THE CENTER FOR
CLIMATE STRATEGIES

Policy Review

Findings Regarding the Hogan Administration 2019 Draft Plan to Implement the Maryland Greenhouse Gas Reduction Act

Center for Climate Strategies, December 19, 2019

Introduction

At the request of the Chesapeake Climate Action Network and Climate XChange, The Center for Climate Strategies (CCS) conducted a policy review of *Maryland's Greenhouse Gas Emissions Reduction Act: 2019 GGRA Draft Plan* (Draft Plan) released by the Maryland Department of the Environment (MDE) in October 2019. This policy review targets key issues and statements within the Draft Plan to support its further development and implementation. CCS reviewed publicly available information regarding the Draft Plan goals, proposed policy measures, and the underlying scenario analysis of sector level actions in order to assess its completeness, clarity, and technical soundness and to highlight revisions needed for alignment with state and international goals.

This policy review is based on application of generally accepted guidelines for policy and regulatory impact analysis and peer review, as well as CCS's 15-year experience developing and analyzing over 20 comprehensive, multi objective, stakeholder-based climate action plans in the United States (including several related processes and studies specifically in Maryland) as well as plans for low carbon development (LCD), low emissions development strategies (LEDS), and Nationally Determined Contributions (NDC) in 20 nations, including more than 40 subnational jurisdictions. As an independent technical and facilitative organization, CCS provides comprehensive review and assessment capabilities across sectors for direct and indirect impacts of public policies and measures and commercial activities that affect GHG emissions and economic, energy, and resource activities. For more information about CCS or our work in Maryland, please see the final section of this paper.

Background on the Policy Review of the GGRA Draft Plan

This review of the Draft Plan and its appendices recognizes the pressing need for both short and long term decarbonization pathways for Maryland as the 34th largest US state emitter[1] and 59th largest global emitter compared to nations.[2] It further recognizes the degree of difficulty and capacities needed

[1] https://www.eia.gov/environment/emissions/state/analysis/
[2] https://ec.europa.eu/jrc/en/publication/fossil-co2-emissions-all-world-countries-2018-report

1850 M Street, NW, Suite 840, Washington, DC 20036
(202) 540-9121 office, (202) 540-9122 fax
www.climatestrategies.us

for developing an effective approach that is implementation-driven, evidence-based, and collaborative in all sectors, and one that meets the combined objectives of emissions reductions, economic progress, energy and resource sustainability, and equity. While the Draft Plan represents a step towards these needs through a multi-sector, multi-objective framework using scenario-based modeling tools and assessments, it also raises many questions and concerns regarding the documentation, modeling and characterization of policy impacts and leaves in doubt the likelihood of meeting either Maryland's legislated 2030 target or the world's larger 2050 global climate stabilization goals.

Summary Findings

Overview findings include the following strengths and weaknesses of the Draft Plan:

Strengths:

- Provides multi sector framework of key actions to address legislatively mandated state greenhouse gas (GHG) reductions and comprehensive planning and evaluation requirements
- Includes evaluation of emissions and economic impacts using qualified impact analysis models
- Identifies an initial set of general sector level strategies and implementation approaches
- Provides supporting evidence of feasibility and attainment for some critical actions

Weaknesses:

- Does not provide consistent, granular level analysis of individual policies and measures
- Relies on a 2017 greenhouse gas inventory which may underestimate electricity emissions, and which does not include nearly 2 million tons of leaked-methane emissions
- Does not optimize emissions reductions and economic outcomes of policies and measures
- Provides low confidence of meeting state mandated GHG reduction targets in 2030
- Omits planning and evaluation for 2040 and 2050 decarbonization and stabilization targets, including 1.5˚ C warming goals
- Contains transportation sector approaches and assumptions that require reconsideration
- Contains energy sector approaches and assumptions that require reconsideration
- Omits evaluation of high renewable energy market penetration approaches
- Omits carbon pricing policy options and mechanisms within or across sectors
- Does not benchmark well against approaches by leading states and nations

Key issues of concern include the following:

The Assertion that the Draft Plan will Achieve the 2030 Target Relies on Flawed Analysis

The Draft Plan estimates significant reductions in emissions by 2030 using a broad approach that does not include a granular analysis of the Plan's specific policies and measures. The work also does not rely on detailed specifications of implementation mechanism or policy design (e.g. level of effort, timing, coverage of parties, eligibility provisions, price and non-price implementation mechanisms, etc.) of the measures in the plan itself. In those few cases where an actual estimate of impact was developed for one of the Draft Plan's elements, it does not appear that such an estimate was incorporated into in the overall analysis of emissions reductions or economic impacts. As a result, the direct impacts analysis

generally does not provide the level of clarity and transparency needed to explain how or whether the modeling inputs relate to the Draft Plan components, or how they turn into the results presented.

The Analysis Process Does Not Appear to Have Sought to Optimize Outcomes

The modeling also does not appear to have been conducted on an iterative basis to allow modification of initial design scenarios to better meet objectives. Effective policy analysis in this type of planning takes the initial modeling results and related policy design "back to the drawing board" for review and modification based on the strengths and weaknesses identified, doing so potentially many times until all key criteria for success are achieved. This approach has been used successfully to improve the clean energy programs of Maryland[3] and other states and could similarly improve economic performance of the Draft Plan. The initial modeling using REMI and EG Pathways presented here should not be characterized as a representation of the full emissions and economic potential of draft policy measures, but rather a first draft.

Carbon Pricing, Modeled and Shown to be Effective, Was Excluded Without Explanation

The analysis done for the Draft Plan included modeling the impact of a pricing mechanism on carbon using a market driven approach to reduce carbon emissions. As the Draft Plan notes, the carbon-pricing mechanism modeled was projected to have the most effect on emissions reductions – over 5 million more tons reduced – between 2020 and 2030. However, this option is not included in the Draft Plan set of recommended policies and measures. Given the beneficial impact of carbon pricing reflected in the scenario analysis it should be included the Draft Plan.

