2005. Smart Growth Towards Economic Performance. Urban & Regional Planning Economic Development Handbook. Taubman College of Architecture and Urban Planning, University of Michigan. http://www.umich.edu/~econdev/smartgrowth/index.html

[184] Nelson, A. C. and Peterman, D. 2000. "Does Growth Management Matter: The Effect of Growth Management on Economic Performance," Journal of Planning Education and Research 19: 277-285.

[185] Other studies support the correlation between employment density and economic productivity. See, e.g. Muro, M. and Puentes, R. 2004. Investing in a Better Future: A Review of the Fiscal and Competitive Advantages of Smarter Growth Development Patterns. The Brookings Institution Center on Urban and Metropolitan Policy,which suggests productivity gains from more mixed-use city planning and concentrating growth. A statistical analysis performed by Ciccone, A. and Hall, R.E. 1996. "Productivity and the Density of Economic Activity," American Economic Review 86(1): 54-70, reveals about 6 percent productivity improvement with a doubling of employment density. The regression analysis performed by Carlino, G. 2001, "Knowledge Spillovers: Cities' Role in the New Economy," Business Review Q4**:** 17-24, suggests a 20 percent to 30 percent higher patenting rate in denser metropolitan and higher employment density areas.

[186] Pozdena, R. 2002. Smart Growth and Its Effects on Housing Markets: The New Segregation. Report for The National Center for Public Policy Research. http://www nationalcenter.org/NewSegregation.pdf

smart growth. In addition, infrastructure investment can occur in other areas, such as in sidewalk and streetscape improvements and multi-story parking facilities (rather than surface lots).

Further analyses for the economic benefits, job creation and job protection in Maryland from this program is included in Chapter 7 of this plan.

## Implementation

The Sustainable Communities Act of 2010 supports programs and policies that encourage land use/location efficiency. The Sustainable Communities Act of 2010 strengthens reinvestment and revitalization in Maryland's older communities by reinventing an existing rehabilitation tax credit and extending the life of the credit through 2014, simplifying the framework for designated target areas in the Community Legacy and Neighborhood Business Works program by creating "Sustainable Communities", establishing a new transportation focus on older communities, and enhancing the role of the Smart Growth Subcabinet in the revitalization of communities. The law promotes equitable, affordable housing by expanding energy-efficient housing choices for people of all ages, incomes, races, and ethnicities to increase

MDP will work with the Smart Growth Subcabinet and sister agencies to implement the Sustainable Communities Act of 2010 and any new funding mechanisms developed as a result of PlanMaryland or recommended by the Sustainable Growth Commission.

## Supporting Laws and Regulations

- The Sustainable Communities Act of 2010 (House Bill 475)
- Maryland Sustainable Growth Commission (Senate Bill 278/House Bill 474)
- Planning Visions (House Bill 294/Senate Bill 273)
- Smart Growth Goals, Measures and Indicators and Implementation of Planning Visions (House Bill 295/Senate Bill 276)
- Smart and Sustainable Growth Act of 2009 (House Bill 297/Senate Bill 280)
- Maryland's Greenhouse Gas Emissions Reduction Act of 2009

### Suggested Laws and Regulations

It was recommended by the Sustainable Growth Commission that Maryland should develop a set of performance measures for sustainable growth. New legislation, regulations, and funding decisions could then be evaluated against a common set of goals. It was also recommended that Maryland identify State and local laws that can be obstacles to smart growth, enforce standards through performance-based State permit approvals and funding delivery, and establish meaningful carrots and sticks to ensure consistency with local planning.[187]

[187] Maryland Sustainable Growth Commission. "2010 Annual Report." December 3, 2010.

Additional statutory or regulatory authority, along with new State programs, might be needed to implement any new funding mechanisms developed as a result of PlanMaryland or recommended by the Sustainable Growth Commission.

## Links to Supporting Documentation

- MDP: http://planning.maryland.gov
- Plan Maryland: http://plan.maryland.gov/home.shtml
- The Sustainable Growth Commission: http://planning.maryland.gov/YourPart/773/sustainableGrowthComm.shtml
- The Sustainable Communities Act of 2010:
- http://planning.maryland.gov/PDF/YourPart/SustainableCommunities/SustainableCommunitiesAct2010.pdf
- Planning legislation Enacted in the 2009 session of the Maryland General Assembly http://www.mdp.state.md.us/OurWork/2009Legislation.shtml
- House Bill 1141 and House Bill 2 from the 2006 Maryland General Assembly http://www.mdp.state.md.us/OurWork/hb1141hb2.shtml
- 1997 Priority Funding Act http://www.mdp.state.md.us/OurWork/1997PFAAct.shtml
- 1992 Planning Act http://www.mdp.state.md.us/OurWork/1992PlanAct.shtml
- Basu, A. 2005. Smart Growth Towards Economic Performance. Urban & Regional Planning Economic Development Handbook. Taubman College of Architecture and Urban Planning, University of Michigan. http://www.umich.edu/~econdev/smartgrowth/index.html
- Buchell, R.W., Downs, A., McCann, B., and Mukherji, S. 2005. Sprawl Costs: Economic Impacts of Unchecked Development. Washington, DC: Island Press.
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- Glaeser, E.L. and Gyourko, J. 2002. "The Impact of Zoning on Housing Affordability," Cambridge: Harvard Institute of Economic Research Discussion Paper Number 1948.
- Gordon, P. and Richardson, H. 1997. "Are Compact Cities a Desirable Planning Goal?" Journal of the American Planning Association 63(1): 95-106.
- Muro, M. and Puentes, R. 2004. Investing in a Better Future: A Review of the Fiscal and Competitive Advantages of Smarter Growth Development Patterns. The Brookings Institution Center on Urban and Metropolitan Policy.
- Nelson, A. C. 2000. Effects of Urban Containment on Housing Prices and Landowner Behavior. Cambridge, MA, Lincoln Institute of Land Policy.
- Nelson, A. C. and Peterman, D. 2000. "Does Growth Management Matter: The Effect of Growth Management on Economic Performance," Journal of Planning Education and Research 19: 277-285.
- Pozdena, R. 2002. Smart Growth and Its Effects on Housing Markets: The New Segregation. Report for The National Center for Public Policy Research. http://www.nationalcenter.org/NewSegregation.pdf.

# Land Use-4: GHG Benefits from Priority Funding Areas and Other Growth Boundaries

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 reduce 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. 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.

MDP works with other State agencies to provide funding for development in Priority Funding Areas and for land conservation in Rural Legacy Areas. Priority Funding Areas reflect Maryland's commitment to direct future development in the State into established communities that are supported by existing or planned public services and infrastructure and to protect irreplaceable natural resources.

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).[188] 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

[188] 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.[189] 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)

## Other Environmental Benefits

Conserving or creating rural, suburban, and urban green space improves quality of life by providing places where neighbors can congregate and people can recreate. Green spaces also protect air and water quality and conserve fish and wildlife habitat.

## Economic Benefits, Job Creation and Job Protection

Growth boundaries support the dense, compact, transit-oriented development in rapid growth areas that are defined as Priority Funding Areas in the State. One of the major benefits of smart growth over sprawl comes from the reduced use of personal vehicles and decreased expenditures on transportation fuels because of the increased usage of public transportation. Since in Maryland petroleum fuels and vehicles are largely supplied by imports, consumer savings on transportation fuels and vehicles can increase spending on more in-state produced goods and services and thus spur the State economy. Comparatively speaking, the fossil fuel supply sectors are among the least labor-intensive sectors in the economy.

