Maryland
Department of
the Environment

Larry Hogan, Governor
Boyd K. Rutherford, Lt. Governor

Ben Grumbles, Secretary
Horacio Tablada, Deputy Secretary

January 17, 2018

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

Dear President Miller and Speaker Busch:

In accordance with §2-1246 of the State Government Article, I am pleased to submit the *2017 Annual State Agency Report* developed as required by Environment Article §2-1305. This report fulfills the Maryland Department of the Environment's requirement to report annually on the status of programs that support the State's greenhouse gas reduction efforts that address climate change.

We hope that the report provides a proper program update to inform State decisions impacting or impacted by climate change in a way that maintains strong economic and jobs growth, thereby ensuring a prosperous Maryland both now and in the future.

Thank you!

Sincerely,

Ben Grumbles
Secretary

cc: Sarah Albert, Mandated Reports Specialist, Department of Legislative Services
Maryland Climate Change Commission

Maryland Department of the Environment 2017 Annual Climate Change Report

12/1/2017

Table of Contents

Introduction

Maryland Department of the Environment's (MDE) Annual Climate Change Report is written in accordance with State Government Article §2-1246, as required by §2-1305 of the Environmental Article. It details the status of programs managed by MDE that support the State's greenhouse gas reduction efforts. The report also recommends policy, planning, regulatory, and fiscal changes to existing programs.

The goal of this report is to provide information to the Governor and General Assembly on State programs that are designed to adapt to the consequences of climate change. This information can fuel future decisions regarding existing and future policies and programs.

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 electricity-producing power plants. This encourages the use of less carbon intense sources, 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, and 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.
- 36 quarterly auctions held to date.
  - Auction 36 held on June 7, 2017.
  - $563,349,579 in cumulative proceeds for Maryland.
- 2016 Program Review in progress as of August 15, 2017.
  - Required by RGGI MOU.
  - Requires a review of all components of the RGGI program.

Estimated Emission Reductions for CY 2017

Maryland's RGGI program will change as a result of the ongoing 2016 Program Review. But any changes will not take effect until 2021, leaving the program's current structure in-place

through 2020. As such, those changes will not materially change the program's anticipated 2020 impact.

The potential emission reductions from the RGGI program in 2020 are estimated to be 3.60 MMtCO_2e. The RGGI states did Integrated Planning Model (IPM) modeling of both the reference case and the 91 policy case (http://www.rggi.org/design/program-review). The difference between the old 166 mtCO_2e and 91 mtCO_2e cap was 21.0 mtCO_2e for the whole region. Maryland had the bulk of the reductions at 13.0 mtCO_2e. 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 the plant operators confirmed they planned to remain operational until at least 2020, their 3 year average emissions (8.19 mtCO_2e) 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 tons of CO_2. Emissions from RGGI sources in 2015 were 18.7 mtCO_2e (from EPA CAM-D). We are 6.3 mtCO_2e ahead of schedule but this also accounts for RPS and EE reductions.

RGGI and the signatory states made extensive modeling runs in the process of selecting 91 ton cap (http://www.rggi.org/design/program_review/materials-by-topic/modeling). From the baseline run it is projected the CO_2e emission would be reduced 8.0 Million tons. RGGI's cap is in short tonnes so these are then converted to metric tonnes. Further, the model used (IPM) shut down plants based on an economic basis. The model projected two facilities closing in MD. However, MDE in consultation received confirmation from the sources that they didn't plan on closing. Therefore, the emissions from these facilities where then added back in and the reduction calculated from there.

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.

While changes to Maryland's general RGGI framework, including the overall carbon cap and price controls, can only be made through the appropriate program review process outlined in the RGGI MOU, changes to how the state allocates allowances and auction proceeds can be made through regulation and legislation, respectively.

Maryland could achieve greater emission reductions by changing its allowance set-aside accounts through MDE regulations, or by changing the portion of allowance proceeds spent on energy efficiency, renewable energy, and other emission reduction programs through changes to the statute governing use of the Strategic Energy Investment Fund (SEIF).

Funding

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

Challenges

The process of auctioning off 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.

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.

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"
- March 2014: All boilers demonstrate compliance with emission limits and perform compliance reports as mandated
- January 2016: 18 new boilers have obtained permits and are subject to the MACT

Estimated Emission Reductions

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% capacity factor. 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 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%. Accounting for overlap, emissions reductions are reduced to .07 $MMtCO_2e$.

Enhancement Opportunities

This program has the potential to be enhanced every time new control technology is developed through new regulations and standards.

Funding

According to RESI's 2015 Study, the Boiler MACT program is expected to use $94,374,000 from 2010 to 2020. 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.

Challenges

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

Greenhouse Gas 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 standards apply to new electric generating units and are 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 it into Maryland state regulations. The MDE Air Quality Compliance Program will then insure that the utilities comply with the requirements. Based on certified emissions reports, the MDE will be able to determine the amount of GHG reductions achieved.

