

# 2020 ANNUAL REPORT

Submitted to the Honorable Larry Hogan, Governor  
- and -  
The Maryland General Assembly  
November 15, 2020



Seen on the cover are masked volunteers during the COVID pandemic cleaning the beach at Sandy Point State Park to honor the 50th Anniversary of Earth Day.

[www.maryland.gov/MCCC](http://www.maryland.gov/MCCC)

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# Maryland Commission on Climate Change

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## Maryland Commission on Climate Change Chair Ben Grumbles' Message

Maryland and the United States confronted unprecedented challenges in 2020. As the climate crisis continues to grow, the COVID-19 pandemic precipitated public health and economic emergencies and exacerbated economic, social, and racial inequities that have plagued disadvantaged and overburdened communities for decades. Amid these mounting crises and a nationwide reckoning with structural racism, the Maryland Commission on Climate Change (the Commission) continued its work to improve Maryland's response to climate change. Through this report, the Commission offers a series of recommendations to the Governor and General Assembly to enhance the state's efforts in climate change mitigation, adaptation, and resilience, to better incorporate environmental and climate justice into the state's climate approach, and to more meaningfully engage with disadvantaged and overburdened communities.

Throughout its tenure, the Commission has relied upon the latest and most widely accepted science to guide its evaluations and recommendations. Among this year's recommendations are a call to adopt more ambitious greenhouse gas (GHG) reduction goals in line with the latest science, including requiring at least 50 percent reduction by 2030 and achieving net-zero GHG emissions by 2045, additional measures to reduce in-state GHG emissions, and executing key adaptation and resiliency measures. These recommendations aim to address economic and public health impacts with a particular focus on addressing environmental justice concerns in communities disproportionately impacted by air pollution and climate change.

For nearly 20 years, Maryland's air quality has been dramatically improving. Policies and regulations have lowered levels of common air pollutants like nitrogen oxides (NO<sub>x</sub>) and particulate matter, as well as numerous toxic pollutants. Reductions of these harmful pollutants have brought dramatic improvements in the quality of the air that Marylanders breathe, as well as citizens in neighboring states. Reducing emissions of common air pollutants like NO<sub>x</sub> also improves water quality and the health of the Chesapeake Bay and contiguous states adjoining the Bay. About one-third of the nitrogen pollution in the Bay comes from airborne pollution from land-based sources like power plants and motor vehicles.

Maryland is making significant progress in the fight to mitigate and adapt to the impacts of climate change. With 3,100 miles of tidal shoreline, much of which includes sensitive ecosystems, Maryland is disproportionately vulnerable to sea-level rise, one of the major consequences of climate change. In response, the State continues to lead. Despite recent efforts by the federal government to roll back

mitigation programs at both the federal and state levels, Maryland is growing the economy and creating jobs while reducing GHG emissions. According to a new report by the World Resources Institute<sup>1</sup>, Maryland slashed its energy-related carbon dioxide (CO<sub>2</sub>) emissions 37.6 percent between 2005 and 2017 – more than any other state – while simultaneously growing the state economy by 17.7 percent. Maryland should continue to demonstrate bold, bipartisan leadership on climate change and economic development.

The Commission recognizes that Maryland is making great progress on climate issues by responding to the latest science with more ambitious reduction goals amid the COVID-19 pandemic. The state must adopt a balanced and equitable approach and continue to serve as a model of bipartisanship to inspire additional climate action locally, regionally, and beyond. With causes and consequences interwoven among nearly all sectors of state and inter-state economy and society, it is also clear to the Commission that recognition of Maryland's vulnerability has been a call to action that the state is answering with ambitious goals and quantifiable measures.

## **Maryland Commission on Climate Change Structure, Priorities, and Progress**

The Commission is committed to helping Maryland find bipartisan, common sense solutions to the problems facing the State. The Commission is comprised of a diverse set of citizens, stakeholders, and policymakers who recommend programs and policies aimed at mitigation, adaptation, and resiliency in response to climate change. The Commission has proven that it is possible to have responsible debate and build consensus on how best to protect our natural resources, promote clean energy, and grow our economy for current and future generations.

The Commission, established in 2007, has played a fundamental role in Maryland's efforts to fight climate change, beginning with its 2008 Climate Action Plan that catalyzed the 2009 Greenhouse Gas Emissions Reduction Act (GGRA of 2009). One of the most significant roles of the Commission is to serve in an advisory capacity to the Maryland Department of Environment (MDE) and other State entities as they work to develop a plan to mitigate and adapt to the impacts of climate change required by the Greenhouse Gas Emissions Reduction Act - Reauthorization of 2016 (GGRA of 2016).

Over the course of 2020, the Commission's working groups undertook diverse efforts to not only develop, but actively implement programs and engage in activities to pursue the body's specific statutory charges. The Commission and its working groups conducted numerous discussions related and in response to the best available climate science. The Commission evaluated several new or

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<sup>1</sup> <https://www.wri.org/blog/2020/07/decoupling-emissions-gdp-us>

evolving approaches to enhance Maryland's plans for the mitigation of and adaptation to climate change.

The Commission's working groups spent a significant amount of time hearing from experts and then discussing many issues, including responding to the latest science on climate change; decarbonizing the power sector, transportation sector and buildings; the impact of climate change on coastal construction, labor and manufacturing, and the agricultural community; natural solutions to climate change including carbon sequestration from forests and healthier soils; new targets for solar development and the offshore wind supply chain; emerging technologies; energy efficiency in homes and at businesses; and long- and short- term climate resiliency and coastal hazard mitigation. The working groups each developed a set of recommendations informed by these proceedings, which can be found in the final chapter of this report. Public involvement is crucial to the Commission process, especially as work is ongoing to finalize MDE's *2019 Greenhouse Gas Emissions Reduction Act Draft Plan (2019 GGRA Draft Plan)* by the end of 2020.

## Science to Inform Maryland Commission on Climate Change Recommendations

The Commission continues to rely on scientific evidence to guide its evaluations and recommendations. The trends in the emission of heat trapping GHGs into the atmosphere and the projected rise in global temperatures closely follow the scientific predictions providing confidence in the predictive capacity of the models employed over the past five decades.<sup>1</sup>

The body of scientific evidence for global climate change is both clear and growing and has demonstrated that the dominant cause is human activity.<sup>2,3</sup> The Intergovernmental Panel on Climate Change (IPCC), is an intergovernmental body of the United Nations dedicated to providing the world with an objective, scientific view of climate change and its natural, political, and economic impacts, risks, and possible responses. The IPCC has concluded that human drivers, including GHG emissions, are "extremely likely to have been the dominant cause of the observed warming since the mid-20th century," recently estimating that human activities have contributed to approximately 1°C (1.8°C) of global warming above pre-industrial levels, particularly the emission of heat-trapping GHGs into the atmosphere. The findings of the IPCC that concluded anthropogenic activity is the primary factor to modern global warming are further confirmed by detailed analyses of climate evidence from the past 2,000 years showing there has been no similar timeframe where the earth heated or cooled over the entire globe simultaneously at such a high rate.<sup>4</sup>

The IPCC in 2018 reiterated the importance of keeping global warming below 1.5°C (2.7°F) and this view has been reinforced by multiple scientific assessments.<sup>5,6,7,8</sup> More recent analyses have evaluated progress toward GHG reductions<sup>9</sup> and determined that the current trajectory is insufficient

to limit global warming below the 1.5°C (2.7°F) target. Watson et al<sup>10</sup> examined the current commitments made by different nations and concluded:

*“To achieve the Paris Agreement's most ambitious goal of keeping global warming below 1.5°C (2.7°F) above pre-industrial levels requires reducing global greenhouse gas (GHG) emissions by 50 percent by 2030. An analysis of current commitments to reduce emissions between 2020 and 2030 shows that almost 75 percent of the climate pledges from signatory nations are insufficient to reduce GHG emissions by 50 percent by 2030.”*

This assessment has resulted in efforts in many states and countries to re-examine targets and timelines for GHG reductions as the consequences of global warming are detected and experienced by communities, including:

### Greenhouse Gas Emissions<sup>8</sup>

The latest analysis of observations from the WMO Global Atmosphere Watch shows that globally averaged surface concentrations calculated from this in-situ network for CO<sub>2</sub>, methane (CH<sub>4</sub>) and nitrous oxide (N<sub>2</sub>O) reached new highs. The growth rates of the CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O concentrations in the atmosphere averaged over the 2015–2017 period for which data have been completed and processed are each about 20 percent higher than those over 2011–2015. Preliminary analysis shows that in 2018, the CO<sub>2</sub> annual mean concentration at Mauna Loa Observatory, Hawaii, reached 408.52 ppm and the increase from 2017 to 2018 was 1.97 ppm. From January to August 2019, the increase in the concentration (de-seasonalized trend) was 0.85 ppm.

### Temperature<sup>7,8</sup>

The average global temperatures for the five-year period 2015–2019 were the highest on record, with 2019 being the second warmest. The average global temperature for 2015–2019 was 1.1°C (1.98°F) above pre-industrial (1850–1900) level and is the warmest of any equivalent period on record. The average temperature is 0.20°C (0.36°F) warmer than the average for 2011–2015.

