Turning Climate Commitments into Results:

Progress on State-led Climate Action

December 2020 Analysis

Analysis conducted by Drew Stilson, Senior U.S. Climate Policy Analyst

Pam Kiely, Senior Director of Regulatory Strategy, and Rama Zakaria, Senior Manager of Regulatory Policy & Analysis also contributed to this report

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Summary

While the Trump administration carried out its unprecedented assault on critical environmental protections, many state leaders powerfully responded to the abdication of leadership and committed to greenhouse gas (GHG) emission reduction targets – pledging at a critical inflection point to cut pollution at the rate science demands. The analysis presented here, however, shows that most of these states face critical gaps between their commitments and the reductions that will be delivered by current policy measures. Even as the federal government readies to pivot back to an active leadership role domestically and internationally on climate, state action remains as important as ever to secure emission reductions both in the near-term and over the next decade to give us a fighting chance of avoiding the worst impacts of climate change on our communities, economies, and ecosystems.

The urgency and the stakes couldn't be higher: the Intergovernmental Panel on Climate Change (IPCC) found that the average of modeled emission pathways limiting warming to 1.5°C show greenhouse gas emission reductions of 45% below 2010 levels by 2030, with emissions continuing to decline dramatically through 2050.[1] Reductions secured today matter. The majority of climate change results from the cumulative buildup of greenhouse gases in the atmosphere over time. Much of the pollution we are emitting today will linger in the atmosphere for decades to come, so persistent reductions are needed – and needed urgently. Moreover, the biggest producers of GHG emissions are also the biggest sources of local air pollution – like particulates, smog-forming contaminants, and air toxics[2] – that is often most concentrated in communities of color and those with significant low-income populations.[3] Achieving deep cuts in greenhouse gas emissions in an effective and equitable manner can improve health outcomes for the millions of Americans who are disproportionately harmed by both climate impacts and local air pollution.

To evaluate whether states are on track to deliver on their climate commitments, EDF conducted an analysis based on historic and projected state-level GHG emissions data from the Rhodium Group's U.S. Climate Service. The projections estimate emissions through 2030 based on state and federal policies that are currently in place. Focusing on states that have committed to achieving economy-wide GHG emission reductions in line with the U.S. commitment under the Paris Agreement – 26 to 28% below 2005 levels by 2025 – EDF found that many states will need to put additional policies in place

[1] See Summary for Policymakers of IPCC Special Report on Global Warming of 1.5°C. Available at: https://www.ipcc.ch/sr15/chapter/spm/. Note that model emissions pathways consistent with limiting warming to 1.5°C include reducing net carbon dioxide emissions to 45% below 2010 levels by 2030 and reaching net zero around 2050. Half of pathways consistent with limiting warming to 1.5°C show a reduction of 40 to 50% below 2010 levels by 2030 for the sum of all greenhouse gas emissions, using the standard carbon dioxide-equivalent metric with a 100-year GWP. We note that this is a simplification of specific actions needed to address long-lived and short-lived climate pollutant emissions; for example, long-lived pollutants will eventually need to reach net zero, whereas short-lived climate pollutants will need their emissions rates reduced but not to a level of zero. However, given that the policy community is focused on combined carbon dioxide-equivalent targets, we aim to be consistent with that approach in this analysis. Therefore, we use a reduction of 45% below 2010 levels by 2030 for all GHGs in this analysis to represent a pathway consistent with limiting warming to 1.5°C. We refer to this benchmark as the IPCC average pathway for a 1.5°C target for 2030 throughout this report.

[2] Several of these pollutants also contribute to climate change by modifying Earth's energy balance.

[3] See Bell, M. L., & Ebisu, K. 2012. Environmental inequality in exposures to airborne particulate matter components in the United States. *Environmental health perspectives*. Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3546368/.

to close the "emissions gap" between business-as-usual projections and their targets. These gaps are even wider looking ahead to the 2030 reduction levels that could limit warming to 1.5°C – consistent with the goals of the Paris Agreement[4] – which the states that have joined the U.S. Climate Alliance ("USCA") have committed to pursue.[5] The divergence in projected emissions from these critical metrics shows that significant policy intervention is urgently needed to secure additional reductions by the end of the decade.

While the impacts of the COVID-19 pandemic have exerted downward pressure on near-term emissions, economies are showing signs of recovery, and GHG emissions are rebounding along with them. State and federal investments to rebuild and revitalize the economy in the wake of COVID-19 create a tremendous opportunity to invest in a clean economy while putting in place policy frameworks that will ensure deep and sustained declines in climate pollution.

State leaders need to build on the momentum they created by setting climate targets, publicly acknowledge their current emissions gaps, and take policy action to achieve the cumulative reductions consistent with achieving their targets. States should leverage a robust toolkit to secure these reductions. In particular, one important tool for policymakers to consider is placing firm, declining limits – in the form of source-based limits, sector-based limits, or economy-wide limits – on carbon pollution that can fill the gaps between the abatement that performance-based policies are expected to deliver and reductions consistent with achieving state targets. Enforceable caps on carbon can act as a backstop that locks in emissions levels if specific measures to deploy clean energy and decarbonize particular industries are not enough on their own.

Landscape for State Climate Action

Despite the urgent need for concrete climate policies capable of cutting pollution to levels that will avert the worst impacts of climate change, federal policymakers in the U.S. have been moving in the wrong direction over the last four years. The IPCC found that the average of modeled emission pathways that limit warming to 1.5°C shows greenhouse gas emission reductions of at least 45% below 2010 levels by 2030 on a carbon dioxide-equivalent basis, with continued sharp declines through 2050.[6] Meanwhile, President Trump formally withdrew the U.S. from the Paris Agreement as of November 4, 2020[7] and rolled back crucial regulations on vehicle fuel economy, carbon

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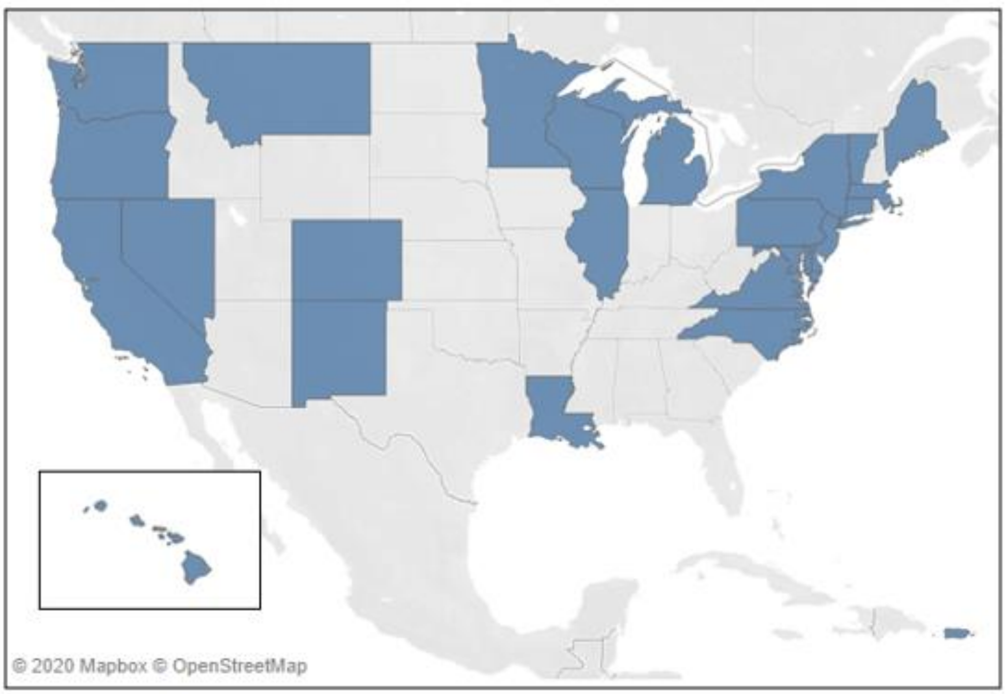
[4] See https://unfccc.int/files/essential_background/convention/application/pdf/english_paris_agreement.pdf.
[5] By joining the U.S. Climate Alliance, states commit to advancing the goals of the Paris Agreement. See http://www.usclimatealliance.org/s/USCA-Factsheet_Dec-2019.pdf. All states evaluated except Louisiana have formally joined USCA, though Governor Bel Edwards has announced comparable reduction targets.
[6] See Summary for Policymakers of IPCC Special Report on Global Warming of 1.5 C. Available at: https://www.ipcc.ch/sr15/chapter/spm/. Note that model emissions pathways consistent with limiting warming to 1.5°C include reducing net carbon dioxide emissions to 45% below 2010 levels by 2030 and reaching net zero around 2050. Half of pathways consistent with limiting warming to 1.5°C show a reduction of 40 to 50% below 2010 levels by 2030 for the sum of all greenhouse gas emissions, using the standard carbon dioxide-equivalent metric with a 100-year GWP. Therefore, we use a reduction of 45% below 2010 levels by 2030 for all GHGs in this analysis to represent a pathway consistent with limiting warming to 1.5°C. We refer to this benchmark as the IPCC average pathway for a 1.5°C target for 2030 throughout this report.
[7] See https://www.npr.org/2019/11/04/773474657/u-s-formally-begins-to-leave-the-paris-climate-agreement.

dioxide pollution from electricity generation, and fugitive methane emissions from oil and gas systems. Congress has been unable and unwilling to deliver vital climate progress.

With that backdrop, many state leaders across the country recognized that the U.S. could not afford to wait for federal leadership to address the climate crisis and took matters into their own hands by setting meaningful targets to reduce climate-warming pollution. Since 2017, 25 governors[8] have joined the U.S. Climate Alliance,[9] a bipartisan coalition of states committed to implementing policies that advance the goals of the Paris agreement – including reducing emissions by 26 to 28% below 2005 levels by 2025, which was the intended near-term contribution for the United States.[10] Louisiana, while not currently a member of the U.S. Climate Alliance, recently established its own goal to achieve a 26 to 28% reduction from 2005 levels by 2025.[11] Several of these states have also set longer term targets, either through executive order or in statute, for 2030 and 2050.

States with Gubernatorial Climate Commitments



[8] Including Puerto Rico.
[9] See http://www.usclimatealliance.org/.
[10] See https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/United%20States%20of%20America%20First/U.S.A.%20First%20NDC%20Submission.pdf.
[11] See https://gov.louisiana.gov/assets/ExecutiveOrders/2020/JBE-2020-18-Climate-Initiatives-Task-Force.pdf.

This leadership is powerful: by focusing on reduction trajectories, these governors have elevated emissions-based metrics for evaluating success and acknowledged that climate change is, at its core, a pollution problem. To achieve climate stability, we need to ultimately put fewer long-lived climate pollutants (predominantly carbon dioxide) into our atmosphere than we take out to prevent further build-up of these gases – a concept referred to as "net zero emissions."

In the United States, we are currently emitting carbon dioxide pollution at seven times the rate that we are actively removing it.[12] The average of carbon dioxide emissions pathways that achieve international temperature targets as analyzed by the IPCC[13] show net zero carbon dioxide emissions achieved globally by around mid-century, but the amount of overall carbon dioxide emitted before that point matters as well. Carbon dioxide can remain in the atmosphere for thousands of years, so emissions entering the atmosphere over the next few years will continue to warm the planet for many decades to come.[14] The earlier we reduce emissions, the better the chance we have at achieving temperature stability at desirable levels. Further, to slow the rate of warming over the coming decades, we also need to lower emissions of short-lived climate pollutants, such as methane, which has an outsized impact on near-term warming. If we act early to reduce short-lived climate pollutants, we can limit near-term warming and its associated damages.

We must take advantage of every cost-effective opportunity to cut climate pollution now, while investing in the innovations that will put us on course for a decarbonized future as soon as possible. State commitments to reduce greenhouse gas emissions are a meaningful step toward addressing climate pollution and a signal to other states and the international community that leaders across the U.S. recognize the need for action – and the scale of ambition required – to address the global threat of climate change. **Following through on these commitments has never been more essential.**

The federal government has an immediate opportunity to take swift action to demonstrate climate leadership domestically and reengage internationally. Yet state action matters as much today as it has for the last four years for securing emission reductions in the U.S. The urgency of the climate crisis demands that states deliver as much as possible while the federal government sprints to catch up, and many states are capable of putting in place frameworks now that can cut pollution faster today while providing the underpinning for new federal policies.