With No 2050 Commitment, the Draft Plan Falls Short of Commitments around the US and the World

The Draft Plan does not include evaluation of specific pathways to meet mid-century (2050) climate stabilization goals and abbreviates long term target setting to a 2030 end date. As a result, it does not provide strategies to facilitate long term deep decarbonization through new and enhanced energy efficient technologies and practices, nor does it specify the types of actions with long-term emissions impact that must be avoided (such as investment in high emitting infrastructure). Given current knowledge and emerging commitments for mid-century climate stabilization at the subnational and national levels, the lack of a near zero-emissions scenario evaluation for 2050 is a glaring omission. Remarkably, the Draft Plan explicitly avoids 2040 or 2050 emissions reductions goals and any reference to 1.5˚ C warming scenarios.

The 2017 Inventory, Which Serves as the Draft Plan's Starting Point, Is Too Low and May Be Miscalculated

The Draft Plan's path to achieving the state's 2030 emissions-reduction target is aided significantly by its very-low starting point, a 2017 inventory of existing emissions which is far lower than the 2014 inventory. The reduction is due largely to a massive drop in emissions from the in-state electricity supply sector which does not align with the fuel mix used or the amount of power supplied. The

[3] http://www.climatestrategies.us/library/library/view/1048

inventory also fails to include fracked-gas leakage emissions, which the Department of the Environment separately estimated (for 2016) to be nearly 2 million metric tons.

Further, the ratios between fuels burned by Maryland powerplants and reported emissions produced as a result indicate the possibility of calculation inconsistencies throughout both the 2014 and 2017 Greenhouse Gas Inventories. The workbooks, while provided online by MDE, have key formulas linking these values removed. This data should be re-checked and corrected if needed to resolve this uncertainty and improve the reliability of the starting point used in the Draft Plan. Future published workbooks and inventories should also make the calculations more transparent.

The Draft Plan Assumes a Transformational Shift to EVs will Achieve its 2030 Target

To achieve the 2030 emissions-reduction target, the Draft Plan's analysis assumes Maryland will adopt 530,000 new EVs over the 5 years leading to 2030. Maryland has less than 20,000 EVs registered today, and the actions articulated in the plan do not appear to be sufficient to achieve such a major near-term shift.

The Draft Plan Also Assumes the Survival of the Obama-Administration CAFE Standard

Significant emissions reductions from the on-road fleet are also dependent upon the continuation of existing federal vehicle-efficiency standards, which the Draft Plan assumes will not be weakened by the Trump Administration - an unlikely scenario. Planning around the existence of a policy facing major prospects of cancellation does not offer a robust approach to planning successfully to meet targets.

The Draft Plan Assumes Transportation Efficiency and Travel-Volume Reductions from Changes which Typically Do Not Produce Those Outcomes

The Draft Plan proposes highway lane expansion along I-270, I-495 and the Baltimore-Washington Parkway as an emissions reduction measure through reduced congestion. However, evidence indicates that traffic congestion returns within a few years as a result of induced demand for travel, and that travel volume growth can be expected to continue in proceeding years. The net effects of added roadway capacity are more likely to exert upward, not downward, pressure on transportation emissions. The Draft Plan's strategy to reach the 2030 target also relies on questionable assertions that car travel will fall 11% by 2030 through ride-sharing (which has been observed to add, not reduce, travel volume), accelerated transit expansions that are unlikely to be implemented in just 10 years, and a series of existing infrastructure-management strategies which are accorded high estimates of travel reduction without any supporting basis. Further, no sensitivity analysis of alternate assumptions is provided for any of the above scenarios to check the impact of uncertainties within the transportation sector. The transportation sector analysis and underlying assumptions require fundamental reconsideration.

The Draft Plan Relies on Carbon Capture and Storage, which is Not Yet in Practice or Reliably Clean, and Omits 2050 Full Renewable Energy Transition

In the power sector, the Draft Plan proposes both combined heat and power (CHP) and carbon capture and storage from fossil-based energy to be treated as "clean." The latter technology is not yet adoptable at scale, has limited reliability and market penetration potential at this stage, and its net effects on emissions require very careful consideration, especially considering that carbon storage by this method

may not be permanent. These issues are absent from the Draft Plan's discussion or analysis. Notably, the clean energy approach in the Draft Plan excludes an assessment of a full transition to renewable energy by 2040 or 2050. This omits technologies and policies of paramount importance. It is hard to imagine a basis for its exclusion, particularly for long term decarbonization scenarios. As a result, energy sector strategies bear full reconsideration.

Discussion of Primary Concerns

1. The Level of Commitment in the 2019 GGRA Draft Plan Is Weak by US and Global Standards

The Maryland GGRA 2019 Draft Plan presents a series of existing and proposed policies and actions asserted to be sufficient to meet the 2030 goal of a 40% reduction in emissions below 2006 levels. It does not contain a plan to achieve any 2040 or 2050 goal. The Draft Plan is required to be developed "in recognition that emissions must be reduced between 80% and 95% from 1990 levels by 2050." Instead, the Draft Plan is framed only as "an important steppingstone in achieving this ambitious goal." The Draft Plan is explicit that the only target and timetable of GGRA is its 2030 reduction goal.[4]

The emissions reduction projections within the Draft Plan reflect this focus. While the plan focuses on major achievements by 2030 to reach the required 40% target, the decline in emissions quickly becomes more gradual after that. Without major outside support in the form of the Obama CAFE vehicle standards and a nationwide shift to electric vehicles, emissions effectively do not drop at all after 2040.[5] The year 2050 roughly one generation away and many domestic and global jurisdictions have begun to treat this as a tangible planning horizon. From a practical standpoint, most buildings built now will be in use in 2050, and most infrastructure built now will be in operation in 2050. Planning decisions made now will directly influence the activity levels and emissions profiles of key sectors in 2050.

