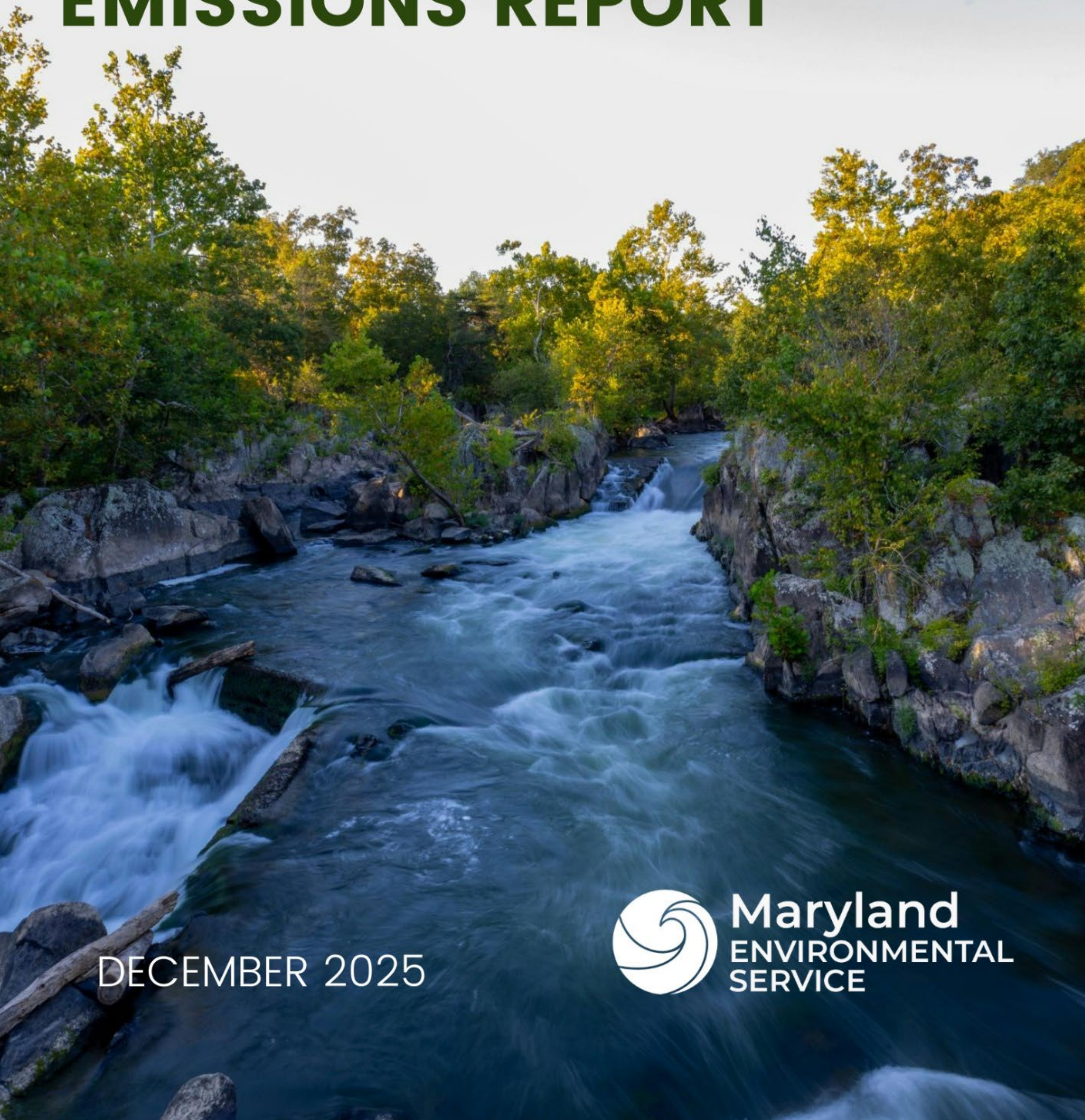
Maryland Environmental Service

REDUCTION OF GREENHOUSE GAS EMISSIONS REPORT



DECEMBER 2025

Maryland ENVIRONMENTAL SERVICE

Message from the Executive Director

The Maryland Environmental Service (MES) is pleased to present our fourth annual report detailing our efforts towards reducing greenhouse gas emissions (GHG) in the State of Maryland. This report is required by Section 3-103.4(f) of the Natural Resources Article of the Annotated Code of Maryland.

MES' mission is to deliver operational and technical service projects to protect and enhance the environment for the benefit of Maryland's citizens. We are a not-for-profit business unit of the State of Maryland, operating on a fee-for-service basis. The agency serves federal, state, and local governments, as well as private sector partners, meeting or exceeding required environmental regulations.

Maryland news organizations headlined energy affordability and artificial intelligence (AI) on a seemingly weekly basis in 2025. Electricity rates in particular frequented news cycles, as retail prices saw sharp increases in Maryland and other states within the Pennsylvania, Jersey, and Maryland (PJM) regional transmission organization. In Maryland, tightening supply-demand dynamics and capacity constraints were amongst the key drivers pushing rates higher, with growing demand from AI data centers oft-cited as the principal demand driver.

Governor Moore has championed AI investment while balancing the State's commitment to advancing clean energy and mitigating climate change. The Next Generation Energy Act and Renewable Energy Certainty Act, which collectively aim to expand generation and accelerate renewable energy deployment, were passed by the Maryland Legislature in 2025 and signed by the Governor. As we reflect on the new legislative requirements, evolving energy markets, and our progress made this year, it is clear that MES is already delivering meaningful contributions to clean energy generation and GHG reductions. Our planned and under-construction projects for electric vehicle supply equipment, fleet electrification, beneficial use of landfill gas, and dissemination of solar siting expertise are designed to build on these successes and further support the State's climate goals.

Sincerely,

Charles C. Glass, Ph.D., P.E.
Executive Director

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1. Introduction to the Maryland Environmental Service

MES was established by the General Assembly in 1970 to assist with the preservation, improvement, and management of the quality of air, land, water, and natural resources, and to promote the health and welfare of the citizens of the state. Today, we employ nearly 800 teammates and operate more than 1,000 environmental projects across Maryland and the Mid-Atlantic Region. As a not-for-profit business unit of the State of Maryland, MES provides multi-disciplinary environmental services to enhance and protect the environment through innovative solutions to the region's most complex challenges.

MES HQ

We are a leader in solving Maryland's environmental problems. MES plans, constructs, and operates projects within our four main operating groups:

- Environmental Dredging and Restoration
- Environmental Operations
- Water and Wastewater
- Technical and Environmental Services

Detailed descriptions of each operating group are given below.

1.1 Environmental Dredging and Restoration Program

The Environmental Dredging and Restoration Group (EDR) provides operational and technical services on behalf of our clients in the areas of dredged material management, outreach and engagement related to dredged material management, habitat restoration, remediation, environmental management system implementation, and permitting and mitigation services. The EDR Group supports our clients with planning, engineering, construction, environmental and regulatory management, and operations for our partners' facilities. MES operates three dredged material containment facilities (DMCFs) and the Paul S. Sarbanes Ecosystem Restoration Project at Poplar Island (Poplar Island) on behalf of the Maryland Port Administration (MPA).

Poplar Island is a restoration effort located in the Chesapeake Bay in Talbot County that beneficially uses dredged material collected from the approach channels to the Baltimore Harbor to restore lost remote island habitat. The three DMCFs include the Masonville DMCF located near the Middle Branch of the Patapsco River in Baltimore, the Cox Creek DMCF in Anne Arundel County, and Hart-Miller Island DMCF, which stopped accepting dredged material inflow in 2009. MES is supporting MPA with the ongoing wildlife habitat restoration effort at Hart-Miller, including the opening of the 300-acre south cell to public use in partnership with the Maryland Department of Natural Resources (DNR). In December 2022, MPA purchased the former Tronox Hawkins Point facility adjacent to the Cox Creek DMCF. MES and our subcontractors are providing support to MPA for remediation planning and site operations at the Sediment Technology and Reuse (STAR) Facility. In coordination with remediation

Cox Creek DMCF

activities, the site will be developed to become the future hub of processing dredged material from the Cox Creek DMCF for innovative and beneficial reuse.

MES further provides environmental management system, sustainability, and remediation services to MPA at their marine terminals, including environmental monitoring and reporting, hazardous waste management, groundwater treatment plant operation and maintenance, hazardous waste landfill post-closure care, and stormwater best management practices (BMP) maintenance, inspection, and repair. In addition, MES supports MPA's sustainability efforts through assistance with grant applications and administration.

1.2 Environmental Operations

The MES Environmental Operations (EO) Group serves county government, large municipalities, the private sector, and state government, offering an array of solutions for solid waste and energy/steam management. The group provides solid waste management services across Maryland, operating recycling centers, composting facilities, landfills, and landfill gas sites. In addition to these operations, our team of scientists offers solid waste engineering and environmental compliance services to our clients.

The group operates award-winning landfills and dual- and single-stream recycling centers, which serve millions of Marylanders, including a one-of-a-kind recycling operation on behalf of the Maryland Department of Aging (MDoA) that reclaims used durable medical equipment (DME) and returns that equipment to Marylanders in need. Additionally, the EO Group manages composting facilities that transform yard, leaf, and food waste into highly sought-after products; namely, Leafgro® and Leafgro Gold®.

The EO Group provides Harford County with integrated solid waste management, including landfill operations, engineering services, composting, recycling, litter control, and management of the county's homeowner drop-off facilities.

The Eastern Shore counties of Caroline, Queen Anne's, Talbot, and Kent (Midshore counties) established a regional agreement with MES to meet the solid waste disposal needs of their citizens for more than a 90-year period. MES currently oversees, engineers, operates, and monitors several solid waste facilities in the Midshore region on behalf of the partnering counties, including active and closed Resource Conservation and Recovery Act (RCRA) Subtitle D landfills, a solid waste transfer station, and multiple pre-RCRA Subtitle D landfills. MES also administers and operates a resident recycling program on behalf of the Midshore counties.

MES operates a dual-stream materials recycling facility (MRF) for the Montgomery County Department of Environmental Protection in Derwood, Maryland. Mixed paper and comingled materials, such as glass, metal cans, and plastic containers that are picked up from local residences, are processed at the facility. MES also operates a similar project at the Prince George's County MRF. This recycling facility accepts single-stream recyclables collected from county residents.

The EO Group also operates highly successful leaf and yard waste composting programs. Two compost products made by MES at the Montgomery County and Prince George's County compost facilities, *Leafgro®* and *Leafgro GOLD®*, are successfully marketed by MES staff. Our *Leafgro GOLD®* Compost is produced using food waste as feedstock at the nationally renowned Prince George's County Organics Composting Facility located in Upper Marlboro, Maryland.

The EO Group, on behalf of the Department of Public Safety and Correctional Services, operates a 4-megawatt (MW) cogeneration facility supplying electricity and thermal resources to the Eastern Correctional Institution (ECI), the largest prison in the state. The group also operates steam plants at the University of Maryland Eastern Shore as well as three other Maryland Correctional Facilities, providing steam for heating, laundry, and cooking.

Rotor being installed in steam turbine at ECI.

EO partners with various state government agencies in Maryland to provide other essential services. The group collaborates with the Maryland Department of the Environment (MDE) to support used oil and antifreeze collection and operate a mobile chlorofluorocarbon recovery unit. Additionally, EO partners with the MDoA to manage the DME program. This program receives discarded medical equipment that would typically end up in a landfill, so it can be refurbished, recycled, and commissioned for reuse at no cost to Maryland residents.

1.3 Water and Wastewater Program

MES' Water and Wastewater (W/WW) Group is comprised of two divisions: the Operations and Maintenance Division and the Engineering Services Division. Municipal, county, private, and state-owned wastewater treatment plants (WWTPs) and drinking water treatment plants are operated by the Operations and Maintenance Division. This division provided certified water and wastewater operators for a total of 270 facilities across Maryland and the Mid-Atlantic region in fiscal year 2025 (FY25). We also have a dedicated maintenance staff that performs periodic maintenance, equipment repairs, and retrofits to ensure that each facility meets or exceeds the applicable regulatory requirements.

Sandy Point State Park Water Tower

The W/WW Group's Engineering Services Division plans and implements capital improvement programs for many of these facilities. These staff manage capital upgrades to achieve compliance with Maryland's Enhanced Nutrient Removal standards and other needed retrofits.

The Engineering Services Division's Biosolids Management Section manages the solids generated from the WWTPs. Engineering, planning, permitting, regulatory compliance, and operational support are furnished by the biosolids staff.