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[12] Based on emission sinks from the Land Use, Land-Use Change, and Forestry sector as reported in EPA 2020. Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2018, available at: https://www.epa.gov/sites/production/files/2020-04/documents/us-ghg-inventory-2020-main-text.pdf.

[13] See Summary for Policymakers of IPCC Special Report on Global Warming of 1.5 C. Available at: https://www.ipcc.ch/sr15/chapter/spm/.

[14] Myhre, G., D. Shindell, F.-M. Bréon, W. Collins, J. Fuglestvedt, J. Huang, D. Koch, J.-F. Lamarque, D. Lee, B. Mendoza, T. Nakajima, A. Robock, G. Stephens, T. Takemura and H. Zhang, 2013: Anthropogenic and Natural Radiative Forcing. In: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. Available at: https://www.ipcc.ch/site/assets/uploads/2018/02/WG1AR5_Chapter08_FINAL.pdf.

Well-designed state policy can accelerate near-term reductions that will reduce both near- and long-term climate damages,[15] while encouraging the innovation and investment that will make deeper cuts in long-lived climate pollutants possible down the road. Successes and challenges at the state level also provide valuable lessons and lay the groundwork for catalyzing federal action. Further, states are uniquely well-positioned to address certain sources, and can act in ways that help overcome gaps or limitations in current federal authorities. We need all hands on deck to establish a resilient and sufficiently ambitious emission reduction framework. If the failure to lead in Congress continues, state action in tandem with federal administrative efforts will be the central partnership that will enable the U.S. to stay on track to achieve a decarbonized future and credibly deliver in the international arena.

State emission reduction commitments and timelines are an important starting point, but far from the finish line. With targets in place, states must swiftly implement policies and regulations that result in actual, quantifiable emission reductions consistent with achieving those targets.[16] States must start putting policies in place now – the urgency of climate change demands immediate and significant action, and the longer we wait to reduce emissions, the more difficult it will become to avoid the most devastating impacts.

Based on analysis completed by EDF using historical and projected emissions data from Rhodium Group,[17] the current suite of climate policies adopted by states with gubernatorial climate commitments[18] **is not nearly enough to bring emissions in those states down to a trajectory consistent with the IPCC average pathway for a 1.5°C target – and in many cases are not sufficient to meet goals set by the states themselves.** This report explores the magnitude of these "emissions gaps," and outlines the challenging but navigable road ahead for states that have set out to reduce their climate pollution. **Ensuring greenhouse gas pollution outcomes is not the only component of success, but it is an essential one.** While there are several critical metrics that should be priorities in pursuit of a stable climate – including advancing equity, improved public health outcomes, deploying cleaner technologies and creating the jobs that come along with them – this analysis focuses specifically on greenhouse gas emissions that directly contribute to the warming of the atmosphere. Greenhouse gas emissions are a central metric to judge the efficacy of any climate strategy.

[15] Well-designed policies should address both short- and long-lived climate pollutants to reduce both near- and long-term climate damages.
[16] Several states have policies in place to limit climate pollution over the coming decade, and others are undergoing policy efforts that have the potential to do so. A list of states that have or are considering a cap on greenhouse gases is presented in Appendix 2.
[17] Based on data from Rhodium Group's U.S. Climate Service. Rhodium Group projects emissions using a modified version of the National Energy Modeling System (NEMS). For more information, see Rhodium Group's 2020 Taking Stock report, available at: https://rhg.com/wp-content/uploads/2020/07/Taking-Stock-2020-The-COVID-19-Edition.pdf, and accompanying Technical Appendix, available at https://rhg.com/wp-content/uploads/2020/07/Taking-Stock-2020-Technical-Appendix.pdf. Note that we have adjusted Rhodium Group's data in some instances. Information about these adjustments is available in Appendix 5.
[18] Joining the U.S. Climate Alliance is considered a gubernatorial climate commitment.

The Impact of the COVID-19 Pandemic

The COVID-19 outbreak has suppressed emissions in 2020 by forcing the U.S. to significantly curtail economic activity across several sectors. As fewer people were driving during initial lockdowns, the transportation sector saw substantially lower emissions in 2020 compared to 2019. Reduced demand for electricity and manufactured goods further drove down emissions during this period.

The short-term reductions in emissions come at the cost of tremendous economic hardship for millions of Americans, and recent emissions projections[19] show that the reductions from COVID-19 are not only temporary, but also insufficient to achieve the level of decarbonization required to mitigate the worst impacts of climate change. We need foundational changes in our economy to achieve a decarbonized future that is more prosperous and more equitable. Economic shutdowns are not a viable option for controlling pollution, and they do not address the worst sources of pollution head-on.

In this report, we present a range of emissions projections based on different economic recovery scenarios as provided in Rhodium Group's U.S. Climate Service data:

- **The High Emissions scenario** is based on data from Rhodium Group's Pre-COVID projections, which reflects emissions as would have been expected in the absence of COVID-19. This scenario represents a likely upper bound for potential emissions trajectories. Actual emissions under business-as-usual are likely to be below this estimate due to the impacts of the COVID-19 pandemic on economic activity.
- **The Low Emissions scenario** is based on data from Rhodium Group's L-shaped recovery scenario, which reflects a series of economic lockdowns that slow recovery for an extended period. This scenario represents the most pessimistic outlook for recovery that Rhodium Group included in their modeling and provides a likely lower bound for potential emissions trajectories. Actual emissions under business-as-usual are likely to be well above this estimate as early signs show economic activity is beginning to rebound from worst-case recovery levels.

In addition to the Pre-COVID and L-shaped recovery scenarios, Rhodium Group provides a V-shaped and W-shaped recovery scenario in the U.S. Climate Service data, which represent alternative emissions trajectories for economic recovery scenarios that fall between the high and low emissions scenarios. In this analysis, we present a range of emissions using the Pre-COVID scenario as a likely upper bound and the L-shaped recovery scenario as a likely lower bound to represent the high amount of uncertainty in projecting future emissions. More information about Rhodium Group's U.S. Climate Service scenarios are available in Appendix 4.[20]

[19] Based on data from Rhodium Group's U.S. Climate Service.
[20] For more detailed information about the Rhodium Group U.S. Climate Service data scenarios and methodology, see Rhodium Group's Taking Stock report, available at https://rhg.com/wp-content/uploads/2020/07/Taking-Stock-2020-The-COVID-19-Edition.pdf and the accompanying Technical Appendix, available at https://rhg.com/wp-content/uploads/2020/07/Taking-Stock-2020-Technical-Appendix.pdf.

Already, there are signs that energy demand and industrial activity are recovering to pre-pandemic levels, bringing emissions back in line with typical output. A study published earlier this summer in the journal *Nature* found that global carbon dioxide emissions decreased by 17% in April compared to 2019, but that by mid-June, emissions had recovered to just 5% below of 2019 levels.[21] The Energy Information Administration's November *Short-Term Energy Outlook* predicts that energy-related carbon dioxide emissions in the U.S. will increase by 6% in 2021 as the economy recovers and energy use increases.[22]

Recent data from Rhodium Group tracking activity in major emitting sectors of the economy show that after significant declines during initial lockdowns, industrial production is recovering rapidly, and that increased activity has brought electricity demand back up to near pre-pandemic levels. As of July, vehicle travel and gasoline demand had returned to near pre-pandemic levels as well, as domestic travel restrictions were being lifted.[23] As the pandemic continues to affect day-to-day decisions, public transit use has decreased in favor of higher emitting personal vehicles. If these trends continue, it's possible that the pandemic could leave us in an even worse position to address our emissions than before the pandemic without strong leadership and innovative policies.

These signs of recovery clearly demonstrate that the emissions impacts of the pandemic are only temporary and will not lead to lasting reductions in pollution at the scale necessary. Fortunately, we have the technologies and policy solutions needed to rebuild better, allowing people to return to their livelihoods while also providing cleaner air to breathe.

How we respond to the COVID-19 pandemic has enormous bearing on the future of the clean energy economy and the impacts of climate change. The need for a robust policy response to get the economy back on track presents an opportunity for direct investments in policies and technologies that reduce pollution from electricity generation, enhance our transportation systems, and accelerate the transition to a clean economy. In developing policies that catalyze economic recovery, **policymakers at both the state and federal level must pair strategic investments with policies that guarantee emissions decline at the pace and scale required.**

Setting Targets at the State Level

The IPCC indicates that global carbon dioxide emission reductions of at least 45% below 2010 levels by 2030 and reaching net-zero around 2050 are consistent with limiting warming to 1.5°C.[24] However, states have taken different approaches to target-

[21] Le Quéré, C., Jackson, R.B., Jones, M.W. *et al.* Temporary reduction in daily global carbon dioxide emissions during the COVID-19 forced confinement. *Nat. Clim. Chang.* **10,** 647–653 (2020). https://doi.org/10.1038/s41558-020-0797-x. See supplementary data, available at: https://www.icos-cp.eu/gcp-covid19.
[22] See Energy Information Administration Short-Term Energy Outlook. November 2020. Available at: https://www.eia.gov/outlooks/steo/outlook.php.
[23] Based on data from Rhodium Group's U.S. Climate Service.
[24] It is important to note that several emissions pathways and timelines can achieve temperature targets, and we are not bound to one specific pathway.

setting using various timelines, levels of ambition, and scopes (e.g., economy-wide or sector-specific). Some states focus on near-term targets, setting goals only for 2030, while others set aspirational long-term targets for 2050, ideally with interim goals. For example, North Carolina has a goal, established through executive order, to reduce GHG emissions by 40% from 2005 levels by 2025,[25] Washington has a statutory goal to reduce GHG emissions by 95% below 1990 levels by 2050 with interim targets in 2030 and 2040,[26] and Hawaii is striving to achieve net-zero by 2045.[27] Some targets cover the entire economy while others target specific sectors like the electric power sector.

Targets across the country also vary with respect to their enforceability. Some states have set statutory targets through the legislature with concrete mandates to achieve the reductions, while others have set targets through executive action.[28] Some targets are binding – set in statute and placing requirements on emitters or directing regulatory agencies to promulgate regulations on emissions – while others are non-binding and don't include an enforceable framework for reducing emissions. For example, New York's 2019 Climate Leadership and Community Protection Act directs the Department of Environmental Conservation to promulgate rules and regulations that ensure compliance with the targets established in the statute.[29] Meanwhile, Minnesota's 2007 legislation[30] – while it requires the development of a climate change action plan and directs the state to develop a regional approach to reducing GHG emissions – stops short of directing any agencies to put regulations in place that would secure the reduction targets.

Regardless of state legislative engagement on climate solutions, governors committing to concrete pollution reduction targets can work purposefully within the parameters of existing authority to enact regulations that will deliver the needed reductions. States have long deployed their authority under air pollution control statutes to adopt air quality management programs for other airborne contaminants – governors such as Kate Brown in Oregon[31] and Tom Wolf in Pennsylvania[32] are demonstrating how to harness existing authority to make meaningful progress on emissions control regulations for greenhouse gases with recent action by their regulatory agencies.

[25] See https://files.nc.gov/ncdeq/climate-change/EO80--NC-s-Commitment-to-Address-Climate-Change---Transition-to-a-Clean-Energy-Economy.pdf.
[26] See http://lawfilesext.leg.wa.gov/biennium/2019-20/Pdf/Bills/Session%20Laws/House/2311-S2.SL.pdf#page=1.
[27] See https://www.capitol.hawaii.gov/session2018/bills/HB2182_CD1_.htm.
[28] More information about state-specific targets between 2025 and 2030 is available in Appendix 1.
[29] See https://legislation.nysenate.gov/pdf/bills/2019/S6599.
[30] See https://www.revisor.mn.gov/statutes/cite/216H.02.
[31] Governor Brown directed state agencies to adopt standards to reduce GHG emissions to 45% below 1990 levels by 2035 and 80% by 2050. See https://www.oregon.gov/gov/Documents/executive_orders/eo_20-04.pdf.
[32] Governor Wolf directed Pennsylvania's Department of Environmental Protection to develop regulations on carbon dioxide emissions from electric power generators consistent with the Regional Greenhouse Gas Initiative. See https://www.governor.pa.gov/newsroom/executive-order-2019-07-commonwealth-leadership-in-addressing-climate-change-through-electric-sector-emissions-reductions/.

