Memorandum:
Policy Considerations for the Maryland Climate Change Commission

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This memorandum identifies policy issues that may be of interest to the Maryland Climate Change Commission as it drafts its November 2015 report on the status of Maryland's climate change efforts and recommendations for legislative action,[1] and as its considers topics for its 2016 agenda. This memorandum focuses on issues relating to the evaluation of Maryland's progress towards its 2020 goal with regard to fuel switching in the power sector, projected changes in vehicle miles traveled, and future growth of electric vehicles. It also provides context regarding other states that have set emission reduction goals for years between 2025 and 2035, and identifies potential additional emission reduction policies that could achieve reductions in future years.

The Georgetown Climate Center (GCC) is a non-partisan law and policy research center based at Georgetown University Law Center that serves as a resource to states to advance climate policy.[2] GCC has provided prior support to Maryland state agencies in a number of capacities, including:

- Serving as the facilitator of the Transportation and Climate Initiative, a collaboration of the transportation, energy, and environment agencies of 11 northeast states and the District of Columbia—including Maryland—that seeks to develop the clean energy economy and reduce greenhouse gas emissions (GHG) in the transportation sector.[3]
- Facilitating ongoing dialogues of states—including Maryland—and other stakeholders to further understanding and analysis of state compliance options under the federal Clean Power Plan, which sets carbon pollution emission guidelines for existing power plants.[4]
- Working with Maryland state agencies and jurisdictions to inform development of policies that strengthen resilience and help prepare communities for the impacts of climate change.

The Climate Center is also funded by the Town Creek Foundation to serve as a resource to the Maryland Climate Change Commission.[5]

This memorandum was shared as a draft to inform and receive input from ongoing discussions; there are no substantive changes in the final version.

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[1] Md. HB 514 §2-1304.

[2] Georgetown Climate Center, www.georgetownclimate.org.

[3] Transportation and Climate Initiative, http://www.transportationandclimate.org/.

[4] *See* Georgetown Climate Center, Working with Stakeholders to Inform Federal Standards to Reduce Carbon Pollution, http://www.georgetownclimate.org/node/5683.

[5] *See* Briefing letter from Stuart Clarke to Members of the Steering Committee of the Maryland Climate Change Commission, April 22, 2015, http://www.mde.state.md.us/programs/Marylander/Documents/Attachment_2_Outside_Resource_Memo_for_4.23_MCCC_Steering_Committee_Meeting.pdf.

Contents

I. Evaluation of progress on 2020 emissions reduction goal

The following sections identify issues that the Commission may want to consider as it evaluates Maryland's progress toward the goal of a 25 percent reduction in GHG emissions by 2020 established by the Maryland Greenhouse Gas Reduction Act of 2009.[6]

A. Fuel switching in the power sector

Greenhouse gas (GHG) emission reductions in the power sector are occurring in significant part because of shifts from higher-carbon-intensity coal-fired generation to lower-carbon-intensity natural gas-fired generation, both in the state of Maryland and in the PJM power grid that supplies electricity imported into Maryland.[7] While this trend is projected to continue for a variety of reasons, the level of future fuel shifting is difficult to project, given the inherent uncertainty of many key factors such as fuel price and implementation of federal environmental regulations in other states. The Maryland Climate Change Commission may want to note and quantify the potential impact of these uncertainties on future GHG emissions, and consider policy options that could help maintain the trend toward cleaner generation in the future.

1. Background: fuel switching uncertainties and implications

Shifts from use of coal-fired electricity generation sources to less carbon-intensive natural gas-fired generation are responsible for a significant amount of current and projected emission reductions in Maryland. These shifts have taken place both within the state and in the broader PJM grid that generates electricity imported into Maryland.

For example, in its analysis related to the Maryland Greenhouse Gas Reduction Act, the Maryland Energy Administration (MEA) projects that the retirement of coal units in the state will provide 2.2 million metric tons (MMT) of CO_2 emission reductions by 2020 compared to business as usual. The completion of new, less-carbon intensive combined cycle natural gas power plants will provide 4 MMT of additional CO_2 reduction; and improvement in carbon-intensity in the PJM electricity grid—reflecting in large part a reduction in coal-fired generation—will result in 6.7 MMT in additional CO_2 reduction.[8]

These projections reflect a trend within the state of Maryland and in the broader PJM electricity grid of reduced generation from coal-fired power plants and an increase in generation from less carbon-intensive combined cycle natural gas-fired power plants. This trend is driven by multiple factors, including the fact that most coal-fired power plants are older[9] and therefore more likely candidates for retirement; that recent federal Mercury and Air Toxics Standards (MATS) require higher levels of pollution control that may change the economics of operating older coal units; and that the price of natural gas has declined significantly in the past decade compared to coal.[10] Anticipation of the EPA's

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[6] Md. Code Ann. Envir. § 2-1204 (LexisNexis 2015).

[7] Emissions attributed to electricity imported into Maryland are accounted for in Maryland's 2013 Greenhouse Gas Reduction Act Plan. Maryland Greenhouse Gas Reduction Act Plan 65 (2013), http://climatechange.maryland.gov/publications/greenhouse-gas-emissions-reduction-act-plan/.

[8] MEA Draft Emission Projections v2 Spreadsheet model. *See also* June 9, 2015 Memorandum on Draft 2020 Electricity and Emissions Projection Methodology from Kevin Lucas to Stuart Clarke, Michael Jones, Tad Aburn.

[9] As of 2010, seventy-three percent of coal-fired electric generators operating in the United States were at least thirty years old. U.S. Energy Information Administration, Most coal-fired electric capacity was built before 1980 (June 2011) http://www.eia.gov/todayinenergy/detail.cfm?id=1990#

[10] The EIA projects that 40 gigawatts of coal-fired generation capacity will retire between 2013 and 2040, citing the cost of compliance with environmental regulations and competition from natural gas-fired generation. U.S. Energy Information Administration, Annual Energy Outlook 2015 26 (2015).

carbon pollution standards, which were finalized this summer and will go into effect in 2020,[11] will also likely be a factor in firm decisions to close older, inefficient power plants.

The U.S. Energy Information Administration projected that compliance with MATS and competition from low-cost natural gas generation and increased renewable generation would lead to the retirement or conversion of 35 GW of coal-fired capacity across the country in 2014-2016.[12]

Within the state of Maryland, an important additional factor is the requirement that generating units hold carbon allowances to cover their CO_2 emissions under the Regional Greenhouse Gas Initiative (RGGI) program. This requirement promotes the use of less carbon-intensive generation sources, as they require fewer allowances for each megawatt hour of electricity generated.

In its draft updated analysis of projected power sector emissions, the MEA takes into account planned closings of coal units and new builds of combined cycle natural gas units that have been recorded with the PJM regional transmission organization by their operators.[13] MEA also takes into account projections for carbon intensity improvements in the PJM electricity grid in future years that EPA modeled as part of its Clean Power Plan analysis.[14] The updated analyses show an increased level of overall reductions resulting from fuel-switching in the PJM region and in Maryland than was projected under the 2013 Maryland Greenhouse Gas Reduction Act plan.[15] This increased level of reductions is generally consistent with EIA projections of nation-wide changes in the electricity sector reflecting the economic and regulatory developments noted above.

At the same time, projections of future shifts in generation have a degree of inherent uncertainty, given that a number of the factors driving these shifts are themselves uncertain and difficult to predict. These include:

- Fuel prices, especially the comparative costs of coal and natural gas;
- General economic activity and impacts on electricity demand (i.e., reduction in demand may reduce fossil fuel-fired generation); and
- The outcome of legal challenges to federal environmental regulations, including challenges the EPA's Clean Power Plan.

Higher natural gas prices, increased energy use due to increased economic activity, or legal decisions adverse to environmental regulations could all result in higher-than-projected emissions from the electricity sector in Maryland or in the PJM region where Maryland's imported electricity is generated.