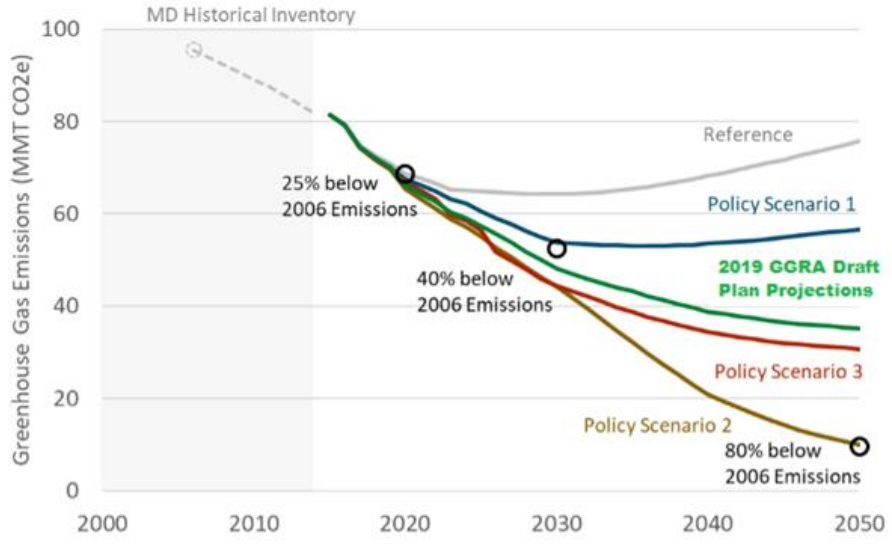
The Draft Plan does not appear to consider 1.5°C stabilization goals evaluated in 2018 by the Intergovernmental Panel on Climate Change (IPCC) Special Report on 1.5°C Warming[6], and instead focuses only on 2.0°C goal evaluated by the IPCC in 2014. The new IPCC recommendation is "For limiting global warming to below 2°C, CO2 emissions are projected to decline by about 25% by 2030 in most pathways (10–30% interquartile range) and reach net zero around 2070 (2065–2080 interquartile range).

In contrast, MDE writes "In order to limit the temperature increase to the established 2°C threshold goal, the Intergovernmental Panel on Climate Change (IPCC) calculated that global GHG emissions must be reduced by 40 percent to 70 percent from 2010 levels by 2050, and further to near or below zero in 2100." (*Page 2, Section 1.2, Climate Change and the Cost of Inaction in Maryland*). However, according to the 2018 evaluation by the IPCC, "In model pathways with no or limited overshoot of 1.5°C, global net anthropogenic CO2 emissions decline by about 45% from 2010 levels by 2030 (40–60% interquartile range), reaching net zero around 2050 (2045–2055 interquartile range).[7]

If it is to be considered a leading jurisdiction, Maryland should consider emissions reductions consistent with the 1.5°C stabilization goals, or 60% reductions by 2030 and net zero emissions by 2045 compared

[4] 2019 GGRA Draft Plan, Section ES-11, p. XVI
[5] 2019 GGRA Draft Plan, Appendix F. Figure 1-4, p. 8.
[6] https://www.ipcc.ch/sr15
[7] https://www.ipcc.ch/site/assets/uploads/sites/2/2019/05/SR15_SPM_version_report_LR.pdf

to 2010 emissions levels. The combined result of the Draft Plan using 2.0°C instead of 1.5°C to set target and using outdated IPCC recommendations complicates projections made throughout the Draft Plan. As can be seen on the chart below showing MDE's emissions projections, it does not put Maryland on a path to achieving the IPCC recommendation of net zero emissions by 2045, nor approaches the 80% reduction goal of the 2016 GGRA.



[8]

Total Net GHG Emissions by Scenario Relative to Policy

Below are commitments made by other states and jurisdictions in comparison to Maryland's 2030 commitment:

Jurisdiction	Energy Goals	Climate Goals	Long-Terms Goals
Maryland GGRA Draft Plan	50% renewable generation by 2030	25% by 2020 40% emissions reduction by 2030	Rejects commitment to 2050 target
Washington (state)	15% renewable by 2020 Coal phased out by 2025 Carbon neutral utilities by 2030[9]	Reduce to 1990 emissions levels by 2020 25% emissions reduction below 1990 levels by 2035[10]	100% carbon-free generation by 2045[11] 50% below 1990 levels by 2050
Minnesota	25% renewable generation by 2025[12]	30% reduction by 2025[13]	Eliminate fossil fuels by 2050 80% reduction in emissions from 2005 by 2050[14]

[8] 2019 GGRA Draft Plan Appendix F, p.50
[9] https://www.climatesolutions.org/sites/default/files/uploads/pdf/legislative_agenda_22feb19.pdf
[10] https://www.seattletimes.com/seattle-news/washington-state-carbon-emissions-spiked-6-percent-in-most-recent-tally/
[11] https://www.greentechmedia.com/articles/read/washington-state-passes-100-clean-energy-by-2045-law
[12] https://www.mprnews.org/story/2007/02/19/renewable
[13] http://mnsolarpathways.org/wp-content/uploads/2018/11/solar-potential-analysis-report-nov15.pdf
[14] https://www.pca.state.mn.us/air/state-and-regional-initiatives

