Maryland
Department of
the Environment

Larry Hogan
Governor

Boyd Rutherford
Lieutenant Governor

Ben Grumbles
Secretary

December 9, 2016

The Honorable Thomas V. "Mike'" Miller, Jr.
President
Senate of Maryland
State House, H-107
Annapolis, MD 21401

The Honorable Michael E. Busch
Speaker
Maryland House of Delegates
State House, H-101
Annapolis, MD 21401

President Miller and Speaker Busch:

In accordance with the Environment Article §2-1305, I am pleased to submit the Department's status report on programs related to greenhouse gas reduction efforts and climate change. Environment Article §§ 2-1301 et seq. governs the Maryland Commission on Climate Change and requires various state agencies to report on the status of programs that support the State's Greenhouse Gas Reduction Efforts and address Climate Change. This status report has also been submitted to the Governor and members of the Maryland Commission on Climate Change.

Sincerely,

Ben Grumbles
Secretary

cc: Sara Albert, Department of Legislative Services (5 copies)

Maryland Department of the Environment 2016 Annual Climate Change Reports

11/1/2016

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Introduction

This document is a composite report consisting of all the State Agency Reports submitted to the governor and the Maryland Commission on Climate Change in 2016. The State Agency reports were created in compliance with State Environment Article §2-1305, which requires each state agency to review their respective planning, regulatory, and fiscal programs. Each agency involved adhered to a common template for ease of reading, but each created their own respective reports.

The reports detail the status of programs managed by MDE that support the State's greenhouse gas reduction efforts. Each report may also recommend policy, planning, regulatory, and fiscal changes to existing programs if applicable.

Maryland Department of the Environment

C. Regional Greenhouse Gas Initiative (RGGI)

Program Description

Maryland is one of nine Northeast and Mid-Atlantic States that participate in the RGGI – a regional market-based cap-and-trade program to reduce CO_2 emissions from fossil fuel-fired power plants in the region. RGGI reduces emissions through an emissions cap applied to the nine-state geographic region. Under the initiative, the participating states issue "allowances" equal to the number of tons of CO_2 emissions allowed under the regional cap. A single allowance permits a source to emit one ton of carbon.

Program Objectives

RGGI's purpose is to reduce (by placing a cap on) CO_2 emissions from fossil fuel-fired power plants. This encourages the use of less carbon intense resources, such as burning natural gas instead of coal.

Implementation Milestones

The RGGI program is mandated by State law and is fully implemented and enforceable through regulations (COMAR 26.09) adopted and enforced by MDE. Specific implementation milestones include:

- 2010 Program Review completed.
  - Required by COMAR 26.09.02.02(E)
  - Contracted with Regional Economic Studies Institute (RESI) to conduct review.
  - Reviewed auctions, auction prices, electricity generation in Maryland, set-aside accounts, COATS, and an overall impact analysis.
- 2012 Program Review completed.
  - Required by RGGI MOU.
  - Required a review of all components of the RGGI program.
- 33 quarterly auctions held to date.
  - Auction 33 held on September 7, 2016.
  - $533,435,511.10 in cumulative proceeds for Maryland.
- 2016 Program Review in progress as of September 13, 2016.
  - Required by RGGI MOU.
  - Requires a review of all components of the RGGI program.

Estimated Emission Reductions for CY 2015

RGGI provides a framework by which emission reductions are implemented under the EmPOWER and Renewable Portfolio Standard (RPS) programs. The potential emission reductions from the RGGI program in 2020 are estimated to be 3.60 $MMtCO_2e$. The RGGI states utilized Integrated Planning Model (IPM) modeling of both the reference case and the 91

ton cap policy case (http://www.rggi.org/design/program-review). The difference between the original 166 million tons of CO_2 cap and the 91 million tons of CO_2 cap was 21.0 million tons of CO_2 for the entire region. Maryland possessed the bulk of the reductions with 13.0 million tons of CO_2. This was converted to 11.79 $MMtCO_2e$ (0.097185), which was further reduced to account for the two coal plants that the model retired. Given that the plant operators confirmed that they planned to remain operational until at least 2020, their 3 year average emissions (8.19 million tons CO_2) where subtracted from the total, arriving at 3.60 $MMtCO_2e$. This is a conservative assumption estimation methodology.

IPM modeling predicted 2015 emissions as 25.0 million tons of CO_2. Emissions from RGGI sources in 2015 were 18.7 million tons of CO_2 (from EPA CAM-D). Therefore, Maryland is 6.3 million tons of CO_2 ahead of schedule, however this also accounts for RPS and energy efficiency reductions.