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[11] Environmental Protection Agency, Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units, EPA-HQ-OAR-2013-0602 (Aug. 3, 2015), http://www2.epa.gov/cleanpowerplan/clean-power-plan-existing-power-plants#CPP-final.

[12] U.S. Energy Information Administration, Annual Energy Outlook 2015 at 22-23 (2015).

[13] June 9, 2015 Memorandum on Draft 2020 Electricity and Emissions Projection Methodology from Kevin Lucas to Stuart Clarke, Michael Jones, Tad Aburn at 2.

[14] Id. at 1. We assume that MEA is referring to projections in a reference case that does not reflect any pre-2021 carbon-intensity changes driven by the beginning of Clean Power Plan compliance in 2020, though it would be useful to have this point confirmed.

[15] Maryland Greenhouse Gas Reduction Act Plan 65 (2013), http://climatechange.maryland.gov/publications/greenhouse-gas-emissions-reduction-act-plan/.

2. Considerations for the Commission related to fuel switching

Given that future GHG reductions from the power sector will depend in part on these uncertainties, the Commission may want to consider the following:

- **Note and quantify uncertainties with a range of sensitivities.** It may be valuable to understand how a range of reasonable fuel-switching scenarios could change future GHG emissions in Maryland, as well as emissions associated with imported electricity from the PJM electricity grid. This could include quantifying the higher level of emissions that would result if projected fuel switching does not occur. The Commission could consider including in its report a range of potential emissions outcomes reflecting these uncertainties, both as they relate to 2020 and beyond.

  For example, the Commission could note projected emissions if coal-fired power plants that are slated to close do not close, or if projected new combined-cycle natural gas units that are projected to come online do not come online.[16] The Commission could also note impacts on projected emissions should the carbon-intensity of the PJM grid be higher or lower than projected in the EPA analysis.

- **Explore policies to help ensure trends toward cleaner generation continue in the future.** These could include:

  - **Increasing Maryland's Renewable Portfolio Standard.** Strengthening Maryland's Renewable Portfolio Standard (RPS) would support the trend of shifting away from high-carbon intensity fossil-fuel generation by creating more demand for renewable energy. Acting in concert with renewable policies of other states that also drive increases in renewable generating capacity across the country,[17] increasing Maryland's RPS would help "lock in" the availability of cost-effective zero-carbon electricity in future years that would displace electricity from more carbon-intensive generation sources. In addition, because Maryland's electricity consumption is decreasing—reflecting in large part energy efficiency investments made under Empower Maryland[18]—increasing Maryland's RPS to require that a higher percentage of overall electricity generation come from renewable resources may prevent a decline in total renewable energy generation compared to projections under the current RPS.

    An important issue related to any potential consideration of strengthening the RPS is the methodology used to account for the emission reductions attributed to the RPS. Under Maryland's RPS, as with most state RPSs, electricity providers can comply with the renewable energy mandate by submitting renewable electricity credits (RECs) acquired from renewable energy generators in other states. The RPS therefore requires increased use of renewable electricity, but that electricity does not have to be

[16] The Maryland Energy Administration has already conducted some of this analysis. *See* MEA Draft Emission Projections v2 Spreadsheet model. *See also* June 9, 2015 Memorandum on Draft 2020 Electricity and Emissions Projection Methodology from Kevin Lucas to Stuart Clarke, Michael Jones, Tad Aburn.

[17] 29 states, the District of Columbia, and three U.S. territories have Renewable Portfolio Standards. Depart of Energy, DSIRE Database, Detailed Map of Renewable Portfolio Standards, http://ncsolarcen-prod.s3.amazonaws.com/wp-content/uploads/2014/11/Renewable-Portfolio-Standards.pdf.

[18] *See* MEA Draft Emission Projections v2 Spreadsheet model. *See also* June 9, 2015 Memorandum on Draft 2020 Electricity and Emissions Projection Methodology from Kevin Lucas to Stuart Clarke, Michael Jones, Tad Aburn.

generated within the state. As MEA noted during its presentation to the Commission's Mitigation Working Group, the current methodology used to quantify the emission benefits of the RPS limits the emission reduction benefit associated with the use of out-of-state RECs to the amount of electricity that is being imported by Maryland.[19] If Maryland's electricity imports continue to decline, and if Maryland were to increase its RPS, the current methodology would likely not capture the full emission benefit of this increase because out-of-state RECs would exceed imported electricity. Arguably, the constraint in the current methodology does not fully reflect the interstate nature of the electricity system and RPS policies. RPS policies allow renewable electricity to be generated wherever it is most cost-effective. Emission reductions associated with this generation will occur wherever fossil fuel-fired power plants reduce generation because renewable electricity generation driven by the state RPS is generated instead, and these benefits will occur whether or not the state is importing energy. MEA has suggested for consideration alternate methodologies that would not tie out out-of-state RECs to imported electricity.[20] Using a methodology that does not limit accounting for benefits of out-of-state RECs—such as either the "all RECs" or "new RECs" alternatives presented by MEA—could help to fully account for the RPS's contribution to the shift away from high-carbon generating sources in the future.

- **Working with other states in the region to support complementary compliance approaches to federal carbon pollution standards that reduce the carbon intensity of power generation in the PJM region**. Under the federal Clean Power Plan, states are required to submit compliance plans to meet minimum carbon pollution limits on existing power plants no later than September 2018.[21] The experience of RGGI, as well as modeling conducted by the PJM regional transmission organization and others, indicates that there may be significant economic and cost-effectiveness benefits to states implementing carbon pollution reduction approaches that function well together.[22] Under the Clean Power Plan, states have the flexibility to adopt mass-based or rate-based approaches, and modeling and analysis by a variety of organizations and experts have indicated that there are likely benefits to states in a power grid generally adopting the same type of approach. In contrast, a patchwork of dissimilar plans in a power grid could lead to market dynamics that create competiveness imbalances and potentially lead to higher overall emissions.[23] Maryland's suite of existing policies, including its participation in RGGI, provides a well-functioning starting point for the

[19] MEA, May 21, 2015 Presentation to Maryland Climate Change Commission Mitigation Working Group, http://www.mde.state.md.us/programs/Marylander/Documents/MWGHandout3MEA05212015.pdf.

[20] June 9, 2015 Memorandum on Draft 2020 Electricity and Emissions Projection Methodology from Kevin Lucas to Stuart Clarke, Michael Jones, Tad Aburn at 4-7.

[21] Environmental Protection Agency, Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units, EPA-HQ-OAR-2013-0602 (Aug. 3, 2015), http://www2.epa.gov/cleanpowerplan/clean-power-plan-existing-power-plants#CPP-final.

[22] PJM Interconnection Economic Analysis of the EPA Clean Power Plan Proposal (2015), https://www.pjm.com/~/media/documents/reports/20150302-pjm-interconnection-economic-analysis-of-the-epa-clean-power-plan-proposal.ashx.

[23] See, e.g., Dallas Burtraw et al., A Proximate Mirror: Greenhouse Gas Rules and Strategic Behavior under the US Clean Air Act (2015), http://www.rff.org/research/publications/proximate-mirror-greenhouse-gas-rules-and-strategic-behavior-under-us-clean.

state's compliance with federal standards. Engaging with other states in the PJM region to consider how different region-wide compliance scenarios would affect overall emissions in the electricity grid may be a valuable step to ensuring that emission reductions from Maryland's programs are not undermined because of incompatible regulatory mechanisms across states.