### Ocean

Scientific evidence is mounting of the significant changes occurring in the oceans. This is captured in the recent IPCC report:<sup>11</sup>

*“It is virtually certain that the global ocean has warmed unabated since 1970 and has taken up more than 90 percent of the excess heat in the climate system (high confidence). Since 1993, the rate of ocean warming has more than doubled (likely). Marine heatwaves have very likely doubled in frequency since 1982 and are increasing in intensity (very high confidence). By absorbing more CO<sub>2</sub>, the ocean has undergone increasing surface acidification (virtually certain). A loss of oxygen has occurred from the surface to 1000 m (medium confidence).”*





In response to this global consequence of climate change, Maryland has prepared the first Maryland Ocean Acidification Action Plan in 2020 in collaboration with the International Alliance to Combat Ocean Acidification.<sup>12</sup>

### Cryosphere

During 2019 and 2020 there continued to be an alarming reduction in the amount of ice on Earth's surface, the so-called cryosphere. Around the world, mountain glaciers are continuing to retreat. Arctic surface air temperatures have increased more than twice as fast as the global mean since the mid-1980s.<sup>13</sup> This is linked to the continued decline in the extent and thickness of ice cover in the Arctic Ocean, which by mid-October 2020 was the least ever recorded at that time of the year. The decline in ice cover is allowing the sea surface to warm, which has far-reaching consequences for weather well down in the United States. As a result of the warming of both the air and surrounding seas, the Greenland ice sheet has been losing mass at an unprecedented rate since the 1990s, twice as fast in 2019 than the average over 2003–2016. Some scientists have suggested that Greenland has reached the point of no return such that, even if global warming were to stop today, the ice sheet would continue to shrink.<sup>14</sup> Although air temperatures over Antarctica are not warming as rapidly as in the Arctic, the surrounding seas are warming. This is destabilizing the ice shelves where massive glaciers meet the ocean,<sup>15</sup> which alone could cause several meters of sea-level rise over the next century or two.

The IPCC Special Report<sup>11</sup> reviewed the observed physical changes in the cryosphere and projected future changes and their implications for sea-level rise under different pathways of global GHG emissions. Sea-level rise in the future will largely be determined by the rate of melting of polar ice sheets, which will be determined by the warming of the atmosphere and surface ocean waters. For the unabated warming path we have been on, the IPCC's median estimate was 71 cm (2.3 feet) of sea-level rise by 2100; however, if GHG emissions were reduced quickly enough to limit the increase of global mean temperature to less than 2°C (3.6°F), as per the Paris Agreement, the median estimate is 39 cm (1.3 feet). That does not tell the full story, as the IPCC estimated that it is possible that sea-level could rise more than 1 m this century and as much as 5 m by 2300 if global emissions continue to grow over the next 60 years. On the other hand, it is unlikely to exceed 1 m even through the next century if emissions can be brought to net zero by or shortly after 2050. A more recent expert estimate generally agrees with the IPCC but also suggests that sea-level rise could be even higher under an unabated warming path.<sup>16</sup> To put it quite simply, the future of Maryland's low-lying coastal areas essentially depends on the amount of ice lost from Antarctic and Greenland ice sheets.

## Extreme Events<sup>7,8</sup>

Many of the extreme events associated with climate change, such as hurricanes, floods or droughts, can bring substantial loss of life or population displacement and inflict major economic impacts.

Heatwaves have been the deadliest meteorological hazard in the 2015–2019 period, with wildfires also occurring especially in the Western United States, the Arctic, including Greenland, Alaska and Siberia, and in the Amazon forest. In June 2019 alone, these Arctic fires emitted 50 Mt of CO<sub>2</sub> into the atmosphere. This is more than was released by Arctic fires in the same month for the totality of the period 2010–2018.

The largest economic losses were associated with hurricanes and tropical cyclones. The 2017 Atlantic hurricane season was one of the most devastating on record, with more than \$125 billion in losses associated with Hurricane Harvey alone.

The trends of increasing frequency of extreme events continues. For only the second time in history, the National Hurricane Center in 2020 has reached the end of the 21 alphabetical tropical storm names for the Atlantic Ocean and the subsequent named storms using Greek letters had reached the sixth letter, Zeta, before the end of October.<sup>17</sup>

## Human Health

The most recent [National Climate Assessment](#)<sup>18</sup> concluded that ongoing climate change is negatively impacting public health by exacerbating climate sensitive health outcomes that are tied to rising temperatures and increases in the frequency of extreme weather events. The public health impacts of ongoing climate change among Marylanders were first outlined in the [2016 joint report](#) by the University of Maryland School of Public Health and the Maryland Department of Health.<sup>19</sup> Direct threats of increasing extreme events in Maryland are best exemplified by the experience of communities in Ellicott City, which have had to deal with three “once in a thousand-year rainfall events” over the last decade alone. Studies have shown that rising frequencies of extreme heat and precipitation events are increasing risk of asthma hospitalizations, myocardial infarctions, and motor vehicle accidents, as well as food and waterborne illness in Maryland.<sup>20-24</sup> More recent work has demonstrated how climate change can simultaneously impact ecosystem health and human health. For example, wintertime temperature anomalies are changing the timing of spring onset, which is closely linked with the tree pollen season, and thus, increasing the risk of asthma hospitalization in Maryland.<sup>25-27</sup>

Since the ongoing trends in increasing frequency of extreme events are projected to continue in the foreseeable future, protecting public health will require the capacity to anticipate and adapt to these

new threats. This should be supported by a clear understanding of underlying community vulnerabilities. For instance, a community may be more vulnerable because it is disproportionately exposed to the new threats, such as inner-city areas with higher prevalence of poverty and air pollution exposure are excessively exposed to heat because of the urban heat island effect, or coastal areas, which are increasingly exposed to allergenic mold because of constant flooding. Likewise, communities may be more vulnerable because they lack the capacity to adapt to the new threats. For example, poor communities are more vulnerable to heat exposure because they do not have access to air conditioning, and individuals undergoing dialysis cannot cope with the heat by drinking more water because of medical restrictions to their liquid intake. Moreover, certain subgroups may be more vulnerable to the new threats because of their underlying conditions, such as certain minority groups, linguistically isolated communities, those suffering from mental health issues, or individuals living with preexisting conditions. The most recent IPCC report highlighted that keeping the ongoing warming to 1.5°C (2.7°F) above the preindustrial average as opposed to 2°C (3.6°F) will reduce frequent exposure to extreme heat waves among 420 million people. Similarly, in Korea it is estimated such benefit will translate into 12 percent reduction in heat wave related mortality.<sup>28</sup> Moving forward, public health early warning systems with seasonal to sub-seasonal lead times incorporating such community specific vulnerabilities may help communities to better prepare against the threats of climate change.

### Wildfire

The year 2020 has already seen one of the worst United States wildfire seasons in recent history with several western states experiencing record areas burned and smoke plumes visible in Maryland. Changing precipitation patterns and rising temperatures combine to exacerbate the intensity and duration of dry periods, yielding more intense wildfires that are frequently beyond our ability to control. The Western United States provides examples of this year after year; however, in 2016, the Great Smoky Mountain wildfires that burned into Gatlinburg Tennessee, destroying thousands of homes and structures, causing over \$1 billion in damages, and costing 14 lives, indicated that the Eastern United States is vulnerable, too. Future climate projections for the region anticipate increases in the frequency of both high and low precipitation events with an overall trend of drying soils.<sup>18</sup> In the United States (1992–2015), approximately 44 percent of wildfires were ignited by lightning, but they accounted for more than 70 percent of land burned.<sup>29</sup> Lightning strikes are likely to increase with climate change but to an uncertain degree in the United States, with projected increases ranging from slight<sup>30</sup> to as much as 50 percent.<sup>31</sup>

The potential for increasing wildfire in Maryland and implications for carbon emissions and sequestration are uncertain, although Maryland scientists at the Maryland Department of Natural Resources (DNR) and the academe continue to monitor and research the changing landscape characteristics of Maryland.

These changes to the physical systems reverberate through biological and human systems that, which have co-evolved to exist under current conditions. A thorough understanding of the ramifications which accompany unmitigated climate change, as well as the complexity of costs and benefits (economic, environmental and human) associated with climate action, is essential to the core function of the Commission. The scientific community is constantly improving and refining the models and projections for various emission reduction scenarios, providing policy makers with increasingly detailed information on which to base its decisions and recommendations. MDE has procured such models to develop the *2019 GGRA Draft Plan*. It is the ongoing endeavor of the Commission and its working groups to ensure that Maryland is utilizing the best science available in order to move forward with progress on limiting climate change (or mitigating) and adapting to evolving conditions.

## References

1. Hausfather et al., 2019. Even 50-year-old climate models correctly predicted global warming. *Science* Dec. 4.  
  
<https://www.sciencemag.org/news/2019/12/even-50-year-old-climate-models-correctly-predicted-global-warming>
2. Maryland Commission on Climate Change Scientific and Technical Working Group, "Appendix 1 of 2015 Maryland Commission on Climate Change Report: Reducing Emissions of Greenhouse Gases Beyond 2020," in 2015 Maryland Commission on Climate Change Annual Report, 2015.
3. U.S. Global Change Research Program, Climate Science Special Report: Fourth National Climate Assessment, Volume I, D. Wuebbles, D. Fahey, K. Hibbard, D. Dokken, B. Steward and T. Maycock, Eds., Washington, DC, 2017, p. 470.
4. Neukom, R., N. Steiger, J. José Gómez-Navarro, J. Wang & J. P. Werner. No evidence for globally coherent warm and cold periods over the preindustrial Common Era.  
*Nature*. Vol 571. 25 July 2019. p552
5. Ripple, W.J, C. Wolf, T.M Newsome, P. Barnard, W.R. Moomaw and 11,258 Scientist signatories from 153 Countries 2019. World Scientists' Warning of a Climate Emergency. *Bioscience*. November 5, 2019.
6. IPCC, 2018: Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty [Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. P. An, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, and T. Waterfield (eds.)].
7. World Meteorological Organization, 2019. WMO Statement on the State of Global Climate in 2018. WMO No 1233. 44pp
8. World Meteorological Organization, 2019. The Global Climate in 2015-19. 24pp.