Estimated Emission Reductions

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, thus, any enhancements are likewise tied to the authority granted by the Clean Air Act.

Funding

RESI's 2015 study estimated that from 2010 to 2020, New Source Performance Standard is expected to use $4,800,000. 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.

Challenges

The main challenge to this standard will lie in finding these emissions solutions that reduce multiple pollutants at once. Once solutions are found that are applicable to the standard power plant, the program's success will ultimately just be a matter of proper communication.

GHG Prevention of Significant Deterioration Permitting Program (PSD)

Program Description

The Prevention of Significant Deterioration (PSD) program is a federal preconstruction review and permitting program. It applies to new major stationary sources and major modifications at existing sources. PSD 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 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 an area is allowed to increase. 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. The National Ambient Air Quality Standards is a maximum allowable pollution amount. A PSD 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 PSD permit application affecting the area is submitted. Significant deterioration is said to occur when the amount of new pollution would exceed 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 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

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

RESI's 2015 study estimated that the total cost for the program between 2010 and 2020 is expected to be $1,210,500. 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.

Challenges

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

Clean Cars Program

Program Description

Maryland's Clean Cars Program is designed to lower emissions from vehicles. The program adopted California'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. It works on a macro level; rather than applying to individuals it sets a standard based on fleet-wide emission averages.

Program Objectives

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

Implementation Milestones

The 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% less smog-forming pollutants and 34% less GHG emissions beginning in 2018
- 2017: The Clean Cars Program was updated to maintain consistency with the California Program, adopting changes designed to:
    - Incorporate amendments to the alternative fuel conversion certification procedure for on-road motor vehicles and engines to streamline testing and provide a reduced burden for small volume conversion manufacturers
    - Incorporate amendment to provide greater flexibility to Intermediate Volume Manufacturers to meet the Zero Emission Vehicle (ZEV) requirement
    - Incorporate amendments to align the CALEV III program and test procedures with the Federal Tier 3 program
    - Incorporate changes to California's Medium and Heavy-Duty greenhouse gas (GHG) regulations to align them with EPA's Phase 1 GHG regulations. These amendments have a non-substantive impact on portions of California's program that are incorporated by reference
    - Incorporate amendments to the On-Board Diagnostics II (OBD II) regulation to improve compliance flexibility as well as strengthen the performance requirements

Estimated Emission Reductions

The 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 2020.

The emission reductions for the Clean Cars Program are estimated to be 5.06 $MMtCO_2e$ in 2020.

Enhancement Opportunities

Enhancement to this program will come naturally in time, as car manufacturers will gradually be mandated to produce a larger and larger percentage of vehicles that pollute less, and more readily available advanced technology will be available (such as hybrid vehicles).

Challenges

The Clean Cars program does not face many notable challenges.

Relevant Information

The job creation and economic benefits of the 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.

National Fuel Efficiency and Emission Standards for Medium and Heavy-Duty Trucks (PSD)

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 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.

On June 19, 2015, EPA and NHTSA, on behalf of the Department of Transportation, each proposed rules to establish a comprehensive Phase 2 Heavy-Duty National Program that will reduce GHG emissions and fuel consumption for new on-road medium and heavy-duty vehicles. This technology-advancing program would phase in over the long-term, beginning in the 2018 model year and culminating in standards for model year 2027.

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
- December 2016: The updated Phase 2 is now effective
    - EPA and NHTSA established rules for a comprehensive Phase 2 that will reduce GHG emissions and fuel consumption

- The EPA is finalizing non-GHG emission standards relating diesel auxiliary power units installed in new tractors
- EPA is clarifying the classification of natural gas and other gaseous-fueled heavy-duty engines
- EPA is finalizing technical amendments to EPA rules that apply to emissions of non-GHG pollutants from light-duty motor vehicles, marine diesel engines, and other non-road engines and equipment
- EPA is requiring engines from donor vehicles used in new glider vehicles meet the emission standards of the year of vehicle assembly
- NHTSA is working to eliminate the differences between Phase 1 EPA GHG standards and their fuel efficiency standards

Estimated Emission Reductions

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. Its 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 $MMtCO_2e$. Appendix C provides a more detailed description of the process used to quantify GHG reductions.

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.

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 addressing operation factors. Operational factor refer to a wide variety of 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 tied into 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.

Evaluating the GHG Emissions Impact of Major New Transportation Projects

Program Description

This program was created as an evaluation program. It 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

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

By its nature 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. They 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.

Zero Waste Program

Program Description

On June 27, 2017, Governor Hogan Signed Executive Order 01.01.2017.13, Waste Reduction and Resource Recovery Plan for Maryland. The Order adopts a first-ever sustainable materials management (SMM) policy for Maryland that aims to minimize the environmental impacts of the materials' use throughout the entire lifecycle. The policy emphasizes environmentally and economically sustainable methods to capture and reinvest resources into our economy – including everything from metals and plastics to energy, nutrients, and soil. It initiates a stakeholder consultation process to establish ambitious but achievable goals and to ensure tracking of complete materials management data. It also empowers new partnerships across State and local agencies, the agricultural, energy, and transportation sectors, environmental organizations, and recycling innovators.