In addition, the increased use of mass transportation will stimulate the demand for services from the public transportation sector and its supporting activities sector. These

[189] Locally designated Priority Funding Areas are evaluated by the MDP against criteria in §5-7B-02 and §5-7B-03.

sectors are very labor-intensive. For example, the labor-intensity of the transit & ground passengers sector is as high as 23 jobs per $1 million of output. That means a $1 million investment in the Public Transportation sector can create 23 direct jobs. The economy-wide job creation potential will be an increase of 29 jobs.

Capital investment of the State funding on the construction of roads, water and sewer facilities, public transportation systems, and other economic development needs in the Priority Funding Areas will create jobs in the construction sector and transit vehicle manufacturing sectors directly. The upstream supply sectors of those directly affected sectors will also experience increased demand and employment through the demand-side multiplier effects. However, a full macroeconomic impact analysis should also take the displaced investment and the associated foregone stimulus impacts into consideration. The increased State government funding support in the development of the Priority Funding Areas will offset the government spending in other general government expenditure areas.

More compact and mixed-use development can save the money of taxpayers, since the government outlays on new infrastructures (such as streets, highways, sewers, water lines, utility distribution systems) and maintenance as well as the cost of delivering public services (such as road maintenance, waste and trash collection, fire and police emergency services) can be reduced. The study by Burchell et al. (2005) show that if 25 percent of the sprawl growth can be replaced by more compact development, at the national level and over the time period of 2000 to 2025, $110 billion government spending on road construction and $2.6 billion on water and sewer infrastructure can be saved. In addition, $420 billion can be saved since the average cost of building a house/home will be $16,000 lower. The same economic modeling is also applied to the top 20 sprawling economic areas in the US. For the Washington/Baltimore area, the per capita savings can reach $6,069 if 25 percent of the low-density development can be shifted to high-density development.

Smart growth is also beneficial to improve the overall local/regional economic performance as outlined in Land Use-3: GHG Benefits from Smart Growth.

Capital investment of State funding to promote the development in Priority Funding Areas will increase the final demand for goods and services from the construction sector and transit vehicle manufacturing sectors directly. The upstream supply sectors of those directly affected sectors will also have increased economic activities through the demand-side multiplier effects. However, a full macroeconomic impact analysis should also take the displaced investment (and the associated foregone stimulus impacts) into consideration. The increased State government funding support in the development of the Priority Funding Areas will offset the government spending in other general government expenditure areas.

Further analyses for the economic benefits, job creation and job protection in Maryland from this program is included in Chapter 7 of this plan.

## 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 will support 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.

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.

Meanwhile, MDP is currently working with State agencies, local governments and other stakeholders to develop PlanMaryland. The plan will include recommendations for additional programs and policies, many in support of priority funding areas. MDP is also working with State agencies to ensure the development and implementation of the accounting for growth strategy of Maryland's Phase I Watershed Implementation Plan, which would create strong disincentives for sprawl development.

## Supporting Laws and Regulations

- The Sustainable Communities Act of 2010 (House Bill 475)
- Maryland Sustainable Growth Commission (Senate Bill 278/House Bill 474)
- Planning Visions (House Bill 294/Senate Bill 273)
- Smart Growth Goals, Measures and Indicators and Implementation of Planning Visions (House Bill 295/Senate Bill 276)
- Smart and Sustainable Growth Act of 2009 (House Bill 297/Senate Bill 280)
- Evaluation and Selection of Proposed Capital Projects (House Bill 1155)
- Transit–Oriented Development (House Bill 373/Senate Bill 204)
- Transit Oriented Development- Tax Increment Financing (House Bill 300)
- Maryland's Greenhouse Gas Emissions Reduction Act of 2009

### Suggested Laws and Regulations

The draft PlanMaryland recommends the establishment of clearly defined Designated Places for development, conservation and sustainable quality of life. These places are based on GrowthPrint, GreenPrint and AgPrint, three existing planning and preservation tools that will help State agencies and local jurisdictions focus limited resources most efficiently and effectively to meet the broader goals for growth and preservation. These areas will be defined jointly as priorities by State and local governments through a collaborative process. The process will establish common geographies for State agencies and local governments to focus and coordinate their efforts.

Additional statutory or regulatory authority, along with new State programs, might be needed to implement the recommendations of PlanMaryland that relate to growth boundaries.

## Links to Supporting Documentation

- Priority Funding Area law - http://www.michie.com/maryland/lpext.dll/mdcode/298ed/1f35d/1f728/1f855?fn=document-frame.htm&f=templates&2.0#
- 2009 Smart, Green and Growing legislation, including the 12 Planning Visions - http://planning.maryland.gov/OurWork/2009Legislation.shtml
- MDP: http://planning.maryland.gov
- Plan Maryland: http://plan.maryland.gov/home.shtml
- The Sustainable Growth Commission: http://planning.maryland.gov/YourPart/773/sustainableGrowthComm.shtml
- The Sustainable Communities Act of 2010:
- http://planning.maryland.gov/PDF/YourPart/SustainableCommunities/SustainableCommunitiesAct2010.pdf

- Basu, A. 2005. Smart Growth Towards Economic Performance. Urban & Regional Planning Economic Development Handbook. Taubman College of Architecture and Urban Planning, University of Michigan. http://www.umich.edu/~econdev/smartgrowth/index.html
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- Nelson, A. C. and Peterman, D. 2000. "Does Growth Management Matter: The Effect of Growth Management on Economic Performance," Journal of Planning Education and Research 19: 277-285.

# Sub-Appendix C-8: Innovative Initiatives Programs

## Innovative Intiatives-1: 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

**By 2020, the potential emission reductions from this program are estimated to be 0.57 MMt$CO_2$e.**

**Figure C-81. Low and High GHG Benefits for Innovative Initiatives-1**

| | | |
|---|---|---|
| Low Estimate | 0.38 MMt$CO_2$ | MDE Quantification Below |
| High Estimate | 0.57 MMt$CO_2$ | MDE Quantification Below |

**Low and High 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 $CO_2$-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 $CO_2$-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-82. 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 $CO_2$-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 | | | | | | |
| | | | | | | | TOTAL | **378,753** |

## Other Environmental Benefits

Information on other environmental benefits is under development. There are significant synergistic benefits with other regulated pollutants from energy efficiency measures in local government buildings, fleet vehicles, procurement practices, and employee vehicle miles traveled; water quality benefits from water efficiency and storm water management programs; and reductions in landfill waste from waste diversion programs.

## Economic Benefits, Job Creation and Job Protection

Maryland is looking ahead by designing and implementing a strategic plan to promote green jobs and better position Maryland for long-term sustainability. Key initiatives include attracting and growing green businesses, fostering green job creation; growing Maryland's green workforce; promoting green practices and encouraging energy & resource efficiency.[190]

Analyses for the economic benefits, job creation and job protection in Maryland from this program is included in Chapter 7 of this plan.

## 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.[191]

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.[192]

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[190] "Creating Jobs in a Green Economy." Maryland Smart Green & Growing. Retrieved from http://www.green.maryland.gov/jobs.html.