Following the 2012 Program Review, the RGGI states implemented a new 2014 RGGI cap of 91 million short tons. The RGGI CO_2 cap then declines 2.5 percent each year from 2015 to 2020. Additionally, the RGGI program was potentially strengthened by the federal Clean Power Plan, which was finalized in 2015. It is not unreasonable to assume that an additional 10 percent to 15 percent emission reduction could be achieved by 2020. By 2030, 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

RGGI and the signatory states made extensive modeling runs in the process of selecting the 91 ton cap (http://www.rggi.org/design/program_review/materials-by-topic/modeling). From the baseline run it is projected that CO_2e emissions would be reduced by 8.0 million tons. As RGGI's cap is in short tones, these are then converted to metric tonnes. Further, the IPM model closed plants based on an economic basis. The model projected two facilities closing in Maryland, however, MDE in consultation received confirmation from the sources that they did not intend to close. Therefore, the reduction was calculated with the inclusion of the emissions from these facilities.

Enhancement Opportunities

The enhancement to the RGGI program that was proposed in the *2012 GGRA Plan* is now fully adopted as part of the implementing regulations for RGGI. RGGI is currently undergoing a review for 2016 as required by the RGGI MOU, the results of which could have impacts on components of the program such as cap size, reduction increments, and overall program structure. No further enhancements can be made to the program outside of the appropriate program review process outlined in the RGGI MOU.

Funding

The RGGI program self-funds by nature. The auctioning of allowances also provides funds for other programs, such as EmPOWER and RPS.

Challenges

Emission reductions may not happen in areas where fewer allowances are sold at auction (e.g., fewer allowances sold in Maryland may result in emission reductions in Pennsylvania). Cooperation can be difficult at times, as different states may possess differing opinions and motives.

Additionally, the process of auctioning CO_2 allowances makes them vulnerable to price gouging when traded after the initial purchase.

Relevant Information

RGGI will spur economic activity. RESI's 2015 study estimated that RGGI, once fully operational, would support a total of 1,015 jobs by 2020, $94,970,706 to $322,862,295 in net economic output and $117,721,558 to $770,226,749 in wages over the lifetime of the program.

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

Program Description

The Boiler MACT rule applies to any stationary source with a boiler or group of stationary sources with boilers that emit 10 tons per year of any single Hazardous Air Pollutant (HAP) of 25 tons per year of any combination of HAPs. The Boiler MACT rules require operators to conduct a boiler tune-up to improve efficiency, minimize fuel consumption, and reduce emissions on an annual and continuous basis.

Program Objectives

The Boiler MACT program's purpose is to reduce greenhouse gas emissions from both Maryland and out-of-state power generators.

Implementation Milestones

EPA adopted new air emissions requirements for industrial, commercial, and institutional boilers under two separate rulemakings. Specific implementation milestones include:

- January 2013: Established national emission standards for Hazardous Air Pollutants (HAPs) for major sources
    - The rule affects thousands of boilers and process heaters at facilities nationwide which are considered as major sources

- February 2013: EPA issued a Boiler MACT rule for smaller "area sources"

Estimated Emission Reductions for CY 2015

The potential emission reductions from the Boiler MACT program in 2020 are estimated to be 0.07 $MMtCO_2e$.

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 CO_2 per year. Actual emissions from this sector have been calculated as roughly 1.45 $MMtCO_2e$ per year assuming the affected boilers operate at an average of 15 percent capacity factor. Using MDE's inventory of boilers that would be subject to the Boiler MACT rule, MDE has calculated that implementation of the Boiler MACT tune-up requirement could result in CO_2 reductions from 98,000 to 14,700 tons per year. This is based on the total CO_2 emissions for impacted boilers being reduced by 1 percent. Accounting for overlap, emissions reductions are reduced to 0.07 $MMtCO_2e$.

Enhancement Opportunities

This program has a chance to enhance itself every time new control technology is developed with new regulations and standards.

Funding

From 2010 to 2020, the Boiler MACT program is expected to utilize $94,374,000.

Challenges

While it does not necessarily experience a major "challenge," the Boiler MACT program is instead perpetually limited by the availability, effectiveness, and overall viability of current control technology.

Relevant Information

According to RESI's 2015 Study, the Boiler MACT program would support a total of 89 jobs by 2020, $76,106,574 in net economic output and $86,578,365 in wages over the lifetime of the program.

D.1.B. GHG New Source Performance Standard

Program Description

The Environmental Protection Agency (EPA) is using the New Source Performance Standard's authority under the federal Clean Air Act to promulgate new regulations to reduce GHG

emissions from fossil fuel-fired power plants. These performance standards apply to new electric generating units and will be based on existing technologies. EPA is coordinating this action on GHGs with a number of other required regulatory actions for other pollutants, thereby enabling electric generating units to develop multi-pollutant strategies to reduce pollutants in a more efficient and cost-effective way than would be possible by addressing multiple pollutants separately.

