MCCC MARYLAND COMMISSION ON CLIMATE CHANGE

2025 Recommendations to the
Maryland Commission on Climate Change

November 12, 2025

The following recommendations were considered and approved by the Maryland Commission on Climate Change for inclusion in the Commission Annual Report to the Governor and General Assembly. Any additional context provided is purely to inform Commission deliberations, is not subject to amendments, and will not be included in the annual report.

Adaptation and Resiliency Working Group

1. **Climate and Health Profile Report Update**
   Initiating in 2026, State agencies (Health, Environment) should update the 2016 Climate and Health Profile Report as an online resource for planners, the public, policy makers, and local officials to incorporate updated health and climate impacts data that can be used in evaluating different mitigation and adaptation strategies and interventions. This activity will reflect recently updated analyses such as the comptroller's report and should be in collaboration with academic centers that can assist with the modeling of health impacts associated with climate changes. The report should include the development of tools and "plug and play" examples that make it easier to interpret and use climate and associated health data in decision making. The update of the Climate and Health Profile Report report should be completed by the end of 2027.

   Additional Context:

   _____

2. **Next Generation Adaptation Plan Public Tracker**
   In support of the Governor's Key Performance Indicator, the Department of Natural Resources will develop a public facing tracker released in 2026 that promotes Maryland's progress on the climate adaptive actions listed in the Next Generation Adaptation Plan.

   Additional Context:

   _____

3. **Enhanced Flood Risk Disclosures**
   In the 2026 legislative session, the General Assembly should take actions to enhance Flood Risk Disclosures in property transactions to reduce exposure to hazardous conditions and notify buyers and lessees of risk earlier in the transaction process. The

disclosure should require information on past flood events and future flood risk resources for residential property transactions including rental properties. Tools and resources to inform these disclosures should be made available by the Department of Natural Resources, Maryland Department of Emergency Management, Maryland Department of the Environment, and Maryland Department of Planning in a transparent, user-friendly format.

Additional Context:

_____

Education, Communication, and Outreach Working Group

1. **Continuous Improvement and Accountability in Climate Action:**
    In light of current volatility in policy and funding, as well as worsening extreme weather, the Department of the Environment, as Chair of the Governor's Subcabinet on Climate, should work with the member agencies to annually seek stakeholder input, update and share their Climate Implementation Plans (CIPs), and incorporate climate awareness and messaging into their existing public facing communications such as advertising, websites, and social media. Agencies should annually report on their progress publicly on the Maryland Department of the Environment webpage.

    Additional Context: *The initial executive order mandated CIPs as a one-time plan from agencies with no reporting of progress or reevaluation for changing conditions. This recommendation adds additional public transparency to agency climate action.*

_____

2. **Climate Education Month:**
    Building on the success of the annual Maryland Climate Teach-In, including the Governor's proclamation of Climate Education Week in 2024 and 2025, the Maryland General Assembly should introduce and pass an updated version of FY 2024 House Bill 993 to declare the month of April, coinciding with Earth Month, as "Maryland Climate Education Month."

    Additional Context: *The declaration of a permanent Maryland Climate Education Month would support Maryland's legislated environmental literacy standards, MSDE's Blueprint for the Future, as well as current and proposed Chesapeake Bay Program goals for school district outcomes.*

    It, along with the Maryland Climate Teach-In (which provides free resources to educators), provides a special opportunity for state agencies, county and municipal governments, and private organizations to come together to celebrate climate awareness and expand education on ways to mitigate climate change and improve resilience in our regional and global environment. Expanding to a full month minimizes

conflicts with Maryland's legislative calendar as well as school district testing and spring breaks. The Teach-In supports efforts in our schools to support stewardship and in advancing green careers.

Mitigation Working Group

1. **Protect SEIF and support clean energy projects in development**:

   Strategic Energy Investment Fund (SEIF) balances over and above revenues assumed in the prior fiscal year budget should be used primarily to advance construction of renewable energy projects already in the development pipeline, to invest in energy efficiency and reducing greenhouse gas emissions, and to support low-income utility bill assistance.