[191] 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
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
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

[192] http://www.dnr.state.md.us/sustainability/network.asp

## Supporting Laws and Regulations

- Montgomery County - Green Power Purchasing
- Anne Arundel County - High Performance Dwelling Property Tax Credit
- Anne Arundel County - Solar and Geothermal Equipment Property Tax Credits
- Baltimore County - Property Tax Credit for High Performance Buildings and Homes
- Carroll County - Green Building Property Tax Credit
- Harford County - Property Tax Credit for Solar and Geothermal Devices
- Howard County - High Performance and Green Building Property Tax Credit
- Howard County - Residential Solar and Geothermal Property Tax Credit
- Local Option - Property Tax Credit for High Performance Buildings
- Local Option - Property Tax Credit for Renewables and Energy Conservation Devices
- Montgomery County - High Performance Building Property Tax Credit
- Montgomery County - Residential Energy Conservation Property Tax Credits
- Prince George's County - Solar and Geothermal Residential Property Tax Credit
- Property Tax Exemption for Solar and Wind Energy Systems
- Special Property Assessment for Renewable Heating & Cooling Systems

## Links to Supporting Documentation

- Maryland Association of Countieshttp://www.mdcounties.org/
- National Association of Counties http://www.naco.org/
- Allegany http://gov.allconet.org/
- Anne Arundel http://www.aacounty.org/
- Baltimore City http://www.baltimorecity.gov/
- Baltimore http://www.baltimorecountymd.gov/
- Calvert http://www.co.cal.md.us/
- Caroline http://www.carolinemd.org/
- Carroll http://www.carr.org/
- Cecil http://www.ccgov.org/
- Charles http://www.govt.co.charles.md.us/
- Dorchester http://www.docogonet.com/
- Frederick http://frederickcountymd.gov/
- Garrett http://www.garrettcounty.org/
- Harford http://www.harfordcountymd.gov/
- Howard http://www.co.ho.md.us/
- Kent http://www.kentcounty.com/
- Montgomery http://www.montgomerycountymd.gov/
- Prince George's http://www.princegeorgescountymd.gov/

- Queen Anne's http://www.qac.org/index.aspx?pageid=33&template=2
- St. Mary's http://www.co.saint-marys.md.us/
- Somerset http://www.visitsomerset.com/
- Talbot http://talbotcountymd.gov/
- Washington http://www.washco-md.net/
- Wicomico http://www.wicomicocounty.org/
- Worcester http://www.co.worcester.md.us/

# Innovative Initiatives-2: 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

**By 2020, the potential emission reductions from this program are estimated to be 0.87 MMt$CO_2$e.**

**Figure C-83. Low and High GHG Benefits for Innovative Initiatives-2**

| | | |
|---|---|---|
| Low Estimate | 0.28 MMt$CO_2$e | MDE Quantification Below |
| High Estimate | 0.87 MMt$CO_2$e | MDE Quantification Below |

**Low and High 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-84. Federal Agency Scopes 1, 2, and 3 Emissions and Reductions

| Agency | Scope 1&2 Goal (%) | Scope 3 Goal (%) | Scope 1&2 Emissions (MMtCO2e) | Scope 3 Emissions (MMtCO2e) | Total Employees | Total Facilities | Scope 1&2 Reductions (MMtCO2e) | Scope 3 Reductions (MMtCO2e) |
|---|---|---|---|---|---|---|---|---|
| Advisory Council on Historic Preservation | N/A | N/A | Blank | 44.3 | 36 | 1 | 0 | 0 |
| Commodity Futures Trading Commission | N/A | N/A | N/A | N/A | 669 | 4 | 0 | 0 |
| Court Services and Offender Supervision Agency | 30 | 21? | ? | 969.812 | ? | ? | 0 | 0 |
| Department of Agriculture | 21 | 7 | 616728 | 258765 | 110-115000 | 26026 | 129512.88 | 18113.55 |
| Department of Commerce | 1 | 6 | 0.3619284 | 0.1832843 | 43000 | 858 | 0.003619284 | 0.010997058 |
| Department of Defense | 34 | 13.5 | 78.4 | 7 | 2328937 | 211266 | 26.656 | 0.945 |
| Department of Education | 0 | 3 | 232 | 14965 | 4348 | 26 | 0 | 448.95 |
| Department of Energy | 28 | 13 | 4634 | 0.858 | 127376 | 19214 | 1297.52 | 0.11154 |
| Department of Health and Human Services | 15.2 | 3.3 | 0.96 | 0.29 | 83745 | 3983 | 0.14592 | 0.00957 |
| Department of Homeland Security | 25 | 7.2 | 1717333.5 | 1602912.6 | 237629 | 14190 | 429333.375 | 115409.7072 |
| Department of Housing and Urban Development | 47.4 | 16.2 | 17715 | 31726 | 9462 | 108 | 8396.91 | 5139.612 |
| Department of Justice | 16.4 | 3.8 | 1.61 | 0.62 | 112000 | 3861 | 0.26404 | 0.02356 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Department of Labor | 27.7 | 23.4 | 231403.1 | 86414.1 | 16404 | 4768 | 64098.6587 | 20220.8994 |
| Department of State | 20 | 2 | 139067 | 33652 | 14664 | 10 | 27813.4 | 673.04 |
| Department of the Interior | 20 | 9 | 0.8351128 | 0.3614084 | 70000 | 47518 | 0.16702256 | 0.032526756 |
| Department of the Treasury | 33 | 11 | 0.2633017 | 0.5100492 | 125881 | 697 | 0.086889561 | 0.056105412 |
| Department of Transportation | 12.3 | 10.9 | 857.9 | 309.5 | 58011 | 11594 | 105.5217 | 33.7355 |
| Department of Veterans Affairs | 29.6 | 10 | 2.991 | 1.077 | 284316 | 7186 | 0.885336 | 0.1077 |
| Environmental Protection Agency | 25 | N/A | 0.14078 | 0.067315 | 17208 | 171 | 0.035195 | 0 |
| Farm Credit Administration | N/A | 10 | 0 | 1921 | 287 | 0 | 0 | 192.1 |
| Federal Housing Finance Agency | 50 | 5 | 13.5 | 1135.2 | 455 | 3 | 6.75 | 56.76 |
| General Services Administration | 28.7 | 14.6 | 2270645 | 156676 | 12827 | 9624 | 651675.115 | 22874.696 |
| Marine Mammal Commission | N/A | 35? | Blank | Blank | 23? | Blank | 0 | 0 |
| Millenium Challenge Corporation | N/A | 15 | 2.174 | 2.513 | 279 | 2 | 0 | 0.37695 |
| National Aeonautics and Space Administration | 18.3 | 12.6 | 1.356 | 0.171 | 18490 | 4884 | 0.248148 | 0.021546 |
| National Archives and Records Administration | 7 | 10 | 75.517 | 15.309 | 3611 | 68 | 5.28619 | 1.5309 |
| National Capital Planning Commission | N/A | 20 | N/A | 60.58 | 44 | 1 | 0 | 12.116 |
| National Endowment for the Humanities | N/A | 6.4 | N/A | 392.7 | 173 | 1 | 0 | 25.1328 |
| National Labor Relations Board | 20 | 5 | 124.5 | 2721.1 | 1740 | 56 | 24.9 | 136.055 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| National Mediation Board | Blank | ? | Blank | Blank | 49 | 1? | 0 | 0 |
| Nuclear Regulatory Commission | 4.4 | 3 | 13800.4 | 21552.7 | 2752 | 2 | 607.2176 | 646.581 |
| Office of Personnel Management | 20 | 5 | 6547.18 | 21295.49 | 6568 | 73 | 1309.436 | 1064.7745 |
| Overseas Private Investment Corporation | ? | ? | Blank | Blank | 230 | 1 | 0 | 0 |
| Peace Corps | 20 | 20 | 64.8 | 1164.6 | 3200 | 461 | 12.96 | 232.92 |
| Pension Benefit Guaranty Corporation | Blank | 5 | 0 | 427.5 | 980 | 11 | 0 | 21.375 |
| Railroad Retirement Board | 27.2 | 6.2 | 4100 | 542 | 900 | 56 | 1115.2 | 33.604 |
| Small Business Administration | 28 | 9 | 291.3 | 11057 | 4740 | 190 | 81.564 | 995.13 |
| Social Security Administration | 21.2 | 13 | 126204.7 | 150103 | 70898 | 1649 | 26755.3964 | 19513.39 |
| Tennessee Valley Authority | 17 | 20.7 | 0.573 | 0.102 | 12457 | 2876 | 0.09741 | 0.021114 |
| US Army Corps of Engineers | 23 | 5 | 338989 | 162274 | 35438 | 888 | 77967.47 | 8113.7 |
| United States Postal Service | 20 | 20 | 5.28 | 8.09 | 581775 | 33620 | 1.056 | 1.618 |
| **Totals** | **690.4** | **344.8** | **5,488,921** | **2,561,118** | **4,291,579** | **405,947** | **1420149.206** | **213962.6939** |

The White House established a 2008 baseline of 68.9 $MMtCO_2e$ 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 $MMtCO_2e$ in 2020.