Program Objectives

The GHG New Source Performance Standard is designed with the intent to lower greenhouse gas pollution from fossil fuel-fired power plants.

Implementation Milestones

The New Source Performance Standard is fully enforceable through the federal Clean Air Act. MDE will implement the federal rules by adopting them into Maryland state regulations and the MDE Air Quality Compliance Program will 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.

Estimated Emission Reductions for CY 2015

The potential emissions reductions from the GHG New Source Performance Standard program has been aggregated with the estimated emission reductions from the GHG Power Plant Emissions Reductions Federal Programs bundle, which is expected to reduce emissions by 0.07 $MMtCO_2e$.

Enhancement Opportunities

The New Source Performance Standard is tied to the Clean Air Act so any enhancements are likewise tied to the authority granted by the Clean Air Act.

Funding

From 2010 to 2020, New Source Performance Standard is expected to utilize $4,800,000.

Challenges

The main challenge to this program exists in finding solutions that reduce multiple pollutants simultaneously. Once solutions are found that are applicable to the standard power plant, the program's success will ultimately depend on proper communication.

Relevant Information

RESI's 2015 study estimated that the GHG New Source Performance Standard program, once fully operational, would support a total of 40 jobs by 2020, $33,142,090 in net economic output and $13,839,722 in wages over the lifetime of the program.

D.1.C. GHG Prevention of Significant Deterioration Permitting Program

Program Description

The Prevention of Significant Deterioration (PSD) program is a federal preconstruction review and permitting program applicable to new major stationary sources and major modifications at existing sources. It requires the application of Best Available Control Technology (BACT) to control emissions of certain pollutants, which now include greenhouse gases (GHGs). Sources subject to the requirements of the PSD program must evaluate and apply currently available measures and future technology as it develops to reduce GHG emissions.

The PSD program's "increment" is the amount of pollution allowed to increase in a given area. The PSD program's increments prevent the air quality in clean areas from deteriorating to the level set by the National Ambient Air Quality Standards, which is a maximum allowable pollution amount. A PSD program increment, however, 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 PSD permit application affecting the area is submitted. Significant deterioration is said to occur when the amount of new pollution exceeds the applicable PSD 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 PSD increment is consumed.

Program Objectives

The PSD program aims to limit the emissions of pollutants and GHGs by mandating that stationary sources use Best Available Control Technology (BACT). BACT determination is designed to be fair, as it considers the cost-effectiveness and relative energy and environment impacts of the controls.

Implementation Milestones

MDE has adopted regulations to implement and enforce the federal PSD program, and has issued several PSD approvals requiring the regulated sources to implement BACTs for GHGs. Specific implementation milestones include:

- January 2011: Requirements will apply to sources' GHG emissions only if the sources are already subject to the PSD 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 PSD program's BACT will apply to projects that increase net GHG emissions by at least 75,000 tons (CO_2 equivalent) per year, but only if the project also significantly increases emissions of at least one non-GHG pollutant
- July 2011: the PSD program's BACT will apply to either new sources that have the potential to emit 100,000 tons (CO_2 equivalent) per year or existing sources modified to increase net emission of CO_2 equivalent by at least 75,000 tons per year
- July 2013: additional sources will be included under the PSD program requirements and a possible permanent exclusion from permitting will be determined for some source categories
- April 2015: EPA will establish an enforceable commitment stating that EPA will complete a streamlining study to evaluate the status of the PSD program for GHG emitting sources
    - No sources with emissions below 50,000 tons (CO_2 equivalent) per year and no modification resulting in net GHG increases of less than 50,000 tons (CO_2 equivalent) per year will be subject to this program's permitting before at least 6 years from now to April 30, 2016

Estimated Emission Reductions for CY 2015

The potential emission reductions from the GHG New Source Performance Standard program has been aggregated with the estimated emission reductions from the GHG Power Plant Emissions Reductions Federal Programs bundle.

Enhancement Opportunities

The PSD will be naturally enhanced as new control technologies are developed. As the BACT changes with new advances, the PSD requirements will adjust and improve.

Funding

The total cost for the program between 2010 and 2020 is expected to be $1,210,500.

Challenges

As mentioned above, PSD will naturally be enhanced as control technologies improve. However, this will require continued funding and research. If resources are shifted away from finding new techniques and technologies to limit GHG emissions, the PSD program will be stalled and may stagnate with a lack of new BACTs.