New Mexico	40% by 2025 50% renewable generation by 2030, 80% by 2040 (Co-ops 40% by 2030)[15]	45% emissions reduction below 2005 by 2030[16]	100% carbon-free electricity by 2045[17]
Colorado	30% renewable generation by 2020[18]	26% emissions reduction by 2025[19] 50% reduction by 2030	90% emissions reduction by 2050[20] 100% renewable generation by 2040
California	33% renewable generation by 2020, 44% by 2024, 52% by 2027, 60% by 2030[21]	Reduce to 1990 emissions levels by 2020 40% emission reduction from 1990 levels by 2030[22]	Carbon neutral statewide by 2045[23]
New York	70% renewable generation 2030[24]	40% reduction of GHGs from 1990 levels by 2030[25]	100% reduction in emissions by 2040[26] 100% reduction of electricity sectors greenhouse gas emissions by 2040

2. The 2019 GGRA Draft Plan Makes Improbable Assumptions regarding Electric Vehicle Adoption

In the transportation sector the Draft Plan includes a scenario wherein the electric vehicle fleet encounters "Increased sales after 2025, and aggressive sales after 2030 (530,000 by 2030, 4.5 Million by 2050)."[27] The scenario assumes that Maryland drivers will purchase over 65,000 EVs in 2020 (10 times that of 2018[i]), an average of 50,000 EVs per year from 2026-2030, and an average of 175,000 EVs per year from 2031-2050.

To put this in context, Maryland's total purchase of both fully electric and plug-in hybrid vehicles was approximately 3,250 in 2017 and 6,300 in 2018.[28] According to the Maryland Motor Vehicle Administration, the total new-vehicle sales in the state was approximately 335,000 and total used sales

[15] https://350newmexico.org/increase_renewable_portfolio_standards_bill_2019/
[16] https://www.governor.state.nm.us/wp-content/uploads/2019/01/EO_2019-003.pdf
[17] https://nawindpower.com/new-mexico-enacts-bill-100-carbon-free-power
[18] http://www.ncsl.org/research/energy/renewable-portfolio-standards.aspx
[19] https://www.westword.com/news/colorado-has-some-very-specific-new-climate-energy-goals-11400794
[20] https://www.westword.com/news/colorado-has-some-very-specific-new-climate-energy-goals-11400794
[21] http://www.ncsl.org/research/energy/renewable-portfolio-standards.aspx#ca
[22] https://www.law.berkeley.edu/research/clee/research/climate/climate-policy-dashboard/
[23] http://www.ncsl.org/research/energy/renewable-portfolio-standards.aspx#ca
[24] http://www.ncsl.org/research/energy/renewable-portfolio-standards.aspx#ny
[25] https://www.dec.ny.gov/energy/99223.html
[26] http://www.ncsl.org/research/energy/renewable-portfolio-standards.aspx#ny
[27] Appendix F Documentation of Maryland Pathways Scenario Modeling, p. 12. https://mde.state.md.us/programs/Air/ClimateChange/Documents/2019GGRAPlan/Appendices/Appendix%20F%20-%20Documentation%20of%20Maryland%20PATHWAYS%20Scenario%20Modeling.pdf
[28] https://evadoption.com/ev-market-share/ev-market-share-state/

were around twice that number in 2018. The overall vehicle market has not grown; the state has registered close to one million vehicle sales per year steadily from 2002 through 2018 and appears to be on track to be consistent with that trend in 2019.[29] The 2018 EV sales figure represents approximately 2% of new car sales in 2018, or 0.6% of the overall new and used sales combined.

In this context, the EV-sales assumption used to show big emissions reductions is both a major departure from recent experience and a bold assumption that this plan will transform the state's automobile purchase marketplace in just six years. Achieving a level of 100,000 EVs sold in 2026 would require EV sales to grow by a factor of 17 over 2018 levels. It would also mean that EV sales constitute one of every three to four new vehicle sales statewide – a complete rearrangement of consumer preference -- with equally bold presumptions that manufacturers will be producing vehicles at that rate.

The assumption that EVs will enter the state at 175,000 vehicles per year from 2031 onward only further stretches the optimism behind the modeling. Functionally, this projects that EVs will become the dominant element of the new-vehicle marketplace or that combined new and used EV purchases will represent approximately a quarter of all sales by that point. The Draft Plan Appendix F acknowledges this in Table 2-19, where it describes the scenario as achieving 100% EV and plug-in hybrid sales by 2050.

This strong projection is not unreasonable or unrealistic if it is supported by equally strong policies and measures within the Draft Plan, or by well-supported expectations of exogenous change (such as federal policy or market shifts). However, the Draft Plan refers to the Clean Cars Act of 2017 provisions that:

- Allow $1.2 million in charging equipment rebates per year (at $1,000 per installation, this would support new infrastructure for 1,200 new cars per year, or just over 1% of the 100,000 sales anticipated in 2026 and beyond)
- Reduce the excise tax credit per unit of vehicle battery capacity, while raising the cap on capacity that is eligible
- Expand the money for the tax credit to $3 million per year – enough to cover 1,000 electric vehicles per year (1% of the 100,000 sales anticipated in 2026 and beyond)
- Tighten EV excise tax credit eligibility to purchase prices at or below $60,000, eliminating the incentive for many existing models
- Give HOV access to EVs with only one passenger

It also cites Maryland joining the Transportation and Climate Initiative (TCI), a joint initiative of northeast and mid-Atlantic states working to develop a regional approach to reducing emissions from the sector. This collaborative effort is laudable, as is Maryland's participation, but it is not yet the source of major policy or market influences on the light-duty vehicle marketplace. Despite references to this as a "Cap and Invest" program in the Draft Plan, TCI participation does not yet establish a cap or drive funds toward investment in Maryland. Neither has Maryland made any commitments to such changes as part of its participation in the TCI.