1.4 Technical and Environmental Services

The Technical and Environmental Services (TES) Group provides comprehensive environmental planning, monitoring, environmental systems maintenance, geospatial, engineering, and renewable energy services to our partners. This includes tasks such as:

- Stormwater Management
- Environmental Planning & Permitting
- Inspection Services
- Monitoring
- Regulatory Reporting
- Renewable Energy Services
- Geographic Information Systems

Emergency Stormwater Drainage Site

One of the group's major projects involves providing environmental compliance and environmental systems maintenance support to the Maryland Aviation Administration (MAA) at the Baltimore Washington International Thurgood Marshall Airport (BWI). This includes accumulating waste deicing fluid at BWI to prevent its discharge to nearby waterways. MES staff collected 2.7 million gallons of spent de-icing fluid at BWI during the FY25 deicing season. Some of the recovered deicing fluid is recycled rather than disposed, thereby reducing costs to MAA.

The TES Group continued to work closely with the State Highway Administration (SHA) providing environmental compliance support services. This included the proper coordination, transportation, and disposal of SHA shop's wastewater and containerized waste. TES is also continually involved with the emergency drainage remediation projects that posed a potential impact on public safety and the environment. In FY25, the stormwater remediation efforts have expanded to cover the entire state, and the team is also working with individual districts to provide similar drainage repair work on a smaller scale.

A team of TES staff assists the Maryland Energy Administration (MEA) with implementation and evaluation of state energy programs and strategies. As a key supporter of the state's efforts to expand residential energy solutions, MES was involved in the program design, testing, and launch of the Maryland Solar Access Program during FY25. This program provides grants of up to $7,500 at a rate of $750 per kilowatt of installed DC solar capacity to help low- and moderate-income households afford solar energy systems. The team additionally streamlined improvements to the Electric Vehicle Supply Equipment (EVSE) Rebate Program, expediting the deployment of funding for commercial and residential EV charging station installations that contribute to Maryland's greenhouse gas reduction goals.

2. Greenhouse Gas and Climate Change Mitigation Policies

2.1 Global Climate Change

The Paris Agreement was adopted at COP21 (2015) with the explicit goal of holding the rise in global average temperature to well below 2°C and pursuing efforts to limit warming to 1.5°C relative to 1850–

1900 pre-industrial levels.[1] The agreement requires parties to prepare nationally determined contributions (NDCs) and to strengthen them every five years under a "ratchet" mechanism.[1]

The *Sixth Assessment Report* (AR6, 2023) from the Intergovernmental Panel on Climate Change (IPCC) concludes that human activities have caused ~1.1°C of warming (2011–2020 compared to pre-industrial levels (1850–1900).[2] AR6 documents impacts, including global mean sea level rise of approximately 8 inches from 1901–2018, ocean acidification, and more frequent extreme weather events, with disproportionate effects on vulnerable communities.[2] The IPCC also warns in AR6 that current trajectories are likely to exceed 1.5°C this century, absent rapid emissions reductions.

Complementing the IPCC, the United Nations Environment Programme's (UNEP) *Emissions Gap Report 2025 (Off Target)* finds that, based on current NDCs, projected end-of-century warming is approximately 2.3–2.5°C and that global annual emissions must fall by approximately 55% by 2035 relative to 2019 to align with a 1.5°C pathway.[3] UNEP further notes that a multi-decadal exceedance of 1.5°C is now very likely, making near-term, deeper cuts essential to limit overshoot and reduce reliance on uncertain carbon-removal methods.[3]

The World Meteorological Organization's (WMO) *State of the Climate 2025* indicates that 2015–2025 is the warmest 11-year period on record, with January–August 2025 global mean near-surface temperatures reaching approximately 1.42°C (±0.12°C) above the pre-industrial average.[4] Record concentrations of CO_2, CH_4, and N_2O, unprecedented ocean heat content, and continued glacial mass loss were also documented in calendar year 2024. WMO, in its *State of the Global Climate 2024* (released Mar 19, 2025), shows that 2024 was very likely the first calendar year that global mean temperatures were more than 1.5°C above pre-industrial levels, while emphasizing that the long-term, multi-decadal temperature goal remains in reach with sustained cuts.[5]

Figure 1 shows annual global mean temperature anomalies relative to 1850–1900, whereas Figure 2 illustrates global mean sea level changes from 1993 through September 2025.

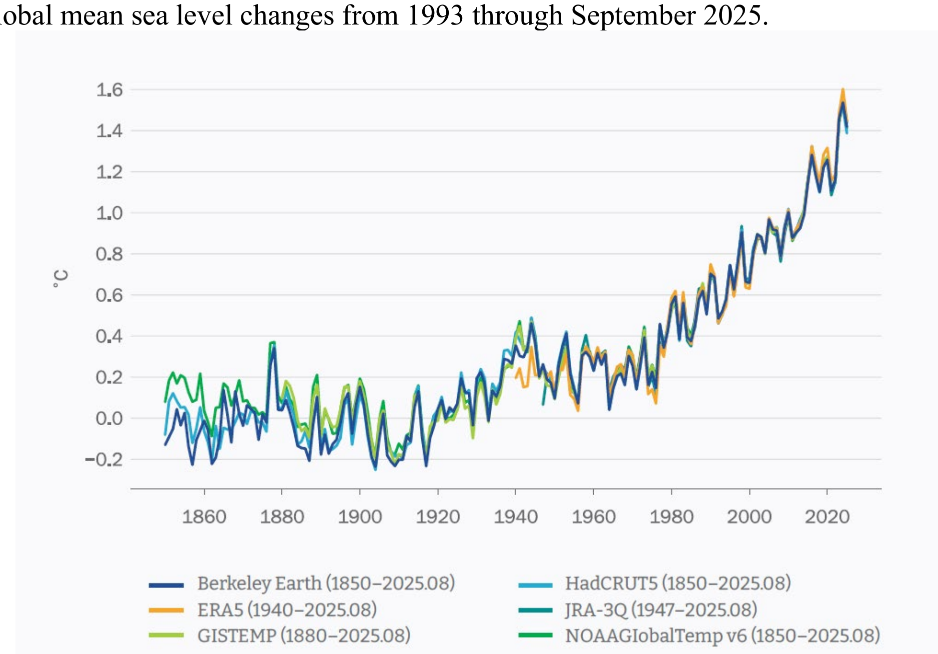

Figure 1 – Annual Global Mean Temperatures Anomalies Relative to 1850 – 1900. From Figure 2 in WMO, 2025.[4]

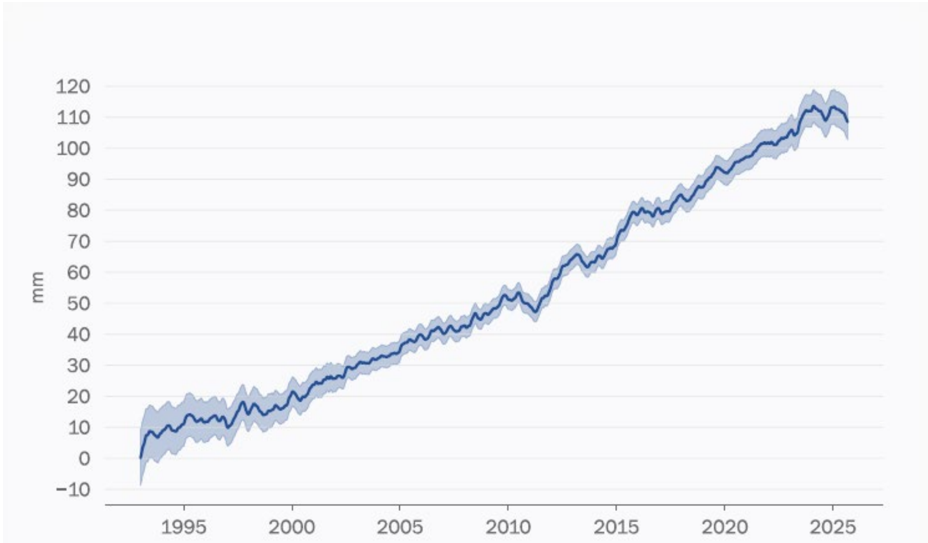

Figure 2 – Global mean sea level change, 1993 – September 2025. From Figure 4 in WMO, 2025.[4]

2.2 National Climate Change Mitigation Policies

U.S. federal climate policy shifted in 2025. On January 20, 2025, Executive Order No.14156 ("Declaring a National Energy Emergency") prioritized securing an affordable, reliable energy supply and emphasized expanded domestic fossil fuel production and critical minerals.[6] On April 8, 2025, Executive Order 14260 ("Protecting American Energy From State Overreach") directed the Attorney General and federal agencies to identify and challenge state or local laws that burden domestic energy production, with particular focus on climate-related rules (e.g., carbon caps).[7]

The One Big Beautiful Bill Act (OBBBA), signed July 4, 2025, enacted significant changes to tax and energy policy, including the accelerated rollback of the Inflation Reduction Act (IRA) clean-energy credits. It ends the clean electricity Production Tax Credit 45Y and Investment Tax Credit (ITC) 48E for facilities placed in service after Dec 31, 2027, unless construction begins before July 4, 2026.[8] The act also tightens timelines for the clean hydrogen production credit (45V) by requiring construction start before Jan 1, 2028, shorter than the IRA's original eligibility to 2032.[8]

Despite these rollbacks, the U.S. submitted an updated NDC in December 2024 targeting 61 – 66% emissions reduction by 2035 (vs. 2005) and aiming for 50% of new vehicle sales to be electric by 2030.[9] However, withdrawal from the Paris Agreement in 2025 has voided the federal pursuit of these targets, creating significant uncertainty around the NDC's implementation.[10]

In June–August 2025, the U.S. Environmental Protection Agency (EPA) proposed repealing all Clean Air Act section 111 GHG standards for power plants and moved to rescind the 2009 Endangerment Finding that underpins federal GHG regulation, triggering extensive legal scrutiny and comment. Amid federal retrenchment, state-level action persisted. The U.S. Climate Alliance reaffirmed collective commitments to 26 – 28% GHG reductions by 2025 and 50 – 52% by 2030 from 2005 levels, and, following the 2024 U.S. NDC, also set a guiding 2035 target of 61 – 66% for coalition members.[11]

2.3 Maryland Climate Change Mitigation Policies

Climate Solutions Now Act (CSNA, 2022)
Maryland's CSNA (SB 528, 2022) sets one of the nation's most ambitious goals: a 60% GHG reduction by 2031 from a 2006 baseline and net-zero by 2045.[12] The law requires Building Energy Performance Standards (BEPS) for covered buildings greater than 35,000 square feet, targeting a 20% GHG reduction from a 2025 baseline by January 1, 2030, and net-zero direct emissions by 2040, with detailed benchmarking and performance requirements set in COMAR 26.28. CSNA also directs state procurement to reach at least 75% zero/low-carbon electricity for state facilities by 2030, transitions state fleets to Zero Emission Vehicles (ZEVs), establishes definitions of overburdened and underserved communities for equity investments, creates the Climate Catalytic Capital (C3) Fund (with at least 40% of the funding allocation to low and moderate income), and mandates use of 20-year Global Warming Potentials in GHG accounting.[12]

Climate Pollution Reduction Plan (CPRP, Dec 2023)
In December 2023, MDE published the CPRP, a whole-of-economy roadmap to achieve 60% reductions by 2031 and net-zero by 2045, projecting major co-benefits and an approximate 80% reduction in fossil fuel use by 2045 with full policy implementation.[13] The CPRP includes many new policies spanning power, buildings, transport, industry, and land-use/natural climate solutions, and stresses new funding mechanisms to deliver equitable decarbonization. Figure 3 summarizes major decarbonization milestones from the CPRP, consistent with MDE's timeline visualization.