Relevant Information

RESI's 2015 study estimated that the GHG PSD Permitting Program, once fully operational, would support a total of 3 jobs by 2020, $4,669,183 in net economic output and $4,455,563 in wages over the lifetime of the program.

E.1.A. Maryland Clean Cars Program

Program Description

Maryland's Clean Cars Program is designed to lower emissions from vehicles. The program adopted the California Clean Car Program's strict vehicle emission standards in November 2007, implementing the California Low Emission Vehicle Standards II (Cal LEV II) for all model year 2011 vehicles.

Program Objectives

The purpose of the Maryland Clean Cars Program is to reduce a number of vehicle emissions, including volatile organic compounds (VOCs) and nitrogen oxides (NOx). The program also directly regulates carbon dioxide (CO_2) emissions. It is designed to limit the pollution from the transportation sector, the fastest growing greenhouse gas emission source. The Maryland Clean Cars Program also has the secondary purpose of reducing our dependency on foreign oil.

Implementation Milestones

The Maryland Clean Cars Program is mandated by the Maryland Clean Cars Act of 2007 and has been fully implemented through regulations codified in COMAR 26.11.34, the Low Emissions Vehicle Program, adopted and enforced by MDE. Specific implementation milestones include:

- California has developed stricter tailpipe and greenhouse gas (GHG) standards
  - Maryland will adopt these standards, also known as Cal LEV III
  - Cal LEV III aims to reduce GHG's and criteria pollutants
  - By 2025, vehicles will emit 75 percent less smog-forming pollutants and 34 percent less GHG emissions beginning in 2018

Estimated Emission Reductions for CY 2015

The Maryland Clean Cars Program's estimated emission reductions are included in the E.1. Motor Vehicle Emission and Fuel Standards estimate. The potential emission reductions from the program are estimated to be 5.57 $MMtCO_2e$ in 2015.

The emission reductions for the Maryland Clean Cars Program are estimated to be 5.06 $MMtCO_2e$ in 2015.

Enhancement Opportunities

Enhancement to this program will come naturally in time, as car manufacturers will gradually be mandated to produce an increasingly larger percentage of lower-pollution vehicles, and more readily available advanced technologies will be available (such as hybrid vehicles).

Challenges

The Maryland Clean Cars Program does not face many notable challenges. However, it may be limited in the future if technology to control pollution does not continue to improve, or improves at a significantly slower rate.

Relevant Information

The job creation and economic benefits of the Maryland Clean Cars Program have been aggregated with the benefits from the Transportation Technologies program group.

RESI's 2015 study estimated that programs under the Transportation Technologies group, once fully operational, would support a total of 1,031 to 1,134 jobs by 2020, $1,112,700,515 to $1,223,970,569 in net economic output and $541,055,221 to $595,160,748 in wages over the lifetime of the program.

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

Program Description

Medium and heavy-duty vehicles are the transportation sector's second largest contributor to fossil fuel consumption and GHG emissions. In 2011, the program was adopted as the first national program designed to reduce GHG emissions and improve fuel efficiency for medium and heavy-duty trucks. The program is implemented through a joint rule issued by EPA and National Highway Traffic Safety Administration. The rule is comprised of complementary standards developed by the agencies under their respective authorities and covers model years 2014-2018. Under the rule, EPA's emission standards and NHTSA's fuel consumption standards cover the following: combination tractors, heavy-duty pickup trucks and vans, and vocational vehicles. EPA's standards also apply to recreational on-road vehicles. The heavy-duty fleet subject to the rule includes all on-road vehicles rated at 8,500 pounds or more, except those covered by the current GHG emissions and federal Corporate Average Fuel Economy standards for model years 2012-2016.

Program Objectives

The National Fuel Efficiency and Emission Standards for Medium and Heavy-Duty Trucks program is designed to reduce emissions from larger vehicles that weigh over 8,500 pounds, such

as combination tractors, heavy-duty pickup trucks and vans, vocational vehicles, and recreational on-road vehicles.

Implementation Milestones

The federal regulations implementing this program were finalized in August 2011. The program is federally enforced by EPA and NHTSA. As of May 2015, this program was working as designed. Specific implementation milestones include:

- June 2015: EPA and NHTSA (on behalf of the Department of Transportation, each proposed rules to establish a comprehensive Phase 2 Heavy-Duty National Program
    - It will reduce GHG emissions and fuel consumption for new on-road medium and heavy vehicles
    - The technology-advancing program would phase in over the long-term, beginning in the 2018 model year and culminating in standards for the 2027 model year

Estimated Emission Reductions for CY 2015

The potential emission reductions from the National Fuel Efficiency and Emission Standards for Medium and Heavy-Duty Trucks program in 2020 have been aggregated with the estimated emission reductions from the Motor Vehicle Emission and Fuel Standards program group. The estimated emissions reductions are estimated to be 5.57 $MMtCO_2e$.