To obtain the low estimate, 1/51 of the total federal reductions was assumed, resulting in 0.277 $MMtCO_2e$ of reductions in 2020. For the high estimate, 25 percent of the Washington Metropolitan Statistical Area Federal employee ratio is used to obtain 4.19 percent. This translates to a reduction of 0.591 $MMtCO_2e$. This, added to the low estimate of 0.277 $MMtCO_2e$ (non-Washington Metropolitan Statistical Area Federal employees), results in a total of 0.868 $MMtCO_2e$ of reductions in 2020.

## Other Environmental Benefits

Information on other environmental benefits is under development. There are potentially significant synergistic benefits with other regulated pollutants from energy efficiency measures in federal buildings, fleet vehicles, procurement practices, and employee vehicle miles traveled; water quality benefits from water efficiency and storm water management programs; and reductions in landfill waste from waste diversion programs.

## Economic Benefits, Job Creation and Job Protection

Information on economic benefits is under development. The federal government's large presence and purchasing power in Maryland is expected to drive significant economic activity in the areas within the purview of Executive Order 13514. The President's Council on Environmental Quality estimates that, nationwide, meeting federal agency GHG pollution reduction targets will result in a cumulative $8 billion to $11 billion in avoided energy costs through 2020.[193] How much of this could be credited to GHG reductions from federal facilities in Maryland will need further scrutiny.

Analyses for the economic benefits, job creation and job protection in Maryland from this program is included in Chapter 7 of this plan.

## Implementation

*Executive Order 13514.*
The federal government is the single largest energy consumer in the U.S. economy.[194] 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).[195] 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.

[193] http://www.whitehouse.gov/administration/eop/ceq/sustainability/fed-ghg.
[194] "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.
[195] 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

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.[196]

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.[197] 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.[198]

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.

*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.[199]

*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

[196] Ibid.
[197] "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.
[198] http://www.whitehouse.gov/administration/eop/ceq/sustainability/fed-ghg
[199] 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.

Federal Energy Management Program.[200] 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.[201] 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.[202]

## Supporting Laws and Regulations

- Executive Order 13514, "Federal Leadership in Environmental, Energy, and Economic Performance", issued October 8, 2009.
- Executive Order 13423, "Strengthening Federal Environmental, Energy, and Transportation Management", issued January 24, 2007.

## Links to Supporting Documentation

- Executive Order 13514, "Federal Leadership in Environmental, Energy, and Economic Performance", issued October 8, 2009. http://www.hss.doe.gov/nuclearsafety/env/rules/74/74fr52117.pdf
- Executive Order 13423, "Strengthening Federal Environmental, Energy, and Transportation Management", issued January 24, 2007
- FEMP Reporting Portal
- FEMP and CEQ Reporting Resources: http://www.fedcenter.gov/programs/greenhouse/inventoryreporting/fempceqresources/

[200] FEMP Reporting Portal
[201] Telephone conversation with Sarosh Olpadwala, U.S. General Services Administration, September 13, 2010.
[202] The Current, MCEC Newsletter, April 2011.

- US Department of Energy/FEMP consolidated Annual GHG and Sustainability Data Report, Version 1.0, October 6, 2010: http://www.fedcenter.gov/programs/greenhouse/inventoryreporting/
- General Service Administration GSA) bottom-up Carbon Footprint Tool for compiling monthly, facility-level data: https://www.carbonfootprint.gsa.gov/
- The Public Sector Standard for GHG Accounting and Reporting applies principles of the Corporate Standard to local, State, and federal agencies and serves as background information for guidance on EO 13514 GHG accounting and reporting requirements. http://www.ghgprotocol.org
- Business Resource Guide 2010 – Contracting with Maryland's Federal Facilities. This includes a contact list for some, but not all, of the federal facilities located in Maryland. http://www.choosemaryland.org/moveyourbusiness/Pages/B2GHowTo.aspx
- Federal Energy Management Program Point of Contact:
  Chris Tremper, Federal Energy Management Program
  EE-2L U.S. Department of Energy
  1000 Independence Ave., SW Washington, DC 20585-0121
  chris.tremper@ee.doe.gov, (202) 586-7632
- GSA Point of Contact:
  Sarosh P. Olpadwala, Office of Federal High-Performance Green Buildings (MG)
  U.S. General Services Administration
  1800 F Street, NW, Room 7204
  Washington, DC 20405-0002
  sarosh@gsa.gov, (202) 501-9190

# 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:[203]

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

**By 2020, the potential emission reductions from this program are estimated to be 0.57 MMt$CO_2$e.**

**Figure C-85. Low and High GHG Benefits for Innovative Initiatives-3**

| | | |
|---|---|---|
| Low Estimate | 0.55 MMt$CO_2$e | MDE Quantification Below |
| High Estimate | 0.57 MMt$CO_2$e | MDE Quantification Below |

**Low and High Estimates – MDE Quantification**

A. Estimated GHG Reductions

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.

[203] ACUPCC Reporting System, November 10, 2010, available: http://acupcc.aashe.org/.

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 metric tons of carbon dioxide equivalents (0.782 $MMtCO_2e$). 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.[204] 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 $MMtCO_2e$).[205]

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 $CO_2$-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 $MMtCO_2e$).

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

[204] 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)

[205] One school has not completed a GHG inventory at this time and therefore, was not included in this estimation.

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 $CO_2$-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 $CO_2$-equivalent (0.821 $MMtCO_2e$).

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:

$$GHG_i = Slope * Year_i + intercept$$

Where

$GHG_i$ = 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

SCPi = 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-86: Baseline GHG Emissions (metric tons of $CO_2$-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 | **36,065** |
| Community College of Baltimore County | | | 18,135 | 18,498 | 18,868 | 19,245 | 21,248 | **23,460** |
| Coppin State University | | | | 3,975 | 4,055 | 4,136 | 4,566 | **5,041** |
| Frostburg State University | 30,299 | 30,335 | 30,370 | 32,388 | 33,300 | 34,212 | 38,775 | **43,337** |
| Goucher College | | | | | | | | **11,500** |
| Harford Community College | | | | 6,057 | 6,178 | 6,302 | 6,958 | **7,682** |
| Howard Community College | 30,045 | 30,839 | 34,095 | 35,710 | 37,734 | 39,759 | 49,883 | **60,007** |
| McDaniel College | | | | 15,259 | 15,564 | 15,875 | 17,528 | **19,352** |
| Morgan State University | | | | | 45,753 | 46,668 | 51,525 | **56,888** |
| Mount St. Mary's University | 15,621 | 15,826 | 16,899 | 16,734 | 17,021 | 17,307 | 18,740 | **20,173** |
| Salisbury University | 26,696 | 27,230 | 27,775 | 28,330 | 28,897 | 29,475 | 32,542 | **35,929** |
| St. Mary's College of Maryland | 14,289 | 16,036 | 21,085 | 25,937 | 19,322 | 20,379 | 25,701 | **31,367** |
| Towson University | | | 52,653 | 53,706 | 54,780 | 55,876 | 61,691 | **68,112** |
| University of Baltimore | | | | 16,220 | 16,544 | 16,875 | 18,632 | **20,571** |
| University of Maryland, Baltimore | | | | 166,307 | 169,633 | 173,026 | 191,034 | **210,917** |
| University of Maryland, Baltimore County | | | 89,761 | 90,952 | 92,143 | 93,335 | 99,291 | **105,246** |
| University of Maryland, Center for Environmental Science | | | | 13,399 | 13,667 | 13,940 | 15,391 | **16,993** |
| University of Maryland, College Park | 365,334 | 370,506 | 387,967 | 405,428 | 422,889 | 440,350 | 527,655 | **614,959** |
| University of Maryland, Eastern Shore | | | | | 23,207 | 23,671 | 26,135 | **28,855** |
| University of Maryland, University College | | | | 22,806 | 23,262 | 23,727 | 26,197 | **28,924** |
| Washington | | | 15,289 | 15,595 | 15,907 | 16,225 | 17,914 | **19,778** |