Evaluating Progress in Tons

EDF completed an analysis based on data from Rhodium Group's U.S. Climate Service comparing business-as-usual (BAU) gross[33] emissions projections[34,35] for each state that had set a concrete greenhouse gas reduction goal as of September 2020 – either through statute, executive order or both. All of these states have either committed to the goals of the U.S. Climate Alliance (26 to 28% below 2005 levels for 2025) or set a comparable reduction target for 2025,[36] **so the first benchmark in this analysis evaluates the "emissions gap" between projected gross GHG emissions and a 26% reduction relative to 2005.**[37] EDF based this analysis on the U.S. Climate Alliance target as it provides a common benchmark for each of the states and allows for assessment of their progress in aggregate toward the shared goal.[38]

Additionally, states committing to the U.S. Climate Alliance goals have explicitly stated their commitment to reducing emissions consistent with the goals of the Paris Agreement – to keep global temperature rise well below 2°C above pre-industrial levels and pursue efforts to limit the temperature increase even further to 1.5°C.[39] To place BAU trajectories in the context of these goals, **EDF also evaluated the emissions levels needed for states to align with the IPCC average pathway for a 1.5°C target – 45% below 2010 levels by 2030.**[40] While many of these states have not explicitly committed to this target beyond their commitment to supporting the goals of the Paris Agreement, several have set comparable goals. This target provides a common benchmark to assess state progress relative to what scientists have determined to be

[33] Gross emissions, in contrast to net emissions, do not account for emission sinks that remove carbon dioxide from the atmosphere (e.g., uptake of carbon dioxide and storage in forests and soils).
[34] BAU emissions shown in this report reflect state and federal policies in place as of May 2020.
[35] In order to sum up greenhouse gas emissions of different gas species (such as carbon dioxide and methane), a metric is required to compare climate impacts of emissions. The standard metric used in the community is carbon dioxide equivalence (CO_2e) with a 100-year time horizon, which requires a Global Warming Potential multiplier for non-carbon dioxide gases to represent the amount of carbon dioxide that would have the same climate impact (using radiative forcing as a proxy) over the following 100 years as the amount of emissions of the non-carbon dioxide gas. We acknowledge that CO_2e is an imperfect metric, and CO_2e represented on a 100-year time horizon, by itself, only conveys long-term climate impacts of emissions. Providing greenhouse gas emissions for two time horizons, 20- and 100-year, to convey climate impacts over all timescales would be the best practice (Ocko et al. 2017; see Appendix 7). Given that the emissions data reported by Rhodium Group's U.S. Climate Service are presented in CO_2e using a 100-year GWP, we also conduct our analysis using this metric to be consistent with the data that is familiar to state-level decision makers. We also note that we use GWP values from IPCC AR4 to retain consistency with Rhodium and EPA but note that newer values are provided in IPCC AR5. We assess the implications of two time horizons and updated GWP values in Appendix 7, and note that updated GWP-100 values do not change the main messages of this report.
[36] Louisiana is not an official member of the U.S. Climate Alliance but established a target by executive order to reduce net emissions by 26 to 28% below 2005 levels by 2025, 40 to 50% by 2030, and 100% by 2050. See https://gov.louisiana.gov/assets/ExecutiveOrders/2020/JBE-2020-18-Climate-Initiatives-Task-Force.pdf. Louisiana's 2025 target is based on net emissions, but for purposes of comparison to other states' emissions and targets, this analysis includes Louisiana's gross emissions in aggregated emissions totals. Louisiana's net emissions target is presented in Appendix 1.
[37] See U.S. Climate Alliance 2019 Fact Sheet. Available at http://www.usclimatealliance.org/s/USCA-Factsheet_Dec-2019.pdf.
[38] Target emissions for 2025 and 2030 in this analysis were calculated based on percent reductions (26% reduction from 2005 gross emissions and 45% reduction from 2010 net emissions, respectively) from historical emissions as provided by the Rhodium Group U.S. Climate Service. Targets are presented in gross emissions. For more information about the calculations used to estimate target emission levels and a comparison of different approaches, see Appendix 6.
[39] See https://unfccc.int/files/essential_background/convention/application/pdf/english_paris_agreement.pdf.
[40] See Summary for Policymakers of IPCC Special Report on Global Warming of 1.5 C. Available at: https://www.ipcc.ch/sr15/chapter/spm/. Note that model emissions pathways consistent with limiting warming to 1.5°C include reducing net carbon dioxide emissions to 45% below 2010 levels by 2030 and reaching net zero around 2050. Half of pathways consistent with limiting warming to 1.5°C show a reduction of 40 to 50% below 2010 levels by 2030 for the sum of all greenhouse gas emissions, using the standard carbon dioxide-equivalent metric with a 100-year GWP. Therefore, we use a reduction of 45% below 2010 levels by 2030 for all GHGs in this analysis to represent a pathway consistent with limiting warming to 1.5°C. We refer to this benchmark as the IPCC average pathway for a 1.5°C target for 2030 throughout this report.

consistent with reduction trajectories limiting long-term climate damages on the path to achieving net-zero emissions by mid-century.[41]

Based on this analysis, few states with climate commitments are on track to meet the 2025 target or an emission reduction trajectory consistent with the IPCC average pathway for a 1.5 °C target for 2030. Prior to the COVID-19 outbreak, the states in aggregate were projected to reduce emissions by 524 million metric tons of carbon dioxide equivalent (MMT CO_2e)[42,43] from 2005 levels by 2025 but would still have needed to reduce emissions by an additional 336 MMT CO_2e to meet the minimum reduction goal of 26% below 2005 levels. Under the most pessimistic COVID-19 outlook for economic recovery (L-shaped), the states are projected to reduce emissions by 793 MMT CO_2e by 2025, leaving a 66 MMT CO_2e gap to reach the target. However, as discussed earlier in this report, with economic activity already rebounding to near pre-pandemic levels, it is highly unlikely that future emissions will be as low as projected under the worst-case economic scenario without policies to decarbonize the economy. **Using Rhodium Group's V-shaped economic recovery scenario as an illustrative mid-range example,[44] current projections show that emissions in the states included in this analysis are expected to be only about 18% below 2005 levels by 2025.**

The gaps widen significantly when looking at the IPCC average pathway for a 1.5°C target for 2030 in the absence of new policy actions (see Figure 1). This result indicates that even if near-term reductions due to COVID-19 make 2025 targets more achievable, they do not put the states on track to reduce emissions in line with what the science requires in the long-term. Prior to COVID-19, the states were projected to reduce emissions by 297 MMT CO_2e from 2010 levels by 2030 but would need to reduce emissions by an additional 869 MMT CO_2e to stay on track with the IPCC average pathway for a 1.5°C target. Even under the most pessimistic COVID-19 outlook for economic recovery (L-shaped), the states are only projected to reduce emissions by 556 MMT CO_2e from 2010 levels by 2030, leaving a 610 MMT CO_2e gap to reduce emissions in line with the IPCC average pathway for a 1.5°C target. **Using Rhodium Group's V-shaped economic recovery scenario, current emission projections**

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[41] See Appendix 1 for information about state-specific goals.

[42] Emission estimates are based on data from Rhodium Group's U.S. Climate Service. Carbon dioxide-equivalent emissions are based on the IPCC 4th Assessment Report (AR4) 100-year global warming potential (GWP). For more information, see Rhodium Group's Taking Stock 2020: Technical Appendix, available at: https://rhg.com/wp-content/uploads/2020/07/Taking-Stock-2020-Technical-Appendix.pdf. Note that we have adjusted Rhodium Group's data in some instances. Information about these adjustments is available in Appendix 5.

[43] Note that the IPCC has updated GWP values in its Fifth Assessment Report (AR5), and that a 100-year time horizon is biased towards long-term climate impacts. However, in order for our analysis to be consistent with and comparable to the Rhodium Group and EPA data familiar to state-level decision makers, we also employ GWP-100 values from IPCC AR4 in this report and note that this does not reflect the latest science nor account for methane's large near-term impacts. However, the use of IPCC AR4 GWP values and a 100-year time horizon does not change the conclusions, because the targets would also need to be recalculated with different GWP values and/or 20-year time horizons. To show how our analysis would be adjusted based on the best available science of GWPs and different time horizons that capture both near- and long-term impacts, we provide an example in Appendix 7.

[44] We use Rhodium Group's V-shaped economic recovery scenario to represent a mid-range case for purposes of presenting illustrative statistics. This does not reflect an expectation that actual emissions are more likely to be in line with the V-shaped recovery scenario compared to other potential scenarios. We present emissions as a range throughout this report to emphasize that future emissions trajectories are highly uncertain and depend heavily on the pace of economic recovery. For more information about Rhodium Group's future emissions scenarios, see Appendix 4.

show that emissions in the states included in this analysis are expected to be only about 11% below 2010 levels by 2030.

Figure 1: Total Gross GHG Emissions from States with Gubernatorial Climate Commitments from 2005 to 2030[45]

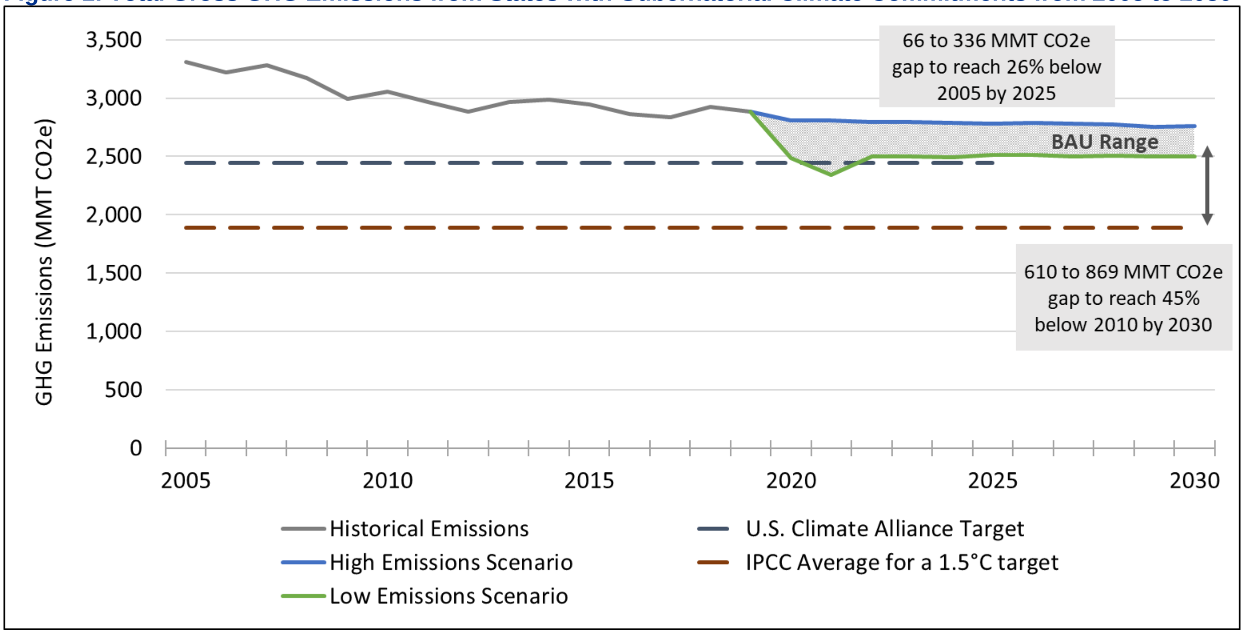

Table 1 below shows these emissions gaps by region.[46] New England and the South Atlantic region are projected to meet the 2025 U.S. Climate Alliance target, and the Mountain West and Midwest regions are projected to meet this target only under the most pessimistic (L-shaped) economic recovery scenario. In all scenarios, the gaps between projected emissions and the IPCC average pathway for a 1.5°C target for 2030 are much wider as emission reductions expected from current policies begin to level off after 2025, demonstrating the urgent need for longer term planning and policies that can continue to drive reductions at the state level beyond 2025.

[45] Based on data from Rhodium Group's U.S. Climate Service. Note that we have adjusted Rhodium Group's data in some instances. Information about these adjustments is available in Appendix 5.
[46] For the purposes of this report, the Pacific region includes California, Hawaii, Oregon, and Washington. The Mountain West includes Colorado, Montana, New Mexico, and Nevada. New England includes Connecticut, Massachusetts, Maine, Rhode Island, and Vermont. The South Atlantic includes Delaware, Maryland, North Carolina, and Virginia. The Midwest includes Illinois, Michigan, Minnesota, and Wisconsin. The Mid-Atlantic includes New Jersey, New York, and Pennsylvania. The Gulf Coast/Caribbean includes Louisiana and Puerto Rico.