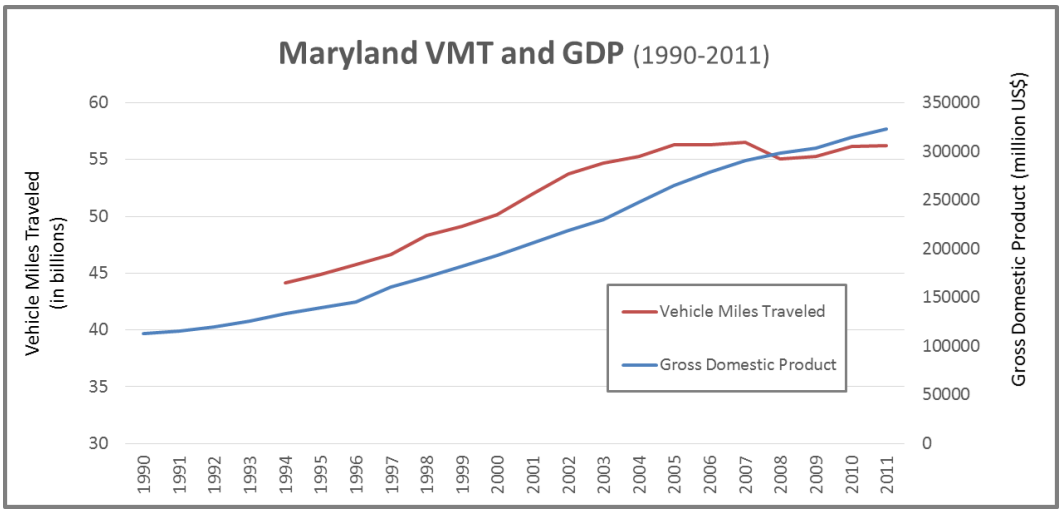
B. Vehicle Miles Traveled

In the transportation sector, significant GHG reductions are projected from decreases in the growth of vehicle miles traveled (VMT). Reducing VMT is considered a critical and necessary strategy for reducing emissions from the transportation sector (together with cleaner vehicles and cleaner fuels, the other "legs of the stool"). Many of the factors associated with current trends of reduced VMT growth, however, reflect changes in economic activity, demographics, and behavioral practices that are difficult to project into the future. Therefore the Commission may want to consider noting and quantifying the potential impacts of different VMT growth scenarios on future GHG emissions, and may want to consider enhanced policies that would help maintain reduced levels of VMT growth in the future.

1. Background: Vehicle Miles Traveled uncertainties and implications

Similar to fuel shifts in the power sector, reduction in growth of vehicle miles traveled is an important component of Maryland's projected GHG reductions from the transportation sector.

Historically, VMT generally grew at a steady pace, and was closely correlated with increases in economic activity (i.e., GDP). In Maryland and throughout the United States, VMT declined or remained stagnant during 2007-2011, at the same time that the U.S. was experiencing the "Great Recession" during 2007-2009.[24]



Sources: U.S. FHWA, U.S. BEA

[24] Vehicle Miles Traveled in the United States declined in 2009 and 2010 (the first annual decrease since 1980). U.S. Department of Energy, Alternative Fuels Data Center, Annual Vehicle Miles Traveled in the U.S.

While some of this decline was no doubt due to reduced economic activity, a number of other indicators point to changes in traveler behavior that are likely contributing to longer-term changes in VMT. These include important demographic changes such as the fact that more people are moving to cities or other areas of compact development where driving is not a necessity, and that driving appears to be a lesser priority for teenagers compared to prior years (fewer are getting licenses at age 16). The U.S. Federal Highway Administration acknowledged such factors in a 2014 forecast that lowered the thirty-year VMT growth projection for the United States, including in baseline scenarios with sustained economic and population growth rates.[25]

While these behavioral and demographic trends are well documented,[26] they are recent; the full extent of these trends, as well as their long-term impact on VMT growth, is difficult to project. The recovering national economy and low gasoline prices may lead to increased rates of VMT growth in the short term. Recently FHWA reported a 3.5 percent increase in VMT for the first six months of 2015 compared to the previous year.[27]

The uncertainty of VMT projections also is reflected in the work the Georgetown Climate Center has done with states through the Transportation and Climate Initiative (TCI). In the course of analysis conducted for TCI, GCC received future VMT projections from 11 states in the northeast and mid-Atlantic, and the percentages assumed for VMT growth varied widely (from approximately 0.4 to 2.2 percent annually). This variation was significantly greater than variation in population growth projections.[28]

States can affect VMT through policy changes and infrastructure investments that promote alternatives to single-occupancy vehicle travel, compact development, and alternative transportation modes. For example, a 2011 analysis by the Maryland Department of Transportation projected that Maryland could decrease its average, annualized 2006 to 2020 VMT growth rate 23 percent below the business-as-usual scenario by incorporating the state's planned transportation investments.[29]

2. Considerations for the Commission related to VMT

Given that future VMT growth will depend on behavioral and demographic trends and changes in the economy that are hard to predict, the Commission may want to consider the following:

- **Note and quantify uncertainties by including a range of emission outcomes that may happen under different VMT growth scenarios**. For example, MDOT suggested in its June 19 presentation to the Commission's Mitigation Working Group that two potential bounds for

[25] U.S. Federal Highway Administration, FHWA Forecasts of Vehicle Miles Traveled (VMT): May 2014 at 5 (2014).

[26] See, e.g., U.S. Public Interest Research Group, Millennials in Motion: Changing Travel Habits of Young Americans and the Implications for Public Policy (2014); Sivak, M. and Schoettle, B., Recent changes in the age composition of U.S. drivers: Implications for the extent, safety, and environmental consequences of personal transportation, Report No. UMTRI-2011-23 (2011).

[27] U.S. Federal Highway Administration, Office of Highway Policy Information, June 2015 Traffic Volume Trends (2015), https://www.fhwa.dot.gov/policyinformation/travel_monitoring/15juntvt/.

[28] Georgetown Climate Center and Cambridge Systematics, Options for Reducing Transportation Emissions in the Northeast and Mid-Atlantic: Appendix Emission Inventory & Forecast (forthcoming).

[29] In the Maryland Climate Action Plan: Maryland Department of Transportation 2012 Implementation Plan, MDOT projected that Maryland would have an average, annualized VMT growth rate of 1.8 percent from 2006 to 2020 in a business as usual scenario. When incorporating the state's planned transportation investments, including multi-modal transportation programs, the state's average, annualized VMT growth rate was projected to be reduced to 1.4 percent. Maryland Department of Transportation, Maryland Climate Action Plan: Maryland Department of Transportation 2012 Implementation Plan at 3.8 (l2011).

future VMT growth in the state would be the "Plans and Programs" VMT growth rate of 0.5 percent and the "Adjusted BAU" VMT growth rate of 1.1 percent.[30] In a forthcoming analysis, the Climate Center uses 0.76 percent as a projected annual average annual growth rate for mid-Atlantic and Northeast region, a rate derived from the varying projections of individual states in the region.[31] The Climate Center report also includes sensitivities that show projected changes to emission outcomes under varying VMT growth rates ranging from 0.4 percent to 1.5 percent. The proposed MDOT bounds of 0.5 percent to 1.1 percent would generally align with the growth rate used in the Climate Center report.

- **Explore policies to help ensure continued reductions in VMT growth in the future.** These could include stronger support for compact development, transit, ride sharing, and travel demand management programs.

  Maryland has long been a leader in smart growth and sustainable communities policies, beginning with the establishment of the nation's first statewide planning commission in 1933.[32] More recent state actions include the 1997 Priority Funding Areas Act that directs state funding to compact development areas and other laws that establish a statewide land use goal, require the use of smart growth measures for local jurisdictions, and establish a variety of tax credits supporting smart growth development.[33] At the same time, a 2011 analysis of development patterns in Maryland found that at least at that time, much of the development was occurring in suburban areas outside of the identified compact development areas.[34] Continued development in such zones could lead to increased rates of VMT growth, as they are typically located farther from employment and amenities. For these reasons, the Commission may be interested in exploring additional land use policies in its future work.