9. UN Environment Program, 2018. Emissions Gap Report. 112pp. ISBN: 978-92-807-3726-4
10. Watson, R., J.J. McCarthy, P. Canziani, N. Nakicenovic and L. Hisas, 2019. The Truth behind the Climate Pledges. November. 30pp. ISBN: 978 0-9831909-3-6. <https://feu-us.org/behind-the-climate-pledges/>
11. IPCC, 2019: IPCC Special Report on the Ocean and Cryosphere in a Changing Climate [H.O. Pörtner, D.C. Roberts, V. Masson-Delmotte, P. Zhai, M. Tignor, E. Poloczanska, K. Mintenbeck, M. Nicolai, A. Okem, J. Petzold, B. Rama, N. Weyer (eds.)].
12. Maryland Department of the Environment and Maryland Department of Natural Resources, 2020. Maryland Ocean Acidification Action Plan. 17p.
13. Blunden, J., and D.S. Arndt. 2020. State of the Climate in 2019. *Bulletin of the American Meteorological Society* 101(8): Si-S429.
14. King, M.D., I.M. Howat, S.G. Candela, M.J. Noh, S. Jeong, B.P.Y. Noel, M.R. van den Broeke, B. Wouters, and A. Negrete. Dynamic ice loss from the Greenland Ice Sheet driven by sustained glacier retreat. *Communications Earth & Environment* 1 (1) doi: 10.1038/s43247-020-0001-2
15. Lhermitte, S., S. Sun, C. Shuman, B. Wouters, F. Pattyn, J. Wuite, E. Berthier and T. Nagler. 2020. Damage accelerates ice shelf instability and mass loss in Amundsen Sea Embayment. *Proceedings of the National Academy of Sciences*.
16. Horton, B.P., N.S. Khan, N. Cahill, J.S.H. Lee, T.A. Shaw, A.J. Garner, A.C. Kemp, S.E. Engelhart, and S. Rahmstorf. 2020. Estimating global mean sea-level rise and its uncertainties by 2100 and 2300 from an expert survey. *npj Climate and Atmospheric Science* 3, 18. doi: 10.1038/s41612-020-0121-5
17. NOAA National Hurricane Center  
<https://www.noaa.gov/news/with-alpha-2020-atlantic-tropical-storm-names-go-greek>
18. US Global Change Program, Fourth National Climate Assessment.  
<https://www.globalchange.gov/nca4>
19. Maryland Department of Health and Mental Hygiene and UM School of Public Health, 2016. Maryland Climate and Health Profile Report. 67p.
20. Soneja S, Jiang C, Fisher J, Upperman CR, Mitchell C, Sapkota A. Exposure to extreme heat and precipitation events associated with increased risk of hospitalization for asthma in Maryland, U.S.A. *Environ Health*. 2016;15:57.
21. Fisher JA, Jiang C, Soneja SI, Mitchell C, Puett RC, Sapkota A. Summertime extreme heat events and increased risk of acute myocardial infarction hospitalizations. *J Expo Sci Environ Epidemiol*. 2017;27(3):276-280.
22. Liu A, Soneja SI, Jiang C, et al. Frequency of extreme weather events and increased risk of motor vehicle collision in Maryland. *Sci Total Environ*. 2017;580:550-555.
23. Soneja S, Jiang C, Romeo Upperman C, et al. Extreme precipitation events and increased risk of campylobacteriosis in Maryland, U.S.A. *Environ Res*. 2016;149:216-221.

24. Jiang C, Shaw KS, Upperman CR, et al. Climate change, extreme events and increased risk of salmonellosis in Maryland, USA: Evidence for coastal vulnerability. *Environ Int.* 2015;83:58-62.
25. Sapkota A, Dong Y, Li L, et al. Association Between Changes in Timing of Spring Onset and Asthma Hospitalization in Maryland. *JAMA Netw Open.* 2020;3(7):e207551.
26. Li X, Zhou Y, Meng L, Asrar G, Sapkota A, Coates F. Characterizing the relationship between satellite phenology and pollen season: A case study of birch. *Remote Sensing of Environment.* 2019;222:267-274.
27. Li X, Zhou Y, Asrar GR, Mao J, Li X, Li W. Response of vegetation phenology to urbanization in the conterminous United States. *Glob Chang Biol.* 2017;23(7):2818-2830
28. Lee et al, 2018. Projection of Future Mortality Due to Temperature and Population Changes under Representative Concentration Pathways and Shared Socioeconomic Pathways. *Int J Environ Res Public Health* 2018 Apr 21;15(4):822. doi: 10.3390/ijerph15040822.
29. Short, K.C., 2017. Spatial Wildfire occurrence data for the United States, 1992-2015, 4th Edition. <https://doi.org/10.2737/RDS-2013-0009.4>
30. Finney, D.L., et al., 2018. A Projected decrease in lightening under climate change. *Nature Climate Change.* Vol 8, 210-213
31. Romos, D.C, et al., 2014. Projected increase in lightning strikes in the United States due to global warming. *Science* Vol. 346, Issue 6211, 14 Nov. pp851-854.



## Greenhouse Gas Reduction Goals and Other Greenhouse Gas Emissions Reduction Act - Reauthorization of 2016 Provisions

In recognition of the escalating urgency of climate change and the reduction pathways recommended by the IPCC in the 2018 Special Report, the Commission recommends that Maryland adopt more ambitious GHG reduction goals by amending the relevant provisions of the GGRA of 2016 to include 1) a statewide emissions reduction goal of 50 percent from 2006 levels by 2030, and 2) a requirement to develop a plan in recognition of the findings by the IPCC that developed nations should achieve net zero GHG emissions as early as 2045. The other provisions of the GGRA of 2016, including requirements to achieve positive economic and employment impacts, should remain the same.

Maryland is a member of the U.S. Climate Alliance (USCA), a bipartisan coalition of governors committed to transitioning to a clean energy economy and advancing the goals of the Paris Agreement. The Paris Agreement is an international commitment “to strengthen the global response to the threat of climate change by keeping a global temperature rise this century well below 2 degrees Celsius above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5 degrees Celsius.” As part of the decision to adopt the Paris Agreement, the IPCC was invited, in 2018, to produce a Special Report on global warming and related emission reduction pathways. The IPCC is the leading world body for assessing the science related to climate change, its impacts and potential future risks, and possible response options.

The IPCC Special Report<sup>2</sup> evaluated emissions reduction pathways that would limit the global temperature increase to the 1.5°C (2.7°F) threshold. Though the report did not evaluate goals for specific countries, the Commission notes that developed nations must follow steeper reduction pathways than developing nations and the global average. The Special Report offered four illustrative global pathways within a range of reduction pathways to limit global temperature increase to 1.5°C (2.7°F). The illustrative pathway with the steepest reduction achieves a 50 percent reduction in net GHG emissions by 2030 relative to 2010 levels. It achieves an 82 percent reduction in net GHG



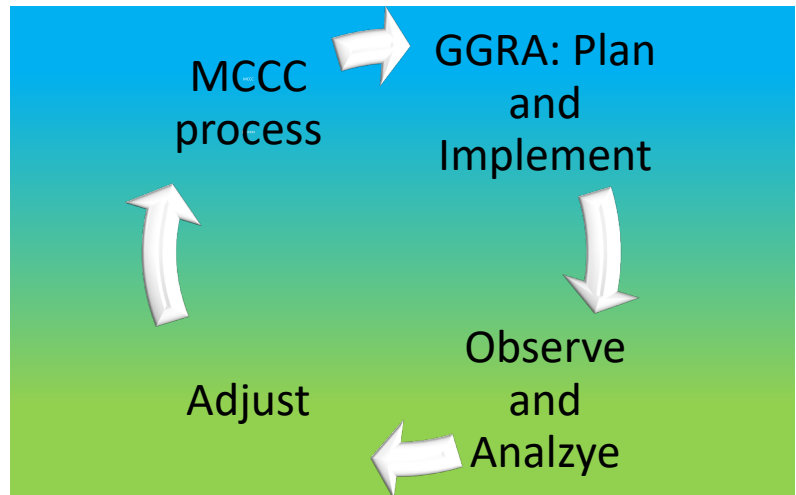
<sup>2</sup> [https://www.ipcc.ch/site/assets/uploads/sites/2/2019/05/SR15\\_SPM\\_version\\_report\\_LR.pdf](https://www.ipcc.ch/site/assets/uploads/sites/2/2019/05/SR15_SPM_version_report_LR.pdf); see p. 14 for pathway reductions.

emissions in 2050, and net-zero carbon dioxide emissions between 2045 and 2055. The illustrative pathways are examples of reduction pathways within a broad range, which encompasses steeper reduction pathways than these percentages, including ones that achieve closer to 60 percent reduction by 2030 and net zero among all GHGs as early as 2044.<sup>3</sup>

The GGRA of 2016 covers six major GHGs, not just CO<sub>2</sub>. Its reduction targets are calculated on gross emissions, not net emissions, and relative to a 2006 baseline, not 2010, so some of the precise percentages in the 2018 IPCC report are not directly comparable to GGRA of 2016 goals. On balance, the goals recommended by the Commission of 50 percent reduction by 2030 and net zero by 2045 would be consistent with developed nations' responsibilities to follow the steeper end of global reduction pathways evaluated by the IPCC.