Table 1: Emissions Gaps by Region[47]

Region	Emissions Gaps (MMT CO_2e)			
	2025 (U.S. Climate Alliance)		2030 (IPCC-based)	
	High	Low	High	Low
Pacific	85	15	113	60
Mountain West	48	30	103	86
New England	-3	-16	23	13
South Atlantic	-1	-27	77	48
Midwest	45	-20	191	119
Mid-Atlantic	73	17	200	155
Gulf Coast/ Caribbean	88	67	161	130
Total	**336**	**66**	**869**	**610**

Note that positive numbers indicate an emissions gap while negative numbers, highlighted in green, indicate that the region is expected to meet the target. The emissions gap is the difference between the BAU projected emissions level and the target emissions for the given year. The high emissions scenario is based on data from Rhodium Group's Pre-COVID projections, and the low emissions scenario is based on data from Rhodium Group's L-shaped recovery projections.

Impact on U.S. Emissions

The states evaluated in this report make up a significant portion of the U.S. in terms of size and economic output. The U.S. Climate Alliance states represent 55% of the U.S. population and an $11.7 trillion economy, which would make it the third largest economy in the world behind the whole U.S. and China.[48] They are also responsible for a sizable portion of the country's GHG emissions. Emissions from the states evaluated in this analysis, which include the U.S. Climate Alliance states and Louisiana, make up about 42% of total U.S. emissions.[49] By meeting the targets assessed in this report, states that have committed to reduce GHG emissions would bring the U.S. as a whole closer to meeting its original commitment under the Paris Agreement.

Under a business-as-usual scenario, using the V-shaped recovery projections as an illustrative mid-range example,[50] U.S. emissions would fall only 20% from 2005 levels by 2025 and 15% from 2010 levels by 2030, leaving sizeable gaps between BAU emissions and the targets evaluated in this report. **But if the states included in this analysis were to successfully reduce emissions in line with these targets, we found that collectively they would shrink the remaining U.S. emissions gap by 34% in 2025 and 43% in 2030 – bringing the country meaningfully closer to these crucial targets.**

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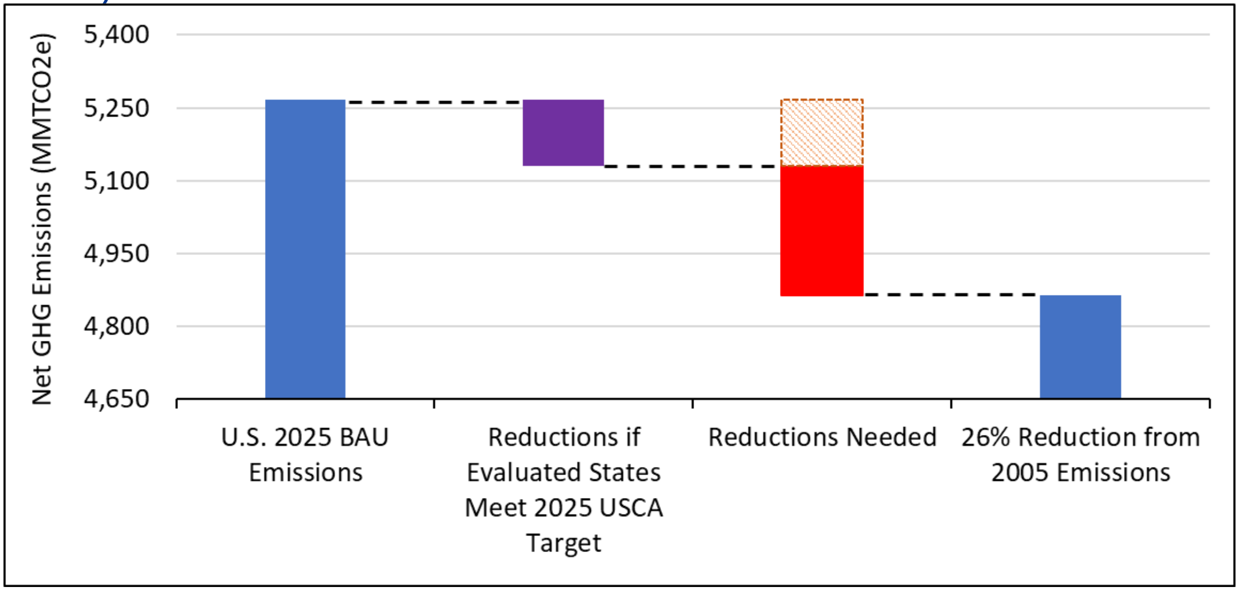
[47] Based on data from Rhodium Group's U.S. Climate Service. Note that we have adjusted Rhodium Group's data in some instances. Information about these adjustments is available in Appendix 5.
[48] See U.S. Climate Alliance 2019 Fact Sheet, available at: http://www.usclimatealliance.org/s/USCA-Factsheet_Dec-2019.pdf.
[49] Emissions from the states included in this analysis made up about 42% of total U.S. emissions in 2019 based on data from Rhodium Group's U.S. Climate Service.
[50] We present emissions as a range throughout this report to emphasize that future emissions trajectories are highly uncertain and depend heavily on the pace of economic recovery. For more information about Rhodium Group's future emissions scenarios, see Appendix 4.

The impact of these states meeting the 2025 U.S. Climate Alliance target on U.S. GHG emissions in 2025 is illustrated in Figure 2 below. The first column shows BAU emissions for the U.S. in 2025. The second column shows the amount of reductions that would be secured if the states included in this report meet the 2025 U.S. Climate Alliance target, closing the gap to the 2025 target of 26% below 2005 levels by over a third. The next column shows the amount of reductions needed to fully close the gap, and the last column illustrates the target for remaining U.S. emissions in 2025.[51]

Figure 2: 2025 U.S. Emission Reductions if States Evaluated Meet 2025 Targets (V-Shaped Emissions Scenario)[52,53]



Meaningful Targets Bring New Challenges

It is laudable and important that these states have led the way in acknowledging the severity of the climate crisis even in the face of inaction from many of their peers. These state leaders have also highlighted a crucial metric for determining the success of climate action: achieving reductions of greenhouse gas pollution at the pace and scale necessary to avert the worst of the crisis.

Yet these gaps illustrate that setting a target is only the start when it comes to addressing climate warming pollution in the states. On their own, they do not provide the policy certainty required to achieve results or assign responsibility for emission reductions to any industries or sectors of the economy. The gaps between state targets and business-as-usual emissions trajectories, which capture state policies adopted through May 2020 – two to three years after many of these commitments were made,

[51] This data is presented for the 2030 target in Appendix 8.
[52] Based on data from Rhodium Group's U.S. Climate Service. Note that we have adjusted Rhodium Group's data in some instances. Information about these adjustments is available in Appendix 5.
[53] This chart presents U.S. GHG emissions in net emissions as forecasted under Rhodium Group's V-shaped recovery scenario. The 26% reduction target is estimated in terms of net GHG emissions.

depending on the state[54] – highlight the urgent need to dramatically scale up the type of policy action that guarantees reductions.

From coast to coast, there are significant gaps between projected emissions and state commitments. The following data display these gaps at the state level for four states. These four states are presented as examples, and Appendix 1 shows state-by-state emissions projections and gaps for all the states included in the analysis. The aggregate analysis uses the 2025 and 2030 targets discussed above, but Appendix 1 also shows states' progress with respect to additional state-specific reduction commitments. Appendix 3 outlines all GHG reduction targets that the states evaluated in this report have committed to achieving, including binding statutory reduction requirements, statutory goals, and executive order commitments.

Washington

Washington was a founding member of the U.S. Climate Alliance in 2017 along with California and New York.[55] Earlier this year, the state adopted legislation updating its original state climate targets[56] to reflect the increasing urgency and necessary ambition. The legislature set statutory goals to reduce GHG emissions 45% below 1990 levels by 2030, 70% by 2040, and 95% by 2050, but stopped short of adopting a policy framework capable of achieving these reductions or directing Washington regulators to develop regulations to ensure that emissions declined consistent with these goals (as legislators had done in 2019 in Colorado, New York, New Jersey, and Maine). As shown in Figure 3 and Table 2 below, despite important efforts to put the power sector on a trajectory to 100% clean energy,[57] Washington will need to adopt additional policies to achieve reductions consistent with its 2025 and 2030 targets.

[54] The U.S. Climate Alliance was formed in June 2017, but some states joined in 2018 and 2019.
[55] See https://www.governor.wa.gov/news-media/inslee-new-york-governor-cuomo-and-california-governor-brown-announce-formation-united.
[56] See https://apps.leg.wa.gov/rcw/dispo.aspx?cite=70.235.020.
[57] See SB 5116, available at http://lawfilesext.leg.wa.gov/biennium/2019-20/Pdf/Bills/Session%20Laws/Senate/5116-S2.SL.pdf?q=20201118144027.

Figure 3: Washington Economy-Wide Gross GHG Emissions and Targets[58,59]

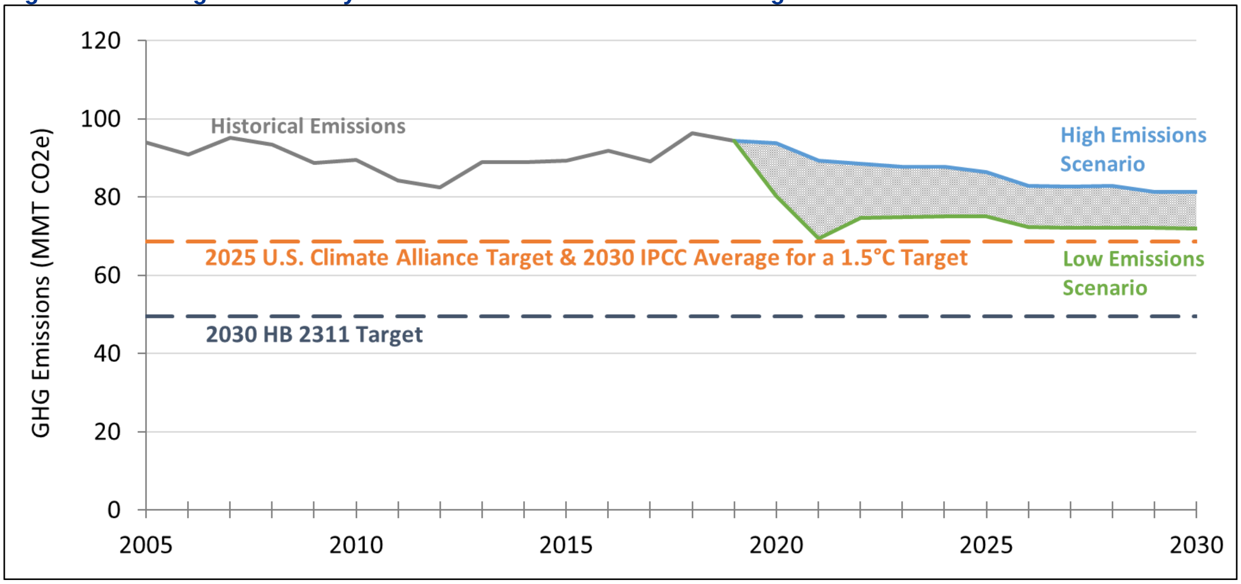


Table 2: Emissions Gaps in Washington, 2025 - 2030

Washington				
Target Year	**Target**	**Emissions Target (MMT CO_2e)**	**Remaining Gap (High Emissions)**	**Remaining Gap (Low Emissions)**
2025	26% below 2005 (U.S. Climate Alliance)	69.5	16.9	5.7
2030	45% below 2010 net emissions (IPCC)	68.6	12.6	3.4
2030	45% below 1990 (HB 2311)[60]	49.5	31.7	22.5