By 2020, the potential emissions reductions for the National Fuel Efficiency and Emission Standards for Medium and Heavy Duty Trucks program are estimated to be 0.28 $MMtCO_2e$.

Enhancement Opportunities

The National Fuel Efficiency and Emission Standards for Medium and Heavy-Duty Trucks program in 2020 will be enhanced in Phase 2, as described above in the "Implementation Milestones" section.

Challenges

The main challenge for this program will lie in the development of new strategies to reduce GHG emissions. These strategies could include improving engine technology, eliminating aerodynamic drag, reducing rolling resistance, and/or addressing operation factors (measures that can reduce truck fuel use, including the installation of speed governors). According to EPA, vehicle speed is the single largest operational factor affecting CO_2 emissions from trucks.

Relevant Information

The economic benefits of the program are aggregated with the benefits of all the programs under the Transportation Technologies group.

RESI's 2015 study estimated that the Transportation Technologies group, once fully operational, would support a total of 1,031 to 1,134 jobs by 2020, $1,112,700,515 to $1,223,970,569 in net economic output and $541,055,221 to $595,160,748 in wages over the lifetime of the program.

H.1. Evaluating the GHG Emissions Impact of Major New Transportation Projects

Program Description

This initiative was created as an evaluation program and aims to ensure that potential increases in GHG emissions associated with the growth and increased vehicle miles traveled (VMT) resulting from major new transportation projects and other major new projects are analyzed, considered, and addressed during the transportation planning process.

Program Objectives

The program's purpose is to ensure that potential "growth related" GHG emission increases (both direct and induced) are addressed when decisions to approve and fund major projects are made.

Implementation Milestones

MDE is working with the Baltimore Regional Transportation Board (BRTB), the Metropolitan Washington Council of Governments (COG), MDOT, and other state agencies/stakeholders to implement separate but related voluntary efforts to:

- Study the existing and future levels of GHG in multiple sectors, including the transportation sector
- Identify viable, feasible, and (in some cases) stretch strategies for reducing GHG emissions across key sectors, including the transportation sector, and to quantify the associated emissions benefits
- Analyze the co-benefits, in terms of other air pollutant reductions, from the identified strategies

Specific implementation milestones include:

- BRTB "How Far Can We Get" Study
    - To understand the level of emission reductions that are achievable through a reasonable level of reduction measure implementation, and to inform the region's next long range transportation plan
- COG "What Would It Take" Scenario
    - Final report was released in May 2010

    - Short term regional actions were likely to be implementable between 2010 and 2020, which include:
        - Increased transit use
        - Increased bike/pedestrian use
        - Pricing
        - Improve operation efficiency
        - Reducing travel
- COG Multi-Sector Working Group (MSWG) – established January 2015
    - Purpose is to examine all sectors of the economy to identify potentially viable local, regional, and state actions to significantly reduce GHG emissions in accordance with the voluntarily adopted goals
    - Draft Technical Interim Report was released July 2015, the final report was presented to the COG board in January 2016, and shortly after the development of a Proposed Action Plan will begin

Estimated Emission Reductions for CY 2015

The potential emission reductions from the Evaluating GHG Emissions Impact of Major New Transportation Projects program in 2020 were not calculated.

Enhancement Opportunities

This program could be enhanced by using different, possibly contractual, third parties to develop independent scenario analyses. Different datasets from diverse sources could help the program devise more accurate evaluations and more viable advice.

Funding

As an evaluation program, this program does not require specific funding.

Challenges

The main challenge to this program will be in the analysis of traffic patterns and how they will be affected by construction projects. Projects often take a long time to finish, even after they are planned and started. Estimations will have to include increased traffic due to speed or lane limitations, as well as considerations for those that change their commute routes. These estimations may even have to be adjusted later for changing traffic patterns well after the start of road work.

Relevant Information

As this is a new effort that is still evolving, no economic analysis of this initiative was conducted.

L. Zero Waste

Program Description

MDE has developed a Zero Waste Action Plan – a comprehensive strategy comprised of short and long term measures designed to nearly eliminate the need for waste disposal facilities by 2030 by reducing the generation of waste and increasing reuse and recycling. The Action Plan establishes the following future statewide recycling and waste diversion rate goals (Table 1):

Table 1. Future State-wide Recycling and Waste Diversion Rate Goals.

	2015	2020	2030
Waste Diversion Goal	54%	65%	85%
Recycling Goal	50%	60%	80%

The program has experienced mixed results, as the recycling rate has lowered, but overall waste generation has been reduced more than expected.