### The Greenhouse Gas Emissions Reduction Act - Reauthorization of 2016 Prescribes an Adaptive Process

MDE is in the final stages of completing the *2020 GGRA Draft Plan* and is treating the more ambitious goals recommended by the Commission as stretch targets. Should the final plan published this year fall short of those new goals, the adaptive process of the GGRA of 2016 will provide opportunities to accelerate efforts over the coming years to achieve greater reductions this decade. In 2022, MDE is required to submit a progress report on the status of GHG reduction efforts and the economic impact of the GGRA of 2016 Plan. The report must include progress toward both the 2030 goal and reductions needed by 2050 in order to avoid dangerous anthropogenic changes to the Earth's climate system. The General Assembly may "maintain, revise, or eliminate" the 2030 goal and consider whether to continue economic impact provisions.



The adaptive process allows the Commission to explore different pathways and strategies and helps address the significant uncertainty in projecting what the future will look like. Different policy scenarios can be represented with models, and associated narratives can be co-produced. The value

<sup>3</sup> [https://www.ipcc.ch/site/assets/uploads/sites/2/2019/05/SR15\\_Chapter2\\_Low\\_Res.pdf](https://www.ipcc.ch/site/assets/uploads/sites/2/2019/05/SR15_Chapter2_Low_Res.pdf); see table 2.4



of the adaptive process is that it allows the State to consider the emissions and economic impact of new technologies, alternative behaviors, processes, governance, etc. and how those policy scenarios help the State meet the goals of the GGRA of 2016 and make adjustments as necessary.

## **A More Equitable and Inclusive Climate Strategy**

Climate change poses a significant threat to vulnerable communities with little adaptive capacity. Furthermore, disadvantaged communities are disproportionately impacted by pollution, often stemming from previous policy and planning decisions. Environmental justice is an ethical mandate that seeks equal protection from environmental and public health hazards for all people regardless of race, income, culture and social class. The state must ensure that equity and environmental justice are key principles of climate policies moving into 2021. Maryland must also ensure that residents and businesses across all communities have ample opportunity to shape and comment on climate policy, direct resources from climate programs like the Regional Greenhouse Gas Initiative (RGGI) to help disadvantaged communities address climate change and benefit from the transition to clean energy, and to repair damage to communities from previous policies.

In Maryland, environmental justice seeks equal protection from environmental and public health hazards for all people regardless of race, income, culture, and social class. Environmental justice requires the development, implementation, and enforcement of environmental laws, regulations, and policies that ensure that no single community will bear a disproportionate share of the negative environmental conditions or pollution. This may include industrial operations, land-use planning and zoning, or municipal and commercial operations, such as through Title V permits issued by environmental regulatory agencies.

“Climate justice” is a term that acknowledges climate change can have differing social, economic, public health, and other adverse impacts on disadvantaged populations. Climate justice begins with recognizing that key groups bear disproportionate climate change impacts. Climate impacts can exacerbate inequitable social conditions.





Achieving environmental and climate justice will require multidisciplinary collaboration among various stakeholders, including communities, businesses, public health and education experts, scientists, engineers and community planners, and federal, state and, local regulatory agencies. Climate justice principles may include:

- Supporting the right to economic development and employment opportunities;
- Sharing benefits and burdens equitably;
- Ensuring decisions are participatory, transparent, and accountable;
- Supporting education for climate stewardship; and
- Using effective partnerships.

The Commission is committed to incorporating environmental and climate justice considerations into all of the recommendations it makes to the state. Some examples of recommendations and actions in this 2020 annual report that address environmental and climate justice include:

- **Adaptation and Resiliency Working Group (ARWG): Environmental and Climate Justice:** ARWG will work alongside other working groups and the Commission to thoroughly and meaningfully integrate environmental justice considerations and action steps into all programming and initiatives. ARWG will look to provide expertise and partner with the Maryland Commission on Environmental Justice and Sustainable Communities (CEJSC) to advise and ensure vulnerable, underserved, and under-resourced communities are given the assistance needed to prepare for and adapt to the impacts of climate change. (Requested by the Commission in 2020)

- **Mitigation Working Group (MWG):** MDE should work with the public, other agencies, the General Assembly, and the Commission on Environmental Justice and Sustainable Communities to identify environmental and climate justice communities and the threats and effects those individual communities are facing. To supplement that practice, MDE should complete a thorough community environmental equity analysis regarding the impact of its suite of climate action policies, programs and proposals on communities of color, low-income communities, communities historically overburdened by pollution, and communities underserved by our energy and transportation systems. Community representatives should be included in the design of the study. The plan should be designed to identify specific goals and objectives (and evaluation/reporting thereof) to ensure equitable distribution of economic benefits produced by climate action strategies, policies, and programs. MDE should commit to prioritizing benefits to communities who have been disproportionately burdened by GHG emissions and other pollutants and are underserved or under-resourced.
- **Education, Communication, and Outreach Working Group (ECO):** The working group will provide support to the Commission, its working groups, and will collaborate with the Commission on Environmental Justice and Sustainable Communities (CEJSC) where possible. ECO recommends that the Commission improve environmental justice outcomes by working with the CEJSC to use tools to support the actions incorporated into all Commission work products (recommendations, work plans, meetings/discussions, membership/participation). Represent the concerns and guidance from vulnerable and underrepresented communities to the Commission by hosting a minimum of five public listening sessions in 2021.
- **Science and Technical Working Group (STWG):** The working group will identify experts from within the academic community that can be a resource to its working group or others. As the various strategies addressing structural racism related to climate evolve within Maryland, STWG will ensure this critical factor is included wherever needed.

In 2021, the Commission will prioritize diversity, equity, inclusion, and justice (DEIJ) considerations in its membership, organizational processes, and recommendations. The Commission and its working groups will actively pursue more diverse membership in the working groups and will provide recommendations for individuals and organizations to the Commission's appointing authorities to support this change.

The Commission Chair will appoint a third co-chair who is specifically empowered to ensure that DEIJ is considered and included in all Commission and working group deliberations and products. The co-chair will lead a team of Steering Committee members consisting of one or two Steering Committee



appointees with environmental justice knowledge and one liaison from each of the Commission's working groups. The co-chair and Steering Committee environmental justice team will provide a progress report in the Commission's 2021 annual report. Environmental and climate justice considerations will be reflected in recommendations that the Commission provides to the state and will identify opportunities to better incorporate those considerations into state programs.

## **COVID-19 Impacts and Recovery Strategies**

The world continues to fight a novel illness that has taken hundreds of thousands of lives in the United States while critical environmental protections that would have reduced health-impairing pollutants continue to be rolled back. Now, more than ever, Maryland should stay the course and lead on environmental protection efforts and make their climate change mitigation and adaptation strategy a key piece of the state's economic recovery from the COVID-19 pandemic. The state's investments in programs and projects via the Strategic Energy Investment Fund (SEIF), managed by the Maryland Energy Administration (MEA), are part of the solution and help stimulate clean energy investment and energy efficiency across the state.

One key policy analysis that the Commission completed in 2020 was the potential to use the increase in remote work as a tool for improving air quality and reducing GHG emissions from the transportation sector. MDE and the Maryland Department of Transportation (MDOT) recognized significant benefits from increased remote work and provided the Commission with a preliminary analysis of the GHG impact of the stay at home orders.

The incentives to increase remote work are viewed as a bridge to decarbonization while maintaining state and regional efforts to increase decarbonization with more charging stations and more incentives for purchasing zero emission vehicles (ZEVs). The Commission considered several stakeholders' recommendations, including ways to expand current MDOT programs and strategies to increase the percentage of remote work-eligible employees in the state. The Commission also explored how the lessons learned could be communicated and applied to the private sector.

## **Key Accomplishments in 2020**

### **Maryland Leads the Nation in GHG Emission Reductions and Economic Development**

Forty-one out of fifty states have grown their economies while reducing emissions since 2005. Of these states, Maryland leads, having reduced its energy-related CO<sub>2</sub> emissions 37.6 percent between



2005–2017 - more than any other state - while growing its economy by 17.7 percent, according to a study by the World Resources Institute.<sup>4</sup>

While the study confirmed the importance of the work of the Commission and the benefits of Maryland’s approach to climate change that stresses bipartisan cooperation and economically beneficial climate action, it also stressed the need for greater action in order for the nation and the world to achieve the reductions necessary to avoid the worst impacts of climate change. The study urged states that have not reduced emissions to follow the example of those that have done so and charged leadership states like Maryland to “invest in the next generation of solutions.” The Commission recommends that Maryland do so by adopting the more ambitious GHG reduction targets in this annual report and pursuing new mitigation strategies in major emitting sectors.

### **Growing Strength of the Regional Greenhouse Gas Initiative**

RGGI continued to grow in its twelfth year. New Jersey’s renewed participation in January of 2020 brought the RGGI collaboration up to 10 states. Virginia finalized its plan to be the 11<sup>th</sup> participating state in the new year, and Pennsylvania continued its regulatory process to begin participation as early as 2022. With another RGGI Program Review starting next year, Maryland and the other participating states are poised to build upon the program’s momentum and accelerate the region’s progress in decarbonizing the electricity sector in the mid-Atlantic and the Northeast, while growing these economies.