  One particular area that the Commission may want to consider exploring is whether there may be an opportunity to calculate greenhouse gas emission projections during existing transportation and planning processes, or expand use of such data.[35] Such information could provide state decision makers with an additional piece of information as they consider the many factors involved in state and local land use and transportation decisions.

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[30] MDOT Presentation to Maryland Climate Change Commission Mitigation Working Group, June 19, 2015, http://www.mde.state.md.us/programs/Marylander/Documents/MWGMDOTPresentation06192015.pdf.

[31] The relevant technical portion of the analysis was conducted by Cambridge Systematics. Georgetown Climate Center and Cambridge Systematics, Options for Reducing Transportation Emissions in the Northeast and Mid-Atlantic: Appendix Emission Inventory & Forecast (forthcoming).

[32] Maryland Department of Planning, Final Plan (2013). *See* Gabe Pacyniak et al., Georgetown Climate Center, State-Level Programs and Policies Supporting Sustainable Communities within Transportation & Climate Initiative (TCI) Jurisdictions 19 (2012), http://www.transportationandclimate.org/state-programs-policies-supporting-sustainable-communities-within-transportation-and-climate-initiative-jurisdictions.

[33] Maryland Department of Planning, Planning Legislation, http://planning.maryland.gov/OurWork/plan-legislation.shtml.

[34] Jason Sartori et al., National Center for Smart Growth Research and Education, Indicators of Smart Growth in Maryland (2011), http://smartgrowth.umd.edu/indicatorsofsmartgrowthinmaryland.html.

[35] Maryland law (Ch. 725), passed in 2010, requires the state's annual consolidated transportation plan to include a description of the extent to which the proposed construction projects satisfy state goals, which include "current state transportation goals, and climate action plan goals required by the Greenhouse Gas Emissions Reduction Act of 2009." The same law requires that the Department of Transportation and advisory committee consider climate action plan goals alongside other factors, in defining the state transportation goals, benchmarks, and indicators. MD. CODE ANN., TRANSP. § 2-103.1 (c)(3)(vi).

C. Attribution of GHG reductions from electric vehicles

Widespread vehicle electrification will likely be necessary in order to achieve significant GHG reductions from the transportation sector in the medium term. Maryland is already a leader in promoting electric vehicles (EVs); however, current deployment levels are lower than near-term deployment targets. In addition, federal, multi-state, and state programs are complementary to each other, which complicates the attribution of future EV deployment to these programs. The Commission may want to consider providing additional detail on the treatment of the overlap from these programs, and consider the use of specific analysis and milestones for state progress toward EV deployment.

1. Background: Attributing GHG reductions from EVs

Significantly electrifying the vehicle fleet will likely need to play a critical role in achieving medium-term GHG reductions in Maryland. The transportation sector accounted for 32 percent of Maryland's 2006 GHG emissions,[36] with 85 percent of transportation-sector emissions coming from on-road gas and diesel vehicles. Maryland's 2013 Greenhouse Gas Reduction Plan projects 27 percent of the reduction in the state's 2020 GHG emissions will come from the transportation sector.[37]

Deployment of electric vehicles has significant potential to reduce transportation-sector GHG emissions, particularly when complemented by GHG mitigation policies in the electric power sector (as are already in place in Maryland). EVs produce significantly fewer GHG emissions than conventional gasoline internal combustion engine (ICE) vehicles. While electric vehicle emissions vary according to the fuel blend of the electricity generated to power the vehicles, the average annual GHG emissions of electric vehicles is significantly lower than that of conventional gas vehicles. When using the national average fuel blend, an all-electric vehicle has annual GHG emissions of 7,657 lbs., whereas a conventional gas vehicle produces 14,815 lbs. of emissions annually. [38] GHG emissions from electric vehicles in Maryland produce even fewer emissions than the national average, given the cleaner electricity generation fuel blend in the region. For example, an electric vehicle charging in Baltimore's 21230 zip code produces average annual GHG emissions of 5,539 lbs – 37 percent of a conventional vehicle's GHG emissions.[39]

Maryland has been a leader in promoting electric vehicles through the Maryland Clean Cars program and Maryland Electric Vehicle Infrastructure Council, its participation in the Zero Emission Vehicle memorandum of understanding (ZEV MOU)[40] and the Transportation and Climate Initiative, and state efforts to promote public charging stations and workplace charging. Such programs have made progress expanding EV infrastructure, as Maryland currently has 294 charging stations and 658 public charging outlets for EVs across the state.[41]

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[36] Maryland's 2013 Greenhouse Gas Reduction Plan at 103.

[37] *Id.*

[38] Emissions measured in pounds of C02 equivalent. United States Department of Energy, Alternative Fuels Data Center, "Emissions from Hybrid and Plug-In Electric Vehicles" (Accessed September 10, 2015) available at http://www.afdc.energy.gov/vehicles/electric_emissions.php

[39] See Alternative Fuels Data Center, "Emissions from Hybrid and Plug-In Electric Vehicles" (Compare Electricity Sources and Annual Vehicle Emissions for Maryland – 21230 zip code).

[40] The governors of California, Connecticut, Maryland, Massachusetts, New York, Oregon, Rhode Island, and Vermont signed a memorandum of understanding in 2013 to cooperate to increase deployment of electric vehicles. *See* State Zero-Emission Vehicles Programs, Memorandum of Understanding (2013), http://www.nescaum.org/documents/zev-mou-8-governors-signed-20131024.pdf.

[41] United States Department of Energy, Alternative Fuels Data Center, Total Public Alternative Fueling Station Counts (accessed September 10, 2015), http://www.afdc.energy.gov/fuels/stations_counts.html.

However, EV current deployment levels are significantly below the state's deployment goals. Under the ZEV Action Plan, released in 2014, the eight signatory states (including Maryland) pledged to deploy 3.3 million zero emission vehicles by 2025.[42] Maryland has a goal of reaching 60,000 ZEVs on the road by 2020 and 300,000 ZEVs by 2025.[43] As of December 2014, 5,544 PEVs were registered in Maryland.[44]

Future deployment levels will depend on many factors, including vehicle cost, technology advances, manufacturer and dealer support, consumer preferences, state and local government policies, and petroleum fuel costs, among others. Important policies include maintaining the current schedule of Zero Emission Vehicle (ZEV) regulations in California in 2018, as well as maintaining or strengthening federal fuel economy and GHG light duty vehicle standards for models years 2022-2025.

A significant number of Maryland's transportation-sector GHG reductions to 2020 will be driven by federal fuel economy and GHG standards. The 2008-2011 light-duty vehicles fuel economy standard is projected to reduce Maryland's GHG emissions 2.27 $MMtCO_2e$ by 2020, and the model year 2012-2016 light-duty vehicle joint fuel economy and GHG standards will reduce emissions an additional 3.19 $MMtCO_2e$ by 2020.[45] Model year 2014-2018 medium- and heavy-duty truck fuel efficiency and GHG standards are projected by MDOT to further reduce emissions by 0.88 $MMtCO_2e$ by 2020 in the state. Fuel economy standards for light duty vehicles for model years 2017-2025 (finalized in 2012),[46] and the recently proposed Phase 2 medium- and heavy-duty truck standards[47] will further reduce GHG emissions and drive EV adoption. Importantly, the federal light duty vehicle standards for model years 2022-2025 will be subject to a mid-term evaluation to be completed by 2018 that could lead to a revision of the GHG standards for those years.[48]

The federal fuel economy and GHG standards drive EV adoption because automobile manufactures produce EVs and other low emissions vehicles to reduce the overall GHG emissions of vehicle fleets.[49] Additionally, the federal standards contain crediting incentives to promote the deployment of EVs and other clean fuel vehicles.[50]

The Maryland Clean Cars Program – Maryland's ZEV regulation – is also driving EV adoption and GHG emissions reductions in the state. The Maryland Clean Cars Program requires that a percentage of all new vehicles sold in the state be ZEVs. However, the effectiveness of Maryland's ZEV regulation has not been fully realized due to the "travel provision" of the California ZEV standards. The "travel provision," section 1962.1(d)(5)(E) of California ZEV standards, allows automakers to apply credits earned for selling an EV in one Section 177 state to meet mandate requirements in all other Section 177 states.[51] In

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[42] Multi-state ZEV Action Plan (2014), http://www.nescaum.org/topics/zero-emission-vehicles/multi-state-zev-action-plan.