Executive Order No. 01.01.2024.19 (June 4, 2024)
Governor Wes Moore's Executive Order 01.01.2024.19 mandates a whole-of-government approach, requiring each state agency to submit a Climate Implementation Plan by Nov 1, 2024, directing MDE to propose a zero-emission heating equipment standard and a clean heat standard, and to work within the Regional Greenhouse Gas Initiative to align the regional CO_2 cap with the State's 100% clean-energy goals.[14]

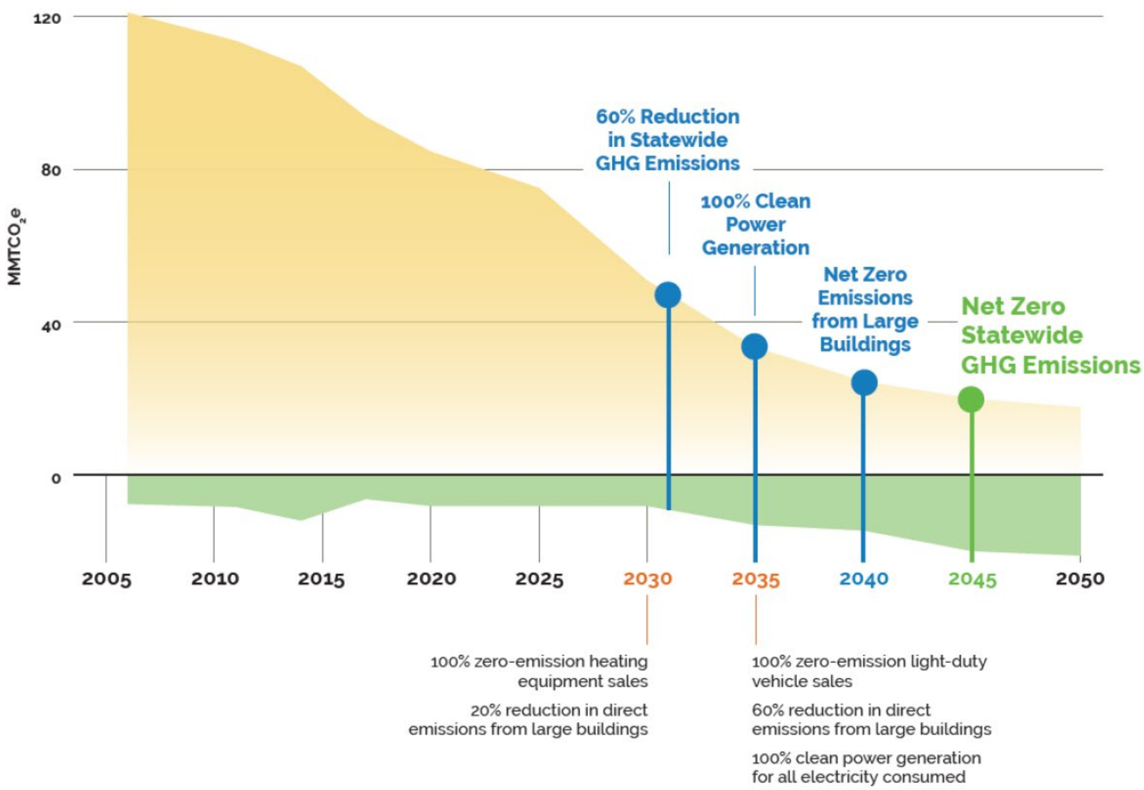

Figure 3 – Major Milestones in Maryland's Decarbonization Timeline; from Figure 1 in MDE, 2023.[13]

2025 Maryland Legislative Session Highlights

- Next Generation Energy Act (HB 1035/SB 937; Ch. 626, 2025)
  Aims to increase in-state generation and storage while strengthening ratepayer protections, and includes: fast-track approval for up to 10 dispatchable projects (prioritizing zero-emission technologies), battery storage requirements (with multi-year procurements and program design for transmission-connected storage), nuclear procurement exploration, and removal of trash-to-energy subsidies to favor low-emission sources.[15]
- Renewable Energy Certainty Act (HB 1036/SB 931; Ch. 624, 2025)
  Establishes uniform siting standards for solar, updates Certificate of Public Convenience and Necessity (CPCN) criteria under the Maryland Public Service Commission (PSC), creates a distributed generation CPCN for certain solar systems less than or equal to 5 MW, and caps state preemption over local zoning within Priority Preservation Areas to 5% per county in an effort to balance farmland preservation and solar deployment.[16]
- BEPS Alterations and Analysis (HB 49; Ch. 844, 2025)
  Refines Maryland's BEPS by accepting late benchmarking submissions through September 1, 2025, introducing an annual reporting fee, and expanding exemptions (e.g., hospitals, certain life-science facilities, emergency generators, among other alterations).[17]

2.4 Maryland Greenhouse Gas Emissions

The Greenhouse Gas Reduction Act requires MDE to complete triennial inventories of the state's GHG emissions. The inventories capture gross GHG emissions from in-state activities, as well as out-of-state GHG emissions for imported electricity. A base inventory was completed for calendar year 2006 and represents the GHG emissions to which future emission reduction targets will be compared. The most recent published triennial inventory was completed for 2020 and shows gross GHG emissions of 85 million metric tons carbon dioxide equivalents ($MMTCO_2e$) using 20-year Global Warming Potentials (GWPs).[18] The results of the 2020 inventory are depicted by sector in Figure 4 and by gas composition in Table 1.

Maryland's 2020 net GHG emissions of 77 $MMTCO_2e$ constitute a reduction of almost 33% compared to the 2006 baseline net emissions of 114 $MMTCO_2e$. The principal driver for this reduction is decreased power plant emissions, largely attributed to Maryland's participation in the Regional Greenhouse Gas Initiative and the ongoing phase-out of coal-fired electricity generation.

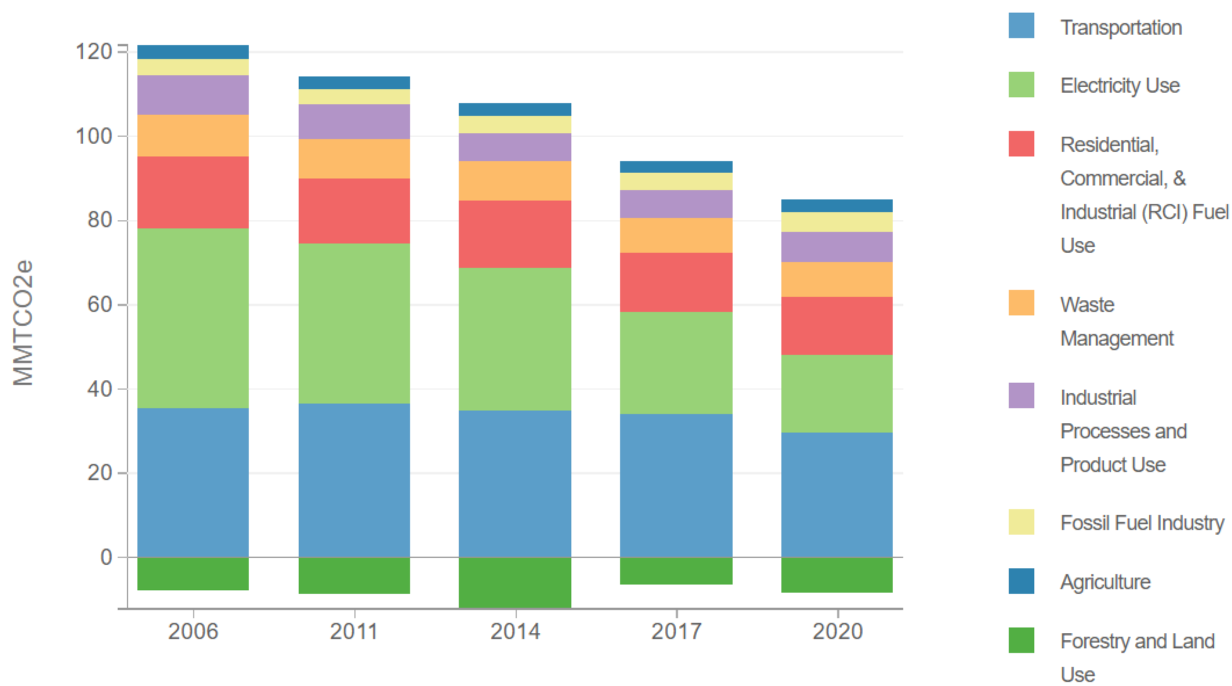

Figure 4 – Maryland GHG Emissions by Sector; from Maryland GHG Emissions by Sector in MDE, 2022.[19]

Gas	Gross Emissions ($MMTCO_2e$)	Percent of Total
Carbon Dioxide (CO2)	66.0	78%
Methane (CH_4)	12.5	15%
F-gases (HFC, PFC, SF6)	5.2	6%
Nitrous Oxide (N_2O)	1.3	2%

Table 1 – Maryland Gross GHG Emissions by Select Gas, 2020; Adapted from Figure of Gross GHG Emissions Breakout by Gas in MDE, 2022. [20]

3. MES Operating Programs - Current GHG Emission Reduction Activities

MES is committed to advancing GHG mitigation across all operating groups. This section provides an overview of current projects and strategies implemented by MES to reduce GHG emissions. Each operating group is actively engaged in targeted activities from fleet electrification and heavy equipment upgrades to landfill gas recovery, biosolids management, and large-scale recycling and composting programs. The following subsections detail the specific actions, technologies, and outcomes achieved in FY25, highlighting MES' ongoing leadership in environmental stewardship.

Note that MES operates facilities and projects on behalf of clients, mostly a mix of state and county governments. To the extent that we capture and report on GHG reductions from our projects, the benefits thereof may also be catalogued by our clients.

3.1 Environmental Dredging and Restoration Projects

MPA Port of Baltimore Diesel Equipment Upgrade Program

The Diesel Emissions Reduction Act (DERA) Program provides grants to improve air quality and public health by reducing harmful emissions from diesel engines. This program offers funds to retrofit or replace older diesel engines to reduce emissions and accelerate the replacement of this equipment with newer, cleaner technologies. The MPA has a robust environmental program, which includes reducing emissions from vehicles, vessels, and cargo handling equipment at port facilities. MES receives the EPA grant funding and administers the program on behalf of MPA. Companies that own vehicles, cargo handling equipment, and vessels take part in the program by matching EPA funds. The funding levels vary depending on the selected technology and equipment or vehicle type.

In FY25, a total of 39 pieces of equipment were replaced by this program, including two tugboat engines, 28 on-road class eight heavy-duty trucks, three forklifts, four terminal tractors, and two mobile pump diesel engines. The EPA's Diesel Emission Quantifier (DEQ) Tool[21] was used to quantify emissions reductions resulting from these replacements. The output from this web-based tool is shown in **Table 2** below. Inputs used for the DEQ tool were obtained from actual usage data from the vehicles that were being replaced. Diesel emissions reductions were achieved because of improved emissions control technologies and enhanced fuel efficiency. It was assumed that fuel efficiency for the upgraded on-road equipment was 6.6 miles per gallon, and for off-road equipment, a 20% improvement in fuel efficiency. Emissions reductions for the criteria air pollutants (NOx, CO, and $PM_{2.5}$) and hydrocarbons (HC) were achieved. GHGs were reduced by an estimated 19.3%, or 473 metric tons of carbon dioxide equivalent ($MTCO_2e$).

***Parameter** (Annual)*	**NO_x**	**$PM_{2.5}$**	**HC**	**CO**	**CO_2**	**Fuel Use (gal)**
Baseline for Upgraded Vehicles/Engines (short tons)	14.639	1.030	1.146	4.804	3,106.8	276,161
Amount Reduced After Upgrades (short tons)	9.159	1.011	1.034	2.067	598.8	53,224
Percent Reduced After Upgrades	62.60%	98.20%	90.20%	43.00%	19.30%	19.30%
***Parameter** (Lifetime)*	**NO_x**	**$PM_{2.5}$**	**HC**	**CO**	**CO_2**	**Fuel Use (gal)**
Baseline for Upgraded Vehicles/Engines (short tons)	73.197	5.150	5.728	24.022	15,534.10	1,380,805

Amount Reduced After Upgrades (short tons)	45.793	5.057	5.168	10.335	2,993.8	266,118
Percent Reduced After Upgrades	62.60%	98.20%	90.20%	43.00%	19.30%	19.30%

Table 2 – EPA DEQ Output for MPA's FY25 Port of Baltimore Diesel Equipment Upgrade Program

MES Electric Pick-Up Trucks at MPA Facilities

MES is actively assisting our client, MPA, with the implementation of the fleet electrification requirements of the CSNA. In FY25, MES, on behalf of MPA, purchased two additional F-150 Lightning battery electric vehicle (BEV) half-ton pickup trucks. These trucks were received in March 2025 and immediately placed into service, replacing two diesel pickup trucks. A fully electric zero-turn mower was received in September 2024 and was placed into service, replacing a 2011 gas-powered zero-turn.

Along with fleet electrification, EDR has focused on the reduction of GHGs by updating additional equipment currently utilized at MPA facilities operated by MES. In FY25, MES, on behalf of MPA, replaced ten pieces of equipment with new, more efficient, and cleaner operating equipment meeting the latest Tier 4 Final EPA requirements. Additionally, MES participated in a pilot test of a first-of-its-kind Diesel-Electric Hybrid Dewatering Pump. In FY26, MES will continue our implementation of ZEVs by adding a BEV pickup and a plug-in hybrid electric (PHEV) SUV.

3.3 Environmental Operations Projects

ECI Cogeneration Facility – Natural Gas Conversion

MES completed the boiler fuel conversion project at the ECI Cogeneration Facility in December 2024, converting two existing 38 MMBtu wood-fired Cleaver-Brooks boilers to natural gas. During the second half of FY25, the Cogeneration Facility consumed 177,268 dekatherms of natural gas and produced 6,166 MWh of electricity. For comparison, in the second half of FY22, which represents the most recent pre-conversion period with similar electric generation volumes, the facility consumed 24,820 standard tons of wood fuel and produced 5,977 MWh of electricity.