   Additional Context: *The federal government has repealed the tax credits available to many solar farm developments. The federal cutbacks apply to projects that fail to begin construction by July 2026. Although the state has passed permitting reforms for renewable generation, many projects currently in the pipeline may fail to meet financial requirements to begin construction.*

---

2. **Recommend policies to increase the use of low-carbon fuels in the transportation sector:**

   The Maryland Department of the Environment should study and make a recommendation regarding the adoption of a Clean Fuel Standard (also known as a Low Carbon Fuel Standard) or other steps to increase the production, importation, and use of low carbon fuels to reduce emissions from the transportation sector, especially in light of the federal government's rollback of the Advanced Clean Cars and Advanced Clean Trucks programs and federal fuel efficiency standards. The recommendation, including an analysis on the net environmental and economic impacts to the state in line with the goals of the Climate Solutions Now Act, should be published by December 31, 2026.

   Additional Context: *Background on Clean Fuel Standards (https://rmi.org/clean-fuel-standards-the-market-based-policy-for-states-looking-to-clean-up-transportation) and a presentation on New Mexico's Clean Transportation Fuel Standard (https://mde.maryland.gov/programs/Air/ClimateChange/MCCC/MWG/2025-06-17%20EPD%20CTFP%20Overview.pdf)*

---

3. **Develop a heat pump market transformation roadmap:**

In 2026, the General Assembly should authorize the use of the Strategic Energy Investment Fund for grants and loans for building electrification. The Governor should direct Maryland Energy Administration, Maryland Department of the Environment, Department of Housing and Community Development, Department of Labor, Maryland Clean Energy Center, and any other relevant agency to collectively develop a heat pump market transformation roadmap informed by the state's heat pump deployment goals, including efficient window heat pumps, as detailed in resources like the Climate Pollution Reduction Plan and the NESCAUM states' Multistate Memorandum of Understanding on Accelerating the Transition to Zero-Emission Residential Buildings. To kick-start this market transformation, in 2026 the Governor should direct relevant agencies to encourage and incentivize a targeted heat pump deployment program for households currently using electric resistance and delivered fuels for heating. The same agencies should partner with local Heating Ventilation Air Conditioning (HVAC) contractor networks, heat pump manufacturers, unions, and others to develop and launch a new heat pump workforce development and training program.

---

4. **Take next steps on developing an economy-wide Cap and Invest program:**

In 2026 the Moore Administration should evaluate and propose potential designs for an economy-wide Cap and Invest program per the MCCC's recommendations in 2024. Any development of a cap and invest program should hold low-income customers harmless. A percentage of the dividends should be distributed to low-income customers.

Additional Context: *For background, see MWG Recommendation #1 on page 19 of the MCCC's 2024 Annual Report:*
https://mde.maryland.gov/programs/air/ClimateChange/MCCC/Documents/MCCC%20Annual%20Report%202024/MCCC_Annual_Report_2024_508.pdf

---

Science and Technical Working Group

1. Accounting of Nitrous Oxide Emissions in Maryland
    The Maryland Department of the Environment and Maryland Department of Agriculture should improve the state's accounting of Nitrous Oxide (N_2O) emissions and develop strategies to mitigate those emissions. The third most important greenhouse gas and the largest currently emitted destroyer of stratospheric ozone, N_2O is produced predominantly in fertilized croplands, with additional emissions from manure management. At present MDE downscales national estimates of N_2O emissions, but the agricultural practices specific to Maryland could inform improved emission estimates as well as effective mitigation measures.

Additional Context:

Collaborative efforts by MDA, MDE, and experts from the University of Maryland Center for Environmental Science and the University of Maryland College Park and others could narrow uncertainties of N2O emission estimates and provide regionally specific recommendations for emission abatement. Widespread use of drained wetlands used for agriculture on the Eastern shore, offer an opportunity for expanding use of drainage control structures to reduce N2O emissions. Manure management and the links between nitrogen and phosphorus nutrition, especially where poultry manure is used for nutrient additions, should also be carefully studied.

Deliverables:

Updated estimates of N2O emissions in Maryland. Report on mitigation options for N2O abatement in Maryland agriculture.

References

Davidson, E., B. Gu, and D. Kanter. 2024. Implementing Nitrous Oxide Abatement Measures. pp. 133- 169 In: United Nations Environment Programme, & Food and Agriculture Organization of the United Nations (2024). Global Nitrous Oxide Assessment. https://wedocs.unep.org/20.500.11822/46562.