These proposed policy actions, most of which are already in place, do not appear to be designed at the scale necessary to drive what would be a rapid transformation of the light-duty car and truck market

[29] http://www.mva.maryland.gov/about-mva/statistics/car-sales-statistics.htm

over the next 12 years. There is also no assurance yet that the national marketplace or federal policy will be supportive of a scenario where such a volume of vehicles is available to the Maryland marketplace.

Buried in the draft plan's technical appendix is a low-adoption scenario, where the state sees only half the rate of EV sales projected in its standard scenario. Even this "low-adoption" alternative is bold, anticipating the state will sell over 8 times as many EVs in 2026 as it did in 2018, and that it will sell over 100,000 EVs a year from 2031 onward. A prudent projection, given that the entire suite of related policies appears to be limited to a small package of subsidies and incentives as well as membership in a voluntary regional program, would be to see EV sales grow in line with regional or national fleet percentages. A far more robust build-out strategy for related charging infrastructure would be valuable to adding confidence to any sales assumptions above those levels.

3. The 2019 GGRA Draft Plan Anticipates Emissions Reductions from Highway Expansion, Despite Consensus to the Contrary

The 2019 GGRA Draft Plan, in Section 4.3.5 regarding "Transportation Technologies" presents an enhancement proposal named "Managed Lanes (I-270/I-495 Traffic Relief Plan Implementation)." This proposal describes adding express lanes to the two mentioned interstate highway as well as to the Baltimore-Washington Parkway. The Draft Plan document, in Table 4.3-7, assesses this initiative an emissions reduction value of 0.051 million (51,000) tons of greenhouse gases.[30] The Draft Plan also makes a statement, in Figure 4.3-7, to the effect that a vehicle traveling at 20 miles per hour may produce over a third more emissions than the same vehicle traveling at 50 miles per hour, and cites the commonly-used MOVES model available from the US Environmental Protection Agency as its source.

Though capacity expansion projects on highway corridors can achieve some measure of congestion reduction in the short term, the clear and consistent pattern is that expansions result in more travel volume. This effect, referred to as "induced demand," occurs immediately, and grows stronger over the following several years. A review of several cases around the United States found consistent increases in cars on the road just after highway expansion, with increases growing more pronounced in all cases over the following decade. The effect identified was significant: adding 10% more capacity (in terms of total lane-miles) to a highway resulted in between 4% and 10% more travel volume on that highway in every case. I-270 has experienced this before, when the widening of I-270 in the 1990s resulted in a return to full congestion by 1998, rather than by 2010 as projected.[31]

Considering that I-270, I-495 and B-W Parkway corridors carry 620,000 motorists daily (per the draft study's own language), this represents a reasonable expectation that even a small increase in capacity would eventually induce thousands – and possibly tens of thousands – of additional trips in the region. Because that additional demand will re-introduce congestion to the highways in question, the pressure on the state's greenhouse gas emissions profile would be upward, rather than downward.

4. The 2019 GGRA Draft Plan's Successful Achievement of 2030 Targets Depends on a Large Reduction in Travel Demand without Credible Strategies in Support

[30] GGRA Draft Plan Document, https://mde.state.md.us/programs/Air/ClimateChange/Pages/2019-Greenhouse-Gas-Emissions-Reduction-Act-(GGRA)--Draft-Plan.aspx

[31] Handy, S. and Boarnet, M. for California Air Resources Board, "Impact of Highway Capacity and Induced Travel on Passenger Vehicle Use and Greenhouse Gas Emissions."

On-road transportation represents about a third of Maryland's annual emissions, per the 2017 greenhouse gas emissions inventory cited in Chapter 3 of the Draft Plan. This sector is also, per the same source, the component of the state's emissions that has fallen the least since 2006. While the state's overall emissions have fallen a reported 30% in that time, transportation emissions have effectively held steady. Despite a mild set of policy options offered in the 2019 Draft Plan, Appendix F states that a significant assumption regarding the Draft Plan's effectiveness is that light-duty vehicle travel is expected to be reduced by 11% by 2030, accredited to "emerging and innovative strategies for highway management, smart transit, etc." There is little confidence that the policy approaches presented would result in such a major drop in vehicle travel.

Table 4.3, starting on page 66 of Appendix F, clarifies a series of significant assumptions that underly this projection:

1. Ride-hailing service is credited with reducing travel volumes by nearly a billion miles traveled in 2030, the equivalent of removing the equivalent of 10,000 cars from the road that year, despite many studies showing these services actually add to, not reduce, total on-road travel demand.[1]
2. Better bicycle and pedestrian infrastructure is projected to avoid 293 million miles traveled that year, equivalent to taking 29,000 vehicles off the road. Improving non-motorized travel options is generally considered a wise and cost-effective approach to managing travel demand, and the Draft Plan refers to a number of existing programs that should continue. However, the analysis gives no basis for the large impact assumed, only mentioning a potential study to determine a basis for calculating reductions in car VMT. This language suggests that no VMT reduction has been calculated, and that no methodology to do so has even been established. Yet, a large numeric projection is used in the analysis.
3. Expanded [Travel Demand Management] strategies (dynamic), telecommute, non-work strategies are projected to reduce travel volume by over 1.1 billion miles traveled, or the travel volume of over 100,000 vehicles in 2030. TDM strategies are very valid approaches to VMT reduction, but in this document, they are described only conceptually, without any listed strategy as to design, level of effort, location, or implementation. Assuming major reductions from them is a hopeful statement rather than a valid basis upon which to project that an actual plan will achieve actual reductions.
4. "Fiscally unconstrained" transit expansion is credited with an expected reduction of 250 million miles driven in 2030, equivalent to removing 25,000 vehicles from the road in 2030. This is concerning because Table 4.6 of Appendix F describes these projects explicitly as "Post-2030", indicating they likely would not impact travel volumes in 2030 or before as the analysis expects. Further, the projects in contemplation – expansion of rail transit and development of a new Bus Rapid Transit network – could easily take a decade to implement and are currently only mentioned in state and county long-range transportation plans. These plans offer no assurance of timing or completion of any of these projects.
5. The plan relies on avoiding 200 million vehicle miles traveled through the completion of the Maryland Area Regional Commuter (MARC) Cornerstone Plan by 2030. This plan, however, is not slated for completion until 2045.[132] Given that many elements of the plan that would increase ridership and reduce VMT involve major planning and capital investment (such as building a new West Baltimore Station, replacing the railcar fleet, eliminating at-grade pedestrian crossings, and major redevelopment projects in collaboration with Amtrak around existing stations), MARC's current plan calls for most of these to occur between 2025 and 2045.