[43] Maryland Department of the Environment, Zero Emission Vehicles, http://www.mde.maryland.gov/programs/Air/MobileSources/Pages/ZEV.aspx.

[44] Maryland Electric Vehicle Infrastructure Council, 2015 Interim Report 4 (2015).

[45] Maryland Climate Action Plan: Maryland Department of Transportation Draft 2012 Implementation Plan at figure ES-1 (2011).

[46] 2017 and Later Model Year Light-Duty Vehicle Greenhouse Gas Emissions and Corporate Average Fuel Economy Standards 77 Fed. Reg. 62624 (Oct. 15, 2012).

[47] Proposed Rulemaking: Phase 2 Greenhouse Gas Emissions Standards and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles, 80 Fed. Reg. 40,138 (proposed July 13, 2015).

[48] 2017 and Later Model Year Light-Duty Vehicle Greenhouse Gas Emissions and Corporate Average Fuel Economy Standards 77 Fed. Reg. 62624 (Oct. 15, 2012).

[49] The EPA lists the production of low emissions vehicles, along with advances in gasoline engines and transmissions, vehicle weight reduction (among others), as projected compliance strategies for MYs 2017-2025 standards. *See* EPA Regulatory Announcement: EPA and NHTSA Set Standards to Reduce Greenhouse Gases and Improve Fuel Economy for Model Years 2017-2025 Cars and Light Trucks (2012).

[50] *See* EPA Regulatory Announcement at 8.

[51] California Code of Regulations, Title 13 Section 1962.1(d)(5)(E).

practice, the travel provision has reduced the regulatory incentive for automakers to market and sell EVs outside of California. The travel provision was originally scheduled to sunset in 2014, but CARB extended the provision through 2017 in response to requests from automakers for compliance flexibility.[52] Under current California regulation, the travel provision is scheduled to sunset in 2017; however, CARB will likely face pressure to extend the travel provision beyond the scheduled expiration. If the travel provision expires as currently scheduled in 2018, it would likely result in increased EV marketing and sales by manufacturers in Maryland and other non-California ZEV states. Should the travel provision be extended, it would likely result in decreased availability and deployment of EVs in Maryland, absent additional state policies.

2. Considerations for the Commission related to attribution of EVs

Although federal standards, the ZEV program, and EV target levels cited in the ZEV MOU all complement each other (in that they all independently require or promote increases in EV deployment), the programs and targets are not additive. The Commission therefore may want to consider:

- Providing more detail on ways that the overlap of these different federal and state programs is accounted for in-progress reporting to clarify that the effect of these programs are not double-counted. EV deployment is driven by federal emissions standards as automakers seek to comply with fleet-wide standards. However, EVs sold in Maryland by automakers seeking to comply with federal standards may also be counted for compliance purposes under the Maryland Clean Cars program ZEV mandate. Similarly, the same vehicles counted under the federal standards and Clean Cars program mandate may also be counted towards Maryland's ZEV MOU goal of reaching 60,000 ZEVs on the road by 2020 and 300,000 ZEVs by 2025.

- Recommending the use of specific analysis and milestones to evaluate state progress toward EV deployment goals. For example, it could be valuable to know what level of public and private charging infrastructure would be considered adequate to meet targeted EV deployment levels. This analysis could inform decisions on the effectiveness of Electric and Low Emitting Vehicle Initiatives (E3) and electric vehicle infrastructure initiatives included in the Greenhouse Gas Reduction Act Plan.[53]

[52] California Air Resources Board, Advanced Clean Cars Summary 11 (2013),http://www.arb.ca.gov/msprog/clean_cars/acc%20summary-final.pdf.

[53] *See* Maryland's 2013 Greenhouse Gas Reduction Plan at 118-120.

II. Considerations related to post-2020 emission reduction needs, goal setting, and additional or enhanced policies

Significant reductions will be required in the medium term (i.e., 2025 to 2035) in order to achieve the long-term goals that Maryland and many other states have articulated and that reflect what science says is necessary to prevent the worst harms of climate change. Setting mid-term goals can help states understand the magnitude of reductions that may be required in different sectors to put states "on-track" to achieving long-term targets. In addition, new or enhanced policies may be required in the near term in order to achieve these significant longer-term reductions. There are a number of policies in the transportation sector that Commission may want to consider with medium- and long-term reductions in mind.

A. Considerations related to a post-2020 target

Many states have near-term (by 2020) GHG reduction goals, as well as long-term goals that tend to converge at around 80 percent reduction from 1990 levels by 2050.

A number of states have set targets in the range of 2025-2035, including some that have done so very recently or are currently in the progress of doing so. States with mid-term goals or that are in the process of setting mid-term goals in that time-range (either through statute or executive action) include:[54]

- California - 40 percent below 1990 by 2030[55]
- Delaware - 30 percent below 2008 by 2030 (proposed)[56]
- Minnesota - 30 percent below 2005 levels by 2025[57]
- New York - 40 percent below 1990 by 2030[58]
- Vermont - 50 percent below 1990 by 2028[59]
- Washington, D.C. - 50 percent below 2012 by 2032[60]

Significant reductions will be needed during interim years to meet 2050 targets. One of the benefits of analyzing mid-term goal possibilities is that it can help understand the magnitude of reductions that may be needed from different sectors in order to put states "on track" to meet long-term targets.

In addition, achieving significant medium-term and long-term reductions may require considering new or enhanced policies to be implemented in the near term, beyond those that are most cost-effective to achieve 2020 reduction goals. In particular, some policies such as widespread vehicle electrification or compact development may take more time to achieve substantial reductions, and therefore may be more cost-effective on a longer timescale than they seem through the lens of short-term benefits.

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[54] For more detail, *see* State Interim Goal Appendix below.

[55] E.O. B-30-15 (2015)

[56] 2015 Climate Framework for Delaware (2014)

[57] Next Generation Energy Act (2007)

[58] 2015 New York State Energy Plan (2015)

[59] 2011 Comprehensive Energy Plan (2011)

[60] A Vision for Sustainable D.C. (2012)

B. Potential policy directions for the Commission to consider further in the context of post-2020 reductions

1. Power Sector

Maryland has already achieved significant reductions from the power sector in recent years; however, significant further reductions will be necessary to meet 2050 goals. Key opportunities will include the following:

- Enhancing Maryland's carbon pollution programs, e.g., its participation in the Regional Greenhouse Gas Initiative, as part of compliance with the Clean Power Plan.
- Encouraging Clean Power Plan compliance strategies in other states in the PJM region that will align well with Maryland's programs, prevent "emissions leakage," and result in improved carbon-intensity of power imported into Maryland.
- Considering policies that will increase renewable energy deployment, including an enhanced renewable portfolio standard and policies that support distributed renewable generation.
- Considering policies that will build on EmPOWER Maryland and other energy conservation policies to achieve additional reductions in electricity demand.
- Considering opportunities to revise electricity-sector regulations to reflect and support transformative clean energy and energy efficiency opportunities in the power sector, similar to the "Reforming Energy Vision" initiative being conducted by the New York State Public Service Commission.