Program Objectives

The Zero Waste program aims to reduce the generation and disposal of waste by increasing reuse and recycling efforts. Though this, it will save energy and natural resources, preserve the capacity of existing solid waste disposal facilities, and reduce greenhouse gases and other pollutants generated by landfills and manufacturing processes.

Implementation Milestones

Specific implementation milestones for the Zero Waste program include:

- December 2015: Jurisdictions with populations greater than 150,000 are required to recycle 35% or more of their waste; jurisdictions less than 150,000 people are required to recycle 20% or more of their waste
    - In no case is the recycling rate to be less than 15% for the larger counties or 10% for the smaller counties
- July 2014: State Government must reduce by recycling the amount of the solid waste stream generated for disposal by at least 30% or an amount that is determined practical and economically feasible, but in no case may the amount recycled be less than 15%
- 2009: a State Agency Recycling Plan was developed and implemented that requires recycling of glass, paper, metal, and plastic at State-owned or State-operated buildings.
    - 2012: Agencies are revising plans to meet the higher goal of 30%
- Scrap tires are banned from disposal in landfills
- 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
- Electronics manufacturers 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 is required to submit a revised recycling plan to MDE. A country's recycling plan is required to address the collection, processing, marketing, and disposition of recyclable materials from county public schools.
    - By October 12013: counties must address multi-family residential recycling in their country recycling plans
    - October 1, 2014: apartments and condominiums with 10 or more units must provide recycling opportunities for residents
- Pursuant to 2011 legislation, MDE was required to study composting in the State and make recommendations to the General Assembly by January 2013 on ways to promote composting. These recommendations were to include any necessary legislative, regulatory, or programmatic changes.

Estimated Emission Reductions for CY 2015

The potential emission reductions from the Zero Waste Program in 2020 are estimated to be 1.48 $MMtCO_2e$.

The per capita waste generation in 2013 is assumed to remain constant in 2020 at 1.096 tons per person per year. Note that this value is low compared to past data. However, in previous projections a historical multi-year average that ended up being too great was used.

The population projection for 2020 is 6,224,550 people (Maryland Dept. of Planning). The recycling rate is assumed to be 60 percent in 2020 (Zero Waste goal). These assumptions provide the total projected waste generation and the total projected recycling tonnage for 2020.

Waste generation in 2020 is broken down by material using the same proportion of each material in the waste stream in 2013 (e.g. polyethylene terephthalate (PET) was 8 percent of the waste stream in 2013, so the projected PET generation in 2020 is 8 percent of the total waste generated in 2020).

For recycling, the projection first calculated the total additional tons recycled in 2020 relative to 2013. This additional recycling tonnage was then allocated to each material by its portion of the waste stream. For example, 1.3 million tons more recycling is expected in 2020 than in 2013. PET is 8 percent of the waste stream, so 8 percent of the additional 1.3 million tons was added to the tons of PET recycled in 2013 to estimate the tons of PET recycled in 2020.

Enhancement Opportunities

The Zero Waste program can be enhanced with the development of more effective recycling and waste management techniques. This includes the use of materials and products that have less of an adverse environmental impact, are quickly decomposed, or are easily reused. The program will also benefit from spreading basic awareness and knowledge about composting.

Funding

The state has allotted $15,869,391 for the Zero Waste program between 2010 and 2020.

Challenges

The main challenge to the Zero Waste program is compliance by the general population, so citizen outreach is vital for the program to succeed. Proper recycling and composting practices should be common knowledge among the populace.

Relevant Information

RESI's 2015 study estimated that the Recycling and Source Reduction Program (which encompasses the Zero Waste program), once fully operational, would support a total of 326 jobs by 2020, $303,588,866 to $419,730,048 in net economic output and $123,645,781 to $175,740,920 in wages over the lifetime of the program.

M.2. Leadership-by-Example: Maryland Colleges and Universities

Program Description

The Lead-By-Example: Maryland Colleges and Universities program aims to improve energy efficiency, reduce waste, and integrate renewable energy practices in all of its agencies' operations and facilities, as well as their purchasing practices. The program includes 23 colleges and universities; all University System of Maryland schools, Morgan State University, St. Mary's College of Maryland, 4 community colleges, and 4 independent institutions.

Program Objectives

The program's objective is to commit schools to being climate neutral by a set date. GHG emissions will be reduced or mitigated from a base year, and the remaining emissions will be offset by purchasing carbon credits or other means.

Implementation Milestones

With the exceptions of Chesapeake College, Harford Community College, Loyola University of Maryland, and Morgan State University, the colleges and universities under the system have created and implemented Climate Action Plans. They are reducing carbon emissions in multiple ways, such as changes to campus heating, using sustainable energy, conserving fresh water, and using energy efficient and sustainable techniques in construction projects.