### **Natural and Working Lands**

Although the agriculture and forestry sectors contribute only a small percentage of Maryland’s total GHG emissions, they more importantly act as sinks and remove carbon dioxide from the atmosphere. Forests, grasslands, croplands, and wetlands all possess carbon-reducing and energy-related benefits that are extensive and complex. These natural and working lands provide opportunities for carbon sequestration that are not possible in other sectors. Through appropriate management, technology, and energy-conscious choices, the potential for land-based sequestration of atmospheric carbon and reduction of other GHGs can be significant, offering a pathway to net negative emissions that is not only available now, but also highly cost-effective.

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<sup>4</sup> <https://www.wri.org/blog/2020/07/decoupling-emissions-gdp-us>

Agricultural GHG emissions include CH<sub>4</sub> and nitrogen oxide NO<sub>x</sub> emissions from enteric fermentation (digestion) in ruminant animals, manure management, and agricultural soils. Emissions from agricultural soils account for the largest portions of agricultural emissions including nitrous oxide emissions from fertilizer application (synthetic, organic, and livestock) and production of nitrogen-fixing crops. However, trees and plants also remove carbon dioxide from the atmosphere through photosynthesis and store it in trunks, stems, branches, roots, and soils.



Around the world there is growing awareness of both the direct and indirect benefits of climate-friendly practices in agriculture, forestry, and grazing. Nature-based solutions that build soil carbon and organic matter likewise serve to ensure water quality and availability and support other important co-benefits, including ecological resilience, higher crop yields, and improved profitability through the lowering of energy, fertilizer, and herbicide/pesticide usage.

The Maryland Department of Agriculture (MDA) and DNR have identified a suite of best practices for soil conservation and forest management. Together, the agencies are advancing programs, policies, and incentives to reduce GHG emissions and enhance resilient carbon sequestration via forestry and soils programs. MDE should integrate the important actions and pathways into the *2020 GGRA Final Plan* while simultaneously working on ways to more efficiently track progress sequestration GHG inventory methodology.

### **Medium and Heavy-Duty Truck ZEV MOU**

Maryland, along with 14 other states and the District of Columbia, announced a joint memorandum of understanding (MOU), committing to work collaboratively to advance and accelerate the market for zero emission medium- and heavy-duty vehicles, including large pickup trucks and vans, delivery trucks, box trucks, school and transit buses, and long-haul semi-trailers (big-rigs). The goal is to ensure that 100 percent of all new medium- and heavy-duty vehicle sales be zero emission vehicles by 2050 with an interim target of 30 percent zero-emission vehicle sales by 2030.

Accelerating the decarbonization of trucks and buses is an essential step to achieve the deep economy-wide emission reductions needed to avoid the worst consequences of climate change and protect the health and welfare of millions of Americans. While trucks and buses only account for 4 percent of vehicles on the road, they are responsible for nearly 25 percent of total transportation sector GHG emissions. In fact, emissions from trucks is the fastest growing source of GHGs, and the number of truck miles traveled on the nation's roads is forecast to continue to grow significantly in the coming decades.

Truck and bus decarbonization also promise to deliver widespread health benefits, particularly in communities with heavy truck traffic that are burdened with higher levels of air pollution. Medium- and heavy-duty trucks are a major source of harmful smog-forming pollution, particulate matter, and air toxics. These emissions disproportionately impact low-income communities and low-income communities of color often located near major trucking corridors, ports, and distribution hubs. The MOU comes at an important transition point for the industry as investment in zero emission vehicle technology for the medium- and heavy-duty sector continues to ramp up. Today, at least 70 zero emission medium and heavy-duty truck and bus models are on the market, and manufacturers are expected to make many more new models commercially available over the next decade. Apart from the public health benefits and avoided health care costs zero emission trucks and buses provide, by 2030, the total cost of ownership for many common commercial vehicles is projected to reach parity with conventionally fueled vehicles.

To provide a framework and help coordinate state efforts to meet these goals, the signatory jurisdictions will work through the existing multi-state ZEV Task Force facilitated by the Northeast States for Coordinated Air Use Management (NESCAUM) to develop and implement a ZEV action plan for trucks and buses.

By promoting and investing in zero emission trucks and buses and the charging and fueling infrastructure needed to serve these vehicles, the signatory jurisdictions will support job creation and help to build a resilient and clean economy.

### **Transportation & Climate Initiative**

The Transportation & Climate Initiative (TCI) process and deliberations are in the final stages with a MOU due in late Fall 2020. Maryland and the other TCI states continued to develop a potential regional clean transportation program during the COVID-19 pandemic and started an additional round of public comment in September of 2020. The Commission recommended that Maryland lead in the implementation of a strong and equitable TCI program to reduce pollution and improve transportation options in communities throughout Maryland and the mid-Atlantic region.

## **Regional Agreement on Offshore Wind Clean Energy**

Maryland, along with North Carolina, and Virginia, formed a three-state collaboration to advance offshore wind clean energy projects in the region and promote the Southeast and Mid-Atlantic States as a hub for offshore wind energy and industry. The creation of the Southeast and Mid-Atlantic Regional Transformative Partnership for Offshore Wind Energy Resources (SMART-POWER) provides a framework to cooperatively promote, develop, and expand offshore wind energy and the accompanying industry supply chain and workforce. Specifically, the three states agree to form a SMART-POWER Leadership Team with representatives from each signatory jurisdiction that will work to streamline the development of regional offshore wind resources.

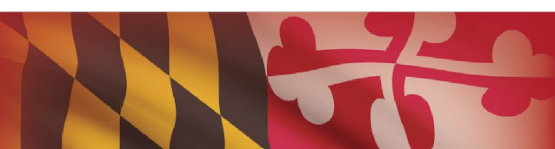
## **Finalizing Hydrofluorocarbon and Methane Regulations**

After efforts to limit fugitive emissions of hydrofluorocarbons (HFC) stalled at the federal level, several states have begun their own initiatives to phase out certain highly potent HFCs - some with the climate forcing effect of approximately 1,400 pounds of CO<sub>2</sub>. Maryland is developing regulations similar to those in California, Washington, and Vermont, which would phase out the use of certain HFCs in multiple end-uses, such as foam products and certain refrigeration equipment in retail establishments such as supermarkets. The phase out of HFCs will encourage the use of substances with lower GHG emissions. Products with alternatives to HFCs are already available. MDE has nearly completed adopting regulations prohibiting the use of high-global warming potential HFCs, consistent with the abandoned federal Rules.

Maryland also has continued its ongoing work to reduce methane emissions from the natural gas supply chain. MDE is finalizing regulations to reduce vented and fugitive emissions of methane from both new and existing natural gas transmission and storage facilities. Six existing facilities in Maryland will begin conducting surveys for methane leaks and report to MDE, beginning May 1, 2021. MDE currently is in the process of evaluating and drafting regulatory options to address methane emissions from the distribution system.

## **Adaptation and Resiliency Efforts**

Addressing climate impacts now and in the future requires a wide range of adaptation solutions to complement the mitigation measures. A suite of solutions is underway in Maryland to address that vulnerability and include a variety of approaches. From practice and place efforts that implement solutions on the ground, to education and communication ensuring all Marylanders are aware of the climate reality and finally scientific efforts to better understand our state and how climate will





influence our livelihoods, they all work together to reduce Maryland's vulnerability to climate change by adapting to the impacts that cannot be avoided.

DNR has undertaken multiple efforts to incorporate resiliency metrics, measures and review into funding and programming decisions. This incorporation ensures that Maryland's resources and communities are protected in the face of climate impacts in Maryland. *Resiliency Opportunity Zones* have been developed to define areas with restoration and conservation potential that provide high value resiliency benefits for communities, economies, public lands and important ecosystems. In close coordination with climate affected communities and public/private/non-profit sectors, a portfolio of projects within these zones, solicited through Grants Gateway, will be assembled that work together to avoid random acts of restoration, optimize resiliency benefits and leverage important habitat, water quality and GHG mitigation gains. This approach lends itself to longer budgeting timeframes, beyond a one-year cycle, which provides fiscal certainty, and generates new financing opportunities with other partners. The continued funding of *Community Resilience Grants / Resiliency through Restoration* funding promotes and supports comprehensive, holistic planning and implementation projects that address both water quality and quantity issues. Through these projects, DNR is helping Maryland communities become more resilient to flood risks and enhance the protection and management of the state's resources including the Chesapeake Bay and the ocean. Projects funded in 2020 included risk reduction planning in Princess Anne, Calvert County, Talbot County, Dorchester County, Montgomery County and Cecil County, and implementation projects in Anne Arundel and St. Mary's counties. This work continues a decade-long effort to provide support to local communities to assess risk, plan risk-reduction efforts and implement projects. The *Stateside Program Open Space* scorecard was updated to evaluate potential acquisition of properties for their coastal community resilience to climate change benefits. These benefits are provided by areas along the shoreline where natural habitats, such as marshes and coastal forests, have the potential to reduce the impact of coastal hazards to the adjacent coastal communities by dampening waves, stabilizing sediment and absorbing water. This recent enhancement complements existing land conservation criteria that avoids conserving lands that will be inundated by sea-level rise and targets adaptation areas important for wetland migration. The Stateside Program Open Space scorecard provides the ecological, resiliency and management justification that Maryland's Board of Public Works relies upon to approve acquisitions.