Among commercially available fossil fuels, natural gas is the cleanest-burning hydrocarbon. Based on EPA AP-42 emission factors and a higher heating value for debarked wood chips of 4,985 Btu/lb., combusting 24,820 tons of wood fuel generated about 22,381 MTCO2e, whereas combusting 177,268 dekatherms of natural gas generated approximately 9,516 MTCO2e for a period-over-period reduction of 12,865 MTCO2e. Thus, the switch to natural gas is expected to roughly halve annual GHG from stationary combustion at the facility for equivalent generation.

Midshore I Landfill

With MEA grant support, MES installed a 5.6 kW Qnergy PowerGen (5650) at the closed Midshore I Landfill in August 2022 to supplement the site's landfill gas (LFG) collection and control system and generate renewable electricity from LFG using free-piston Stirling engine technology. The unit was interconnected on June 7, 2023, and during the July 1, 2024, to June 30, 2025, performance period, it backfed 1,200 kWh to the grid. The PowerGen has combusted approximately 3,895,000 standard cubic feet (scf) of LFG since installation, including 372,000 scf during FY25. Operation of the unit resulted in

Qnergy PowerGen at Midshore I Landfill

approximately one $MTCO_2e$ of GHG reductions as calculated with EPA's Landfill Gas Energy Benefits Calculator.[22]

The Midshore I Landfill is also registered under Verra's Verified Carbon Standard, where methane destruction through PowerGen combustion or flaring yields carbon offsets verified annually by a third party. Since 2013, over 253,000 carbon offsets have been transacted, each equivalent to one $MTCO_2e$ that has been additionally removed through project activity. MES continues to flare or beneficially use LFG generated at the closed Midshore I Landfill into FY26.

Reducing GHG Emissions Through Heavy Equipment Upgrades

MES' Midshore II Landfill team took delivery of a new electric-drive bulldozer near the end of FY24—a Caterpillar D6XE—which replaced a conventional, solely diesel-powered dozer. The D6XE features a high-drive design and an electric powertrain that delivers maximum torque at any speed, with 90% fewer parts than a conventional powertrain. It is projected to be 35% more fuel-efficient than its predecessor, saving 3,511 gallons of diesel and offsetting 37 $MTCO_2e$ annually using the EPA's Simplified GHG Emissions Calculator.

TANA H555 Compactor at Midshore II

In FY25, MES also trialed and purchased a Tana H555 compactor for use at the Midshore II Landfill. A two-week demonstration period at the landfill showed that the Tana H555 achieved a 19% higher waste compaction rate and substantial fuel savings compared to the existing Caterpillar 836K landfill compactor. The Tana H555 landfill compactor is more fuel efficient than conventional compactors because its full-width twin drum design and rigid frame allow it to achieve higher compaction rates with fewer passes, reducing both fuel consumption and operating hours. Additionally, the Tana H555 is powered by a highly fuel-efficient engine and features simplified maintenance and controls, further lowering operating costs compared to traditional four-wheel compactors.

The Tana H555 is expected to save approximately 26,500 gallons of diesel annually, resulting in an estimated reduction of 278 $MTCO_2e$ per year, as calculated using the EPA's Simplified GHG Emissions Calculator. Together, these equipment upgrades are projected to appreciably reduce the landfill's off-road diesel fuel consumption while also improving operational efficiency. MES expects to take delivery of additional hybrid electric heavy equipment in FY26.

Giant Miscanthus Demonstration Project

Giant Miscanthus Test Plot

A recent University of Maryland study suggests that cultivating the perennial species *Miscanthus × giganteus* (Giant Miscanthus) on marginal land can help reduce regional warming and drying by increasing solar reflection, evapotranspiration, and lowering sensible heat transfer. Giant Miscanthus is a sterile, warm-season grass propagated by rhizome division. Stands can persist for up to 25 years with minimal inputs compared to grain crops. It grows to about 12 feet tall, with roots extending nearly eight feet deep, and is used for biofuels and bioproducts such as poultry bedding.

In November 2023, MES partnered with Twin Maples Farms, LLC to plant approximately 15 acres of Giant Miscanthus in an exhausted borrow pit at the Midshore II landfill—land considered marginal after soil removal. While the crop typically yields 7–12 tons per acre by its third season, the stand was not harvested after the 2024 growing season due to suboptimal yields, likely driven by its cultivation on marginal land and unfavorable precipitation patterns during 2024. However, growth improved significantly in 2025, and the stand is expected to be harvested prior to the 2026 growing season. Once fully established by its third growing season, the crop may yield 7 to 12 tons per acre.[23] With net carbon sequestration proportional to crop production[24], the crop may sequester approximately 12 $MTCO_2e$ annually at the high end of expected yields.

MES is also working with the University of Maryland Extension to monitor giant miscanthus yields, soil moisture, and site performance. This collaboration includes field sampling, soil moisture monitoring, and agronomic assessments to better understand giant miscanthus productivity and its potential carbon benefits through biomass accumulation.

Recycling Operations

Recycling and organics diversion remain among the most effective strategies for GHG emissions reduction in Maryland's solid waste sector. By substituting recycled materials for virgin feedstocks, MES-supported recycling programs reduce the primary energy requirements and associated GHG emissions of manufacturing, while composting and food waste diversion avoids methane generation from landfills and sequester carbon in soils.

MES estimates avoided GHG emissions from recycling and composting using the EPA's Waste Reduction Model (WARM), which compares baseline (e.g., landfilling or waste-to-energy) and alternative (e.g., recycling, composting) management scenarios for a range of materials. The difference between these scenarios represents the net GHG emissions avoided by implementing the alternative practice.

In FY25, MES-operated recycling and composting programs—including the Montgomery County and Prince George's County Materials Recovery Facilities, the Midshore Regional Recycling Program, Harford Waste Disposal Center, the DME program, and food waste diversion from BWI—collectively avoided an estimated 209,696 MTCO2e compared to baseline waste management practices. This is equivalent to removing approximately 44,919 passenger vehicles from the road for one year. The largest contributors were the Montgomery County MRF (105,801 $MTCO_2e$ avoided), Prince George's County MRF (90,761 $MTCO_2e$), and the Midshore Regional Recycling Program (MRRP) (8,054 $MTCO_2e$). Organics composting at the Prince George's County Organics Composting Facility also provided substantial reductions, with 2,485 $MTCO_2e$ avoided.

These results are consistent with prior years' MES GHG reports, which have shown that recycling and composting programs are among the most significant sources of GHG mitigation performed by MES. The WARM tool's life-cycle approach ensures that both direct and upstream emissions are accounted for, though it is important to note that actual GHG benefits may accrue over the long term as materials are processed and products are manufactured.

An analysis of estimated GHG emissions avoided by operating these recycling programs is presented in Table 3 and detailed in the subsections that follow.

Environmental Operations Project	**Source Reduced** *(tons)*	**Recycled*** *(tons)*	**Composted** *(tons)*	**FY25 Change (Alt - Base)** [e] *('$MTCO_2E$)*	**Eq. Cars Removed**[e] *(#)*
Montgomery County MRF[a]		40,749		(105,801)	22,463
Prince George's County MRF[a]		30,033		(90,761)	19,270
Midshore Regional Recycling Program[a]		3,168		(8,054)	1,710
Harford Waste Disposal Center[a]		2,231	16,505	(3,434)	729
MDoA Durable Medical Equipment Program[a,b]	141	99		(981)	208
BWI Food Scraps[a, c]			116	(3)	1
Prince George's County Organics Composting Facility[d]			62,172	(2,485)	528
Totals	**141**	**76,279**	**116,415**	**(209,010)**	**44,800**

a - Material amounts represent sold and/or outbound tonnages for FY25

b - Emissions reductions from source-reduced (repurposed) durable medical equipment not captured in WARM estimate.

c - BWI food waste is excluded from Prince George's County Organics Composting Facility emission reduction calculation to avoid double-counting.

d - Includes only composting of food waste and grass, those materials that result in a net reduction of GHG emissions compared to the baseline scenario of landfilling.

e - Estimated emission reductions based on the implemented waste management alternative for the project relative to baseline emissions for landfilling or waste-to-energy, depending on the project.

Table 3 - Estimated Avoided GHG Emissions by Implementing the Alternative Relative to the Baseline Waste Management Practice ($MTCO_2e$)

Montgomery County MRF – Carbon Emissions Modeling

The Montgomery County MRF is a dual-stream recycling facility that MES has been operating since 1999. Montgomery County residents separate their recyclables into two separate categories: paper/cardboard and glass/plastic/metals. Separating the recyclables into two separate streams results in less contaminated end products that can be better marketed for resale.

Montgomery County MRF recycling data for FY25 is shown in Table 4. Compared against a baseline of combusting all recycled material at the Montgomery County Resource Recovery Facility (MCRRF), except ferrous and non-ferrous metals, operation of the Montgomery County MRF reduced GHG emissions by an estimated 105,801 $MTCO_2e$. It should be noted that this analysis assumes that all ferrous and non-ferrous metals from ash produced at the MCRRF are recycled.

Commodity	FY25 Tonnage Recycled	Avoided Emissions ($MTCO_2e$)
Corrugated Containers	15,777	(42,022)
Mixed Paper (general)	18,322	(56,281)
HDPE	956	(2,000)
PET	1,625	(3,742)
PP	207	(441)
Mixed Plastics	333	(739)
Aluminum Cans	533	-
Steel Cans	965	-
Glass	1,762	(576)
Totals =	**40,479**	**(105,801)**

Table 4 – EPA WARM Carbon Emissions Modeling Results, Montgomery County MRF

Prince George's County MRF – Carbon Emissions Modeling

The Prince George's County MRF is a single-stream system located in Capitol Heights that provides recycling services for material collected from approximately 300,000 homes in the county. WARM modeling performed for the Prince George's County MRF was compared against a baseline of disposing the materials at the Brown Station Road Landfill. A summary of recycled commodities managed at the Prince George's County MRF and their respective avoided emissions is presented in Table 5 below.

Commodity	FY25 Tonnage Recycled	Avoided Emissions ($MTCO_2e$)
Corrugated Containers	15,019	(45,865)
Mixed Paper (general)	9,543	(32,145)
HDPE	865	(674)
PET	2,299	(2,428)
PP	448	(365)
Mixed Plastics	340	(321)
Aluminum Cans	479	(4,380)
Mixed Metals	1,039	(4,582)
Totals =	**30,033**	**(90,761)**

Table 5 – EPA WARM Carbon Emissions Modeling Results, Prince George's County MRF

Midshore Regional Recycling Program

The MRRP is a cooperative partnership between Caroline, Kent, Queen Anne's, and Talbot Counties that was established in 1993. The MRRP is a residential recycling drop-off program that allows residents of the four Midshore service counties to drop off their separated paper, cardboard, metal cans, and glass at one of thirty-three separate locations throughout the region. These source-separated recyclables are collected, transported, marketed, and sold by MES on behalf of the Midshore counties. In addition, the

MRRP manages the residential electronics drop-off and recycling program on behalf of the Midshore counties.

In FY25, MES delivered 3,158 tons of materials to local recycling markets via the MRRP, offsetting an estimated 8,054 $MTCO_2e$ of GHG emissions (Table 6). The baseline scenario evaluated was the disposal of these materials at the Midshore II Landfill.

Commodity	**FY25 Tonnage Recycled**	**Avoided Emissions ($MTCO_2e$)**
Corrugated Containers	1,249	(4,543)
Mixed Paper (primarily residential)	581	(2,242)
Mixed Plastics	388	(367)
Mixed Electronics	53	(49)
Mixed Metals	144	(633)
Glass	744	(221)
Totals =	**3,158**	**(8,054)**

Table 6 – EPA WARM Carbon Emissions Modeling Results, Midshore Regional Recycling Program

Harford County Integrated Solid Waste Management

The EO Group has been providing solid waste management services for Harford County since 2015. These services include:

- Operation of the County's Landfill and Homeowner Drop-Off Center
- Yard Waste Composting
- Single Stream Recycling Services
- Litter Control and Adopt-a-Road Programs
- Recycling Education and Outreach
- Engineering and Procurement Services

Curbside recycling material brought to the homeowner's drop-off site at the Harford Waste Disposal Center is transported to a transfer station and then to a commercial recycling facility in Baltimore County. Waste management data was input into the EPA's WARM model and compared to the baseline scenario of landfilling. An estimated 4,836 $MTCO_2e$ emissions were avoided because of Harford County's recycling programs (Table 7).