The colleges and universities have been tracking their progress in two separate reports: GHG reports, which are essentially annual, and progress reports, the first in 2012 with multiple proceeding reports. Each college or university drafts its own individual report(s).

Estimated Emission Reductions for CY 2015

The potential emission reductions from the Leadership-By-Example: Maryland Colleges and Universities program in 2020 are estimated to be 0.56 $MMTCO_2e$.

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 (using 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. One school did not complete a GHG inventory at the time, and therefore was not included in the estimation.

To estimate the emission reductions, 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. The calculation uses the formula:

$$RED_{2020}=BAU_{2020i} - [(1-TAR_i) * SCP_i]$$

Where:

- RED_{2020} = The total GHG emissions reduction estimated for 2020 based upon the assumptions for each school
- BAU_{2020i} = The business-as-usual emissions estimated for each school (i) in 2020
- TAR_i = Percentage reduction target for 2020 for each school (i) in 2020
- SCP_i = Scope 1, Scope 1 and 2, or Scope 1, 2, and 3 emissions (depending upon each school's applicable target for 2020) estimated in 2020

The final result is simply the sum of all individual school's reductions.

Enhancement Opportunities

The Lead-By-Example: Maryland Colleges and Universities program can be enhanced by increasing public awareness of the state's efforts. Although emission reductions are obtained from the program itself, outreach conducted by the State will add authenticity when the general public and companies are asked to reduce their emissions/energy usage.

Funding

The state has allotted $38,686,850 for the Lead-By-Example: Maryland Colleges and Universities program between 2010 and 2020.

Challenges

This program will eventually reach a point where further efficiency simply isn't possible, or does not require a unique initiative to attain. When this occurs, the program will have attained its goal and either be terminated or left to uphold existing standards (from the present emission levels).

Relevant Information

RESI's 2015 study estimated that the Leadership-By-Example: Maryland University Lead by Example Initiatives program, once fully operational, would support a total of 182 jobs by 2020, $89,416,504 in net economic output and $56,152,345 in wages over the lifetime of the program.

M.3. Leadership-By-Example: Federal Government

Program Description

The Lead-By-Example: Federal Government program aims to improve energy efficiency, reduce waste, and integrate renewable energy practices in all of its agencies' operations and facilities, as well as their purchasing practices.

Program Objectives

Federal facilities located in Maryland are directed to use environmentally friendly techniques and methods to "lead by example." Such techniques include energy reduction in public buildings, facilities, and lands, improved efficiencies in fleet vehicles and fuels, water conservation, waste reduction, waste recycling, purchasing of products/services with lower life-cycle impacts, and greater use of renewable energy.

Implementation Milestones

On October 8, 2009, Executive Order (EO) 13514 "Federal Leadership in Environmental, Energy, and Economic Performance" was signed, which calls on the federal government to reduce its GHG emissions from direct sources to 28 percent below 2009 levels by 2020 and implement aggressive energy and water efficiency programs. Federal agencies are specifically

directed to set agency-wide reduction targets for Scopes 1, 2, and 3 GHG emissions and to develop and implement Strategic Sustainability Performance Plans designed to meet the targets.

In July 2010, the federal government-wide target was expanded to require a 13 percent reduction by 2020 for GHG emissions from indirect sources, such as employee travel and commuting.

EO 13693 "Planning for Federal Sustainability in the Next Decade," was signed on March 19, 2015, revoking EO 13514. The goal of EO 13693 is to maintain Federal leadership in sustainability and greenhouse gas emission reductions. Beginning in fiscal year 2016, Federal Agencies shall:

- Promote building energy conservation, efficiency, and management by reducing agency building energy intensity by 2.5 percent annually through the end of fiscal year 2025
- Improve data center energy efficiency at agency facilities
- Ensure that minimum amounts of building electric energy and thermal energy shall be clean energy
- Improve agency water use efficiency and management, including stormwater management
- Improve agency fleet and vehicle efficiency and management by taking actions that reduce fleet-wide per-mile GHG emissions from agency fleet vehicles, relative to a baseline of emission in fiscal year 2014, if an agency operates at least 20 motor vehicles

Estimated Emission Reductions for CY 2015

The potential emission reductions from the Leadership-By-Example: Federal Government program in 2020 are estimated to be 0.415 $MMTCO_2e$.

The White House's Council on Environmental Quality released Guidance for Federal Greenhouse Gas Accounting and Inventories as part of EO 13514. EO 13514 establishes a federal government-wide target of 28 percent reduction in Scope 1 and Scope 2 emissions, and a target 13 percent reduction in Scope 3 emissions by 2020.