The incorporation of resiliency into decision making processes is one part of the state's portfolio of adaptation and resiliency efforts. On the ground projects help achieve the state's goals around adaptation and resiliency. Deployment of *Continuous Monitoring and Adaptive Control (CMAC) Retrofits for Flood Control in Howard County* not only provides cost-efficient water quality management in compliance with MS4 permit requirements but also supports sound water quality management and reduces flood hazards. With funding from DNR, Howard County partnered with



OptiRTC to assess and develop a prioritization methodology for determining locations for the technology. As part of MDOT MPAs “Strategy for Resiliency in the Face of Climate Change,” the *Fairfield Marine Terminal Wet Basin Redevelopment Project* filled in an obsolete wet basin. A storm water management and sand filtration system was constructed in 2019 to capture and filter 14 acres of stormwater runoff. The construction also elevated the terminal area to protect cargo from future sea level rise and extreme weather flooding events. The *Installation of Tide Gauges in Somerset and Talbot Counties* via a partnership with DNR, Maryland Emergency Management Agency, United States Geological Survey, Somerset and Talbot Counties in Crisfield and Claiborne expanded the network of gauges throughout the Chesapeake Bay measuring water levels. The two new gauges fill a data gap and will allow for more local and accurate reporting of water levels ongoing and during flood events thereby providing critical information to help reduce flood hazards.

Education, awareness, research and training around climate change competencies for adaptation programming are critical components to addressing adaptation needs in Maryland and is another aspect of the state’s diverse portfolio of adaptation efforts. Through the *Maryland Climate Leadership Academy*, Maryland has continued to support the work of the Commission, by serving as a tool that establishes a community of climate smart local government and infrastructure leaders. The Academy advances professional competencies in integrating climate change into decision-making across sectors and occupations and helps to ensure that decision-makers across sectors and Maryland communities are appropriately trained and educated to successfully integrate climate change adaptation efforts into their operations and activities. DNR is a participating investigator in a grant, *Evaluating an Adaptation Strategy to Enhance Coastal Marsh Resilience: Thin Layer Sediment Placement*. The grant aims to gather data to inform thin-layer placement as a restoration technique to promote marsh resilience in the face of sea level rise. Through this project, replicated restoration experiments are being conducted at several reserve sites across the nation, with the purpose of examining the effectiveness of thin-layer sediment placement as a marsh adaptation strategy. Novel aspects of the project include the broad distribution of sites, the examination of the effectiveness of thin-layer sediment placement at different marsh elevations, a standardized monitoring protocol and the incorporation of biochar (carbon material produced through the conversion of biomass in an oxygen limited environment) to improve soils and plant health. Monitoring guidance developed as part of this study is now being used to inform a marsh enhancement project with the Army Corps of Engineers on the Deal Island Wildlife Management Area. Additionally, the *Maryland’s Ecological Effects of Sea Level Rise Project* is monitoring and modeling the wave attenuation and flood reduction benefits of marshes, seagrass and other nature-based features. This three-year project will quantify the protective services of Maryland’s natural features and investigate how those services may change as sea levels rise. Wave, water level, and current sensors were deployed in the summer of 2020 and DNR engaged state, federal and local partners through a Management Transition Advisory Group. This study expands on previous monitoring conducted in Somerset County and will assist managers

with identifying restoration needs and priorities in areas where natural features can enhance community resiliency to climate change impacts. With funding from NOAA through DNR, the University of Maryland Center for Environmental Science - Integration and Application Network is developing a suite of *Maryland Climate Adaptation Indicators* and Coastal Adaptation Report Card to assess where Maryland is on adaptation efforts and track progress in the years to come. The approach involves stakeholder workshops and feedback to identify which indicators are of highest priority for Marylanders. The indicators will provide the Maryland Commission on Climate Change, its working groups, state agencies, and others with an assessment tool for adaptation action in the state moving forward.

Maryland recognizes the need to invest, support, and expand adaptation and resiliency efforts to effectively address climate change impacts on resources and communities. The ARWG undertook the task in 2020 to start the development of an Adaptation Framework for the state. In 2020, the ARWG identified key sectors (natural resources, natural and working lands, human health, water quality and quantity and protecting critical infrastructure) and focus areas (climate jobs and training, diversity and environmental justice, and local government and state service delivery) to serve as the pillars of the framework. Through DNR funding to the University of Virginia for support, broad engagement by working group members and stakeholders and a team at DNR, the working group has made significant progress on the framework and developing strategies to guide adaptation in Maryland for the next 10 years. Looking forward to 2021, the refinement and finalization of the Adaptation Framework will be the main priority of the ARWG in coordination with state agencies and the Commission. This effort will provide the state with a 10-year framework to guide efforts around adaptation and resiliency, ensuring Maryland successfully protects its resources and communities from the impacts of climate change.

## **Maryland should Continue to Demonstrate Bipartisan Leadership on Climate Change**

The aforementioned recommendations will help Maryland continue to protect the economy, the local environment, and the health of all of its residents. It is crucial that the state maintain its aggressive course of both mitigation and adaptation actions with or without supportive federal leadership. According to the IPCC, “effective adaptation and mitigation responses will depend on policies and measures across multiple scales: international, regional, national and sub-national.”

Adaptation within Maryland has a clear connection to reducing vulnerability and risk, but mitigation efforts at the state level are also essential. Eliminating GHG emissions in Maryland is not enough to mitigate climate change singularly, but it is critical that Maryland continue to lead by example. At the same time, the state must keep working to expand regional efforts and partnerships. Climate change

is a global problem, and Maryland's programs and policies must be part of a larger climate action plan to be broadly effective at preventing many of the costs of unmitigated climate change to the state.

The Commission recognizes that many other states and municipalities are making great strides in similar efforts and hopes that Maryland's proactive and economically balanced approach may serve as a model to inspire additional action from neighboring states and beyond. With causes and consequences interwoven among nearly all sectors of state and inter-state economy and society, it is also clear to the Commission that national leadership will be imperative to ensure adequate and equitable progress into the future.



## Maryland Commission on Climate Change Working Group Recommendations for 2020–2021

The Commission is required to report to the Governor and the General Assembly annually and include recommendations of future plans for consideration. Each year, the four working groups draft recommendations that are reviewed by the Commission's Steering Committee and the full body.

### Adaptation and Resiliency Working Group Recommendations

- 1) Adaptation Indicators and Report Card. In 2021, ARWG will work with the University of Maryland Center for Environmental Sciences (UMCES) to finalize the Maryland Coastal Adaptation Report Card. Once complete, ARWG will work with ECO to develop a communications outreach strategy to effectively communicate to all climate stakeholders the existence of the report card. ARWG and its partners will identify where best to integrate the identified indicators and report card findings into programming to help further the goals of the State of Maryland and the Commission. (Requested by the Commission in 2019, completion in 2021).
- 2) Evaluate and Update the State's Adaptation Strategy. Building on the efforts initiated in 2020, ARWG and partners will continue development of a framework to guide the state's adaptation efforts. The framework will guide and prioritize action over the next ten years, specifically in vulnerable and underserved communities. The approach includes five sectors (water resources, human health, natural and working lands, natural resources and protecting critical infrastructure) as well as three cross-cutting focus areas (environmental justice, climate jobs and training, state service delivery and local government) to ensure the strategy is comprehensive and integrated. (Requested by the Commission in 2019, completion in 2021).
- 3) Water Quality and Climate Change Resiliency Portfolio. ARWG will continue to support the State's effort to develop a long-term portfolio of natural infrastructure projects that optimize water quality, living resources, GHG reduction, and other health and environmental benefits in coastal and estuarine shorelines. ARWG will work to finalize the portfolio and implement the approach across funding opportunities as they become available. (Identified in the State's Phase III Watershed Implementation Plan, completion in 2021).
- 4) Advance Saltwater Intrusion Plan Recommendations. Continue to advance saltwater intrusion plan recommendations. Convene meetings of subject matter experts, disseminate information and support projects that facilitate implementation of Maryland's Plan to Adapt to Saltwater Intrusion and Salinization. The ARWG will receive periodic updates from the Maryland Department of Planning

(MDP) regarding this effort and will provide guidance to MDP and other state agencies on how to increase or expedite plan implementation." (Suggested by MDP).

5) Maryland's Climate Leadership Academy. ARWG and partners will continue to foster a community of climate-smart local government and infrastructure leaders through the participation in and promotion of the Maryland Climate Leadership Academy. ARWG will help identify content for the online learning lab and short courses to help advance Commission goals and initiatives (i.e., Maryland Energy Administration-specific training, Maryland Department of Health-specific training, Coast Smart guidance on new program update). Efforts will be directed to developing a "short course" on identified sector specific training. Relevant climate trainings identified by ARWG, the Commission and partners will be developed for deployment through the Climate Leadership Academy (Suggested by DNR).

6) Environmental and Climate Justice. ARWG will work alongside other working groups and the Commission to thoroughly and meaningfully integrate environmental justice considerations and action steps into all programming and initiatives. ARWG will look to partner with the CEJSC to advise and ensure vulnerable, underserved and under-resourced communities are given the assistance needed to prepare for and adapt to the impacts of climate change. (Requested by the Commission in 2020).

### **Education Communications and Outreach Working Group Recommendations**

The ECO Working Group's work is related to three specific charges in the Commission law:

- Communicating with and educating Maryland residents about the urgency of acting to reduce the impacts of climate change;
- Addressing any disproportionate impacts of climate change on low-income and vulnerable communities; and
- Developing broad partnerships with local, state, and federal agencies and the private sector.