## Figure C-87: Schools with Established 2020 GHG Reduction Targets (metric tons of $CO_2$-equivalent)

| Institution | Assumptions for 2020 Reductions | 2020 Business As Usual Emissions | 2020 Reductions |
|---|---|---|---|
| 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 $CO_2$-equivalent) | 546,097 |
| | | Total Emissions Avoided ($MMtCO_2e$) | **0.546** |

## Figure C-88: ACUPCC Schools with Estimated 2020 GHG Reductions (metric tons of $CO_2$-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 ($mtCO_2$) | 565,146 |
| | | Total Emissions Avoided ($MMtCO_2e$) | **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.

## Other Environmental Benefits

No other environmental benefits were identified for this version of the draft 2012 GGRA Plan but will be provided in future iterations.

## Economic Benefits, Job Creation and Job Protection

Analyses for the economic benefits, job creation and job protection in Maryland from this program is included in Chapter 7 of this plan.

## 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.

## Supporting Laws and Regulations

This is a voluntary program so there are no laws or regulations affiliated with this program.

## Links to Supporting Documentation

- American College and University Presidents' Climate Commitment: http://www.presidentsclimatecommitment.org/
- Association for the Advancement of Sustainability in Higher Education: http://www.aashe.org/
- Clean Air Cool Planet: http://www.cleanair-coolplanet.org/for_campuses.php
- Maryland Green Building Council Annual Report 2010, available: http://www.dgs.maryland.gov/pdfs/2010GreenBldgReport.pdf

## Figure C-89 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 |
| **TOTAL** | **20** | **9** | | | | | | | | | | | |

# Innovative Initiative-4: GHG Early Voluntary Reductions

**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 plans 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

**By 2020, the potential emission reductions from this program are estimated to be 1.03 MMt$CO_2$e.**

**Figure C-90. Low and High GHG Benefits for Innovative Initiatives-4**

| | | |
|---|---|---|
| Low Estimate | 0.26 MMt$CO_2$e | MDE Quantification Below |
| High Estimate | 1.03 MMt$CO_2$e | MDE Quantification Below |

**Low and High Estimates – MDE Quantification**

Qualification of Reductions

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 $CO_2$-equivalent through their emission certification reports. The largest contributor was the Sparrows Point Steel Manufacturing Facility which reported approximately 4.0 million tons of $CO_2$-equivalent. As part of its climate action plan, the Sparrows Point facility has suggested approximately 500,000 tons of potential $CO_2$-equivalent reductions which could be achieved from energy efficiency improvements and renewable energy generation. If all other manufacturing facilities were able to achieve a similar rate of reduction this would result in a total reduction of 1.03 million tons per year. If only 25 percent of the manufacturing facilities were able to achieve this rate of reduction the resultant savings would be 258,000 tons of $CO_2$-equivalent per year.

A survey is being completed that will provide more detail on the voluntary reduction efforts. This information will be available for the December 2011 draft of the GGRA Plan.

## Other Environmental Benefits

If voluntary reductions are achieved through energy efficiency measures, the consumption of less energy will also mean that other pollutants may be reduced, including nitrogen oxides, sulfur oxides, particulate matter, and air toxics.

## Economic Benefits, Job Creation and Job Protection

After Maryland's stationary sources submit voluntary reduction plans, MDE will be better able to assess job impacts. If voluntary reductions are achieved through energy efficiency measures, the sources will realize an economic benefit because they will be purchasing less energy. The exact amount will depend on the specifics of each plan.

Analyses for the economic benefits, job creation and job protection in Maryland from this program is included in Chapter 7 of this plan.

## Implementation

MDE will send a letter advising sources in the manufacturing of the provision in the law allowing for potential future credit in return for an early GHG reduction plan. MDE will review, comment on, and if appropriate approve the plans. After sources submit and implement their plan, MDE will track the amount of early reductions achieved.

## Supporting Laws and Regulations

- The Greenhouse Gas Emissions Reduction Act of 2009

# Innovative Initiatives-5: State of Maryland Initiative to Lead by Example

Lead Agency: DGS

## Program Description

Maryland's State government has initiated a comprehensive suite of lead-by-example programs to improve efficiency, reduce waste, and integrate renewable energy and sustainable practices in its agencies' operations and facilities. These programs are embodied in five major initiatives:

- High Performance Buildings
- Green Maryland Act of 2010
- Maryland Environmental Footprint
- Generating Clean Horizons
- Project Sunburst

The first two, High Performance Buildings and Green Maryland Act of 2010, are addressed in this Section.[206] Collectively, the five initiatives 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.[207]

## 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.[208] 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*.[209]

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.
- Fiscal Year 2011 – Three projects were funded for design; they are located in three counties.

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[206]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".

[207] 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/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).

[208] Senate Bill 208, Chapter 124, Acts of 2008.

[209] 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.

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.* As of January 2010, 46 schools had attained or were seeking LEED certification. [210]

*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.[211] 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.[212]

## Existing Programs – Procurement

*Green Maryland Act of 2010*
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. In recognition of this, the General Assembly established a legislative framework 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.[213]

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

[210] Detail on individual projects is found in Maryland Green Building Council 2009 Annual Report, http://www.dgs maryland.gov/press/pubs/2009GreenBldgReport.pdf , and 2010 Annual Report, http://www.dgs maryland.gov/pdfs/2010GreenBldgReport.pdf
[211] 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.
[212] EmPOWERingMaryland Clean Energy Programs Fiscal Year 2011 Draft, MEA, pp. 7-8. 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
[213] Senate Bill 693 / House Bill 1124, Chapters 593 and 594, Acts of 2010.

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.[214]
- 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

**By 2020, the potential emission reductions from this program are estimated to be 2.30 MMt$CO_2$e.**

### Figure C-91. Low and High GHG Benefits for Innovative Initiatives-5

| | | |
|---|---|---|
| Low Estimate | 0.20 MMt$CO_2$e | SAIC Quantification Appendix B, Pg. 51 |
| High Estimate | 2.30 MMt$CO_2$e | MDE Quantification Below |

**High Estimate – MDE Quantification**

### Figure C-92. Summary of Estimated Avoided GHG Emissions in 2020 (MMt$CO_2$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 | 0.10 | 0.10 |

[214] Some of these programs are recommended in the 2008 Climate Action Plan, su*pra*., fn. 2.

| | | |
|---|---|---|
| Performance Contracts | | |
| 5. LEED | 0.10 | 0.12 |
| **Total** | **1.24** | **2.30** |

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). 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-93. Summary of GHG benefits for a 25 Percent Reduction

| 2008 Base Year $MMtCO_2e$ | 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-94. 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 $CO_2$-equivalent | $MMtCO_2e$ | | | | |
| 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 |
| | | | | | **0.45** | | **0.89** |

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-95. 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-96. Comparison of 25 Percent and 50 Percent GHG Reductions**

| | Base Year 2005 | 25% Reduction from Base 2020 | Low Estimate | 50% Reduction from Base 2020 | High Estimate |
|---|---|---|---|---|---|
| **MMt$CO_2e$** | 0.80 | 0.6 | **0.20** | 0.4 | **0.40** |

4. Energy Performance Contracts

Estimates from work conducted by SAIC under contract to MDE.