[32] https://evadoption.com/ev-market-share/ev-market-share-state/

Expecting a 25-year plan to be implemented in 10 years is unrealistic, and not a sound basis for projecting emissions reductions.

6. Transit expansion projects in general involve a trade-off, as the 2019 GGRA draft plan itself recognizes. Providing more service is energy-intensive, and (unless the vehicle is running on energy derived from a zero-carbon source) offsets to some extent the emissions reductions achieved. There is no indication that the VMT reduction assumption made in the underlying analysis takes this net effect into account.

In total, over 3 billion miles traveled are projected to be avoided by all listed measures. Of that figure, at least a third must be questioned based on estimates from ride-hailing alone.

The same table presents a significant assumption that autonomous and connected vehicle technologies are projected to achieve the equivalent fuel savings (72 million gallons in 2030 alone) of taking around 140,000 cars off the road that year. Truck fuel efficiency savings of over 5 million gallons that year is also expected. This represents a projection of nearly a million tons of GHGs avoided from a technology that is not yet developed, let alone in implementation at any scale, anywhere in the world.

5. The 2019 GGRA Draft Plan Reduces Deployment Goals for Renewable Resources and is Dependent upon Unproven Technologies to Meet Emissions Goals

A major initiative highlighted in the Draft Plan is the implementation of a Clean and Renewable Energy Standard (CARES), which is stated to build off the existing Renewable Portfolio Standard (RPS). This initiative would mandate 50% clean electricity by 2030 and 100% clean electricity in Maryland by 2040, replacing the existing RPS mandate of 50% renewable generation by 2030 with a goal of reaching 100% renewable generation by 2040. The definition of "clean electricity" in GGRA includes Combined Heat and Power (CHP), nuclear and natural gas generation with carbon capture and storage (CCS) technology.

The replacement of RPS with Clean Energy Standards (CES) has been of debate at the state level for some time. The benefit of CES is the inclusion of emissions-reduction technologies,[33] creating a larger base of systems that can be implemented under the standard and is therefore seen as more market driven. However, the ultimate goal of any emissions reduction regime is to meet the target of an 80% reduction in domestic emissions by 2050, in accordance with the goals of the UNFCCC. The Draft Plan states that modeling forecasts a 56.14% reduction in GHG emissions by 2030 and a 67.17% reduction by 2050, falling well short of the 80% reduction target.

Further, the 2019 GGRA far overestimates GHG reductions, as emissions models compare 2006 gross emissions with 2017 net emissions, highlighting a major inconsistency. The approximate reduction is approximately 45% by 2030 and 62% by 2050. In addition, the baseline criteria for GGRA is a 40% reduction from 2006 emissions levels. Widely accepted target reductions are typically based upon 2001 or 1990 emissions criteria, both of which typically create a far lower baseline for comparison. The model data provided in the 2019 GGRA appendices to not provide data back to 2001 in order to determine this baseline.

Coal generation is said to be phased out under the 2019 GGRA, with the proposed Clean and Renewable Energy Standard (CARES) mandating 100% "clean" generation by 2040. However, under the proposed

[33] https://www.thirdway.org/report/clean-energy-standards-how-more-states-can-become-climate-leaders

plan a minimum of 8% of all electricity consumed in Maryland would still be derived from coal in 2040, and generation from coal and oil could continue to operate at 2030 levels through 2040. The methodology to achieve the 2040 "clean energy" goal is to purchase Renewable Energy Credits (RECs) from other states that matches coal consumption on a MWh basis. However, as renewable energy mandates become more prevalent in the PJM interconnection[34] (13 states in which Maryland buys and sells power), the ability to purchase renewable energy from other states becomes less probable. 12 member states already have renewable energy mandates of 18% or more, and PJM operators expect 38MW of additional renewable generation to come online by 2028 just to meet those targets[35]. Maryland currently imports 2/3 of the electricity that it consumes,[36] and therefore positions itself to be entirely dependent upon energy projects from other states to meet its emissions targets.

The 2019 GGRA plan states that it is dependent upon the Regional Greenhouse Gas Initiative (RGGI) in PJM to improve the emissions factor from its energy imports. This again puts Maryland in the position to be mostly dependent upon the actions of other states and generators in order to meet its emission criteria. Further, current modeling shows that fossil generation is expected to continue to provide half of all generation in the RGGI/PJM territory through 2030.[37]

6. The 2017 Greenhouse Gas Inventory, used as the Draft Plan Starting Point, is Dramatically Below 2014 Levels Without Solid Support or Explanation. Both 2014 and 2017 Inventories Possess Calculation Inconsistencies Supporting Electricity Generation Figures.