2. Transportation

Since transportation represents the second-largest source of Maryland's emissions,[61] it will be critical to achieve significant reductions from transportation as part of reaching any mid-term GHG goal (i.e., by 2030). Georgetown Climate Center's analysis for TCI has shown that federal standards are projected to achieve significant reductions in the sector, but that these reductions, even when combined with current state actions, will not be sufficient to put states "on track" to achieving the significant long-term reductions needed by 2050, suggesting that more state action is needed. Some potential policies actions that the Commission may want to consider include:

- **Setting sector-specific emission goals.** Identifying an aspirational, non-binding level of reduction in specific sectors may be a valuable first step for serious discussions about how to achieve those reductions. For example, if achieving reductions from the transportation sector is critical, then it may be helpful to track those goals specifically, either within the state or across multiple states.

[61] According to Maryland's updated GHG inventory, the power sector is the largest source of emissions in the state when emissions attributed to imported electricity are included. If only emissions from in-state generation are compared, the transportation sector is the largest source of GHG emissions. Maryland Department of the Environment, The 2015 Greenhouse Gas Emissions Reduction Act Plan Update 66-67 (2015), http://www.mde.state.md.us/programs/Air/ClimateChange/Documents/2015GGRAPlanUpdate/GGRA%20Report%20FINAL%20(11-2-15).pdf.

- **Addressing transportation as a multi-state region.** Working together as a region has many benefits, especially with regard to transportation systems, which regularly cross state boundaries. Some important strategies, like shifting more freight to rail or short-sea shipping, are inherently related to the multi-state I-95 corridor. In other cases, like with RGGI, a regional approach allows the development of policies that otherwise may have been difficult to implement by a single state acting alone. For an example of a state taking this approach, New York State's new Energy Plan, released in June 2015, calls on New York to explore regional policies to reduce transportation-sector emissions through TCI.

- **Monitoring the carbon intensity of petroleum fuels entering the state.** Recent analysis has raised concerns that more carbon-intensive tar-sands-derived petroleum may soon be representing a greater share of Northeast and mid-Atlantic petroleum, and other states in this region are considering policies to address this. The Commission may want to consider whether this is an important issue to track and monitor. The U.S. State Department in a Draft Environmental Impact Statement (EIS) on the Keystone XL pipeline, projects Canadian Tar Sands oil will emit 17 percent more life-cycle GHGs than conventional U.S. gasoline.[62] This amounts to what the U.S. State Department characterizes as a "high increase" in well-to-wheels emissions. This ratio may increase as the supply of tar sands oil available in domestic energy markets expands.

- **Exploring policies that can both reduce emissions and address transportation revenue shortfalls**. The structure of transportation revenues—largely based on fixed gas taxes at both the federal and state levels—means that as the vehicle fleet gets more efficient, funds to support transportation infrastructure and operations decline. The commission may want to consider whether there are policy designs that could both reduce GHG emissions from the transportation sector and also provide additional proceeds for investing in clean and resilient transportation. (This issue may also best be tackled regionally.)

- **Expanding support for Electric Vehicles**. Increasing deployment of electric vehicles and other zero-emitting vehicles is likely to be a key driver of emission reductions from transportation. To further expand EV support, the Commission could consider (or recommend that the legislature and agencies consider) policies and actions that would:

    - Create fleet-purchase consortiums that seek to reduce EV vehicle costs to state, municipal, and private fleet buyers (and would have the effect of helping drive overall cost reductions);

    - Convert Maryland's EV excise tax credit to a rebate, as the state has done with incentives for EV charging stations.

    - Enhance promotion of the Northeast Electric Vehicle Network, further engage vehicle manufacturers and dealers, and work with the other ZEV MOU states to ensure consumer comfort with EVs;

    - Further support workplace charging;

[62] U.S. State Department, Draft Environmental Impact Statement (EIS) Keystone XL Project at 44-45 (2013), http://keystonepipeline-xl.state.gov/documents/organization/205563.pdf.

- Ensure that electricity regulatory rules and rate structures support greater EV deployment;
- Continue to direct funds to EV and EVSE incentive programs; and
- Continue to direct funds for public education and outreach about the purchase and use of EVs.
- Engage dealers and encourage dedicated members of sales staff to specialize in electric vehicle sales. Dedicating select sales staff to handle electric vehicle sales promotes adoption by ensuring consumers have access to specialized and knowledgeable EV experts. Supporting these practices will neutralize disincentives created by the greater time commitment selling an EV requires, reduce the time it takes to close a sale, improve consumer satisfaction, and encourage sales staff to sell vehicles. One industry expert recommends automakers or other entities provide dealer and sales staff with a $250 bonus or incentive a piece (for a total of a $500 incentive per vehicle), but cautions against incentivizing beyond that amount.[63]

III. Conclusion

The Maryland Climate Change Commission may want to consider several factors related to the evaluation of emission reduction progress toward Maryland's 2020 goal. These include accounting for uncertainties in continuing reductions of GHG emissions due to shifts to lower-carbon electricity generation and reductions in the growth of vehicle miles traveled. The Commission may also want to consider providing additional information on how emission reductions due to electric vehicles are accounted for given that federal fuel economy and GHG standards, Maryland's ZEV mandate, and other state EV-supportive policies all contribute toward Maryland's EV deployment goal. In considering the level of emission reductions that may be required beyond 2020, the Commission may find goals set by other states in the 2025-2035 time frame informative, and may want to consider policies in the transportation and power sector that could achieve additional reductions in the medium-term. The following appendix lists interim GHG reduction goals of other states, analyzes them against a 2006 baseline, and identifies how these goals were established (e.g., by statute, executive order, or through a state plan).

[63] Conference Call with UC Davis, recommendation of Eric Cahill.

Appendix: Details on states' interim GHG reduction goals

A. Table summarizing states with GHG reduction goals in the 2025-2035 period

This table provides brief summaries of states with interim (2025-2035) economy-wide greenhouse gas reduction goals. More detailed information about the states' interim goals follows in Appendix C.

	Economy-wide GHG Emissions Goals		Interim Goal (2025-2035) Summary & Notes
	Goal Sources	**Goal Levels**	
CA	Executive Order B-30-15 (2015) Global Warming Solutions Act AB 32 (2006) Executive Order S-3-05 (2005)	Return to 1990 levels by 2020 40% below 1990 by 2030 80% below 1990 by 2050	In 2015, Gov. Brown issued Executive Order B-30-15 establishing an interim goal of 40% below 1990 levels by 2030. Pending bill S.B. 32 would put that target into legislation.
DE	2015 Climate Framework for Delaware 2009 Energy Plan recommended setting goal	30% below 2008 by 2030 (proposed)	Gov. Markell issued the 2015 *Climate Framework for Delaware*, which proposed a GHG reduction goal of 30% below 2008 levels by 2030. The target was subject to public comment.
DC	A Vision for Sustainable DC (2012)	50% below 2012 by 2032 80% below 2012 by 2050	*A Vision for Sustainable DC* plan, issued in 2012, includes the 2032 interim goal of reducing emissions 50% below 2012 levels by 2032.
MN	The Next Generation Energy Act (2007)	15% below 2005 by 2015 30% below 2005 by 2025 80% below 2005 by 2050	Gov. Pawlenty signed the Next Generation Energy Act in 2007, establishing the state's GHG reduction goals, including the 2025 interim goal.
NH	New Hampshire Climate Action Plan (2009)	20% below 1990 by 2025 80% below 1990 by 2050	As part of the *New Hampshire Climate Action Plan*, released in 2009 by the NH Department of Environmental Services, the Climate Change Policy Task Force recommended an interim GHG reduction goal of 20% below 1990 levels by 2025.
NY	2015 New York State Energy Plan (2015) Executive Order No. 2 (2011) Executive Order No. 24 (2009)	10% below 1990 by 2020 40% below 1990 by 2030 80% below 1990 by 2050	The 2015 New York State Energy Plan establishes an interim GHG reduction goal of 40% below 1990 levels by 2030.