**Figure C-97. GHG Reductions from Environmental Performance Contracts**

| Emissions Category | GHG Reductions (Million Metric Tons $CO_2e$) | | |
|---|---|---|---|
| | 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,[215] 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-98. 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.

LEED emissions were calculated using the assumptions about the number of buildings in the program description and the GHG reductions described in the quantification

[215] 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

document. Base reductions represent 2020 Silver LEED and aggressive reductions represent 2020 Gold LEED

**Figure C-99. GHG Reductions from LEED**

| | | | | Metric Tons GHG Reductions | | | Estimated Benefits Metric Tons | | Low Estimate $MMtCO_2e$ |
|---|---|---|---|---|---|---|---|---|---|
| **Fiscal Year** | **Projects** | **Certification** | **Points** | **2015** | **2020** | **2015** | **2020** | **2015** | **2020** |
| 2008-2009 | 2 | Silver | 33 | 2,000 | 3,200 | 4,000 | 6,400 | 0.00 | 0.01 |
| 2009 | 9 | Silver | 33 | 2,000 | 3,200 | 18,000 | 28,800 | 0.02 | 0.03 |
| 2010 | 17 | Silver | 33 | 2,000 | 3,200 | 34,000 | 54,400 | 0.03 | 0.05 |
| 2011 | 3 | Silver | 33 | 2,000 | 3,200 | 6,000 | 9,600 | 0.01 | 0.01 |
| | | | | | | | | **Total** | **0.10** |
| | | | | Metric Tons GHG Reductions | | | Estimated Benefits Metric Tons | | High Estimate $MMtCO_2e$ |
| **Fiscal Year** | **Projects** | **Certification** | **Points** | **2015** | **2020** | **2015** | **2020** | **2015** | **2020** |
| 2008-2009 | 2 | Gold | 39 | 2,600 | 4,000 | 5,200 | 8,000 | 0.01 | 0.01 |
| 2009 | 9 | Gold | 39 | 2,600 | 4,000 | 23,400 | 36,000 | 0.02 | 0.04 |
| 2010 | 17 | Gold | 39 | 2,600 | 4,000 | 44,200 | 68,000 | 0.04 | 0.07 |
| 2011 | 3 | Gold | 39 | 2,600 | 4,000 | 7,800 | 12,000 | 0.01 | 0.01 |
| | | | | | | | | **Total** | **0.12** |

## Other Environmental Benefits

Increasing energy efficiency in Maryland State government's facilities operations and purchasing practices reduces the need for power generation from fossil fuel sources. In addition to reducing GHG emissions, this will create reductions in nitrogen dioxide, sulfur dioxide and mercury.

- Nitrogen dioxide emission reductions will help Maryland meet air quality standards for ground level ozone and fine particulate matter. The reductions will also significantly help Maryland reduce nitrogen pollution in the Chesapeake Bay.
- Sulfur dioxide emission reductions will help Maryland further reduce fine particulates and also help achieve the visibility improvements required to comply with federal regional haze requirements.
- Mercury, a toxic pollutant, is primarily released by air pollution sources but ultimately affects water quality and bioaccumulates in fish tissue. Mercury reductions will help improve water quality in Maryland.

## Economic Benefits, Job Creation and Job Protection

Analyses for the economic benefits, job creation and job protection in Maryland from this program is included in Chapter 7 of this plan.

## 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.

## Supporting Laws and Regulations

- Executive Order 01.01.2001.02, "Sustaining Maryland's Future with Clean Power, Green Buildings, and Energy Efficiency".[216]
- State Buildings Energy Efficiency and Conservation Act of 2006 (Senate Bill 267).[217]
- Maryland Green Building Council (Senate Bill 332/House Bill 94).[218]
- EmPower Maryland Executive Directive.[219]
- High Performance Buildings Act of 2008 (Senate Bill 208), summarized above.
- High Performance Buildings Act - Applicable to Community College Capital Projects (Senate Bill 234/House Bill 1044), summarized above.
- Green Maryland Act of 2010 (Senate Bill 693/House Bill 1164), summarized above.

[216] The Executive Order established the Maryland Green Building Council. It also directed State agencies to procure clean power and set goals for energy efficiency, renewable energy, efficient product purchases, pollution prevention, and alternative fuel vehicles in State government.

[217] The law established a goal of reducing average energy consumption in State buildings from 2005 levels by 5 percent by 2009 and 10 percent by 2010.

[218] The law codified and re-established the Maryland Green Building Council to promote high performance buildings, systems, and policies for State-owned and leased facilities.

[219] This Administration initiative set a target to reduce Maryland's per capita electricity consumption 15 percent by 2015. It called on State government to increase energy efficiency through improved facility operations and purchasing practices, and established accountability through energy data reporting into StateStat, the Maryland statistics-based government management process. EmPOWER Maryland's specific directives to State government include:

- Replace incandescent lights with compact fluorescent lights in State facilities;
- Expand energy performance contracting in State programs;
- Increase the State Agency Loan Program, which funds energy-efficient lighting, controls, and heating, ventilating and air conditioning systems;
- Require all new State buildings larger than 20,000 cubic feet to be more energy efficient;
- Purchase ENERGY STAR® products;
- Expand the Community Energy Loan Program, which provides low-interest revolving loans to local governments and nonprofit organizations to install energy efficiency improvements; and
- Ensure accountability by incorporating energy data into StateStat.

## Links to Supporting Documentation

- Maryland Climate Action Plan, August 2008, Chapter 4: http://www.mde.state.md.us/programs/Air/ClimateChange/Documents/www.mde.state.md.us/assets/document/Air/ClimateChange/Chapter4.pdf
- Maryland Climate Action Plan, August 2008, Appendix D: http://www.mde.state.md.us/programs/Air/ClimateChange/Documents/www.mde.state.md.us/assets/document/Air/ClimateChange/Appendix_D_Mitigation.pdf
- Maryland Green Building Council 2009 Annual Report: http://www.dgs.maryland.gov/press/pubs/2009GreenBldgReport.pdf
- Maryland Green Building Council 2010 Annual Report: http://www.dgs.maryland.gov/pdfs/2010GreenBldgReport.pdf
- EmPOWERing Maryland Clean Energy Programs FY11 Draft, Maryland Energy Administration. energy.maryland.gov/documents/fy11programbook.pdf.
- DGS Energy Performance Contracts: http://www.dgs.maryland.gov/greenefforts
- State Agency Loan Program: http://www.energy.state.md.us/Govt/stateLoan.html
- State Buildings Energy Efficiency and Conservation Act of 2006: Senate Bill 267 (Chapter Number: 427)
- Maryland Green Building Council (Senate Bill 332/House Bill 942): Chapter Number: 115 & 116
- High Performance Buildings Act of 2008 (Senate Bill 208): Chapter Number: 124
- High Performance Buildings Act - Applicable to Community College Capital Projects (Senate Bill 234/House Bill 1044): Chapter Number: 527 & 528
  Green Maryland Act of 2010 (Senate Bill 693/House Bill 1164): Chapter Number 593 & 594

# Innovative Intiatives-6: State of Maryland Carbon and Footprint Initiatives

Lead Agency: DGS

## Program Description

The *Maryland Environmental Footprint* program was launched by Governor O'Malley in 2009 to calculate, reduce, track and report the environmental footprint of State agencies and universities in five areas: 1) electricity and building energy; 2) water use; 3) vehicle fuel; 4) waste/recycling; and 5) aggregate GHG emissions. The program is part of the Governor's *Smart, Green and Growing* initiative to "…strengthen the State's leadership

role in fostering smarter, more sustainable growth and to inspire action among all Marylanders to achieve a more sustainable future."[220]