ECO is the Commission's public relations arm. ECO will provide support to the Commission and its working groups and will collaborate with the CEJSC where possible to uphold ECO's charges outlined above. ECO recommends that the Commission do the following:

1. Improve environmental justice outcomes by working with the CEJSC to use tools to support the actions incorporated into all Commission work products (recommendations, work plans, meetings/discussions, membership/participation). Represent the concerns and guidance from vulnerable and underrepresented communities to the Commission by hosting a minimum of five public listening sessions in 2021.
2. Expand diversity, equity, inclusion, and justice on the Commission and in its working groups



by:

- a. Supporting recruitment efforts by identifying and cultivating participants in the listening sessions;
  - b. Providing member recruitment suggestions to the Commission; and
  - c. Identifying goals and outcomes and track progress towards outcomes.
3. Build strong connections between the Commission and the CEJSC by:
    - a. Providing summary reports and action statements;
    - b. Highlighting opportunities to build stronger outcomes; and
    - c. Communicating agency-specific environmental and climate justice outcomes to the Commission to leverage ongoing efforts within the CEJSC and government.
  4. Coordinate with the Maryland Department of Education and partners like Maryland Climate Leadership Academy, Maryland Association of Outdoor Education, The Chesapeake Bay Program, and the National Association of Marine Educators to identify opportunities to collaborate around climate policy curriculum.
    - a. Support a minimum of five content requests from education entities by August 2021.
    - b. ECO will provide a minimum of five guest speakers for education entities to discuss climate policy in Maryland by August 2021.

### **Mitigation Working Group Recommendations**

#### **Recommendations for Greenhouse Gas Mitigation**

#### **GHG Reduction goals and other GGRA of 2016 Provisions**

In recognition of the escalating urgency of climate change and findings from recent scientific reports, Maryland should adopt more ambitious GHG reduction goals by amending the relevant provisions of the GGRA of 2016:

- 2-1204 (1) The State shall reduce statewide GHG emissions by 50 percent from 2006 levels by 2030.
- 2-1205 (c)(3) The plans shall be developed in recognition of the finding by the Intergovernmental Panel on Climate Change that developed countries will need to reduce GHG emissions to net zero as early as 2045.

Other provisions of the GGRA of 2016, including requirements to achieve positive economic and employment impacts and for MDE to provide regular progress reports, should remain. Building upon



the *2019 GGRA Draft Plan* and the forthcoming *2020 GGRA Final Plan*, Maryland should set in place a firm timeline for developing mitigation policies to meet these targets.

State agencies should consider climate change impacts and climate justice during the development of all regulations and should, when proposing draft regulations, explain such impacts and invite public comment.

## Transportation

Maryland should lead in the interstate TCI discussions to develop, finalize, adopt, and implement an ambitious, equitable, and sustainable regional transportation cap-and-invest program that creates a new source of funding for clean transportation solutions that reduce GHG emissions; enhance public health protections, particularly for fence-line and frontline environmental justice communities; and rebuild our economy by creating new clean energy and clean transportation jobs. The TCI program should begin as soon as possible, ideally by 2022.

Maryland and the Zero Emission Electric Vehicle Council (ZEEVIC) should continue to support zero emissions public and private vehicles by purchasing ZEV state vehicles except for cases where that is not possible or practical, supporting the strongest legally possible vehicle emission standards and opposing Federal rollbacks, promoting and/or requiring charging infrastructure in multi-family dwellings, and supporting the purchase of zero emissions vehicles through continued and expanded incentives designed to benefit low-income, underserved, and over-burdened communities.

To improve transit service and reduce emissions from buses, and building upon MDOT/MTA's early zero emissions bus deployments, MDOT/MTA should:

- a. reduce the backlog of deferred maintenance projects in the MTA Capital Needs Inventory over the next six years in order to adequately serve the public and reduce vehicles on the road;
- b. accelerate zero emission bus purchases, such that all new state bus purchases are zero emissions starting no later than 2025; and
- c. continue to expand ZEV options on State-administered master contracts available for use by county transit systems and collaborate with county systems on charging infrastructure deployment.

The county transit systems should accelerate zero emission bus purchases, with the goal of all new transit bus purchases being zero emissions.





MDOT/MTA should continue taking action to ensure that the Purple Line Light Rail project is completed without further delay.

To the extent federal relief (or recovery or stimulus) funds become available for transportation, worker protections (e.g. hazard pay, sick leave, personal protective equipment, enhanced sanitation) should be included as part of spending priorities in order to keep workers and riders / users safe and service as predictable, and reliable as possible.

## **Electricity**

Maryland should develop a three-pronged incentive approach to utility, commercial, and residential scale battery storage consisting of: up-front rebates, performance incentives, and access to low-cost financing.

Maryland should continue to increase storage capacity and deploy other grid improvements to facilitate the use and dependability of renewably sourced generation.

MDE and the Public Service Commission (PSC) should work with the other RGGI states to ensure that RGGI's third regional program review begins as soon as possible in 2021. Maryland should also champion additional program improvements, including a more ambitious cap, as part of this next program review to further reduce GHG emissions; enhance public health protections, particularly for fence-line and frontline environmental justice communities; and rebuild our economy by creating new clean energy jobs.

The PSC and other relevant agencies and commissions should participate in a detailed study around the current function of our grid and necessary changes to create a more customer-centered, affordable, reliable and environmentally sustainable energy system. The PSC can draw heavily on the experience of the PC-44 process to address current and predicted issues related to resilience, reliability, cost, deep decarbonization and technological advancements.

The PSC should complete a cost-benefit analysis of energy storage that incorporates energy and non-energy benefits as well as avoided costs from storage deployment.

Based on the energy storage cost-benefit analysis and ongoing energy storage pilot projects, the Maryland Energy Administration should develop a megawatt or megawatt hour storage goal based on peak shaving/shifting and integration of renewable sources. Other states have used five percent of summer peak energy to develop their goals.



The PSC and MEA should study and make recommendations to the Commission regarding increasing the net energy metering cap of 1,500MW and/or exempting community solar and low-income households from the cap, while considering rate impacts and the incidence of those impacts, land use impacts, potential for rate reform, and environmental justice. The PSC and MEA should provide a progress report to the Commission within one year.

The General Assembly should establish a clear, enforceable schedule to responsibly manage Maryland's transition off its remaining coal-fired power plants by no later than 2030 and replace the capacity with equivalent non-coal-fired power, including the creation of a workforce and community transition plan to support laid-off workers and impacted communities.

The General Assembly should set forth a 100 percent clean energy by 2040 plan to ensure Maryland's electricity is made up of electricity with zero or net zero carbon emissions, and that is focused on providing the benefits of clean energy to overburdened and underserved communities first.

## **Buildings**

*Maryland should enable fuel-switching to let Marylanders choose lowest cost energy systems.*

The General Assembly should amend the Public Utilities Article (PUA) section §7-211 to allow electrification of existing fossil fuel systems through the EmPOWER Maryland Program (EmPOWER) and direct the PSC to require the electric utilities to proactively encourage customers with propane or oil heating systems to replace those systems with electric heat pumps, especially for homes with central air conditioning, especially for low income households and consumers. State agencies also should modify programs they manage to facilitate fuel-switching if not already allowed.

*Maryland should let EmPOWER facilitate beneficial electrification.*

The General Assembly should amend the PUA section §7-211 to change the core objective of EmPOWER from electricity reduction to a portfolio of mutually reinforcing goals, including GHG emissions reduction, energy savings, net customer benefits, and reaching underserved customers. In so doing, the PUA should allow for beneficial electrification. Beneficial electrification strategies are those that provide three forms of societal benefits: reduced energy consumption (total source BTUs), lower consumer costs, and reduced GHG emissions. Beneficial electrification programs should be prioritized first for low-income households and consumers and should be aligned with other health and safety upgrades to consider a whole-home or whole-building retrofit approach to ensure cost effectiveness and a focus on benefitting underserved homes and businesses first.

*Maryland should offer incentives for efficient electric heating systems.*



Based on the findings of the Building Energy Transition Plan in 2021, including the study of the market potential and consumer economics of renewable thermal and beneficial electrification, the General Assembly should establish a program of incentives to accelerate the deployment of electric systems for primary space and water heating of new and existing buildings.

*Maryland should offer incentives for Net-Zero energy all-electric new buildings.*

The Maryland Building Codes Administration should develop optional codes and standards for all electric net-zero energy buildings, including allowance of near-site renewable energy systems such as community solar projects, and determine how to incentivize builders to design to those standards. This work should be coordinated with the Maryland Department of Housing and Community Development (DHCD) in shaping incentive offerings since DHCD already has a Net Zero Loan Program in place and could provide useful insights on program design and existing market gaps to increase the reach of other incentive efforts.

*Maryland should lead by example through the electrification and decarbonization of state buildings.*

The General Assembly should require that all new state-owned buildings and major renovations to existing state-owned buildings use efficient electric systems for primary space and water heating unless granted an exception based on cost or building characteristics that would make an electric system impractical, including existing use of district heat or combined heat and power. This requirement should apply to projects covered by the Maryland High Performance Building Act.

*Maryland should set a goal of 50 percent of space heater sales to be electric heat pumps (air source or ground source) by 2025.*

The General Assembly should direct the Public Service Commission to ensure that EmPOWER programs, incentives, and implementation plans are sufficient to meet an aspirational goal of 50 percent of space heater sales being electric heat pumps (air source or ground source) by 2025.