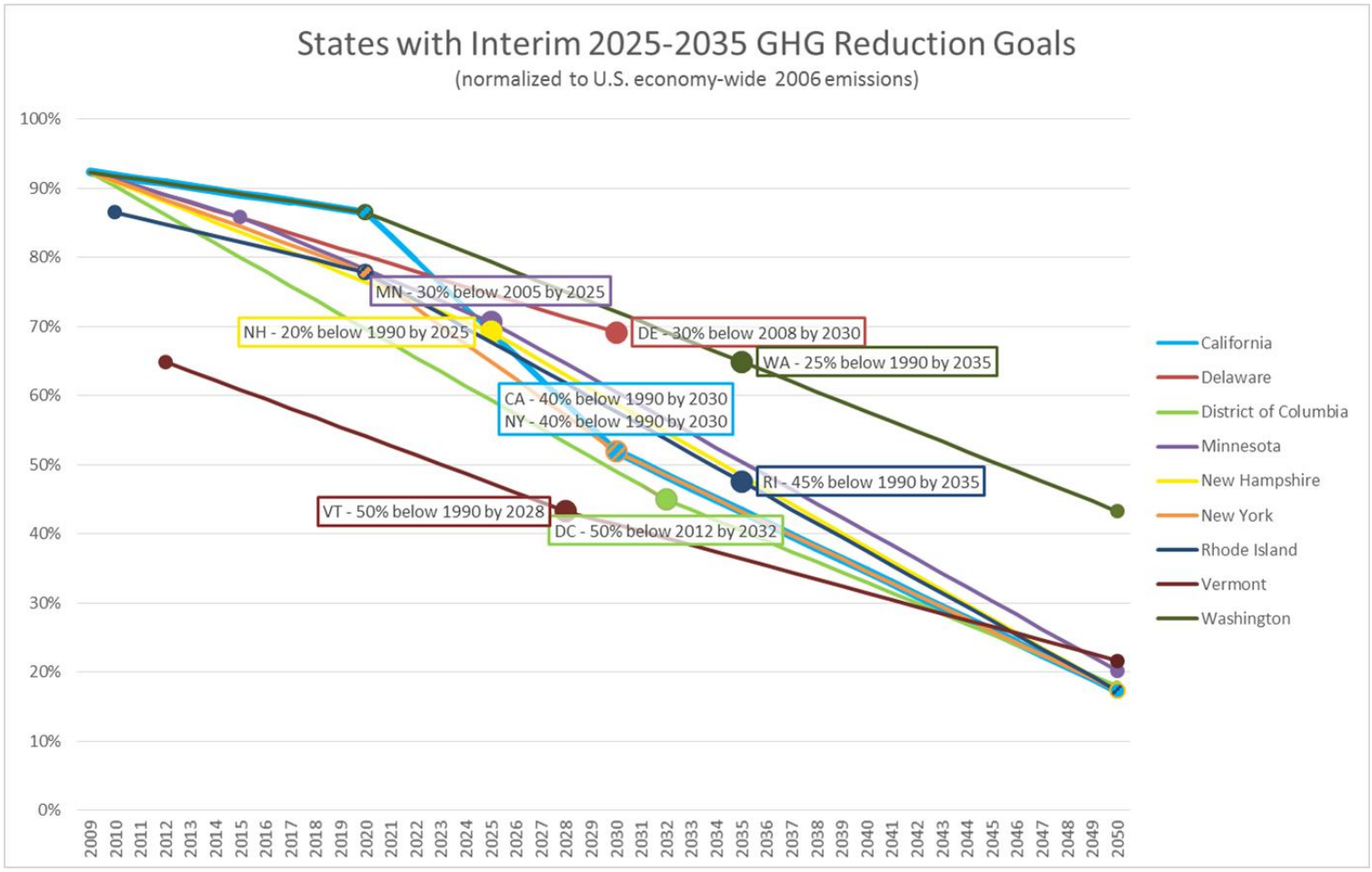
RI	Rhode Island Executive Climate Change Coordinating Council (E.O. 14-01); S. 2952 (2014) Resilient Rhode Island Act (2014) Rhode Island Greenhouse Gas Action Plan (2002)	10% below 1990 by 2020 45% below 1990 by 2035 80% below 1990 by 2050	Rhode Island established its interim goal of 45% below 1990 levels by 2035 in the Resilient Rhode Island Act (2014).
VT	2011 Comprehensive Energy Plan Act No. 168 (S.259) (2006) 30 V.S.A. § 202a	50% below 1990 by 2028 75% below 1990 by 2050	In 2006, Vermont passed Act 168, which included an interim GHG reduction goal of 50% below 1990 levels by 2028.
WA	H.B. 2815 (2008) S.B. 6001 (2007)	Return to 1990 levels by 2020 25% below 1990 by 2035 50% below 1990 by 2050	In 2007, Gov. Gregoire signed into law S.B. 6001, establishing the interim GHG reduction goal of 25% below 1990 by 2035. The same target previously had been set by executive order.

*Former administrations in Florida and Michigan had set interim (2025-2035) GHG reduction goals through executive action. In Florida, Executive Order 07-127 (Gov. Crist, 2007) set goals of returning to 2000 levels by 2017, decreasing to 1990 levels by 2025, and achieving 80% below 1990 levels by 2050. In Michigan, Executive Directive 2009-4 (Gov. Granholm, 2009) set an interim goal of 20% below 2005 levels by 2025.

**CO, CT, HI, IL, MA, ME, NJ, NM, OR, and PA each have set GHG emissions reduction goals, but no interim (2025-2035) goal, and are not included in this chart.

B. Chart of state interim goals relative to 2006 baseline

To better compare state goals articulated as reductions from different baseline years ranging from 1990 to 2008, the graph normalizes state goals against 2006 U.S. economy-wide GHG emissions (U.S. EPA GHG Inventory). Goal pathways are linearly interpolated between state goal points. 2009 emissions are used as a starting point, with the exception of Rhode Island and Delaware, which had early goals articulated for years 2009-2012. States' interim goals are labelled.



C. Mechanisms for establishing state interim GHG reduction goals in the 2025-2035 period

1. California

- Gov. Arnold Schwarzenegger first issued Executive Order S-3-05, establishing an economy-wide GHG emissions reduction target of returning to 1990 levels by 2020 and achieving 80 percent below 1990 levels by 2050. The targets were put into law in 2007 with the passage of the Global Warming Solutions Act - AB 32.[64]
- Gov. Jerry Brown signed Executive Order B-30-15 on April 29, 2015, setting the state's interim target of 40 percent below 1990 levels by 2030. The Executive Order instructs all state agencies and departments to use existing authorities to reduce GHG emissions.[65]

2. Delaware

- Gov. Jack Markell released the Climate Framework for Delaware on March 2, 2015, proposing a goal of reducing GHG emissions 30 percent below 2008 levels by 2030.[66] The Climate Framework also provides recommendations for adapting to climate impacts in the state.
- The Climate Framework for Delaware was posted for public comment for 90 days following its release. Additionally, the state held an engagement workshop for local governments, stakeholder organizations, and the public to share information and gather feedback on the Framework.[67]

[64] Office of Gov. Brown, "Executive Order S-3-05," *available at* http://gov.ca.gov/news.php?id=1861

[65] Office of Gov. Brown, "Governor Brown Establishes Most Ambitious Greenhouse Gas Reduction Target in North America," (April 29, 2015) *available at* http://gov.ca.gov/news.php?id=18938

[66] Delaware Division of Energy & Climate, "The Climate Framework for Delaware" *available at* http://www.dnrec.delaware.gov/energy/Pages/Climate-Framework.aspx