Commodity	FY25 Tonnage Recycled	FY25 Tonnage Composted	GHG Emissions Compared to Baseline ($MTCO_2e$)
Food Waste (non-meat)	NA	4	(3)
Yard Trimmings[a]	NA	16,500	1,405
Mixed Plastics	12	NA	(11)
Mixed Electronics	59	NA	(55)
Mixed Metals	33	NA	(145)
Structural Steel	1,409	NA	(2,746)
Mixed Recyclables	600	NA	(1,879)
Totals =	**2,113**	**16,504**	**(3,434)**

a. Includes all sold material mulched or composted for WARM modeling purposes.

Table 7 – Carbon Emissions Avoided Due to Recycling Programs, Harford County Solid Waste

Durable Medical Equipment

Many residents of Maryland require the use of DME, such as wheelchairs, walkers, shower chairs, and other assistive devices to maintain their safety and mobility. Often the cost of this equipment is a serious burden, not only to uninsured residents, but also to insured residents whose insurance approvals are delayed or denied. To address this need, the MDoA has developed an innovative statewide DME reuse program that provides medical equipment at no direct cost to Maryland residents in need.

DME can be donated to any of the 21 collection locations across the state, and, additionally, the program can make direct residential and commercial curbside pickups of bulk DME donations.

MES operates the DME program on behalf of MDoA. In FY25, the program repurposed and source reduced 141 tons of medical equipment. In addition, the program recycled 105 tons of mixed metals from medical equipment that could not be repurposed. Compared against a baseline waste management scenario of landfilling, and using the EPA's WARM tool, the recycling of these materials resulted in 981 $MTCO_2e$ of avoided GHG emissions.

Organics Composting

Organics composting is a key strategy employed in Maryland to reduce methane emissions from landfills. In addition to diverting organic waste, such as food waste and yard waste, from the landfill or waste incinerator, composting also recycles nutrients and sequesters carbon into soil, and plays a role in the circular economy.

Food waste management continues to present an opportunity for reducing GHG emissions nationally. In 2018, the EPA estimated that 63 million tons of food waste were generated as part of their municipal solid waste inventory.[25] Most of this food waste was landfilled, and only 4% composted. Composting under aerobic conditions minimizes the production of methane, a potent GHG, while enhancing soil health and closing nutrient loops.

MES operates several large composting facilities that generate high-quality, marketable material. These include the Prince George's County Organics Composting Facility, the Montgomery County Yard Trim Facility, and, as previously detailed, the HWDC. In addition, MES collects food waste from BWI and transports this material to food waste composting and anaerobic digestion facilities in the state.

Prince George's County Organics Composting Facility

MES continues to operate the Prince George's County Organics Composting Facility in Upper Marlboro. Yard waste is composted in windrows and converted into a dark, humus-like material that MES markets as Leafgro®. MES utilizes the GORE® in-vessel aerated pile system, as shown in the image below, to convert food waste processed at the facility into Leafgro GOLD®. MES sold 11,088 tons of Leafgro GOLD® and 16,227 tons of Leafgro® in FY25.

MES used the EPA's WARM model to determine the GHG emissions avoided by composting food waste in lieu of landfilling as the baseline scenario. A total of 19,666 tons of food waste were composted at the facility in FY25, resulting in 9,471 $MTCO_2e$ of GHG emissions avoided. Because the baseline scenario of landfilling at the Brown Station Road Landfill includes LFG energy recovery, the WARM results produced for composting most of the remaining materials (e.g., yard waste) received at the facility resulted in a net increase GHG emissions (Table 8).

Food Waste Composting System at Prince George's County Organic Composting Facility

Commodity	**FY25 Tonnage Composted**	**GHG Emissions compared to Baseline ($MTCO_2e$)**
Food Waste	19,666	(9,471)
Yard Trimmings	39,873	6,729
Grass	1,396	(239)
Leaves	1,103	542
Branches	18	10
Totals =	**62,056**	**(2,429)**

Table 8 – Carbon Emissions, Alternative to Baseline Waste Management, Prince George's County Organic Composting Facility

Montgomery County Yard Trim Composting Facility

The Montgomery County Yard Trim Composting Facility is located near Dickerson and has been in operation since 1983. Leaves, grass, and yard trim collected in Montgomery County are accepted at this site, where the materials are composted using windrow composting. Finished compost produced at the site is sold in both bulk and bagged form by MES staff as the trademarked Leafgro® product. MES staff sold a total of 16,696 and 21,005 tons of bagged and bulk compost, respectively. The bagged Leafgro® compost is a popular organic product sold at garden centers and retail operations in the Mid-Atlantic region.

MES modeled the net GHG emissions of the composting operations at the Montgomery County Yard Trim Composting Facility compared to a baseline of disposing of the materials at the MCRRF. It should be noted that WARM does not account for carbon dioxide emissions when combusting biomass such as yard trimmings because it is considered a biogenic source of emissions.[26]

A summary of the WARM modeling results is given in Table 9. The WARM modeling results indicate GHG emission reductions of 6,036 $MTCO_2e$ for waste-to-energy (WTE) (baseline), and 3,993 $MTCO_2e$ for composting (implemented alternative).

Management Practice	FY25 GHG Emissions Comparison ($MTCO_2e$)
WTE	(6,036)
Composting	(3,993)
Net (Composting – WTE)	2,043

Table 9 – Carbon Emissions, Alternative to Baseline Waste Management, Montgomery County Yard Trim Compost Facility

BWI Food Scraps

MES, now through the TES Group, collects food scraps from the BWI Airport and transports them to food waste composting facilities in the state. In FY25, MES collected 116 tons of food waste at BWI and estimates that BWI food waste composting resulted in three $MTCO_2e$ of avoided emissions, compared to the baseline scenario of WTE at the Baltimore Refuse Energy Systems Company (BRESCO) in Baltimore, MD.

3.4 Technical and Environmental Services Projects

Solar Feasibility for State and Local Government

MES has continued to work with MEA to provide no-cost solar technical assistance to state and local entities thanks to the MEA grant program. MES collaborates directly with a qualified contractor who completes the feasibility study and provides the applicant with important information regarding their options for solar. In FY25, technical assistance reports were issued for the City of Laurel, City of Rockville, and Baltimore County, among others.

Technical assistance includes, for example, photovoltaic array sizing and siting, shading, estimated solar electricity generation, system costs, and return on investment. An example of Solar Insolation and Climate Data is shown in Figure 5. By providing this essential service, MES enables local governments to make better-informed decisions on solar energy.

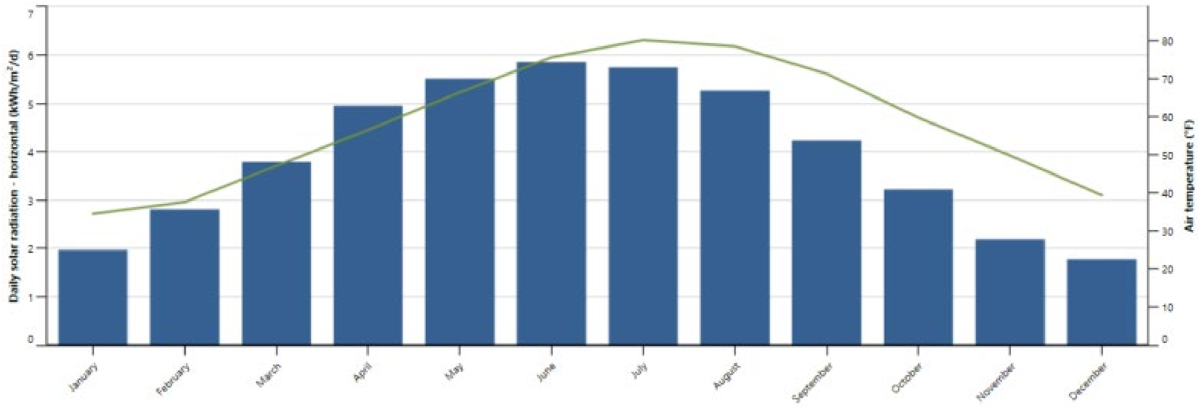

Figure 5 – Example Solar Insolation and Climate Data for Rockville, MD

Stormwater Management and Restoration Projects

TES provides stormwater management support to several clients, including state universities and counties. These services include inspections of stormwater best management practices (BMPs) to evaluate condition and functionality and provide recommendations for repair and maintenance. Proper management of stormwater BMPs is important for the reduction of stormwater runoff pollutant loads entering local waterways. TES also assists clients with the identification and implementation of restoration projects. This may include installation of new stormwater BMPs, retrofit of existing BMPs, or implementation of alternative practices.

One notable project completed by TES was a 7-acre tree planting at the Maryland School for the Deaf - Frederick Campus. A total of 780 trees were planted, consisting of 5 distinct native species. Due to the young age of the trees, the estimated annual CO_2 absorption of one tree would be approximately 3-6 kg per year, totaling 2,340 to 4,680 kg per year for the full site. The planting was completed in April 2024, and during FY25, TES staff completed inspections to monitor tree health and survival rate. TES will continue annual inspections of the planting in support of MSD's Municipal Separate Storm Sewer (MS4) Permit.

Newly planted trees at the Maryland School for the Deaf - Frederick Campus

3.5 Water and Wastewater Program Projects

Biosolids Program GHG Impacts

MES operates 63 municipal WWTPs encompassing a wide range of capacities and treatment technologies. EPA classifies sludge solids as either untreated sludge or treated by a process to reduce pathogens (to biosolids) that allows the material to be recycled or beneficially reused. Some of the available options across the industry for beneficially recycling treated biosolids include land application onto farmland or in forests to encourage tree growth, reclaiming mine sites, or distribution to the public (for highly treated for pathogen removal, or "Class A" biosolids).

MES uses a flexible biosolids management process, where untreated sludges from most of the smaller capacity WWTPs are transported to one of three larger, regional facilities. Once those sludges are received at our regional facilities, they are dewatered and treated further using lime stabilization for pathogen reduction. This process treats the sludges and reduces the pathogens in the final product to meet EPA and MDE standards, making it suitable for land application onto farmland. This lime stabilization treatment is called Class B pathogen reduction. The final lime-stabilized product is then transported and land-applied by a contractor to farms in Virginia.

Biosolids use is endorsed by the agricultural community. The lime-stabilized treated material is popular with farmers, who value its nutrient content, organic matter, and soil-conditioning properties. MES' WWTPs generated a total of 2,188 dry tons of solids in FY25, with approximately 53% (on a dry solid basis) of that material beneficially reused onto farmland in FY25.

The biosolids management carbon footprint for MES' facilities was calculated using the Biosolids Assessment Emissions Model (BEAM, version 3.1).[27] This model was originally developed by the Canadian Council of Ministers of the Environment in 2009, and further refined to its current version (version 3.1) by the Northeast Biosolids and Residuals Association in 2024. BEAM is the standard method of choice for biosolids management practitioners for determining the carbon footprint of each practice. Assumptions used in the BEAM model are given in Table 10.

One of the advantages of land application is sequestering carbon in the soil and offsetting the GHG emissions when substituting biosolids for commercial fertilizers.[28] Biosolids land application is also endorsed by the EPA, most state environmental agencies, and universities.

The GHG mitigation impact from land applying biosolids can be determined by calculating the carbon footprint using data for our current biosolids management method (land applying from our three regional sludge processing facilities: Dorsey Run, Freedom District, and MCI) and then comparing that result to a hypothetical scenario where all of our material is landfilled. The difference in carbon footprints for these two scenarios indicates the expected GHG emissions avoided by land application instead of landfilling. The results for this exercise are presented in Tables 11 and 12. The landfilling option results in a carbon footprint of 9,503 $MTCO_2e$ per year. Thus, land application avoids 2,590 $MTCO_2e$ per year in additional carbon emissions. This has the same impact as removing 604 passenger vehicles from the roadways every year.

Biosolids carbon is sequestered in the soil during land application. Also, biosolids offset the use of energy-intensive commercial fertilizers. In most cases, land application results in a net negative sequestration of CO_2 emissions. Landfilling sludge solids generates increased landfill gas emissions, in the form of methane, a potent GHG.