Scope 1, 2, and 3 emission data, reduction goals, total number of employees, and total number of facilities were obtained for 41 Federal agencies via agency sustainability plans. MDE calculated Scopes 1, 2, and 3 reductions for each federal agency from this data.

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 GHG reduction estimate, 1.5/51 of the total federal reductions was assumed, resulting in 0.415 $MMtCO_2e$ of reductions in 2020.

Enhancement Opportunities

The Lead-By-Example: Federal Government program can be enhanced by increasing public awareness of the Federal government's efforts. Although emission reductions are obtained from the program itself, outreach conducted by the State and/or Federal government will add authenticity when the general public and companies are asked to reduce their emissions/energy usage.

Funding

The state has allotted $40,094,750 for the Lead-By-Example: Federal Government program between 2010 and 2020.

Challenges

This program will eventually reach a point where further efficiency simply isn't possible, or does not require a unique initiative to attain. When this occurs, the program will have attained its goal and either be terminated or left to uphold existing standards (from the present emission levels).

Relevant Information

RESI's 2015 study estimated that the Leadership-By-Example: Federal Government program, once fully operational, would support a total of 1,347 jobs by 2020, $179,016,115 in net economic output and $121,429,442 in wages over the lifetime of the program.

M.4. Leadership-By-Example: Local Government

Program Description

Maryland county and municipal governments, together with State agencies, are adopting policies and practices to obtain high performance and energy-efficient buildings, facilities, and vehicle fleets. The policies also aim to reduce the carbon footprint in 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.

Program Objectives

The Lead-By-Example: Local Government program aims to improve energy efficiency, reduce waste, and integrate renewable energy practices in all of its agencies' operations and facilities, as well as their purchasing practices.

Implementation Milestones

This program combines both voluntary and mandatory initiatives. There are a wide range of implementation tools being used at the local level including ordinances, resolutions, and voluntary sustainability plans.

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 25 percent and 50 percent reductions from the base year, respectively.

Estimated Emission Reductions for CY 2015

The potential emission reductions from the Leadership-By-Example: Local Government program in 2020 are estimated to be 0.25 $MMTCO_2e$.

There is difficulty in quantifying the GHG emissions for this program for a multitude of reasons. First, local governments are comprised of both counties and cities, which means that there is a question of overlap between cities inside multiple counties. Second, there is not a universal base year and/or goals(s) year. Furthermore, data is incomplete for a majority of the counties, with less than 30 percent of counties having completed a GHG inventory. There is also concern that the counties reductions will be included in part of the State's own 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) that is less than the GGRA base year (2006). In this case 2006 is used as a base year 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 that either the existing seven counties with goals increase those goals and/or additional counties add significant reduction goals. It is assumed that this will result in a 50 percent increase in what would be achieved in the low-quantification scenario. As such, 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 reductions could be partially or totally subsumed as part of other mitigation program.

Enhancement Opportunities

The Lead-By-Example: Local Government program can be enhanced by increasing public awareness of the state's efforts. Although emission reductions are obtained from the program itself, outreach conducted by the State will add authenticity when the general public and companies are asked to reduce their emissions/energy usage.

Funding

The Lead-By-Example: Local Government program is allocated funds by county. Baltimore County had a budget of $250,000, but after exceeding it, the city council expanded it to $750,000 for future years. Frederick County used a federal grand from the US Department of Energy for $659,800. Harford County and Prince George's County had a budget of $250,000 which they have also exceeded. Howard County uses a tax credit program that provided 565 credits equal to over $2.5 million for renewable energy systems. Queen Anne's County is expected to save $350,000 on power due to a new lower rate, and also was awarded an EmPOWER fund of $15,000. Washington County received a similar $15,000 grant from the EmPOWER program. Talbot County received a grant from the American Recovery and Reinvestment Act, and also made $132,158 from the sale of surplus carbon and renewable energy credits. Wicomico County collects gases from their Newland Park Landfill, selling them for carbon credits ($183,000 worth in 2012). It also sells power from solar arrays, and Salisbury (a city within Wicomico) received an $80,000 grant from EmPOWER.

From 2010 to 2020, the program is expected to utilize $62,060,220.

Challenges

This program will eventually reach a point where further efficiency simply isn't possible, or does not require a unique initiative to attain. When this occurs, the program will have attained its goal and either be terminated or left to uphold existing standards (from the present emission levels).

Relevant Information

RESI's 2015 study estimated that the Leadership-By-Example: Local Government program, once fully operational, would support a total of 1,982 jobs by 2020, $248,107,910 in net economic output and $187,011,716 in wages over the lifetime of the program.