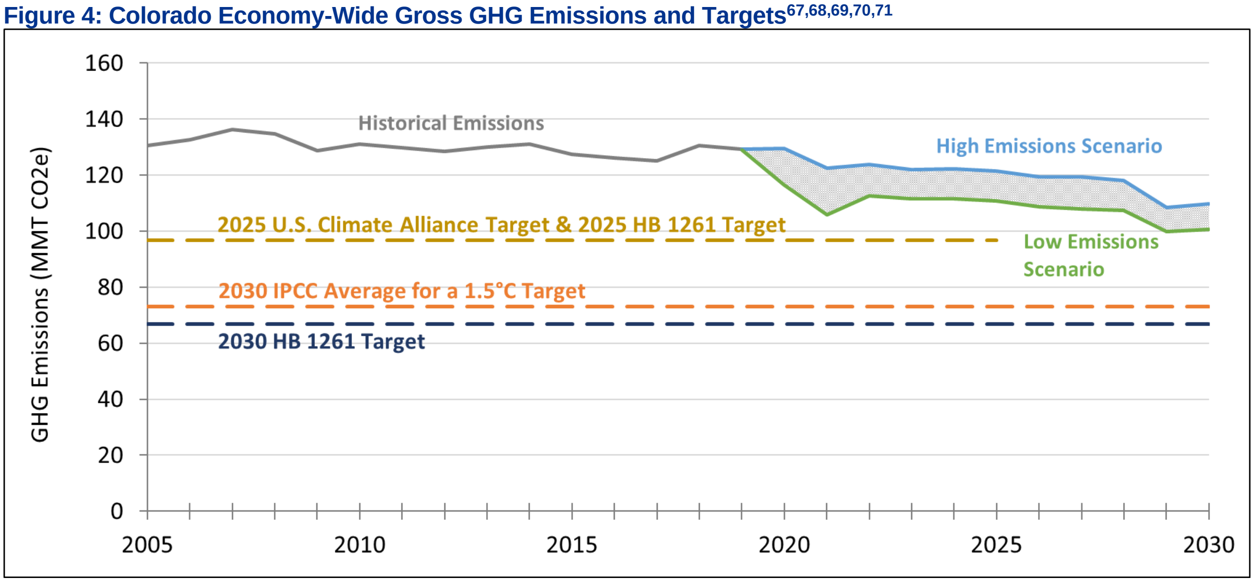
Colorado

Colorado joined the U.S. Climate Alliance in July 2017, committing to implement policies consistent with the goals of the Paris Agreement.[61] The state reinforced the 2025 target in statute and established additional mandatory reduction requirements in HB19-1261, which was signed into law in May 2019 and requires the Air Quality Control Commission ("AQCC") to adopt regulations that reduce GHG emissions by 26% below 2005 levels

[58] The 2030 HB 2311 target is based on 1990 emissions. 1990 emissions are not available in Rhodium Group's U.S. Climate Service data, so this target is based on Washington's 1990 – 2015 Greenhouse Gas Emissions Inventory report. See https://fortress.wa.gov/ecy/publications/documents/1802043.pdf.
[59] The 2025 U.S. Climate Alliance target and 2030 IPCC average for a 1.5°C target are shown as a single line on this chart because the 2030 net emissions target does not differ enough from the 2025 U.S. Climate Alliance gross emissions target to present as a separate line.
[60] See http://lawfilesext.leg.wa.gov/biennium/2019-20/Pdf/Bills/Session%20Laws/House/2311-S2.SL.pdf#page=1.
[61] See https://www.denverpost.com/2017/07/11/colorado-signs-us-climate-alliance-joining-states-committed-paris-climate-agreement/.

by 2025, 50% by 2030, and 90% by 2050.[62] Despite targeted rulemakings to reduce methane leaks from oil and gas production,[63] increase deployment of zero emissions vehicles,[64] and cement the retirement of coal units to meet federal regional haze obligations,[65] the state remains far from securing economy-wide reductions consistent with its targets as shown in Figure 4 and Table 3 below. Moreover, the AQCC has yet to propose a rulemaking package that would secure the required reductions, despite an overdue statutory requirement that the AQCC propose rules by July 1, 2020 "to implement measures that would cost-effectively allow the state to meet its greenhouse gas emissions reduction goals."[66]

Figure 4: Colorado Economy-Wide Gross GHG Emissions and Targets[67,68,69,70,71]



[62] See https://leg.colorado.gov/sites/default/files/2019a_1261_signed.pdf.
[63] See https://drive.google.com/file/d/1jtnB87KPTIvO36Ep5V0nmtUhpXjB7o29/view.
[64] See https://drive.google.com/file/d/1JoxtqZx6xBToVP7H5DUEbuTo5V5Zb83E/view.
[65] See footnote 65.
[66] See SB19-096; https://leg.colorado.gov/sites/default/files/2019a_096_signed.pdf.
[67] EDF replaced Rhodium Group's methane estimates for Colorado's Oil & Gas sector based on a separate EDF analysis using site-level measurements and peer reviewed methods. Specifically, EDF estimated current methane emissions from the Oil & Gas sector using a combination of GHGRP and Alvarez et al. data. Historical methane emissions were back projected using production data from Enverus. Future methane emissions were projected based on proprietary production data from Rystad Energy.
[68] EDF adjusted Rhodium Group's emission projections to account for the recently adopted retirement dates of coal-fired units as outlined in the Colorado APCD's August 20, 2020 Request for Hearing Document Package, available at https://cdphe.colorado.gov/ozone-and-your-health/regional-haze. In addition, we adjusted for the more recent decision that Craig 3, Rawhide and Ray D Nixon will retire at the end of 2028. See https://coloradosun.com/2020/11/23/three-coal-plants-shut-down-colorado/. Note that the Rhodium Group assumes Craig 1 retires at the beginning of 2025, whereas the APCD indicates it will retire at the end of 2025. The impact of this closure on 2025 emissions is less than 1 MMT CO_2e. In the L-shaped scenario, Rhodium Group's model retires the Rawhide plant at the end of 2020 as it finds this retirement to be economic. EDF's adjustment assumes all replacement capacity is zero-emission.
[69] Note that Rhodium Group's emission projections for Colorado do not precisely account for the requirements of SB 19-236 that qualifying retail utilities reduce carbon dioxide emissions 80% from 2005 levels by 2030, although the coal unit adjustments and assumption that the replacement energy would be carbon-free should capture many of the expected reductions. See https://leg.colorado.gov/sites/default/files/documents/2019A/bills/2019a_236_enr.pdf.
[70] EDF adjusted Rhodium Group's emissions data to account for Colorado's rules designed to reduce emissions of hydrofluorocarbons ("HFCs"). APCD, Memorandum of Notice, Regulation Number 22, February 20, 2020. See https://drive.google.com/drive/folders/1irIUGWl4j4BOkkq4J1g54hscK7ov_BS8.
[71] While the 2025 U.S. Climate Alliance target is based on gross emissions for purposes of this analysis and the state's target is based on net emissions, LULUCF sinks are not large enough to separate these targets enough to represent as separate lines on the chart.

Table 3: Emissions Gaps in Colorado, 2025 - 2030

Colorado					
Target Year	**Target**	**Emissions Target (MMT CO_2e)**	**Remaining Gap (High Emissions)**	**Remaining Gap (Low Emissions)**
2025	26% below 2005 (U.S. Climate Alliance)	96.6	24.9	14.2
2025	26% below 2005 net emissions (HB 19-1261) [72]	97.3	24.2	13.5
2030	45% below 2010 net emissions (IPCC)	73.1	36.5	27.6
2030	50% below 2005 net emissions by 2030 (HB 19-1261)[73]	66.7	43.0	34.0

Minnesota

Minnesota joined the U.S. Climate Alliance just days after it was announced in June 2017 along with nine other states.[74] The state had preexisting targets under the Next Generation Energy Act ("NGEA"), signed by Governor Pawlenty in 2007, to reduce GHG emissions to 15% below 2005 levels by 2015, 30% by 2025, and 80% by 2050.[75] Minnesota missed its 2015 target,[76] and even under the most pessimistic economic recovery scenario, Minnesota's projected emissions are not low enough to be consistent with the thirteen-year-old target, let alone a trajectory consistent with the IPCC average pathway for a 1.5°C target. As shown in Figure 5 and Table 4 below, Minnesota will need to put additional policies or regulations in place to close the significant gaps to its 2025 target as well as the IPCC average for a 1.5°C target, and maximize cumulative reductions over the upcoming decade consistent with achieving these critical goals. Despite having robust authority to regulate greenhouse gas emissions, the Minnesota Pollution Control Agency has not adopted any regulations designed to significantly reduce climate pollution since the state joined the Climate Alliance.[77] Minnesota should swiftly set revised, more ambitious targets consistent with science – and pursue policies that will secure the needed reductions.[78]

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[72] See https://leg.colorado.gov/sites/default/files/2019a_1261_signed.pdf.
[73] See https://leg.colorado.gov/sites/default/files/2019a_1261_signed.pdf.
[74] See https://www.governor.wa.gov/news-media/united-states-climate-alliance-adds-10-new-members-coalition-committed-upholding-paris.
[75] See https://www.revisor.mn.gov/statutes/cite/216H.02.
[76] See https://www.pca.state.mn.us/sites/default/files/lraq-2sy19.pdf.
[77] See https://www.pca.state.mn.us/air/state-and-regional-initiatives.
[78] See https://climate.state.mn.us/.

Figure 5: Minnesota Economy-Wide Gross GHG Emissions and Targets

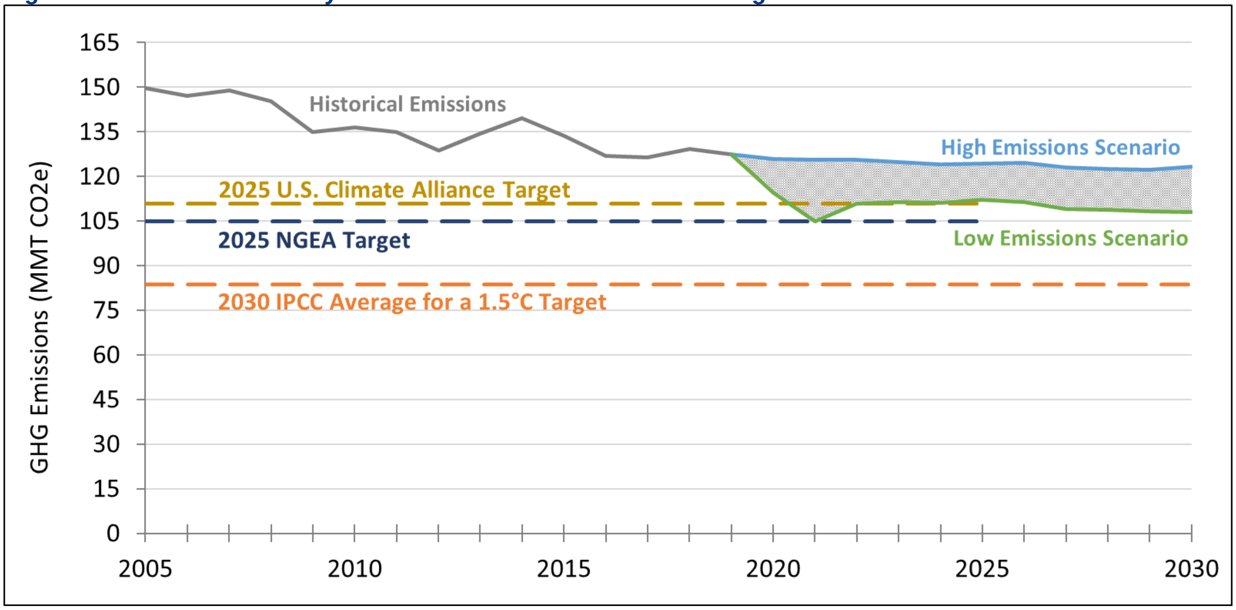


Table 4: Emissions Gaps in Minnesota, 2025 - 2030

Minnesota				
Target Year	**Target**	**Emissions Target (MMT CO_2e)**	**Remaining Gap (High Emissions)**	**Remaining Gap (Low Emissions)**
2025	26% below 2005 (U.S. Climate Alliance)	111	13	1
2025	30% below 2005 (Next Gen Energy Act)[79]	105	19	7
2030	45% below 2010 net emissions (IPCC)	84	40	24