The *Maryland Environmental Footprint* is part of a comprehensive suite of lead-by-example programs the State government has initiated to reduce its agencies' carbon footprints in the construction and operation of their buildings and facilities and in their purchasing practices.[221] Collectively, the programs significantly advance the lead-by-example policy recommendations of the Maryland Commission on Climate Change.[222]

Existing Program

In consultation with the Governor's Delivery Unit, three agencies – the Maryland Environmental Services, DGS and DNR – co-led the development of the *Maryland Environmental Footprint* program through a series of meetings with State agencies and the University System of Maryland in 2009. Energy, fuel, and waste data were collected from State agencies. From this, energy expenditure calculations were made and a baseline and reduction goals for State government were established. The *State Government Environmental Footprint Reduction Goals* policy statement was issued June 10, 2009. It established goals in four overarching areas: 1) electricity and building energy; 2) fleet vehicle fuel; 3) waste reduction, reuse, recycling; and 4) water use.[223] The interagency group collected and reviewed existing executive orders, directives and laws in order to harmonize and assimilate previously established goals – in some cases conflicting or overlapping – into the *Footprint* goals.[224]

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[220] Reducing Maryland State Government's Environmental Footprint, CY09 Annual Report, prepared for the Governors Delivery Unit by Maryland Environmental Services, p. 4. See http://www.green.maryland.gov/carbon_footprint_page html for a link to the report.

[221] Five programs make up the suite: 1) High Performance Buildings; 2) Green Maryland Act of 2010; 3) Maryland Environmental Footprint; 4) Generating Clean Horizons; and 5) Project Sunburst. High Performance Buildings and Green Maryland Act of 2010 are addressed in policy Innovative Initiatives-5: State of MD Initiative to Lead by Example. Generating Clean Horizons and Project Sunburst are addressed in policy Energy-12: Incentive and Grant Programs to Support Renewable Energy.

[222] 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/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).

[223] The State Government Environmental Footprint Reduction Goals policy statement is reproduced at the end of this Section.

[224] Examples include:

- Executive Order 01.01.2001.02, "Sustaining Maryland's Future with Clean Power, Green Buildings, and Energy Efficiency", established the Maryland Green Building Council. It also directed State agencies to procure clean power and set goals for energy efficiency, renewable energy, efficient product purchases, pollution prevention, and alternative fuel vehicles in State government.
- Executive Order 01.01.2001.06 set goals for reducing water consumption by State agencies by 10 percent from 2000 to 2010;

The annual progress of each agency and university, and the State government as a whole, is tracked on the *Maryland Environmental Footprint* page[225] of Maryland's *Smart, Green and Growing* website.[226] The website also contains a link to the *2009 Annual Report* on the *Footprint* initiative, which summarizes the major achievements of the first year and recommends next steps for 2010 and beyond.

Programs under Consideration

The *Report's* recommended next steps include:

- Training of State agency staff and university students.
- Identifying additional targets for *Footprint* reductions.
- Considering adding additional *Footprint* parameters, including stormwater management, nitrogen sources, forest canopy cover, reduction of impervious surfaces and others.[227]

In addition:

- DGS will work with DNR and the Maryland Environmental Services to adopt and implement as *Maryland Environmental Footprint* reduction goals:
    - A schedule for the State government's purchase of electricity from renewable sources that exceeds the State's RPS interim and final (2022) targets; and
    - A strategy to encourage State purchasing agents to consider the end-of-life disposal stage of equipment and goods when making purchasing decisions.

## Estimated Greenhouse Gas Emission Reductions in 2020

This program references a specific Governor's Initiative and the quantification of potential GHG reductions is aggregated in the quantification of Innovative Initiatives-5: State of Maryland Initiative to Lead by Example.

## Other Environmental Benefits

Increasing energy efficiency and reducing waste in Maryland State government's facilities and fleet vehicle operations reduces the need for power generation from fossil

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- State Buildings Energy Efficiency and Conservation Act of 2006 established a goal of reducing average energy consumption in State buildings from 2005 levels by 5 percent by 2009 and 10 percent by 2010.
- EmPOWER Maryland – 2007 Executive initiative set a target to reduce Maryland's per capita electricity consumption 15 percent by 2015. It called on State government to increase energy efficiency through improved facility operations and purchasing practices, and established accountability through energy data reporting into StateStat, the Maryland statistics-based government management process.

[225] http://www.green.maryland.gov/carbon_footprint_page html. The 2009 energy data shows a 10 percent reduction in energy usage among state agencies as compared to 2008.

[226] http://www.green.maryland.gov/leading_by_example.html.

[227] Supra, fn. 1, Reducing Maryland State Government's Environmental Footprint, CY09 Annual Report, Executive Summary.

fuel sources. In addition to reducing GHG emissions, this will create reductions in nitrogen dioxide, sulfur dioxide and mercury.

- Nitrogen dioxide emission reductions will help Maryland meet air quality standards for ground level ozone and fine particulate matter. The reductions will also significantly help Maryland reduce nitrogen pollution in the Chesapeake Bay.
- Sulfur dioxide emission reductions will help Maryland further reduce fine particulates and also help achieve the visibility improvements required to comply with federal regional haze requirements.
- Mercury, a toxic pollutant, is primarily released by air pollution sources but ultimately affects water quality and bioaccumulates in fish tissue. Mercury reductions will help improve water quality in Maryland.

## Economic Benefits, Job Creation and Job Protection

Analyses for the economic benefits, job creation and job protection in Maryland from this program is included in Chapter 7 of this plan.

## Implementation

The *Maryland Environmental Footprint* program is driven by an executive policy statement. DGS, Maryland Environmental Services and DNR have primary responsibility for administering the program. Programmatic progress is tracked on the Governor's *Maryland Environmental Footprint* page of Maryland's *Smart, Green and Growing* website and in the *Maryland Environmental Footprint's* annual reports, also published on the website.

## Supporting Laws and Regulations

- Executive Order 01.01.2001.02, "Sustaining Maryland's Future with Clean Power, Green Buildings, and Energy Efficiency"
- Executive Order 01.01.2001.06 (set goals for reducing water consumption by State agencies by 10 percent from 2000 to 2010)
- State Buildings Energy Efficiency and Conservation Act of 2006: Senate Bill 267, Chapter Number 427
- EmPOWER Maryland – 2007 Executive initiative

## Links to Supporting Documentation

- State Government Environmental Footprint Reduction Goals, June 10, 2009.

# Innovative Initiatives-7: 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.[228] 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.[229]

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.[230]

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

[228] The Governor's Workforce Investment Board, "Maryland's Energy Industry Workforce Report," September 2009, Accessible at: http://www.mdworkforce.com/pub/pdf/energyworkforce.pdf
[229] Ibid.
[230] 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.

- Convene short-term public-private working groups to handle specific issues raised within the recommendations.[231]

## 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.

## Other Environmental Benefits

There is tremendous environmental benefit to promoting economic development opportunities associated with reducing GHG emissions in Maryland. Green jobs can include anything from planting trees to producing cleaner energy, which can reduce air pollution and increase water quality.

## Economic Benefits, Job Creation and Job Protection

The recommendations made by the task force are intended to support green job creation and protection in Maryland. The job creation and protection analysis is under development and is expected to be completed by May 2011. DBED estimates that by 2012, there will be 2,500 new jobs tied to green industry and energy efficiency.

Analyses for the economic benefits, job creation and job protection in Maryland from this program is included in Chapter 7 of this plan.