The GGRA Draft Plan uses the MDE 2017 Greenhouse Gas Inventory as its starting point to develop policy impacts. This inventory estimates that Maryland emitted a net 66.8 million tons (78.5 million emitted and 11.7 million absorbed). By contrast, only three years earlier, the 2014 inventory counted a net 81.8 million tons (93.4 million and 11.7 million absorbed). The resulting net emissions change – about a 16% drop, all coming from reduced or cleaner energy use – is dramatic.

Even more dramatic is the in-state electricity sector's emissions reduction. Maryland achieves an apparently revolutionary change in carbon intensity from the electricity produced in the state. While Maryland bought 10% less electricity from its own powerplants in 2017 (37.8 million GWh[38] down to 34.1 million GWh[39]), total emissions from that generation fall by over 40% (nearly 20 million tons down to below 12 million). This a full 1/3 reduction in carbon intensity from in-state electricity in just 3 years.

A shift of this magnitude is a major result on its own. The state has, according to these two analyses, transformed its carbon intensity and gone past its legislated 2020 target. Surprisingly, this result is presented with no significant comment, either in the Draft Plan or in the detailed appendix (Appendix D to the Draft Plan) describing the 2017 inventory. Notably, the 2014 and 2017 figures are never

[34] https://blog.arcadiapower.com/maryland-renewable-energy/
[35] https://www.transmissionhub.com/articles/2014/03/generation-deactivation-slow-growth-of-electricity-load-highlighted-in-pjms-2013-rtep-report.html
[36] https://www.eia.gov/state/analysis.php?sid=MD
[37] https://mde.maryland.gov/programs/Air/ClimateChange/Documents/2019GGRAPlan/Appendices/Appendix%20F%20-%20Documentation%20of%20Maryland%20PATHWAYS%20Scenario%20Modeling.pdf
[38] Maryland Department of the Environment, "Maryland 2014 Periodic GHG Emissions Inventory," footnote 1, p. 10. Available at https://mde.maryland.gov/programs/Air/ClimateChange/Pages/GreenhouseGasInventory.aspx
[39] Maryland Department of the Environment, "2017 Greenhouse Gas Inventory Documentation," footnote 1, p. 11. Available at https://mde.maryland.gov/programs/Air/ClimateChange/Pages/GreenhouseGasInventory.aspx

presented side-by-side in the Draft Plan. No mention is made of these implications in the 2017 documentation. This raises a question regarding whether any checks for consistency were carried out.

Based on this dramatic reduction in business-as-usual emissions, the Draft Plan asserts two key statements:

1. Maryland has already exceeded its 2020 goal of 25% emissions reductions below 2006 levels. That goal is approximately 71.5 million tons of net emissions – far below the 2014 inventory but more than achieved by 2017's far-lower numbers.
2. The policies and actions articulated in the plan will lower the state's emissions from the 2017 level to below the 2030 target.

A review of the detailed description of emissions sources for 2014[40] and 2017[41], however, raises questions that should be answered before the 2017 inventory can be treated as a reliable basis for this planning. The following concerns arise:

The shift from coal to natural gas from 2014 to 2017 reduces emissions more than studies indicate is likely. Coal-fired electricity emissions in Maryland are shown to have fallen nearly 10 million tons (from 18.4 down to 8.75) while natural gas emissions rise only 2.6 million tons (from 1.1 million to only 3.7 million) to help fill the energy gap. No other source rises – the petroleum and imported-energy emissions are both shown falling as well. Studies indicate that natural gas replacing coal could cut emissions by 40%[42] to 50%[43], but this change represents a 4:1 tradeoff – well outside the likely reduction due to fuel switching. Even if all of Maryland's 10% demand reduction is attributed to coal, the tradeoff remains over 3:1. Further, reductions from natural gas replacing coal are highly questionable due to methane leakage, which some studies[44] find to entirely eliminate the emissions-reduction benefit.

Further examination of the Maryland Greenhouse Gas Inventory calculations identifies that reported natural gas *usage* grew at a rate over 4 times faster than reported natural gas *emissions*:

Year	**Natural Gas Usage (Inventory Calculations)[45]**	**Natural Gas Emissions (CO2e from Draft Plan)**
2014	4.83 billion cubic feet	1.12 million tons
2017	34.55 billion cubic feet	2.75 million tons
Difference	29.72 billion (*615% increase*)	1.63 million (*146% increase*)

[40] 2019 GGRA Draft Plan, Table 2.4-1, p. 20.
[41] Maryland Department of Environment, "GGRA 2019 Draft Plan Appendix D – 2017 Greenhouse Gas Emission Inventory Documentation," Table ES-1, p. 4. Available at https://mde.state.md.us/programs/Air/ClimateChange/Documents/2019GGRAPlan/Appendices/Appendix%20D%20-%202017%20Greenhouse%20Gas%20Emission%20Inventory%20Documentation.pdf
[42] Bizjournals.com, "Natural gas power plants emit 40% less CO2 than coal plants, says study," 1/10/2014. https://www.bizjournals.com/denver/blog/earth_to_power/2014/01/natural-gas-power-plants-produce-40.html
[43] Environment and Energy Leader, "Report: Combined-Cycle Plants Release Far Less CO2 Than Coal," Jan. 2014. https://www.environmentalleader.com/2014/01/report-combined-cycle-plants-release-far-less-co2-than-coal/
[44] Scientific American, "Leaky Methane Makes Natural Gas Bad for Global Warming," 6/26/14. https://www.scientificamerican.com/article/leaky-methane-makes-natural-gas-bad-for-global-warming/
[45] Maryland Department of the Environment, "Greenhouse Gas Inventory" spreadsheet resources for 2014 and 2017 inventory calculations. Available at https://mde.maryland.gov/programs/Air/ClimateChange/Pages/GreenhouseGasInventory.aspx

Further confusing the picture, a double-check of the calculations of the ratios between fuels and reported emissions in those workbooks indicate calculation inconsistencies throughout both the 2014 and 2017 quantifications of emissions by fuel type. The math supporting 2014 and 2017 inventories (at least regarding generation of electricity within the state of Maryland) should be re-checked, and corrected if needed, to resolve this uncertainty and improve the reliability of the starting point used in the Draft Plan.