*Maryland should prioritize an equitable level of benefits for all Marylanders.*

The Governor, State Agencies, Commissions, and General Assembly should ensure that all policy decisions to reduce GHG emissions from the building sector in Maryland, including those within these recommendations, prioritize an equitable level of benefits to limited income households, the state's affordable and multi-family housing stock, and low income ratepayers, and concurrently with the benefits provided to others.

*Maryland should improve interagency coordination for holistic building retrofits.*

The Governor, via Executive Order, or General Assembly, via legislation, should revive an Interagency Task Force with the goal of increased and consistent coordination across programs, policies, and funding streams to retrofit Maryland's existing residential and commercial buildings to achieve



healthier, safer, more efficient, and climate-friendly homes and businesses. This Green and Healthy Task Force would identify opportunities to align lead, mold, asbestos, and indoor air quality remediation intervention schedules with energy efficiency upgrades and electrification retrofit programs to ensure a more cost-effective, whole-building retrofit program that meets Maryland's various health, safety, affordability, and climate action goals. Progress should be tracked and measured through a public state dashboard.

State agencies should take into account carbon intensity when purchasing structural materials for public infrastructure projects.

### **Natural and Working Lands**

Maryland should provide incentives to Maryland's farmers and forest landowners to realize the full potential of climate friendly soil and forest management practices.

Maryland should identify permanent, dedicated sources of funding for land-based sequestration to recognize Maryland's farmers for their leadership role in advancing climate solutions, provide supplemental income to the agricultural community, and promote rural economic development.

The Mitigation Working Group will collaborate with the Adaptation and Resiliency Working Group to re-examine GHG reduction targets for the natural and working lands sector to assess potential sequestration capacity and demonstrate the cost-effectiveness of practices identified and incentivized through developing soil, forest, and wetland programs. In addition, the two working groups will evaluate opportunities to capitalize on emerging ecosystem services markets, and especially those for carbon credits, to attract private investment in forest and soil sequestration projects.

### **Mitigation Working Group 2021 Workplan Recommendations**

#### **GHG Reduction Goals and other GGRA of 2016 Provisions**

MDE should compare its processes against the World Resources Institute (WRI) accounting and reporting standard for GHG reduction goals and identify any inconsistencies. The MWG will evaluate formal adoption of the WRI protocol.

MDE should create an open source online access point for the E3 Maryland PATHWAYS emissions model, like the Chesapeake Assessment Scenario Tool (CAST) that provides model inputs and allows the public to do scenario planning.



## Environmental and Climate Justice and Just Transition

MDE should work with the public, other agencies, the General Assembly, and the Commission on Environmental Justice and Sustainable Communities to identify environmental and climate justice communities and the threats and effects those individual communities are facing.

To supplement that practice, MDE should complete a thorough community environmental equity analysis regarding the impact of its suite of climate action policies, programs and proposals on communities of color, low-income communities, communities historically overburdened by pollution, and communities underserved by our historic energy and transportation systems. Community representatives should be included in the design of the study. The plan should be designed to identify specific goals and objectives (and evaluation/reporting thereof) to ensure equitable distribution of economic benefits produced by climate action strategies, policies and programs. MDE should commit to prioritizing benefits to communities who have been disproportionately burdened by GHG emissions and other pollutants and are underserved or under-resourced.

The MWG should study policy solutions like California's Buy Clean California Act (AB262) and Washington State's Buy Clean and Buy Fair Washington Act to determine whether such policies would be beneficial to Maryland jobs and GHG goals.

As part of the manufacturing study required by the GGRA of 2016 in 2022, the Commission, working with other state agencies should analyze (1) how to promote manufacturing in-state in a way that creates sustainable, high-quality jobs related to renewable energy (including transportation, building retrofits, etc.), and (2) benefits of including provisions in procurement and other policies like prevailing wages, project labor agreements, labor harmony agreements, and buy Maryland/buy USA/hire Maryland policies.

The MWG should study and report on long-term job impacts on industries and communities as energy transition policies are implemented. This includes both job loss and job creation opportunities. The goal is to ensure the generation of sustainable economic benefits from climate action strategies, policies, and programs and address economic dislocations. Design efforts to ensure a just transition for workers and communities. Just transition policies must address wage replacement, guarantees of health care and retirement security, job training and job placement. Efforts for communities must address loss of tax base and strains on community programs. The study should also include programs to minimize negative impacts, including creating jobs in remediation and clean up.

## Transportation

MDOT should compile and provide to MWG research from ZEEVIC and others on barriers to ZEV and mechanisms to reduce those barriers, and the impact of ridesharing and connected autonomous vehicles on GHG emissions.

## Building Energy Use

*Maryland should produce an Energy Transition Plan by the end of 2021.*

The State should develop an Energy Transition Plan to coordinate long-term activities and ensure that the overall buildings sector strategy achieves equitable benefits for disadvantaged communities, anticipates and prevents escalating distribution system costs for shrinking pools of natural gas customers, and takes advantage of opportunities for economic growth, including for the agricultural community from renewable fuel development and EmPOWER market optimization. In 2021, the MWG should coordinate the necessary research and planning process.

As part of the Energy Transition Plan, MDE should commission a study of the market potential and consumer economics of renewable thermal / beneficial electrification examining incremental first costs, payback periods, appropriate incentive levels and source GHG savings associated with oil, propane, electric and natural gas options.

The MWG should consult with PSC on a methodology or series of alternative methods to evaluate source emissions and electric loads associated with building electrification.

## Short-Lived Climate Pollutants

MDE should update its supplemental GHG inventory estimating the impact of methane pollution leaking from natural gas production and distribution systems using the latest available estimates of leakage rates, and under the latest versions of both the 20-year global warming potential and 100-year global warming potential for methane.

## Natural and Working Lands

The MWG will evaluate the use of waste from managed forests, the forest products industry, food crops, horticulture, livestock, and food processing for energy, where consistent with IPCC definition for renewable bioenergy, and where carbon stocks are renewed within a year of use.



## Science and Technical Working Group Recommendations

As requested by Commission, the STWG will provide guidance related to setting priorities on how Maryland can achieve prevailing GHG reduction goals set by State and/or through federal legislation.

**Blue Carbon.** Work with the Commission and external partners (COMPASS, Restore America's Estuaries) to explore the opportunities associated with blue carbon for carbon sequestration, protecting shorelines and enhancing the tidal ecosystem. Blue Carbon is defined as the carbon accumulating in vegetated, tidally influenced ecosystems such as tidal forests, tidal marshes and intertidal to subtidal seagrass meadows. Blue carbon exhibits significant potential for both mitigating and adapting to the adverse impacts of climate change. The Commission is interested to know if multiple benefits for sustaining wetlands, enhancing coastal resilience, reducing flood risks and protecting infrastructure can be achieved. This will be achieved through virtual events such as webinars and on-line workshops during COVID-19 restrictions.

**Identify New Technologies and Innovations.** The STWG will build up its membership with experts in new technologies that can reduce emissions or sequester carbon. As the impacts of climate change continue to become a threat to ecosystems and human health, a significant number of innovative concepts are being recommended. For those innovations that seem to hold promise, the STWG will hold mini-review sessions to determine if broader investigations should be considered.

**Advise Maryland's Ocean Acidification Activities.** The STWG will assist MDE and DNR in developing an Ocean Acidification Research and Monitoring Action Plan as part of the State's membership in the International Alliance to Combat Ocean Acidification. The STWG, in coordination with agency partners, will hold a workshop of regional scientists who are working on ocean acidification within the Chesapeake and Coastal Bays. The purpose of this ocean acidification workshop will be to share knowledge on emerging research, consider the need for additional monitoring, and discuss mechanisms for reducing the impact to Maryland. In addition, the STWG will work with the ECO Working Group to engage the public in the challenges and potential solutions associated with ocean acidification.

**Review GHG Reduction Plans.** Many local, state, and other national governments have developed GHG reduction plans that are either more aggressive than Maryland's and/or have innovative reduction strategies that Maryland has not currently incorporated into its own planning efforts. The STWG will convene a task force of internal (current STWG members) and external experts to review other plans to determine if some of their actions should be fully considered when the State develops its updated plan in 2020. The STWG anticipates this task force to meet several times over the next two years.



Environmental and Climate Justice. STWG will identify experts from within the academic community that can be a resource to its working group or the others. As the various strategies addressing structural racism related to climate evolve within Maryland, STWG will ensure this critical factor is included wherever needed.

Advise the ARWG and UMCES on Resiliency Indicators. UMCES in coordination with the ARWG has been holding a series of mini-workshops (including one with the STWG) to select indicators. These workshops have been held Maryland-wide. The draft indicators will be posted on the project's website (<https://mdcoastaladaptation.net>) by mid-November, inviting written feedback and comments from stakeholders. Depending on responses, one more workshop may be held before the end of 2020. The selection of indicators is key to developing a Maryland Climate Adaptation Report Card in 2021.

Enhance Interactions between the Commission Working Groups. Continue to have STWG members participate in the other working groups and respond to requests from other working groups. This has occurred mostly with the ARWG and MWG and will be expanded to the ECO Working Group. STWG will assist the other working groups with identifying common science and engineering priorities for planning or implementation of strategies. This will be initiated through a small workshop(s) to identify the common issues that require deeper evaluation of what is needed to inform mitigation, adaptation and communication of climate issues.