Hagedorn, J.G., E.A. Davidson, T.R. Fisher, R.J. Fox, Q. Zhu, A.B. Gustafson, E. Koontz, M.S. Castro, and J. Lewis. 2022. Effects of drainage water management in a corn–soy rotation on soil N2O and CH4 fluxes. Nitrogen 3, 128–148. https://doi.org/10.3390/nitrogen3010010.

Kanter, D. et al. (14 coauthors). 2021. Improving the social cost of nitrous oxide. Nature Climate Change, https://doi.org/10.1038/s41558-021-01226-z.

Madramootoo, C.,M. Essien, K. Ekwuknife. 2024. Long-Term Benefits of Controlled Drainage, American Society of Agricultural and Biological Engineers), Vol. 67(3) 563-571; ISSN 2769-3295   https://doi.org/10.13031/ja.15542.

Tian, H. et al. (57 co-authors). 2024. Global nitrous oxide budget 1980-2020. Earth System Science Data, https://doi.org/10.5194/essd-16-2543-2024.

---

2. **Measures to Decrease Methane Production and Emission**

The Maryland Department of Agriculture and University partners should explore the following measures to quantify and decrease methane production and emission: (a) Decrease nutrient inputs to Chesapeake Bay: Reduced nitrogen from agriculture, wastewater, and stormwater, oxidized nitrogen from combustion and fertilizers, and phosphorus; (b) Investigate wetland restoration methods that do not lead to increased methane production; (c) Develop mechanisms to incentivize manure and waste processing technologies at agricultural, municipal, and industrial sites, at scales appropriate for applications in Maryland, such as composting, anaerobic digestion, or other technologies that capture, transform, or eliminate methane.

Additional Context:

For a more precise global C budget, soil temperature, spatiotemporal CH4 variations between wetland types, and tidal effects should be considered in accounting for CH4 fluxes in wetlands in general and tidal freshwater wetlands specifically (Keshta et. al, 2023).

Keshta, Amr E., Stephanie A. Yarwood, and Andrew H. Baldwin. 2023. "Methane emissions are highly variable across wetland habitats in natural and restored tidal freshwater wetlands." Wetlands 43.5 (2023): 53.

_____

3. **Update of the 2008 "Global Warming and the Free State" Report**
By December 31, 2027, the Maryland Department of the Environment and the Department of Natural Resources, in partnership with Maryland Universities, should update the MCCC's 2008 Comprehensive Assessment of Climate Change Impacts in Maryland, also known as "Global Warming and the Free State" by incorporating the most recent assessments by the Intergovernmental Panel on Climate Change, the National Climate Assessment and other relevant scientific findings. This update will consider reports, including the following:
    (a) findings from the 2016 Maryland Climate and Health Profile Report;
    (b) the STWG's Sea-Level Rise Projections for Maryland, 2023;
    (c) findings of the study "Maryland's Climate Pollution Reduction Plan" (2023);
    (d) prospective scenario analysis of Maryland's Net-Zero 2045 goal across the major sectors: transportation, energy, residential, agricultural, etc.; and
    (e) the 2025 Maryland Plan to Adapt to Saltwater Intrusion and Salinization.

Additional Context:

Maryland's comprehensive climate impacts assessment was completed 17 years ago and is woefully outdated. Findings from the Sixth IPCC Assessment and Fifth U.S. National Climate Assessment, both completed in 2023, would be extracted as they apply to Maryland. This would be augmented by downscaling projections included in the IPCC model archives under different greenhouse gas emissions scenarios to provide richer understanding of climate changes and impacts throughout the state. The update would also consider other recent scientific findings relevant to Maryland. The update would take 12 to 18 months and rely primarily on voluntary contributions by Maryland scientists and adaptation experts. Modest financial support for organization and report preparation would be required.

_____

4. **The Cost of Climate Change: Health and Economic Benefits of Action by Maryland.**
The Maryland Department of the Environment and its University partners should enhance air quality models currently used to calculate co-benefits of criteria pollutants, such as ozone and particulate matter, to include short-lived and locally dominant

pollutants, ultrafine particles, and black carbon (soot). The species have major health impacts and are monitored but models have not been evaluated. Costs avoided should be calculated with models, including EPA's Benefits Mapping and Analysis Program (BenMAP).