Item	Assumptions
Biosolids Tonnages and Analytical Data	FY25 data from MES in-house databases
Land Application Site Locations	Assumes Culpeper, Va.
Landfilling Practice - for Cambridge, Deep Creek Lake, and ECI WWTPs	Landfilled sludges assume no LFG utilization for energy at disposal sites
Landfill Option for Dorsey, Freedom, and MCI WWTPs	Assumes disposal to King George County, Va. Landfill; uses LFG utilization for energy (50 % energy recovery from landfill gas)
Polymer Usage	Assume 38 lb./day (from MES data for select WWTPs)
Lime stabilization dosage	Assumes 0.25 T lime/dry ton sludge treated (typical value)
Electricity for lime stabilization	Assumes negligible electrical use
U.S. Department of Energy eGrid region	RFC East - weighted GHG emissions = 300 g CO_2 eq/kwh generated for Dorsey Run and Freedom: RFC West - weighted GHG emissions = 456 g CO_2eq/kwh generated for MCI
Global Warming Potential (GWP)	GWP = 20; as stipulated in the Maryland Climate Solutions Now Act (CSNA)
Average Truckload Weight	20 wet tons = 18 metric tons (mt)
Pathogen Treatment	Class B (for both land app; unstabilized for landfilling)
Bulk density of lime-stabilized biosolids	50 lb./cu. ft = 881 kg/m^3
Class 8 Heavy Duty Truck Fuel Efficiency	6.6 miles/gallon diesel fuel
BEAM default values	As indicated in model

Table 10 – Assumptions Used – BEAM Model

Facility Name	Annual Amount Generated - FY25		Current Practice Emissions				
	Wet Tons/yr	Dry Tons/yr	Management Method	Scope 1 Emissions	Scope 2 Emissions	Scope 3 Emissions	Total $MTCO_2e$ /year
Cambridge WWTP	3,920	656	Landfilling	4,928	-7	23	4,944
Deep Creek Lake WWTP	456	133	Landfilling	956	6	24	986
Eastern Correctional Institution (ECI) WWTP	456	87	Landfilling	611	1	23	635
Dorsey Run AWWTP	907	220	Class B Land Application	3	3	40	46
Freedom District WWTP	2,828	755	Class B Land Application	60	24	49	133
Maryland Correctional Institution (MCI) WWTP	995	190	Class B Land Application	14	7	120	141
WWTPs - Transportation Practice Only	12,745	147	Transportation to Other WWTPs	28	0	0	28
Totals =	**22,307**	**2,188**		**6,600**	**34**	**279**	**6,913**

Table 11 – Carbon Footprint for MES WWTPs, Current Practice – Land Application

Facility Name	Estimated Annual Amount Generated - FY 25		Landfilling Emissions				
	Wet Tons/yr.	Dry Tons/yr.	Management Method	Scope 1 Emissions	Scope 2 Emissions	Scope 3 Emissions	Total $MTCO_2$ e/year
Cambridge WWTP	3,920	656	Landfilling	4,928	-7	23	4,944
Deep Creek Lake WWTP	456	133	Landfilling	956	6	24	986
Eastern Correctional Institution (ECI) WWTP	456	87	Landfilling	611	1	23	635
Dorsey Run AWWTP	880	176	Landfilling	589	-3	23	609
Freedom District WWTP	2,745	604	Landfilling	2099	5	54	2,158
Maryland Correctional Institution (MCI) WWTP	844	152	Landfilling	119	0	24	143
WWTPs - Transportation Practice Only	12,745	147	Transportation to Other WWTPs	28	0	0	28
Totals =	**22,046**	**1,955**		**9,330**	**2**	**171**	**9,503**

Table 12 – Carbon Footprint for MES WWTPs, Hypothetical Practice – Landfilling Instead of Land Application

3.6 Initiatives at MES Headquarters (HQ)

EV Charging

This project, which creates scalable electric vehicle supply equipment (EVSE) infrastructure at the MES headquarters, completed design and began construction in October 2025. The initiative supports MES' sustainability goals by enabling a transition to EVs and features robust charging infrastructure that is designed to support MES' current and future EV fleet, including models like the Chevy Bolt, Ford Mustang Mach-E, and Ford Lightning. Transitioning MES fleet vehicles to EVs eliminates direct CO_2, NO_x, and particulate emissions from the vehicles. The final design increases MES's capacity for new EVs via transfer of two Level II charging ports from future phases to this current phase for a total of 14 new charging ports ready for operation by Spring 2026 and the new electrical infrastructure being installed remains capable to allow MES to grow our electric vehicle charging capacity to 50 ports in future phases.

EVSE Construction-in-Progress

Solar Array

Solar arrays consisting of both rear ground and roof-mounted, thin-film solar panels were installed at MES HQ in 2008. These arrays were augmented in 2016 with a 300-kilowatt (kw) canopy-type solar array that was installed in portions of the MES headquarters parking lot. The aggregate power rating of MES HQ solar arrays is 599 kW. MES acquired ownership of the rear solar field in December 2024 and continues to operate under a Power Purchase Agreement with Luminace Inc. for the parking lot solar array.

Monthly performance data of our solar arrays is presented in Figure 6. Predictably, our solar arrays' FY25 monthly capacity factors were highest in the summer and lowest in the winter, averaging 11% on an annual basis. A total of 553,816 kWh was produced in FY25. Overall, the solar arrays generated what amounts to 71% of MES HQ's total annual consumption. Using the EPA's online GHG Equivalencies Calculator, one can estimate the carbon emissions avoided for various mitigation strategies: in this case, from generating electricity via solar. This amount of solar energy is equivalent to the avoidance of 174 $MTCO_2e$ per year, which corresponds to removing 41 passenger cars from public roadways for one year.

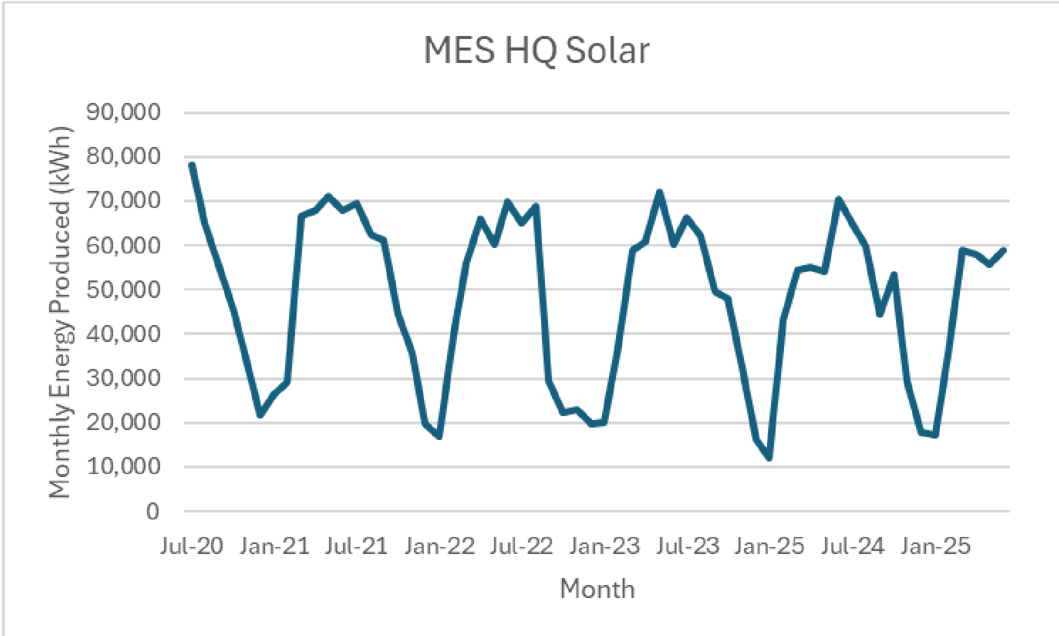

Figure 6 – Headquarters Solar Performance, FY21 – FY25

The MES HQ solar system is registered with the Maryland PSC and is registered in PJM's Generation Attribute Tracking System. As a Tier 1 renewable energy source, the solar arrays at MES headquarters generate not only renewable energy but also Solar Renewable Energy Certificates (SRECs). With one SREC generated for each MWh of energy produced, the system generated 553.8 SRECs in FY25.

Electrification of Fleet Vehicles

MES continues to support Maryland's climate goals by integrating EVs into its fleet where feasible. As of the date of this report, MES operates three BEVs, a Chevrolet Bolt, a Ford MACH-E, and a Ford Lightning F-150, and three PHEVs, including a Ford Fusion, a Mitsubishi Outlander, and a new Toyota RAV4. All are assigned to agency headquarters or regional operations. Two additional Ford Lightning F-150 electric pickup trucks are deployed at Maryland Port Administration (MPA) facilities. These vehicles have replaced older gasoline and diesel-powered models, resulting in measurable reductions in greenhouse gas emissions.

Based on U.S. Department of Energy emissions estimates[29] and the regional electricity generation mix, MES estimates that the use of these EVs and PHEVs in FY25 resulted in the avoidance of approximately 11 $MTCO_2e$ compared to conventional gasoline vehicles. This is equivalent to removing about two gasoline-powered passenger cars from the road for one year. At this time, MES does not have additional EVs on order but will continue to evaluate opportunities for further fleet electrification as funding and operational needs allow.

Vehicle	FY25 Mileage	EV Emissions: Estimated Emissions (g CO_2/mi)	EV Emissions: Total Emissions (MTCO2e)	Conventional Vehicle Emissions: Average Estimated Emissions (g CO_2/mi)	Conventional Vehicle Emissions: Total Emissions (MTCO2e)	Emissions Avoided MTCO2e
Chevy Bolt (HQ)	9,000	96	0.9	400	3.6	2.7
Ford Lightning F-150 (HQ)	11,000	169	1.9	400	4.4	2.5
Ford MACH - E (W/WW)	11,200	138	1.5	400	4.5	2.9
Ford Fusion	3,100	216	0.7	400	1.2	0.6
Mitsubishi Outlander	16,500	263	4.3	400	6.6	2.3
		Totals =	**9.3**		**20.3**	**11.0**

Table 13 – MES Electric Vehicle Emissions

Telecommuting Impact on GHG Emissions

One of the many workplace practices that remains from the COVID-19 pandemic is the implementation of telecommuting policies. Not only did this result in public health protection, but it also benefited work sites in the form of less office space needed and a reduction in building energy required. The "hybrid" telecommuting policy for MES personnel based out of MES HQ resulted in an eco-friendlier outcome in terms of employee fuel use due to avoided commute driving. The gallons of fuel avoided by the lesser commute were documented in a survey conducted in November 2025, which asked MES HQ staff about their work commute data (number of days worked from home, average round-trip commute distance, etc.). From this survey data, we were able to estimate the total fuel use avoided and thus, the amount of GHG emissions realized from implementing a telecommuting policy.

A total of 95 staff members responded to the survey. MES made several assumptions to calculate the number of miles driven avoided due to telecommuting. It was assumed that a five-day work week was in place, and that passenger vehicles such as cars and light trucks were driven. The survey also assumed that the work year was 50 weeks in length, to account for leave time. It also did not include those MES staff who work in field assignments, since they are usually required to report to a worksite each day. Mileage avoided by the five employees who used their personal EVs to commute was excluded from the survey, as was the one staff member who worked part-time. Also, the average fuel efficiency for the four employees who drove HEVs was assumed to be approximately 50 miles per gallon, per EPA estimates.

Using these assumptions, the survey data was used to estimate the total vehicle fuel savings by implementing the teleworking policy, which was 20,409 gallons. Using a value of 0.00889 $MTCO_2e$ avoided per gallon of fuel used, a total of 181 $MTCO_2e$ emissions per year were avoided because of the teleworking policy. This is equivalent to removing 42 passenger cars per year from the roadways.

While the estimated GHG emission reductions from telecommuting were not as high in FY25 as they were in FY23 (321 $MTCO_2e$) or FY24 (284 $MTCO_2e$), implementation of the policy has nonetheless provided meaningful GHG reductions for MES.

Building Energy Performance Standards

To meet the requirements of the MDE's Building Energy Performance Standards (BEPS), MES conducted an energy benchmarking assessment for its headquarters facility. BEPS applies to buildings in Maryland with a gross floor area of 35,000 square feet or greater. MES HQ, with approximately 45,000 square feet of gross floor area, falls within the scope of this regulation.

MES connected its Energy Star Portfolio Manager account with MDE-BEPS to share MES HQ energy use. MES also synced with BGE's Energy Use Data System to automatically transfer MES' BGE energy use to Portfolio Manager.

The next step in the compliance process is to obtain third-party verification of the benchmarking data entered into Portfolio Manager. This verification ensures the accuracy and integrity of the reported energy use data. For buildings subject to BEPS, the MDE requires that benchmarking data for the calendar year 2025 be independently verified by June 1, 2026. Verification must be performed by a qualified third party, not by the reporting entity itself. To facilitate this requirement, the Maryland Department of General Services has made a consultant available under a task order, which state agencies such as MES may utilize for third-party verification services.

4. Quantifying MES' Carbon Footprint

MES continues to advance its Agency-wide sustainability goals by quantifying and seeking to reduce its carbon footprint. In FY25, MES maintained its approach of aligning the GHG inventory period with the fiscal year, ensuring consistency with operational data capture. Each MES operating group defined its projects and assets for GHG quantification following the control approach and used standardized tools and calculators, such as the EPA Simplified GHG Emissions Calculator, EPA Local GHG Inventory Tool for WWTPs. Emission factors from published sources were applied to estimate carbon emissions per unit of activity.

4.1 FY25 GHG Estimate

Figures seven through ten provide details on the estimated emissions from each of the agency's operating arms, with the exception of EDR, and MES HQ during FY25.