7. Fracked-Gas Leakage Emissions Do Not Appear to be Included in the Inventories or Future Scenarios

MDE undertook an analysis to assess the greenhouse gas emissions from fracked natural gas, estimating that if Maryland consumed 67% of its natural gas from fracked sources (national average)[46], the associated emissions from leakage of methane would be the equivalent of 1.9 million tons of carbon dioxide equivalent (CO_2e) emissions. The calculations describing Maryland's natural gas emissions[47] in 2017, however, do not reflect this additional element.

The 2019 GGRA Draft Report on page 33 refers to these emissions only as emissions the state would have to "potentially offset." However, these emissions are entirely within the standard definition of fuel-cycle emissions (often referred to as "well-to-wheel" or "well-to-plant" emissions), and should be included in the inventory, rather than as a footnote regarding potential offsets.

The 2017 inventory should contain either this figure (sourced from 2016 data) as a placeholder, or calculate a 2017 figure consistent with it, and should incorporate that amount as part of the natural-gas emissions estimate.

Conclusion

In summary, this review finds that the Draft Plan is unlikely to meet state mandated emissions reductions targets in 2030 or long term decarbonization pathways needs through 2040 and 2050. It needs improvements in its transparency (clarity and detail), openness and stakeholder inclusion, level of ambition for the short and long term, viability of analysis assumptions, and inclusion of all measures and strategies needed to meet goals. These limitations are particularly evident for the transportation and energy sectors, which represent 80 percent of all Maryland emissions. The Draft Plan also does not appear to have exercised the necessary steps to mitigate potential macroeconomic impacts or craft optimized designs of policies and programs needed to stimulate economic growth and employment. At this stage the Draft Plan provides a relatively low level of confidence that proposed actions would meet Maryland's 2030 goal and excludes pathways for 2050 climate stabilization scenarios.

[46] Maryland Department of the Environment, "Natural Gas Life-Cycle Greenhouse Gas Emissions Inventory Attributable to Fracked Gas in 2017", page.5, "https://mde.maryland.gov/programs/Air/ClimateChange/Documents/2017%20GHG%20Inventory/MethaneGHGReport.pdf"

[47] Maryland Department of the Environment, "2017 Greenhouse Gas Inventory Documentation," footnote 1, p. 11. Available at https://mde.maryland.gov/programs/Air/ClimateChange/Pages/GreenhouseGasInventory.aspx

About The Center for Climate Strategies

The Center for Climate Strategies (CCS) helps government and stakeholders work together to develop policy and program actions that achieve goals for climate stabilization and resilience, economic development and private investment, energy and resource security, health and environmental quality, and socioeconomic equity. CCS is an independent, expert 501c3 nonprofit organization located in Washington, DC with global partners.

CCS recognizes the integrative nature of climate change and the need for collaborative, self-determined, solutions that are visionary and pragmatic. Through projects with public and private institutions, we build and deploy capacity to design, evaluate, and implement new strategies in all sectors. Our team is highly trained, multi-disciplinary, and multilingual, and has conducted over 100 high impact projects in the US, Latin America, Asia, Europe, Africa, and the Middle East.

CCS Support for Maryland Climate Change Activities

Since 2007, CCS has provided a variety of technical and facilitative support to the state of Maryland and its stakeholders for the development and implementation of climate mitigation and adaptation action plans, including in-depth analyses of baselines and multi objective response options. These include:

- In 2007-2008 CCS developed the "Final Maryland Greenhouse Gas Inventory and Reference Case" published in June 2007.[48]
- In 2007, CCS provided facilitation and technical for development of the "Climate Action Plan Interim Report to the Governor and General Assembly, January 14, 2008" through the Maryland Commission on Climate Change.[49]
- In 2007-2008, CCS provided technical support to the Maryland Department of Natural Resources and the Maryland Climate Commission for development of the Maryland Climate Action Plan provisions on climate change adaptation, published in August 2008.[50]
- On November 6, 2009, CCS released the "Southern Regional Economic Assessment of Climate Policy Options and Review of Economic Studies of Climate Policy" for the Southern Governor's Climate Initiative, including review of the regional scale up potential for Maryland climate mitigation actions.[51]
- On December 14, 2011 CCS helped the Maryland Department of the Environment launch the Transportation and Land Use Strategies Work Group to identify new actions to spur economic growth, save energy, and integrate Chesapeake Bay protection efforts with energy and transportation programs.[52]
- CCS provided technical support to enable Maryland's transportation and clean energy programs to meet targets of the Maryland Greenhouse Gas Reduction Act (GGRA) through its "Special Report: Enhancements to The Empower Maryland And Maryland Renewable Portfolio Standard Clean Energy Programs" published July 24, 2013.[53]

[48] http://www.climatestrategies.us/library/library/view/942
[49] https://msa.maryland.gov/megafile/msa/speccol/sc5300/sc5339/000113/005000/005152/unrestricted/20080043e.pdf (pages 59 – 63), and www.climatestrategies.us/library/library/download/943
[50] www.climatestrategies.us/library/library/download/943
[51] www.climatestrategies.us/library/library/download/902
[52] http://www.climatestrategies.us/articles/articles/view/48
[53] http://www.climatestrategies.us/library/library/view/1048

- CCS mobilized over $1 million in philanthropic funds to support its in-kind assistance for these Maryland climate change efforts.