Additional Context:
As the Comptroller recently reported to the MCCC, inaction will cost Maryland money, "climate change is already costing Maryland Millions of dollars annually" We propose to quantify substantial costs avoided due to morbidity and mortality co-benefits. The Comptroller's report identified health as a major expense:

Heat related illnesses/deaths
• Food, water and vector borne illnesses
• Fatal and non-fatal injuries from extreme weather

The greatest cost of inaction, however, will result from indirect effects. The major impact on health comes not directly from changing weather but from increases in air pollution at higher temperatures (Scientific and Technical Working Group, 2008); air pollution is the third or fourth highest cause of death globally and in the US (Brauer et al., 2024; Fuller et al., 2022; Landrigan et al., 2018; Lelieveld et al., 2015). Higher temperatures and more frequent heat waves lead to increased emissions of nitrogen oxides (NOx) from soils and electricity generation as well as volatile organic compounds (VOC) and black carbon (BC) from traffic. These lead to the following additional adverse health outcomes:

• Ultrafine (UFP) and fine particulate matter (PM2.5) related mortality
• Higher ozone (Los Angeles type smog) and lost lung function
• Diesel soot (BC) related mortality and cancer

One comment on the Comptroller's report was that the costs will be felt locally but local action alone will not avoid those costs, but local action can have substantial local benefits. Conversion from coal to solar, wind, or nuclear, and replacing internal combustion powered vehicles with electric as part of Maryland's GHG reduction plan will also reduce emissions of neighborhood air and water pollutants and our vulnerability to climate change. Maryland is in attainment for PM2.5, but above the WHO guidelines; Maryland is nonattainment for ozone. Some of these pollutants show strong spatial gradients, and control measures will especially benefit disadvantaged communities and help serve the goal of environmental justice (Aubourg et al., 2023; Dickerson et al., 2024). https://mde.maryland.gov/Environmental_Justice/Pages/MDEnviroScreen.aspx MDE is supporting the regulatory air pollution models GCAM and CMAQ to calculate the impact of climate change on criteria pollutants in Maryland. These models can also handle short-lived pollutants (UFP and BC) but have not been tested and evaluated against observations of these species. MDE has a ten-year record of UFP at two Maryland sites but we have only begun to examine these data and more observations are needed, especially from a mobile laboratory. We request supporting simulations of

effects of reduced emissions associated with GHG reductions on these additional species.

The BenMAP-CE (Benefits Mapping and Analysis Program - Community Edition) tool is commonly used to determine both the health and economic impacts from changes in criteria pollutants estimated using regulatory air quality models. Other tools are available from the UMD Institute for Health Computing. The BenMAP health impact function uses "Cost of Illness" and "Willingness to Pay" metrics to identify the financial burden associated with hospital visits, direct costs, lost work, etc. The relationships that BenMAP uses to define the economic burden of health outcomes will be applied to the results from the machine learning model. A similar combination of regulatory air quality modeling (i.e., CMAQ) and BenMAP supported the 2015 update to the Greenhouse Gas Reduction Act. From the expected improvements morbidity and mortality from reduced exposure to UFP, we will use a machine learning model (Georgiades, 2024).

From prior experimental and numerical model work we know the temperature sensitivity of ozone (photochemical smog) production as well as BC and VOC emissions (Bloomer et al., 2010; Bloomer et al., 2009; Dreessen et al., 2023; Hall-Quinlan et al., 2023; He et al., 2013; Hembeck et al., 2022; Hembeck et al., 2019; Stewart et al., 2025). We will run appropriate specific climate change scenarios (60% by 2031) for the MCCC to report to the MDE.

If Maryland does nothing to reduce GHG emissions there will be substantial costs associated with a changed climate – if we act locally, it may help avoid hotter temperatures but it definitely will reduce our health burden from local pollution. Our State should lead by example to avoid global impacts then Maryland will reap substantial benefits locally too.

Deliverables:

Estimated economic and health impacts of increase in O3, BC, PM2.5, and UFP due to climate change for:

· Business as usual.

· A 60% reduction (2006 base) in Maryland's vehicular and energy production emissions.

· Net zero GHG emissions in Maryland.

References

Aubourg, M.A. et al., 2023. Community-driven research and capacity building to address environmental justice concerns with industrial air pollution in Curtis Bay, South Baltimore. Front. Epidemiol., 3:1198321.