Environmental Operations – FY25

Total GHG Emissions = 231,122 $MTCO_2e$

Stationary Combustion	Mobile Sources	Gases / Refrigerants	Electricity
222,163	4,558	857	3,544

Stationary Combustion

Landfill[1] Emissions
- MS-I: 40,541 MTCO2e
- MS-II: 139,299 MTCO2e

ECI Cogen
- 13,190 MTCO2e

Steam Plants
- 28,856 MTCO2e

	Mobile Sources	Gases / Refrigerants	Electricity
Landfills	2,175	3	205
Steam & Cogen	3	0	3,107 (Steam & Cogen[2])
Recycling	2,003	857	232 (Recycling[2])
Mobile Ops	377	0	0

[1]Direct emissions from landfill gas. Other stationary combustion emissions present, but in relatively insignificant quantities.
[2]Imported electricity for steam plants and certain recycling facilities was not obtained and, therefore, GHG emissions from electricity importation is underestimated.

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Figure 7 – Estimated GHG Emissions by EO, FY25

Water & Wastewater – FY25

Total GHG Emissions = 10,967 $MTCO_2e$

Plant Operations[1]	Biosolids Operations[2]	Fleet Vehicles[3]
3,883	6,913	450

1. *Includes Scope 1 (direct emissions).*
2. *Includes Scope 1 (direct emissions), Scope 2 (purchased electricity) and Scope 3 (indirect from chemical usage). However, Scope 3 emissions are excluded from the Total GHG Emission estimate for the Group.*
3. *Includes Scope 1 (direct emissions) from mobile sources.*

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Figure 8 – Estimated GHG Emissions by W/WW, FY25

Water/Wastewater GHG Emissions Estimate Notes

- The liquid process train emissions were calculated using a model developed by the Water Environment Association of Ontario and the Ontario Water Works Association. This GHG Emissions Inventory Tool (v 02) determines the carbon footprint of both water and wastewater facilities.[30] The carbon footprint of MES' drinking water treatment plants (WTPs) was not calculated due to the paucity of raw data on electricity and chemicals usage. These two items constitute the majority of emissions for WTPs. Also, only direct scope 1 emissions were calculated for the WWTPs' liquid process train since most of the plants do not have separate data for purchased electricity (scope 2) and reliably published emissions factors for chemical use (scope 3). Thus, the emissions calculations presented here should be considered biased low.
- The biosolids processes carbon footprint was described earlier in this report (see Table 10).
- Scope 1 direct emissions for the W/WW Group vehicle operations (passenger vehicles and work trucks) were obtained from FY25 gasoline purchase data and converted to carbon emissions using a factor of 8.887 kg CO_2 per gallon of gasoline used.

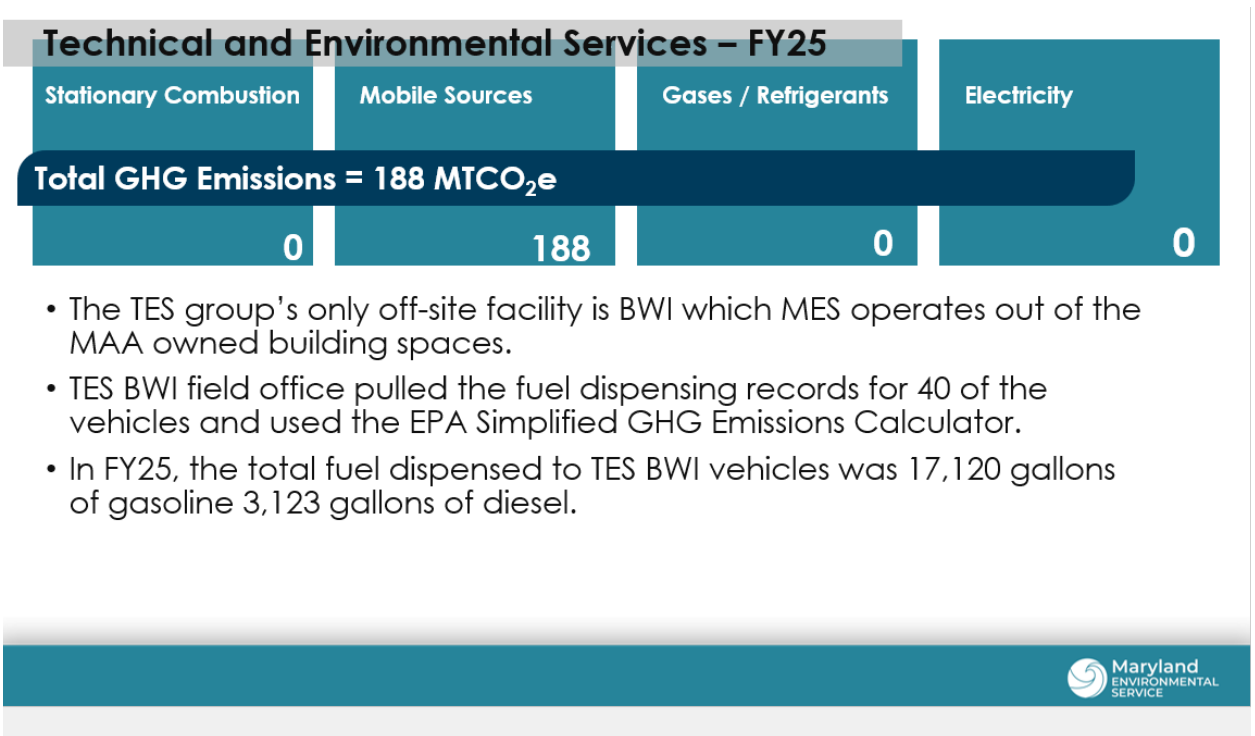


Figure 9 – Estimated GHG Emissions by TES, FY25

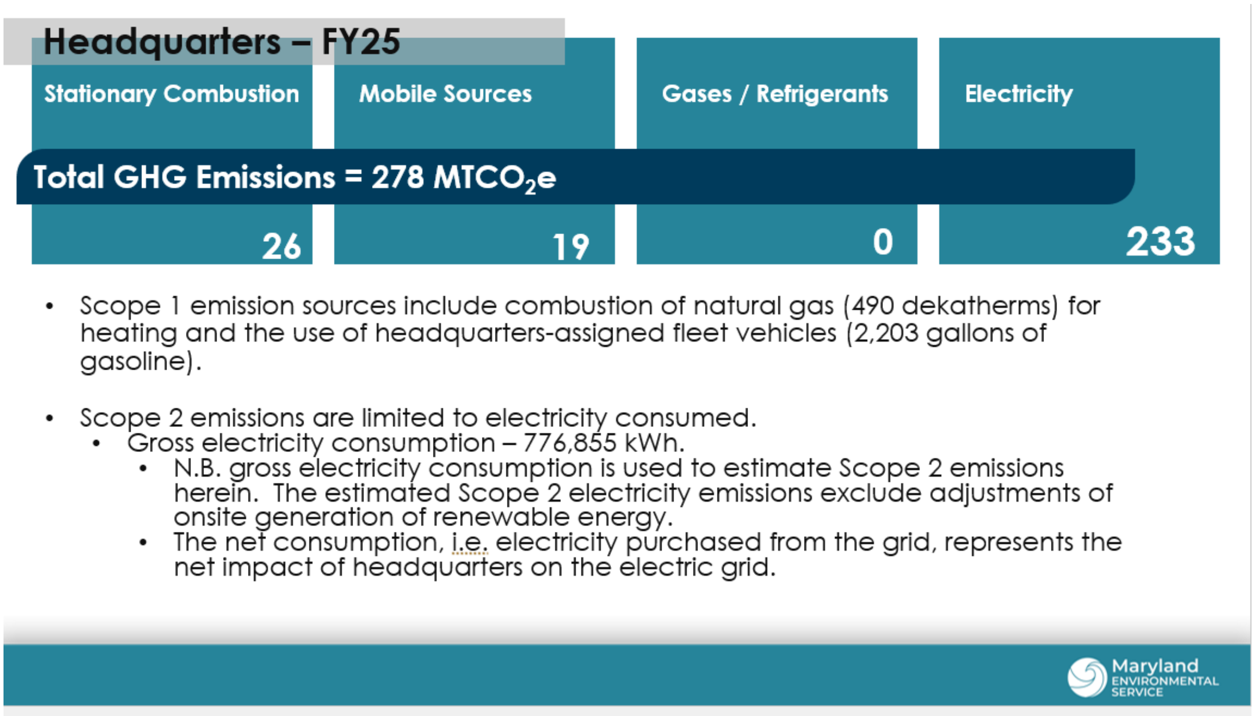


Figure 10 – Estimated GHG Emissions by HQ, FY25

MES estimates that agency-wide GHG emissions for FY25 were 243,828 $MTCO_2e$, a modest increase over FY24's 214,936 $MTCO_2e$. The bulk of emissions remains concentrated in stationary sources, particularly landfill gas and energy plants. The return to operation of the ECI Cogeneration Facility contributed to higher stationary combustion emissions in FY25, reversing the temporary reductions observed during FY24 during the boiler fuel conversion project.

Mobile sources and electricity consumption continue to be significant contributors, though their relative share remains stable. Improvements in data quality, asset delineation, and the adoption of gross electricity consumption for Scope 2 reporting have enhanced the accuracy and repeatability of MES' GHG inventory.

Data Gaps and Future Improvements

MES has made progress in closing data gaps since the initial CY22 baseline, but anticipates that it will take three to five rigorous reporting cycles to comprehensively report on the agency's Scope 1 and 2 emissions. Reporting challenges that persist include:

- Electricity use at MES-controlled, but client-owned facilities
- Asset demarcation
- Verification processes

MES will continue to refine its GHG inventory and expects further improvements in data quality in the coming reporting periods.

5. Future Carbon Emissions Mitigation Projects

5.1 Electrification

According to the U.S. EPA's *Inventory of U.S. Greenhouse Gas Emissions and Sinks*, the transportation sector is the largest contributor to national GHG emissions, accounting for approximately 28% of total U.S. emissions.[31] Maryland's CSNA requires state agencies to transition their passenger vehicle fleets to EVs by 2031 as part of statewide efforts to reduce emissions.

Even when accounting for upstream electricity generation from the power grid, EVs produce fewer emissions per mile than internal combustion engine (ICE) vehicles. Life cycle analyses confirm that while EV manufacturing, particularly battery production, results in higher emissions during the first few years, overall emissions across a 12–15-year lifespan are reduced compared to ICE vehicles.[32]

In addition to GHG reductions, EV adoption decreases tailpipe emissions of criteria pollutants such as CO, NO_x, and particulate matter, improving local air quality. Although upstream power generation can still produce some NO_x and SO_2, these emissions are generally lower than those from conventional vehicles.

HQ EVSE: Blink Level 2 Charger

Headquarters EVSE Construction-in-Progress

MES Progress Toward CSNA Goals:
MES continues to support Maryland's climate goals by integrating EVs into its fleet where feasible. As of this report, MES operates three BEVs (Chevrolet Bolt, Ford Mustang Mach-E, Ford Lightning F-150) and three plug-in hybrid electric vehicles (Ford Fusion, Mitsubishi Outlander, Toyota RAV4), primarily assigned to headquarters and regional operations. Additionally, two Ford Lightning F-150 electric pickup trucks are deployed at MPA facilities, replacing older gasoline and diesel-powered models and resulting in measurable reductions in emissions.

Based on U.S. Department of Energy estimates and the regional electricity generation mix, MES calculates that EV and PHEV use in FY25 avoided approximately 11 $MTCO_2e$, equivalent to removing about two gasoline-powered passenger cars from the road for one year.

To support future fleet electrification, MES completed design and began construction of scalable EVSE infrastructure at headquarters in October 2025. This project will deliver 14 new Level II charging ports by spring 2026 and includes electrical upgrades to accommodate up to 50 ports in future phases, ensuring capacity for continued EV adoption.

5.2 Beneficial Use of Landfill Gas at Midshore II

The Midshore II Regional Solid Waste Facility, owned and operated by MES on behalf of the Midshore counties, is an appreciable source of LFG. Estimates from LandGEM modeling indicate that the landfill may currently be generating 600 standard cubic feet per minute (scfm) of LFG. Recognizing the energy value inherent in LFG, MES initiated a comprehensive request for proposals (RFP) in September 2024 to identify private partners for the beneficial use of LFG. The RFP stipulated the collection and control of LFG in accordance with the Maryland Landfill Methane Regulations, in addition to promoting the beneficial use of the captured LFG. MES received several proposals from offerors for renewable natural gas (RNG) production at the landfill.