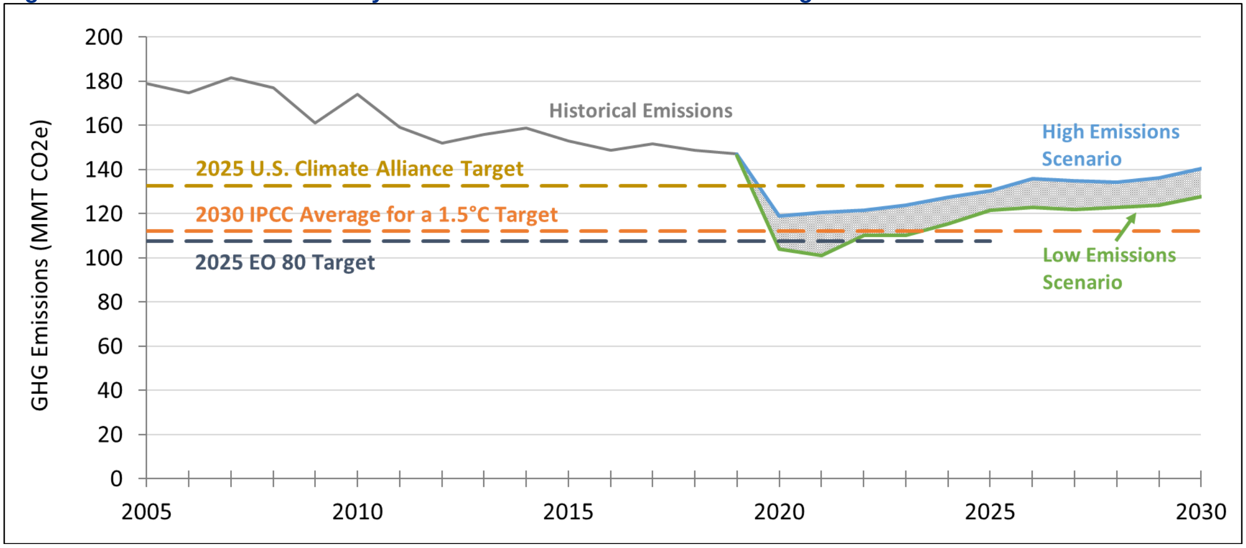
[79] See https://www.revisor.mn.gov/statutes/cite/216H.02.

North Carolina

North Carolina joined the U.S. Climate Alliance in September 2017, just a few months after its inception.[80] Since making this commitment to the goals of the Paris Agreement, the state has primarily focused on planning.[81] Governor Roy Cooper followed up on the state's commitment to the goals of the Climate Alliance with Executive Order 80 ("EO 80") in 2018, which reiterated the urgency of GHG reductions by establishing an economy-wide GHG target of 40% below 2005 levels by 2025.[82] The Executive Order also established a zero-emission vehicle target for 2025 and called on the Department of Environmental Quality to develop a Clean Energy Plan to encourage the state to invest in clean energy resources. That plan was released one year later in October of 2019 and included a recommendation that the state reduce carbon dioxide emissions from the electric power sector by 70% from 2005 levels by 2030 and to net-zero by 2050.[83]

It is crucial that the state begin to deliver on these targets immediately and, as importantly, that the reductions the state achieves result in a permanently decarbonized economy. As shown in Figure 6 below, achieving emissions levels consistent with the EO 80 target and the IPCC average for a 1.5°C target is in reach. However, our analysis shows that emissions will not remain at those levels in the long-term as economic activity and energy demand drive emissions back up in the future. Governor Cooper will need to deliver on the commitments he has made with an eye toward the future. With 2025 rapidly approaching, the Governor should set economy-wide reduction targets looking to 2030 and beyond – and swiftly develop the regulations necessary to put the state on track for achieving them.

Figure 6: North Carolina Economy-Wide Gross GHG Emissions and Targets



[80] See https://governor.nc.gov/news/north-carolina-joins-14-states-bipartisan-us-climate-alliance.
[81] See https://www.ncleg.net/Sessions/2017/Bills/House/PDF/H589v6.pdf.
[82] See https://files.nc.gov/ncdeq/climate-change/EO80--NC-s-Commitment-to-Address-Climate-Change---Transition-to-a-Clean-Energy-Economy.pdf.
[83] See https://files.nc.gov/ncdeq/climate-change/clean-energy-plan/NC_Clean_Energy_Plan_OCT_2019_.pdf.

Table 5: Emissions Gaps in North Carolina, 2025 - 2030

North Carolina				
Target Year	Target	Emissions Target (MMT CO_2e)	Remaining Gap (High Emissions)	Remaining Gap (Low Emissions)
2025	26% below 2005 (U.S. Climate Alliance)	133	-2	-11
2025	40% below 2005 (EO 80)	107	23	14
2030	45% below 2010 (IPCC)	112	29	16

Note: negative values indicate that the state's emissions are projected to be below the target for that year.

Accelerating Near-Term Reductions

Acting now to reduce greenhouse gas emissions has both near- and long-term benefits. For example, reducing emissions of short-lived climate pollutants (e.g. methane) – which govern the rate of warming – is crucial for slowing the pace of warming and limiting associated damages. On the other hand, reducing emissions of long-lived climate pollutants (e.g., carbon dioxide) – which govern the maximum extent of warming – is crucial for limiting the overall amount of warming we experience in the long-term. This is because long-lived climate pollutants can last for centuries in the atmosphere, [84] thus committing us to warming for generations to come. Therefore, as we continue to emit carbon dioxide into the atmosphere over the next decade, and even over the next few years, we will continue to exacerbate the climate damages we are already seeing.[85]

While annual emissions of short-lived climate pollutants generally dictate their climate impact, the amount of long-lived climate pollutants emitted in any single year is less important than the overall amount emitted over several decades. Therefore, we must ensure that total reductions in carbon dioxide over time are consistent with assessments of carbon dioxide budgets that estimate the cumulative amount of carbon dioxide that can be emitted while staying below a particular temperature target.[86] In order to limit the cumulative amount of long-lived climate pollutant emissions, state leaders need to act quickly and implement policies that reduce emissions with the urgency the problem demands – with a consistent and persistent downward trajectory over the course of this decade that aligns with estimated carbon dioxide budgets.

[84] Myhre, G., D. Shindell, F.-M. Bréon, W. Collins, J. Fuglestvedt, J. Huang, D. Koch, J.-F. Lamarque, D. Lee, B. Mendoza, T. Nakajima, A. Robock, G. Stephens, T. Takemura and H. Zhang, 2013: Anthropogenic and Natural Radiative Forcing. In: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. Available at: https://www.ipcc.ch/site/assets/uploads/2018/02/WG1AR5_Chapter08_FINAL.pdf.
[85] Continuing to emit carbon dioxide will continue to exacerbate damages unless we scale up removal mechanisms.
[86] For more information about carbon dioxide budgets, refer to the IPCC 2018 Special Report on the impacts of global warming of 1.5°C, available at: https://www.ipcc.ch/site/assets/uploads/sites/2/2019/06/SR15_Full_Report_High_Res.pdf.

Figure 7: Example Emissions Trajectories for States Evaluated (2020 - 2030)

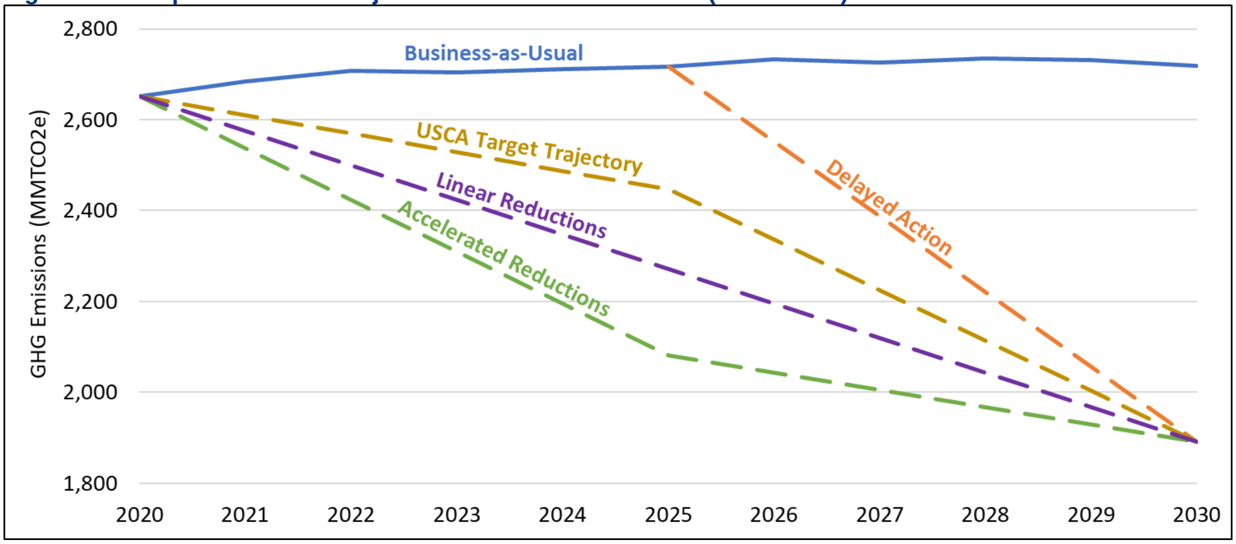


Figure 7 above illustrates different trajectories the states we analyzed could collectively take while achieving the *annual* emissions target for 2030, derived from the IPCC average pathway for 1.5°C. These trajectories include one that delays action until 2025, one where emissions decline linearly from 2020 to meet the 2025 Climate Alliance target, one where emissions decline linearly from 2020 to the 2030 target, and one where reductions are accelerated with most of the decline taking place in the first five years. While all of these pathways result in the same quantity of emissions in 2030, they differ significantly in the amount of pollution actually entering the atmosphere over the decade.

Figure 8 and Figure 9 below underscore the profound implications for total greenhouse gas pollution. The area in the charts beneath the emission reduction trajectory shows the cumulative quantity of emissions entering the atmosphere from the states, while the area between the reduction trajectory and the BAU trajectory indicates the cumulative quantity of emissions reduced. Both trajectories have the same emissions in 2030, **but the accelerated reduction trajectory prevents twice as much pollution from entering the atmosphere over the course of the decade.** This is an example of how crucial the reduction pathway is toward a point-in-time target.

Figure 8: Example Delayed Action Emission Reduction Trajectory for Evaluated States (2020 - 2030)

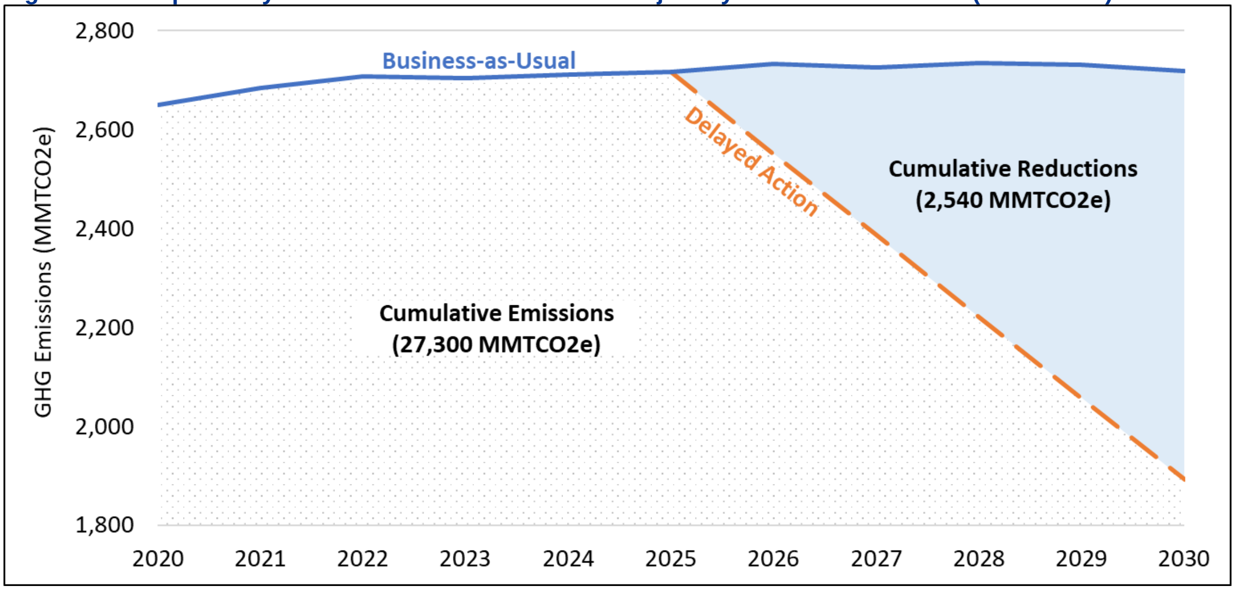


Figure 9: Example Accelerated Emission Reduction Trajectory for Evaluated States (2020 - 2030)