Bloomer, B.J., Dickerson, R.R. and Vinnikov, K., 2010. A Chemical Climatology and Trend Analysis of Ozone and Temperature over the Eastern US. Atmospheric Environment, 44((21-22)): 2543-2551.

Bloomer, B.J., Stehr, J.W., Piety, C.A., Salawitch, R.J. and Dickerson, R.R., 2009. Observed relationships of ozone air pollution with temperature and emissions. Geophysical Research Letters, 36.

Brauer, M. et al., 2024. Global burden and strength of evidence for 88 risk factors in 204 countries and 811 subnational locations, 1990-2021: a systematic analysis for the Global Burden of Disease Study 2021. Lancet, 403(10440): 2162-2203.

Dickerson, R.R. et al., 2024. Mobile laboratory measurements of air pollutants in Baltimore, MD elucidate issues of environmental justice. Journal of the Air & Waste Management Association: 18.

Dreessen, J. et al., 2023. VOC and trace gas measurements and ozone chemistry over the Chesapeake Bay during OWLETS-2, 2018. Journal of the Air & Waste Management Association, 73(3): 178-199.

Fuller, R. et al., 2022. Pollution and health: a progress update. Lancet Planetary Health, 6(6): E535-E547.

Georgiades, P., Kohl, M., Mihalis A. Nicolaou, Theodoros Christoudias, Andrea Pozzer, Constantine Dovroli, and Jos Lelieveld, 2024. High-resolution global ultrafine particle concentrations through a machine learning model and Earth observations. Earth System Science Data, discussions.

Hall-Quinlan, D.L. et al., 2023. Inferred vehicular emissions at a near-road site: Impacts of COVID-19 restrictions, traffic patterns, and ambient air temperature. Atmospheric Environment, 299.

He, H. et al., 2013. High ozone concentrations on hot days: The role of electric power demand and NOx emissions. Geophysical Research Letters, 40(19): 5291-5294.

Hembeck, L., Dickerson, R.R., Canty, T.P., Allen, D.J. and Salawitch, R.J., 2022. Investigation of the Community Multiscale air quality (CMAQ) model representation of the Climate Penalty Factor (CPF). Atmospheric Environment, 283.

Hembeck, L. et al., 2019. Measured and modelled ozone photochemical production in the Baltimore-Washington airshed. Atmospheric Environment-X, 2.

Landrigan, P.J. et al., 2018. The Lancet Commission on pollution and health. Lancet, 391(10119): 462-512.

Lelieveld, J., Evans, J.S., Fnais, M., Giannadaki, D. and Pozzer, A., 2015. The contribution of outdoor air pollution sources to premature mortality on a global scale. Nature, 525(7569): 367-+.

Scientific and Technical Working Group, S., 2008. Global Warming in the Free State.

Stewart, R.K. et al., 2025. Human Health Impacts of Energy Transitions across the United States among Sociodemographic Subpopulations for the Year 2050. Environmental Science & Technology.

Individual Commissioner

5. **Impact of elimination of federal environmental regulations and efforts:**
   Working in partnership with Maryland Universities, request the various state agencies that have purview to investigate and provide an overview of federal environmental regulations that were, or are proposed to be eliminated, that could significantly harm

Maryland's efforts to protect its environment by their absence, and for the state to enact regulations that can help fill the void.

Additional Context:

For examples of potential and real Federal rollbacks See MDE presentation to MWG 7/29/25: Meeting the Moment: Maryland's Strategic Response to Federal Rollbacks https://mde.maryland.gov/programs/Air/ClimateChange/MCCC/MWG/Response%20to%20Federal%20Rollbacks%20-%20MWG%20-%20July%2029.pdf

and MDE July presentation to Commission, Status of Maryland Climate Action and Path Forward, Part 2 Federal Policy Rollbacks https://mde.maryland.gov/programs/air/ClimateChange/MCCC/Commission/July%20MCCC%20-%20GHG%20Reduction%20Policies%20Facing%20Implementation%20Uncertainties.pdf

The following report on "Expanding Non-Federal Climate Leadership in the United States" was just released by the University of Maryland's Center for Global Sustainability: https://cgs.umd.edu/sites/default/files/2025-11/Report_United%20States%20Pathways%20to%202035.pdf

_____