In March 2025, MES subsequently issued a notice of intent to award a contract to Chesapeake Utilities Corporation (CPK), whose proposal included upgrading LFG to RNG and transporting it via virtual pipeline to an interconnect in Bridgeville, Delaware. CPK engaged in an extensive and lengthy due diligence process, evaluating project economics, regulatory requirements – notably safe harbor rules under the IRA's ITC, and market conditions, particularly the volatility of Renewable Identification Number pricing. Despite this effort, CPK ultimately withdrew its proposal in September 2025, citing that project economics did not meet internal standards for approval.

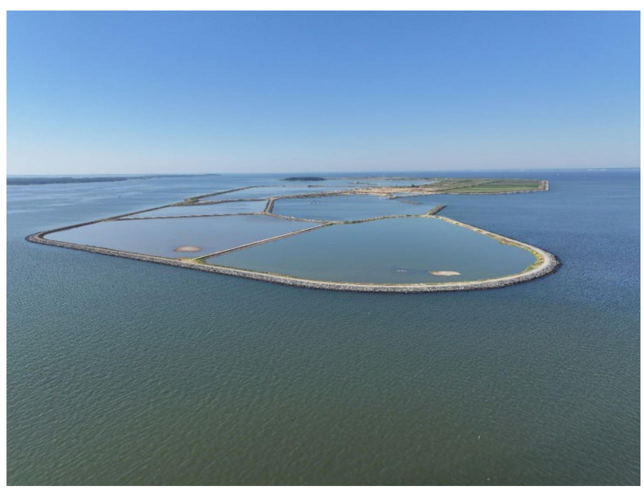
MES continues to pursue beneficial use options for Midshore II LFG. Recent technical and financial analyses indicate that an LFG electric generation system may be feasible at the site, with the potential to consume a high percentage of extracted LFG. Electric generation from LFG offers a reliable, market-based approach to monetizing landfill gas while achieving substantial GHG reductions. MES is actively evaluating the development of this system, further supporting Maryland's climate mitigation goals and regulatory compliance.

Midshore II Landfill, September 2025

5.3 Environmental Dredging and Restoration Projects

The Paul S. Sarbanes Ecosystem Restoration Project at Poplar Island

The Paul S. Sarbanes Ecosystem Restoration Project at Poplar Island is an ecosystem restoration project beneficially using dredged material for wetland and upland restoration in the Chesapeake Bay. The U.S. Army Corps of Engineers is the federal sponsor, and MPA is the state sponsor of the Poplar Island project. Beneficially using dredged material to restore Poplar Island's wetlands has the potential for providing significant carbon sequestration. This sequestered carbon is known as "blue carbon." The Blue Carbon Manual (manual) created by the Blue Carbon Initiative outlines defensible field and laboratory methods to determine carbon sequestration rates of wetlands. In FY24, the University of Maryland Center for Environmental Science (UMCES) began using the methodology outlined in the manual to begin a Tier 3 carbon assessment for determining the rates at which the wetlands on Poplar Island are sequestering carbon in the vegetation and soil. In FY25, this



Poplar Island

effort continues as UMCES integrates their long-term monitoring efforts with new data targeted to fill in any gaps and assess carbon sequestration trends as the restored marshes mature. Tier 3 carbon assessments require highly specific data, including the carbon stocks from each component (elevation change, soil carbon, aboveground and belowground biomass, and carbon gas fluxes) from both the low and high marsh. UMCES has finished compiling existing data, will complete the remaining necessary sampling, and then begin data analyses required for the assessment report. MES works closely with UMCES and MPA, providing management and review throughout the assessment. The services provided will assist MPA in assessing potential environmental benefits of carbon sequestration related to restoring wetlands through the beneficial use of dredged material. The information gained will be used to conduct benefit analyses of existing and future dredged material projects.

MPA Diesel Equipment Upgrade Program

MES on behalf of MPA received a $3.47 million EPA DERA grant in August 2024. This additional DERA funding will support the continuation of the Port of Baltimore Diesel Equipment Upgrade Program (http://www.dieselupgrades.org/). The program incentivizes and accelerates the upgrade or retirement of older diesel engines at the Port of Baltimore to cleaner and zero-emission solutions, leading to significant emission reductions and air quality and public health benefits. This funding will assist the equipment owners with replacing 42 units of cargo handling equipment and off-road equipment with EV and Tier 4 diesel units over the next two years.

5.4 Technical and Environmental Services Projects

In conjunction with engineers from the W/WW Group, TES staff are planning to serve as a third-party monitor for a project funded by the Maryland Department of Agriculture (MDA) to evaluate the function of an anaerobic digester at a Long Green Farm in Rising Sun, Maryland. The goal is to sample and monitor a newly implemented process of running collected manure and food scraps through a digester to capture biogas, which will be converted into electricity to power buildings and homes on the farm. The digester will generate a maximum of approximately 80 kW, providing sufficient electricity for the dairy farm's operation, with any excess electricity generation sold back to the local electric utility.

MES is responsible for reviewing the process control data as well as digestate use, nutrient balance, and GHG emissions to assess the system's effectiveness and environmental benefits. Insights gained through this project can help inform future applications of similar systems within MES operations and at client facilities, supporting the broader goal of advancing environmentally responsible and energy-efficient solutions across Maryland.

TEDOM Anerobic Digester/Generator at Long Green Farm in Rising Sun, Maryland

6. Conclusion

MES continued to make meaningful progress in reducing GHG emissions across its operations in FY25, despite a challenging and evolving policy landscape and a tightening fiscal environment. The agency's most significant achievements stem from robust recycling and composting programs, which remain the largest contributors to avoided emissions, as well as targeted upgrades in stationary combustion sources and heavy equipment. The conversion of the ECI Cogeneration Facility to natural gas, expansion of electric vehicle adoption, and investments in clean energy infrastructure at HQ have all contributed to measurable reductions in MES' carbon footprint. Looking ahead, continued focus on scaling proven mitigation programs, advancing decarbonization technologies, and refining data quality and verification processes will be essential for MES to meet future milestones under the CSNA. MES remains committed to practical, cost-effective climate action and to maintaining its leadership in environmental stewardship for the State of Maryland.

REFERENCES

[1] United Nations Framework Convention on Climate Change (UNFCCC). Key aspects of the Paris Agreement. Available from: https://unfccc.int/most-requested/key-aspects-of-the-paris-agreement

[2] Intergovernmental Panel on Climate Change (IPCC). Summary for policymakers. In: Climate Change 2023: Synthesis Report. Geneva: IPCC; 2023. p. 1–34. doi:10.59327/IPCC/AR6-9789291691647.001

[3] United Nations Environment Programme (UNEP). Emissions Gap Report 2025: Off target – Continued collective inaction puts global temperature goal at risk. Nairobi: UNEP; 2025. doi:10.59117/20.500.11822/48854

[4] World Meteorological Organization (WMO). State of the Climate: Update for COP30. Geneva: WMO; 2025. Available from: https://library.wmo.int/idurl/4/69057

[5] World Meteorological Organization (WMO). State of the Global Climate 2024. Geneva: WMO; 2025. Available from: https://wmo.int/sites/default/files/2025-03/WMO-1368-2024_en.pdf

[6] The American Presidency Project. Executive Order 14156: Declaring an Energy Emergency. 2025. Available from: https://www.presidency.ucsb.edu/documents/executive-order-14156-declaring-national-energy-emergency

[7] The American Presidency Project. Executive Order 14260: Protecting American Energy from State Overreach. 2025. Available from: https://www.whitehouse.gov/presidential-actions/2025/04/protecting-american-energy-from-state-overreach/

[8] Tax Foundation. How the One Big Beautiful Bill changes green energy tax credits. 2025. Available from: https://taxfoundation.org/blog/big-beautiful-bill-green-energy-tax-credit-changes/

[9] Climate Action Tracker. USA: 2035 NDC. 2025. Available from: https://climateactiontracker.org/countries/usa/2035-ndc/

[10] Climate Action Tracker. USA: Targets. 2025. Available from: https://climateactiontracker.org/countries/usa/targets/

[11] U.S. Climate Alliance. Pressing forward: Governors' enduring fight for a resilient & sustainable future. 2025 Annual Report. Washington (DC): U.S. Climate Alliance; 2025. Available from: https://www.usclimatealliance.org/

[12] Climate Solutions Now Act of 2022. Article II, Section 17(b) of the Maryland Constitution. Chapter 38. Available from: https://mgaleg.maryland.gov/2022RS/bills/sb/sb0528e.pdf

[13] Maryland Department of the Environment (MDE). Maryland's Climate Pollution Reduction Plan: Policies to reduce statewide greenhouse gas emissions by 60% by 2031 and create a path to net-zero by 2045. Baltimore (MD): MDE; 2023. Available from: https://mde.maryland.gov/programs/air/ClimateChange/Maryland%20Climate%20Reduction%20Plan/Maryland%27s%20Climate%20Pollution%20Reduction%20Plan%20-%20Final%20-%20Dec%2028%202023.pdf

[14] Maryland Governor. Executive Order No. 01.01.2024.19: Leadership by State Government—Implementing Maryland's Climate Pollution Reduction Plan. 2024.

[15] Maryland State Legislature. Next Generation Energy Act. 2025. Available from: https://mgaleg.maryland.gov/mgawebsite/Legislation/Details/hb1035?ys=2025rs

[16] Maryland State Legislature. 2025. Renewable Energy Certainty Act. Available from: https://mgaleg.maryland.gov/mgawebsite/Legislation/Details/SB0931?ys=2025RS

[17] Maryland State Legislature. 2025. Building Energy Performance Standards – Alterations and Analysis. Available from: https://mgaleg.maryland.gov/mgawebsite/Legislation/Details/hb0049?ys=2025RS

[18] Maryland Department of the Environment (MDE). Maryland 2020 GHG emissions by sector. Greenhouse Gas Inventory. Baltimore (MD): MDE; 2022. Available from: https://mde.maryland.gov/programs/air/climatechange/pages/greenhousegasinventory.aspx

[19] Maryland Department of the Environment (MDE). Maryland GHG emissions trends by sector (figure). In: Greenhouse Gas Inventory. Baltimore (MD): MDE; 2022. Available from: https://mde.maryland.gov/programs/air/climatechange/pages/greenhousegasinventory.aspx

[20] Maryland Department of the Environment (MDE). Maryland gross GHG emissions breakout by gas 2022 (figure). In: Greenhouse Gas Inventory. Baltimore (MD): MDE; 2022. Available from: https://mde.maryland.gov/programs/air/climatechange/pages/greenhousegasinventory.aspx

[21] U.S. Environmental Protection Agency (EPA). Diesel Emissions Quantifier (DEQ) Tool, version 9.1. 2022. Available from: https://cfpub.epa.gov/quantifier/index.cfm?action=main.home

[22] U.S. Environmental Protection Agency (EPA). Landfill Methane Outreach Program (LMOP) landfill gas energy benefits calculator. Updated 2024 Dec. Available from: https://www.epa.gov/lmop/landfill-gas-energy-benefits-calculator#download

[23] Kalmbach B, Toor G, Ruppert D. Soil fertility recommendations—nitrogen, phosphorus, and potassium requirements of Miscanthus (EB-443). College Park (MD): University of Maryland Extension; 2020.

[24] He Y, Jaiswal D, Liang X, Long S. Perennial biomass crops on marginal land improve both regional climate and agricultural productivity. Glob Change Biol Bioenergy. 2022. doi:10.1111/gcbb.12937

[25] U.S. Environmental Protection Agency (EPA). National overview: facts and figures on materials, wastes and recycling. 2024. Available from: https://www.epa.gov/facts-and-figures-about-materials-waste-and-recycling/national-overview-facts-and-figures-materials

[26] U.S. Environmental Protection Agency (EPA). Documentation for greenhouse gas emission and energy factors used in the Waste Reduction Model (WARM), management practices chapters. 2020.

[27] Biosolids GHGs. Available from: https://www.biosolidsghgs.org/

[28] Brown S. *Building carbon credits with biosolids recycling. BioCycle. 2004;45(9):25.*

[29] *U.S. Department of Energy. Beyond Tailpipe Emissions Calculator. Available from: https://www.fueleconomy.gov/feg/Find.do?action=bt2*

[30] Water Environment Association of Ontario, Ontario Water Works Association. Emissions Inventory Tool, version 02. 2023. Available from: https://owwa.ca/owwa-weao-greenhouse-gas-emissions-inventory-tool/

[31] U.S. Environmental Protection Agency (EPA). Inventory of U.S. greenhouse gas emissions and sinks: 1990–2022. 2024. Available from: https://www.epa.gov/system/files/documents/2024-04/us-ghg-inventory-2024-main-text_04-18-2024.pdf

[32] Sadavarte P, Shindell D, Loughlin D. Comparing the climate and air pollution footprints of lithium-ion BEVs and ICEs in the US incorporating systemic energy system responses. PLOS Clim. 2025 Oct 29.

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