[67] Delaware State News Release, "Governor Markell highlights Delaware's significant progress in addressing climate change, announces new Climate Framework" (March 2, 2015) *available at* http://news.delaware.gov/2015/03/02/governor-markell-highlights-delawares-significant-progress-in-addressing-climate-change-announces-new-climate-framework/

3. *District of Columbia*

- In July 2011, Mayor Vincent Gray launched the Sustainable DC planning initiative, led by the District Department of the Environment and Office of Planning. The District released its first sustainability plan, *A Vision for a Sustainable DC*, in April 2012. The plan sets broad policy goals, including reducing citywide GHG emissions 50% by 2032 and 80% by 2050, cutting citywide energy use 50% by 2032, and shifting transportation modes so that 75% of all trips are walking, biking, or transit by 2032.[68]

4. *Minnesota*

- Gov. Tim Pawlenty signed the Next Generation Energy Act in 2007, establishing the state's GHG reduction goals of 15% below 2005 levels by 2015, 30% below 2005 levels by 2025, and 80% below 2005 levels by 2050.[69]

5. *New Hampshire*

- New Hampshire's 2009 *Climate Action Plan* set an overall goal of reducing GHG emissions 20% below 1990 levels by 2025 and 80% below 1990 levels by 2050. The plan also identified 67 policy recommendations that could achieve these goals.[70]

6. *New York*

- In 2011, Gov. Andrew Cuomo reaffirmed a 2009 executive order that established an economy-wide goal of reducing GHG emissions 80% below 1990 levels by 2050.[71] The 2009 executive order also a created a Climate Action Council responsible for producing a climate action plan. [72]
- New York's 2015 State Energy Plan established an economy-wide goal of reducing GHG emissions 40% below 1990 levels by 2030. The Plan, released June 25, 2015, also includes 2030 goals of generating 50% of electricity from renewable energy sources and decreasing energy consumption in buildings by 23% from 2012 levels.

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[68] DC OFFICE OF PLANNING & DISTRICT DEPARTMENT OF THE ENVIRONMENT, A VISION FOR A SUSTAINABLE DC 17, 19, 25 (2012), *available at* http://sustainable.dc.gov/sites/default/files/dc/sites/sustainable/publication/attachments/sustainable%20DC%20Vision%20Plan%202.2.pdf. The plan does not specify a baseline, but appears to imply that reductions are relative to the date of publication in 2012.

[69] MINNESOTA STATE LEGISLATURE, STATE SENATE, SF 145 (DECEMBER 15, 2009) *available at* https://www.revisor.mn.gov/bills/text.php?number=Sf0145&version=2&session=ls85

[70] NEW HAMPSHIRE DEPARTMENT OF ENVIRONMENTAL SERVICES, NH CLIMATE ACTION PLAN, *available at* http://des.nh.gov/organization/divisions/air/tsb/tps/climate/action_plan/nh_climate_action_plan.htm

[71] N.Y. EXEC. ORDER NO. 2, N.Y. COMP. CODES R. & REGS. tit. 9, § 8.2 (2011) (Gov. Andrew M. Cuomo continuance of Gov. David A. Patterson executive order, N.Y. EXEC. ORDER NO. 24, N.Y. COMP. CODES R. & REGS. tit. 9, § 7.24 (2009)).

[72] N.Y. EXEC. ORDER NO. 24, N.Y. COMP. CODES R. & REGS. tit. 9, § 7.24 (2009).

7. *Rhode Island*

- In 2002, Rhode Island released its *Greenhouse Gas Action Plan*, which set a target of reducing GHG emissions to 1990 levels by 2010 and 10% below 1990 levels by 2020. The plan provided 52 prioritized options for reducing greenhouse gas emissions.[73]
- On August 1, 2014, Gov. Chaffee signed into law the Resilient Rhode Island Act. The Act establishes greenhouse gas emissions reduction targets of: 10% below 1990 levels by 2020, 45% below 1990 levels by 2035, and 80% below 1990 levels by 2050. The Act created an executive climate change coordinating council, which must submit a greenhouse gas reduction plan by December 31, 2016.[74]
- In June 2015, Rhode Island released a preliminary draft of Energy 2035: Rhode Island State Energy Plan.[75] The draft State Energy Plan puts forward strategies for reducing energy use and emissions.

8. *Vermont*

- Vermont's Act 168, passed in 2006, set a state goal of reducing GHG emissions 25% from 1990 levels by 2012, 50% by 2028 and 75% by 2050 (if practicable using reasonable efforts).[76] The Act also required the creation and implementation of a Climate Action Plan.[77] The 2007 *Final Report and Recommendations of the Governor's Commission on Climate Change* presented a general list of policies and recommendations.[78]
- In 2011, Vermont released a comprehensive energy plan that set a goal of achieving 90% of the state's energy from renewable sources by 2050 (this goal includes the transportation sector).[79]

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[73] RHODE ISLAND GREENHOUSE GAS STAKEHOLDER PROCESS, RHODE ISLAND GREENHOUSE GAS ACTION PLAN (2002), *available at* http://righg.raabassociates.org/Articles/GHGPlanBody7-19-02FINAL.pdf

[74] STATE OF RHODE ISLAND GENERAL ASSEMBLY "RESILIENT RHODE ISLAND ACT OF 2014" 2014 H-7904-SUBSTITUTE A, *available at* http://webserver.rilin.state.ri.us/BillText/BillText14/HouseText14/H7904A.pdf

[75] State of Rhode Island: Office of Energy Resources, *The Rhode Island State Energy Plan*, http://www.energy.ri.gov/energyplan/index.php.

[76] VT. STAT. ANN. 10 § 578.

[77] VT. STAT. ANN. 10 § 578.

[78] FINAL REPORT AND RECOMMENDATIONS OF THE GOVERNOR'S COMMISSION ON CLIMATE CHANGE (2007), *available at* http://www.anr.state.vt.us/imaging/ANRdocs/secoffice/climatechange/2007OctGCCCFinalRpt.pdf

[79] VERMONT DEPARTMENT OF PUBLIC SERVICE, COMPREHENSIVE ENERGY PLAN2011: VERMONT'S ENERGY Future 3 (2011), *available at* http://publicservice.vermont.gov/publications/energy_plan/2011_plan.

- In September 2015, the Vermont Public Service Department released a public review draft of the 2015 Comprehensive Energy Plan. The draft plan updates many of the transportation-sector objectives set out in the 2011 Comprehensive Energy Plan and proposes additional ambitious climate and energy goals, including:
    - Reducing per capita total energy consumption 15 percent by 2025 and at least 33 percent by 2050;
    - Obtaining 25 percent renewable energy by 2025 and 40 percent by 2035; [80]
    - Reducing total transportation energy use by 20 percent by 2025 from 2015 levels and reducing transportation-sector GHG emissions 30 percent by 2025.[81]

9. Washington

- In 2007, Gov. Gregoire signed into law S.B. 6001, establishing GHG reduction targets of a return to 1990 levels by 2020, 25% below 1990 levels by 2035, and 50% below 1990 levels by 2050.[82] The same target had previously been set by executive order. Under HB 2815, signed in 2008, the state Department of Ecology was instructed to prepare a GHG reduction plan offering policy options to achieve the 2020 target.[83]

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[80] Vermont Public Service Department, *2015 Comprehensive Energy Plan Public Review Draft*, 1 (2015) http://publicservice.vermont.gov/publications/energy_plan/2015_plan

[81] *Id* at 124-125.

[82] REV. CODE WASH. § RCW 70.235.020, "GREENHOUSE GAS EMISSIONS REDUCTIONS" *available at* http://app.leg.wa.gov/rcw/default.aspx?cite=70.235.020

[83] WASHINGTON STATE DEPARTMENT OF ECOLOGY, "WASHINGTON STATE CLIMATE POLICY LAWS AND EXECUTIVE ORDERS," *available at* http://www.ecy.wa.gov/climatechange/laws.htm