## 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

[231] Ibid.

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 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.

## Supporting Laws and Regulations

- Maryland Greenhouse Gas Emissions Reduction Act of 2009

### Suggested Laws and Regulation

Consider bills to provide a loan forgiveness or reimbursement program for State students majoring in jobs in green tech fields. Consider giving grants to community colleges and vocational schools for job training programs in the field of clean energy.

## Links to Supporting Documentation

- The Governor's Workforce Investment Board, "Maryland's Energy Industry Workforce Report," September 2009, Accessible at: http://www.mdworkforce.com/pub/pdf/energyworkforce.pdf
- 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.
- The Pew Charitable Trusts, "Pew Finds Clean Energy Economy Generates Significant Job Growth," June 6, 2009, Accessible at: http://www.pewtrusts.org/news_room_detail.aspx?id=53254.
- The Pew Charitable Trusts, "The Clean Energy Economy," June 2009, Accessible at: http://www.pewcenteronthestates.org/uploadedFiles/Clean_Economy_Report_Web.pdf, Page 4.

# Innovative Initiatives-8: Public health Initiatives Related to Climate Change

Lead Agency: DHMH

## Program Description

Climate change will have profound and largely negative effects on the health of Maryland's citizens. Throughout the world, the prevalence of some diseases and other threats to human health depend largely on local climate. Extreme temperatures can lead directly to loss of life, while climate-related disturbances in ecological systems, such as changes in the range of infective parasites, can indirectly impact the incidence of serious infectious diseases. In addition, warm temperatures can increase air and water pollution, which in turn harm human health.

Dealing with these negative effects will be costly in terms of actual dollars spent for health care by State government, private businesses, and individuals; increased burden of disease on individuals; time off work and out of school; and lost productive years of life. However, many strategies for reducing GHG emissions have beneficial effects on health, such as improved air quality. In a 2007 report, the Intergovernmental Panel on Climate Change concluded that human beings are exposed to climate change through changing weather patterns and indirectly through changes in water, air, food quality and quantity, ecosystems, agriculture, and economy. At this early stage the effects are small but are projected to progressively increase in all countries and regions.

Because the potential risks to health of unmitigated climate change are so extreme and the potential benefits to health of certain policies to reduce GHG emissions are significant, these risks, costs, and benefits were considered for all climate change and

energy policies. The development within DHMH of more specific adaptation strategies associated with climate change will be coordinated with MDE, MDP, and the Maryland Emergency Management Administration and will depend on existing surveillance activities for vector-borne disease and environmental public health tracking.

A combined effort is needed in order to minimize the public health risks of climate change. Through continued coordination between DHMH and other State agencies, preemptive measures can be taken to both prevent and minimize the impact of climate change on public health. In 2002, DHMH received Center for Disease Control funding to plan for a Statewide Environmental Public Health Tracking Network that will be part of the national tracking network. Maryland used the funding to build capacity and enhance infrastructure. The results range from starting or improving surveillance to enabling faster responses to environmental public health questions and faster action to prevent disease.

Before Maryland's Tracking Program began, the Maryland Center for Cancer Surveillance could not provide to local health departments spatially displayed information on colorectal screening and treatment rates. To meet the Cancer Program's needs, the Maryland Tracking Program developed a mapping tool known as the Interactive Health Application. This led to the creation of the Cancer Prevention, Education, Screening and Treatment Mapper. Local health departments now use the Cancer Prevention, Education, Screening and Treatment Mapper to improve cancer screening and prevention. In addition, the Maryland Tracking Program has helped the Center for Cancer Surveillance and MDE better coordinate on issues of environmental public health. The two agencies are now more efficiently sharing and using data, which will help them respond to environmental public health needs across the State.

## Estimated GHG Emission Reductions in 2020

Although no emissions reductions can be attributed directly to this program, the continued development of the State Climate Change Environmental Health and Protection Advisory Council will allow for a more thorough refinement/development of existing/future programs, potentially increasing their total reductions.

## Other Environmental Benefits

By determining what environmental health risks to the public exist that result from climate change, attention can be given to address areas of the environment which would otherwise be overlooked when dealing with the common concerns of climate change.

## Economic Benefits, Job Creation and Job Protection

Although no jobs can be attributed directly to this program, the continued development of the State Climate Change Environmental Health and Protection Advisory Council will allow for a more thorough refinement/development of existing/future policies, potentially increasing their ability to create jobs.

Analyses for the economic benefits, job creation and job protection in Maryland from this program is included in Chapter 7 of this plan.

## Implementation

DHMH has been working with MDE to improve the capabilities of its Environmental Public Health Tracking infrastructure. This online tool presents both health and environmental data at various levels that can be used by the public and, in a secure fashion, by health department personnel, to present detailed information about health and environmental data at a detailed level sufficient to be useful for health impact assessment.

The Maryland Tracking Program has been used to provide useful information and data to communities concerned about environmental public health issues. The Environmental Chemistry Laboratory can now analyze urine samples for a broad range of pesticides, organophosphates, pyrethroids and heavy metals. This provides Maryland with the ability to assess pesticide exposure in the population, either in response to acute exposures, or, potentially, to broader population-based surveys. The Environmental Public Health Tracking Network project showed that asthma rates were associated with ozone and particulate levels in air. The project also helped DHMH and MDE forge a closer working relationship regarding the analysis and interpretation of linked environmental and health data.

DHMH is also working with the Commission on Environmental Justice and Sustainable Communities, MDE, and MDP on the introduction of health indicators that could be used by MDP and other agencies to evaluate the potential impacts of climate change adaptation or mitigation strategies, as well as the potential health consequences of projects related to adaptation to sea level rise. DHMH has strengthened its coordination with DNR and MDE related to monitoring and reporting of Chesapeake Bay-related health concerns, specifically with respect to harmful algal blooms. Additionally, the Mid-Atlantic Zoonotic and Vector Borne Disease Inter-Agency Workgroup, a collaboration of DHMH, DNR, and MDA, has been meeting regularly regarding monitoring of vector borne diseases.

## Links to Supporting Documentation

- Maryland Environmental Public Health Tracking
  http://eh.dhmh.md.gov/tracking/

# Innovative Initiatives-9: Title V Permits for GHG Sources

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

## Other Environmental Benefits

It is difficult to determine other environmental benefits related to Title V since the benefits attributable to Title V, as discussed previously, are based upon the relevance of this program to policymaking, transparency issues and market efficiency.

## Economic Benefits, Job Creation and Job Protection

It is difficult to determine new job creation and current job protection benefits related to Title V since the benefits attributable to Title V, as discussed previously, are based upon the relevance of this program to policymaking, transparency issues and market efficiency.

Analyses for the economic benefits, job creation and job protection in Maryland from this program is included in Chapter 7 of this plan.

## 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 $CO_2$-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 $CO_2$-equivalent and no modification resulting in net GHG increases of less than 50,000 tons per year $CO_2$-

equivalent will be subject to Title V permitting before at least 6 years from now to April 30, 2016.

## Supporting Laws and Regulations

- Clean Air Act (United States Code Title 42, Chapter 85)
  http://frwebgate.access.gpo.gov/cgi-bin/usc.cgi?ACTION=BROWSE&TITLE=42USCC85&PDFS=YES
- Title V Operating Permits Program (40 CFR part 70)
  http://www.access.gpo.gov/nara/cfr/waisidx_04/40cfr70_04.html

## Links to Supporting Documentation

- Clean Air Act - http://www.epa.gov/air/caa/
- EPA Title V Operating Permits Program - http://www.epa.gov/oaqps001/permits/
- EPA Office of Inspector General, Title V Evaluation Report, March 9, 2005
  http://www.epa.gov/oig/reports/2005/20050309-2005-P-00010.pdf