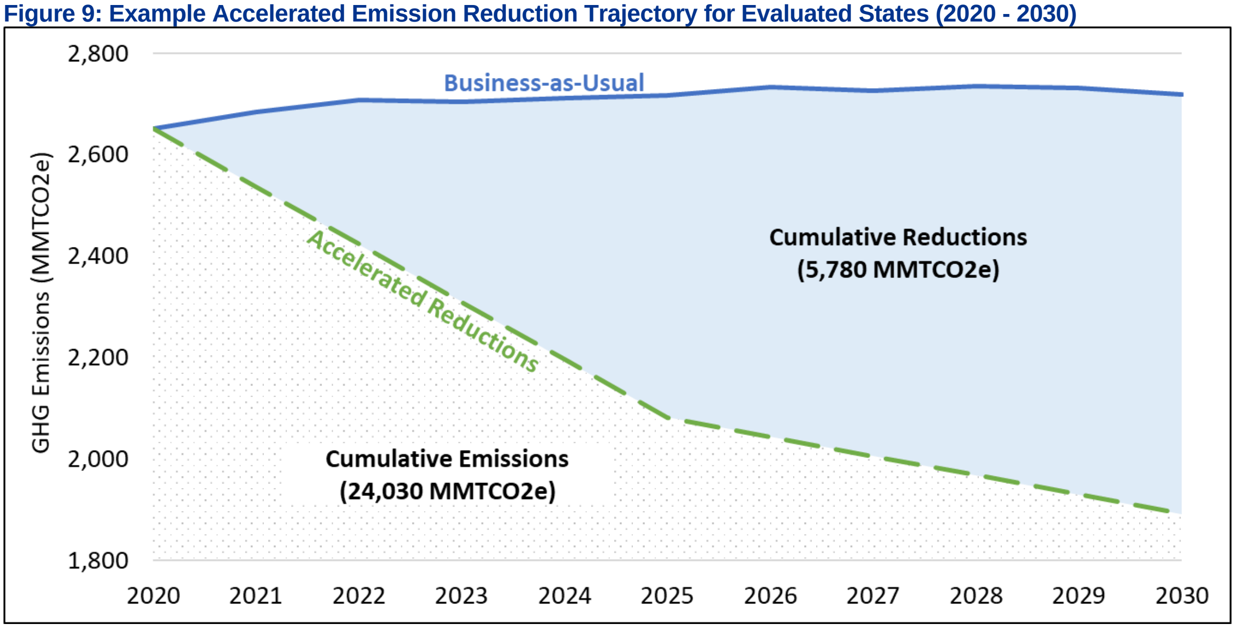
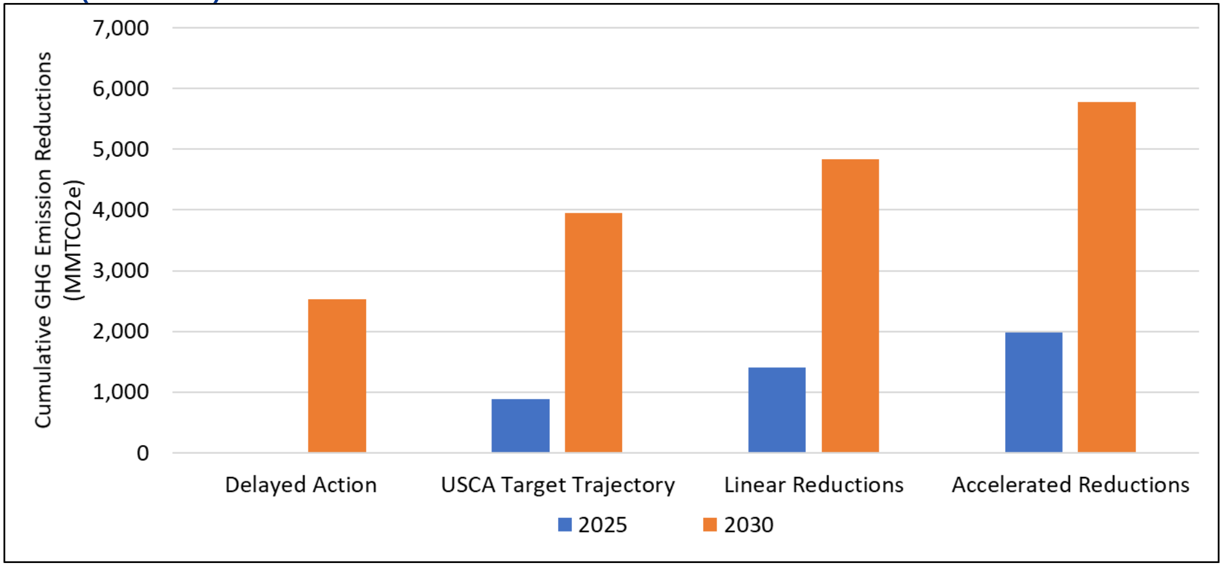


Figure 10 below summarizes the total cumulative reductions for each of the example emissions trajectories, further illustrating that regardless of annual emission levels in 2030, the trajectory we take to reduce emissions has a significant impact on the quantity of pollution we put into the atmosphere over time – which will determine the scale of warming we experience and the intensity of climate impacts.

Figure 10: Cumulative Emission Reductions for Example Trajectories Relative to BAU for Evaluated States (2020 - 2030)



To minimize the damages from cumulative emissions, it is not enough to achieve a certain emissions level by 2030 or 2050 if most of the reductions take place in the final few years leading up to the deadline and far greater total quantities of greenhouse gases are emitted as a result. Near-term targets such as the 2030 target evaluated in this report should be used to establish an immediate and persistent reduction trajectory that delineates the cumulative emissions allowable over the decade. It is critical to create a reduction trajectory consistent with the carbon dioxide budget from which this targets was derived.[87] Avoiding the worst impacts of climate change will require securing as many reductions as possible as early as possible to stay within the estimated greenhouse gas budgets.

The Right Policy Toolkit

This analysis reveals that the state policy toolkit for ensuring emission reductions needs to contain the right set of options for the task. Popular state policies include requiring 100% clean electricity, adopting low- and zero-emission vehicle standards, and enacting aggressive building codes that promote efficiency and electrification. These are critical efforts to redouble, as surgical interventions will continue to be important to drive technology deployment and accelerate the pace of change in certain sectors. However, comprehensive action with policy tools that both focus on enforceable emission limits and reach across sectors will be essential to make progress at the scale that science demands. Importantly, a declining limit on emissions can allow a state to guarantee emission outcomes at the pace and scale necessary.

[87] See section C.1.3 of the See Summary for Policymakers of IPCC Special Report on Global Warming of 1.5°C. Available at: https://www.ipcc.ch/sr15/chapter/spm/.

For example, California's 2017 Climate Change Scoping Plan[88] acknowledges that different policy approaches vary considerably in terms of the certainty of reductions and highlights the value of that certainty when crafting a suite of climate policies designed to secure emission outcomes consistent with meeting state targets. Based on their analysis, California expected a significant emissions gap after accounting for the abatement from known policy commitments and identified the need for an emissions control policy to fill that gap. The enforceable limit of the state's cap-and-trade program acts as a backstop to reach required emission levels, even while other performance standards help drive reductions and catalyze the technology and systems changes necessary for deep levels of decarbonization.

Many climate policies are performance based – while they guarantee the *rate* of emissions (e.g. carbon intensity of fuel sold, or emissions per square foot of a building), the total level of emissions will still fluctuate depending on the level of economic activity. These types of policies can be paired effectively with emission limits to constrain the total *amount* of emissions entering the atmosphere. Other states have recently acknowledged the need for pollution caps that provide certainty in emission outcomes. Oregon is developing regulations to cap and reduce emissions from stationary sources, transportation fuels, and liquid and gaseous fuels in accordance with Governor Brown's recent executive order,[89] and Governor Wolf of Pennsylvania directed the Department of Environmental Protection to cap emissions from the electric power sector by developing a rule consistent with the Regional Greenhouse Gas Initiative.[90] States in the Northeast are also evaluating the development of a program that would put a cap on emissions associated with transportation fuels sold across the region.[91]

A well-designed policy that pairs an enforceable limit with a price on pollution can deliver tremendous environmental benefits. Most importantly, if designed correctly such a policy can dramatically accelerate near-term reductions and provide a clear price signal that incentivizes clean investments. Programs like emission allowance markets can be designed to cover all emissions across the economy under one limit, and even link with other markets to improve efficiency and expand opportunities for cost-effective abatement. These options provide a powerful tool to enable high ambition by ensuring we capture low-cost reductions in the near-term while catalyzing the innovation necessary to mitigate costs in the future.

Such policy approaches must be designed to prioritize equitable outcomes and address the needs of each state's unique communities. Pollution impacts are most often concentrated in communities of color and those with significant low-income populations,[92] and climate policies target many of the same air pollution sources that burden these communities. Well-designed strategies for limiting greenhouse gas pollution can be tailored to help improve local pollution impacts, spur the deployment of

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[88] See https://ww2.arb.ca.gov/sites/default/files/classic//cc/scopingplan/scoping_plan_2017.pdf.
[89] See https://www.oregon.gov/gov/Documents/executive_orders/eo_20-04.pdf.
[90] See https://www.oa.pa.gov/Policies/eo/Documents/2019-07.pdf.
[91] The Transportation and Climate Initiative is developing a program to cap and put a price on carbon dioxide emissions from transportation fuels. For more information, see https://www.transportationandclimate.org/.
[92] See Bell, M. L., & Ebisu, K. 2012. Environmental inequality in exposures to airborne particulate matter components in the United States. *Environmental health perspectives*. Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3546368/.

clean energy, and distribute economic benefits in ways that directly support the most overburdened and underserved populations. A comprehensive state climate policy framework should prioritize improvements to air quality, public transportation options, and clean energy systems in disproportionately impacted communities. These same communities have been hit hardest by the COVID-19 pandemic, and the jobs that the clean energy transition will create, along with workforce training, can and should be directed to the communities most in need.

In developing climate policy approaches, EDF recommends that states:

- **Use short-term targets to develop an immediate and persistent reduction trajectory toward longer-term targets that constrain total allowable pollution.** States should use, at minimum, the short-term goals identified in this report to establish an emission reduction trajectory over the next decade that accounts for the cumulative amount of long-lived climate pollutants and aligns with IPCC's estimated carbon dioxide budgets.
- **Establish a declining, enforceable limit on greenhouse gas pollution**. These limits should cover emissions from all of the state's major sources of pollution and would provide a critical backstop for other complementary policies – guaranteeing emission reductions will be achieved. Emission limits can be source-based, sector based, or applied across multiple sectors.
- **Ensure environmental and economic benefits are directed to disproportionately impacted communities**. Prioritizing a robust public engagement process to identify and implement policies helps ensure benefits from greenhouse gas reduction policies, including improvements in local air quality, are directed to disproportionately impacted communities and those most overburdened by pollution from the fossil-fuel economy. Such policies can be adopted alongside, and as part of, an emission cap framework. Policies and investments should also support communities and workers impacted by the transition from fossil fuels.
- **Consider an approach that puts a price on pollution**. If well designed, deploying a carbon price to help meet pollution limits can enable much greater ambition by securing emission reductions as cost-effectively as possible, jumpstarting innovation, and accelerating early action. Climate policies that price pollution can achieve greater reductions by keeping the costs low for consumers, and they can generate substantial benefits for communities most vulnerable to climate impacts and other environmental harms if the value from these programs is directed to disproportionately impacted communities. When designing such a program, consider where flexibility helps enhance ambition and where flexibility can be restricted to help target the co-pollutant benefits of greenhouse gas mitigation to communities most impacted by harmful air pollution.
- **Catalyze the development and deployment of clean technologies**. Supporting the ongoing adoption of performance-oriented policies can accelerate the development and deployment of clean technologies. In conjunction with an emission cap, these policies can clean up our cars and buildings and make

pollution reduction targets easier to achieve over time, while also being tailored to ensure the benefits accrue to where they are most needed.