New Program Initiatives

Specifically, the Order contains the following initiatives:

- A stakeholder consultation process to improve the Department's methodology for tracking waste generation, source reduction, and recycling, including recommendations to better account for business recycling activities and new voluntary statewide goals for continuous improvement in SMM;
- A technical assistance partnership between the Departments of Commerce and the Environment will help establish new recycling businesses in Maryland;
- A partnership between the Departments of Agriculture and the Environment will provide research and demonstration of innovative nutrient recovery technologies in order to facilitate adoption of these technologies;
- A partnership between the Maryland Energy Administration and Maryland Department of the Environment will research and promote adoption of energy recovery technologies such as anaerobic digestion;
- A partnership between the Departments of Transportation and the Environment will provide guidance to increase the reuse of dredged materials, including by State agencies; and
- Outreach partnerships will increase awareness of the benefits of and opportunities for waste diversion.

Future Challenges

The new Order replaces Executive Order 01.01.2015.01 Executive Order for Maryland. The new approach recognizes that SMM efforts require collaboration, and the specifics of the initiatives conducted under the Order will be shaped by stakeholder input. As the Department initiates the new partnerships and consultation processes included in the Order, it will work to better quantify the GHG emissions benefits and jobs impacts of the initiatives for inclusion in the 2018 GGRA Plan.

Leadership by Example: Maryland Colleges and Universities

Program Description

The lead-by-example program for Colleges and Universities 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 24 colleges and universities in Maryland: all University System of Maryland schools, Morgan State University, St. Mary's College of Maryland, 4 community colleges, and 4 independent institutions. These schools were initially united under the American College & University Presidents' Climate Commitment (ACUPCC), but have since come to be rebranded under the Second Nature organization.

Program Objectives

The program's objective is to commit schools to becoming 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, depending on their plan.

Implementation Milestones

With the exceptions of 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 a multitude of different ways, such as changing 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 more or less yearly, and Progress reports, the first being from 2012 with multiple afterwards. Each college or university drafts its own individual report(s).

Estimated Emission Reductions

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% 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% 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

This Lead-by-Example program can be enhanced by increasing public awareness of the state's efforts. Although we get obvious emission reductions from the program itself, if the government is more vocal about its efforts, it adds authenticity when it asks the general public and companies to reduce their emissions and energy usage.

Funding

The state has allotted $38,686,850 for the Lead-By-Example – College program between 2010 and 2020. 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.

Challenges

This program will eventually reach a point where further efficiency simply is not possible, or does not require a whole initiative to attain. At this point, it will have attained its goal and either be shut down, or left to uphold stale "non-changing" standards [from the present emission levels].

Leadership by Example: Federal Government

Program Description

The lead-by-example program for the Federal Government 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

The program's objective is for federal facilities located in Maryland 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

In 2009, the "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% below 2009 levels by 2020 and implement aggressive energy and water efficiency programs (Executive Order 13514, issued October 8, 2009). 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% reduction by 2020 for GHG emissions from indirect sources, such as employee travel and commuting.

Estimated Emission Reductions

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 President Obama's Executive Order 13514. The order establishes a federal government-wide target of 28% reduction in Scope 1 and Scope 2 emissions, and a target 13% 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% reduction goal is applied to the 2010 Scopes 1 and 2 goals, and is added to the 13% reduction to the 2010 Scope 3 goal, a composite 20.5% 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 .415 $MMtCO_2e$ of reductions in 2020.

Enhancement Opportunities

This Lead-by-Example program can be enhanced by increasing public awareness of the government's efforts. Although we get obvious emission reductions from the program itself, if the government is more vocal about its efforts, it adds authenticity when it asks the general public and companies to reduce their emissions/energy usage.

Funding

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

Challenges

This program will eventually reach a point where further efficiency simply is not possible, or does not require a whole initiative to attain. At this point, it will have attained its goal and either be shut down, or left to uphold static, non-changing standards.

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 program for local government 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% and 50% reductions from the base year, respectively.

Estimated Emission Reductions

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 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, less than 30% of counties have completed a GHG inventory. There is also 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 will 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.

Enhancement Opportunities

This Lead-by-Example program can be enhanced by increasing public awareness of the state's efforts. Although we get obvious emission reductions from the program itself, if the government is more vocal about its efforts, it adds credibility when it asks the general public and companies to reduce their emissions/energy usage.

Funding

The lead by example local government is allocated funds by county. Baltimore County had a budget of $250,000, but it was expanded to $750,000 for future years after it exceeded the initial budget. Frederick County used a federal grant 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.

RESI's 2015 study estimated that from 2010 to 2020, the program is expected to use $62,060,220. 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.

Challenges

This program will eventually reach a point where further efficiency simply is not possible, or does not require a whole initiative to attain. At this point, it will have attained its goal and either be shut down, or left to uphold static, non-changing standards.