Achieving Reductions to Close Emissions Gaps

As this analysis shows, setting ambitious climate targets is only the beginning of the challenging process of reducing emissions to levels that avoid the worst impacts of climate change. These targets are necessary to outline the scope of the challenge – states that have established these targets are far ahead of states where leadership has ignored the urgency of climate change and failed to demonstrate any commitment to act. It is critical to build on the foundation of these targets and deploy policies that are designed to ensure the goals are achieved.

Regardless of the specific suite of policies deployed, it is imperative that states focus on the targets they have set, acknowledge their current emissions gaps,[93] and take action to achieve quantifiable reductions in pollution needed to limit warming over the coming decades. This requires not only meeting existing targets, but accelerating emission reductions in the near-term to minimize the cumulative buildup of long-lived climate pollutants in the atmosphere and the severity of the climate impacts that will result. States have the authority and the opportunity to drive down emissions; the urgency and the scale of the problem demands their leadership.

[93] The State of New Mexico's work under Gov. Lujan Grisham offers a good example, engaging in a robust data analysis, transparently laying out the emissions gap, and setting a course to enact comprehensive emission reduction policies to ensure the gap is closed. Available at: https://www.climateaction.state.nm.us/documents/reports/NMClimateChangeReport_2020.pdf.

Appendix 1: State-by-state Data

This appendix provides state-by-state business-as-usual greenhouse gas emission projections as well as gaps between those projections and emission reduction targets for the states included in the analysis (those with gubernatorial climate commitments,[94] which includes 25 states and Puerto Rico). Targets include the two benchmarks evaluated in this report for all jurisdictions (26% below 2005 levels by 2025 and 45% below 2010 levels by 2030), as well as any additional economy-wide state-specific targets for this timeframe set via statute or executive order. This appendix presents GHG targets for years through 2030[95] as the analysis focuses on emissions within this timeframe. All economy-wide state-specific targets are outlined in Appendix 3, where information on additional state targets not presented in this appendix (e.g., targets beyond 2030) is also available.

Emissions projections are based on data from Rhodium Group's U.S. Climate Service.[96] Carbon dioxide-equivalent emissions are based on the IPCC 4th Assessment Report (AR4) 100-year global warming potential (GWP).[97] Note that the IPCC has updated GWP values in its Fifth Assessment Report (AR5), and that a 100-year time horizon is biased towards long-term climate impacts. However, in order for our analysis to be consistent with and comparable to the Rhodium Group and EPA data available to state-level decision makers, we also employ 100-year GWP values from IPCC AR4 in this report, and note that this does not reflect the latest science nor account for methane's large near-term impacts. However, the use of IPCC AR4 GWPs and a 100-year time horizon does not change the conclusions, because the targets would also need to be recalculated with different GWP values and/or 20-year time horizons. To show how our analysis would be adjusted based on the best available science of GWPs and different time horizons that capture both near- and long-term impacts, we provide an example in Appendix 7.

Target emissions in this analysis were calculated based on percent reductions from historical emissions as provided by the Rhodium Group U.S. Climate Service. Where historical emissions were not available from Rhodium Group (i.e., emissions before 2005), alternative data sources were used as noted throughout this appendix. All emissions and emissions targets are presented in gross emissions. Net emissions targets are adjusted to reflect the gross emissions level needed to achieve the net emissions target based on projected LULUCF sinks from Rhodium Group's U.S. Climate Service data. More information about how emissions targets were estimated in this analysis is available in Appendix 6.

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[94] Joining the U.S. Climate Alliance is considered a gubernatorial climate commitment.
[95] Note that we do not include historical targets, including targets for the year 2020, in this appendix. For more information about state targets, see Appendix 3.
[96] Note that Rhodium Group uses a downscaling methodology to estimate state-level emissions based on the 2020 EPA Greenhouse Gas Inventory. Because of this, state-level estimates do not align exactly with state GHG inventory estimates. For more information, see Appendix 5.
[97] For more information, see Rhodium Group's Taking Stock 2020: Technical Appendix, available at: https://rhg.com/wp-content/uploads/2020/07/Taking-Stock-2020-Technical-Appendix.pdf.

California

Figure 11: California Economy-Wide Gross GHG Emissions and Targets[98]

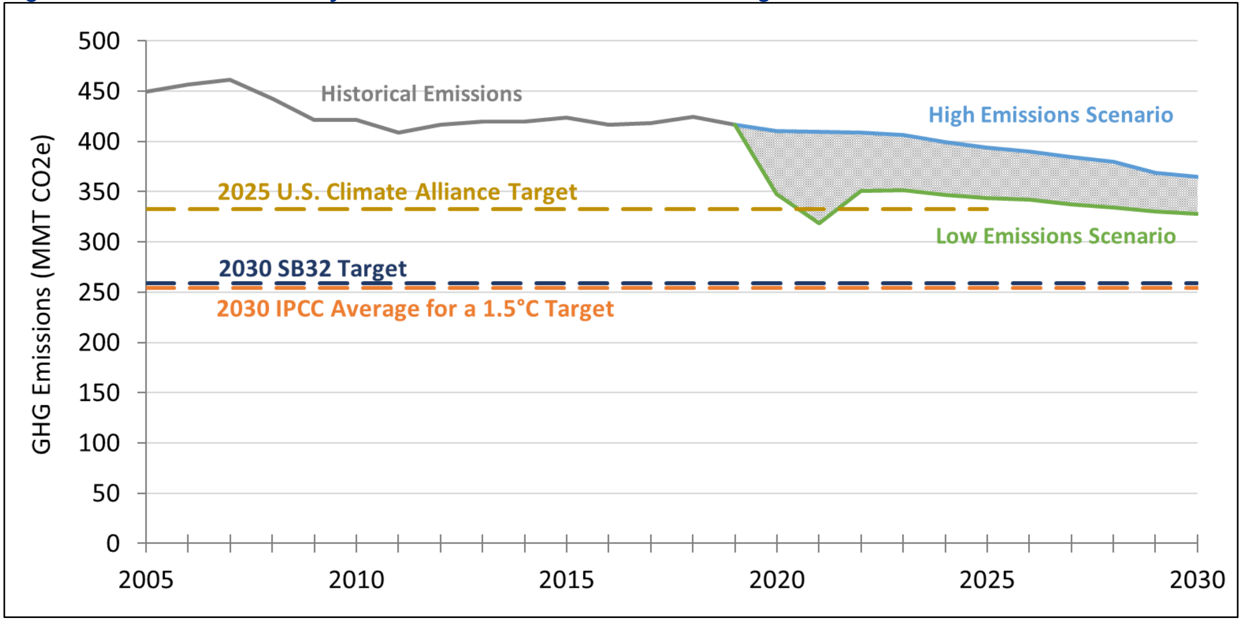

Table 6: Emissions Gaps in California, 2025 - 2030

California				
Target Year	**Target**	**Emissions Target (MMT CO_2e)**	**Remaining Gap (High Emissions)**	**Remaining Gap (Low Emissions)**
2025	26% below 2005 (U.S. Climate Alliance)	333	61	11
2030	40% below 1990 (SB32)[99]	259	106	69
2030	45% below 2010 net emissions (IPCC)	254	111	74

Note: negative values indicate that the state's emissions are projected to be below the target for that year.

While California has an economy-wide cap-and-trade program in place as a backstop to ensure emissions decline in line with the state's targets, Rhodium Group's modeling shows a gap in 2030. This is likely due in part to the fact that the cap-and-trade program, which began in 2013, is calibrated to achieve cumulative reductions consistent with a linear trajectory towards the 2030 target. Because the program allows for banking, it captured some significant early reductions that, if the budget is not adjusted, could offset some emissions in 2030. These early reductions are highly valuable, though it does mean that while the state is poised to meet the cumulative requirements

[98] The 2030 SB32 target is based on 1990 emissions. 1990 emissions are not available in Rhodium Group's U.S. Climate Service data, so this target is based on California's 1990 emissions as reported by the California Air Resources Board. See https://ww2.arb.ca.gov/news/climate-pollutants-fall-below-1990-levels-first-time.
[99] See https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201520160SB32.

of their emissions target over the entire time horizon, the state's annual emissions in 2030 may exceed the statewide target for that year. Additionally, while the cap-and-trade program covers approximately 80% of the state's greenhouse gas emissions, this does leave approximately 20% of emissions not subject to the emission cap and projected increases in uncapped sectors may play a role in Rhodium Group's projections.

There are limitations to how Rhodium Group can capture California's cap-and-trade program in their model. For example, the model is limited in its ability to capture AB32 impacts outside of the power sector due to the regionality of the end-use demand modules.

Colorado

Figure 12: Colorado Economy-Wide Gross GHG Emissions and Targets[100]

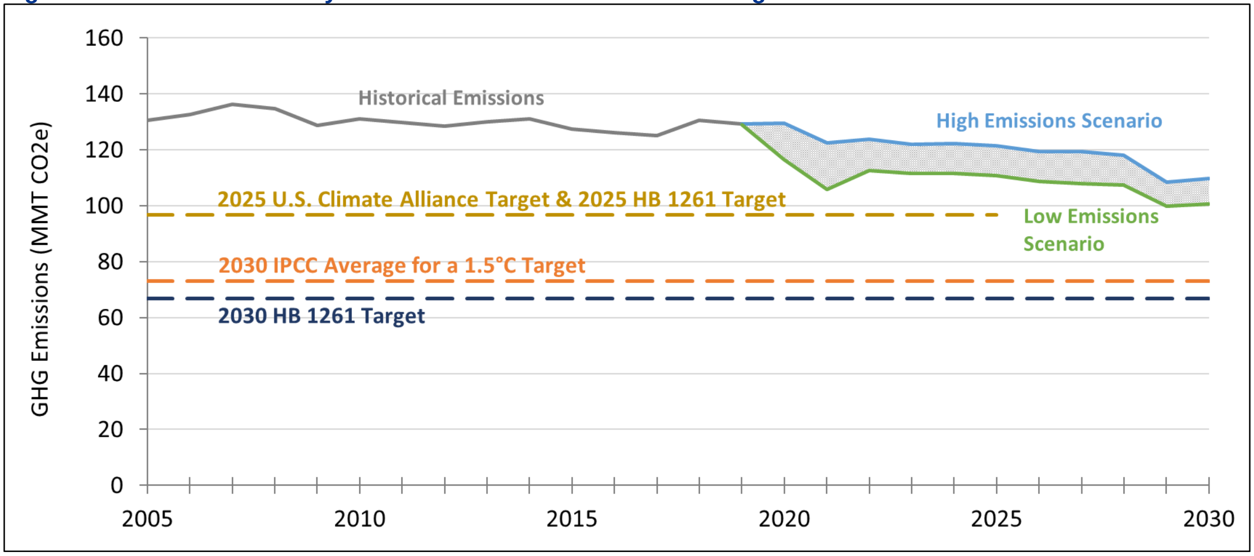

Table 7: Emissions Gaps in Colorado, 2025 - 2030

Colorado				
Target Year	Target	Emissions Target (MMT CO_2e)	Remaining Gap (High Emissions)	Remaining Gap (Low Emissions)
2025	26% below 2005 (U.S. Climate Alliance)	96.6	24.9	14.2
2025	26% below 2005 net emissions (Climate Action Plan to Reduce Pollution)[101]	97.3	24.2	13.5
2030	45% below 2010 net emissions (IPCC)	73.1	36.5	27.6
2030	50% below 2005 net emissions by 2030 (Climate Action Plan to Reduce Pollution)[102]	66.7	43.0	34.0

EDF replaced Rhodium Group's methane estimates for Colorado's Oil & Gas sector based on a separate EDF analysis using site-level measurements and peer reviewed methods. Specifically, EDF estimated current methane emissions from the Oil & Gas sector using a combination of GHGRP and Alvarez et al. data. Historical methane emissions were back-projected using production data from Enverus. Future methane emissions were projected based on proprietary production data from Rystad Energy.

[100] While the 2025 U.S. Climate Alliance target is based on gross emissions for purposes of this analysis and the state's target is based on net emissions, LULUCF sinks are not large enough to separate these targets enough to represent as separate lines on the chart. For more information about how gross and net targets are estimated in this analysis, see Appendix 6.
[101] See https://leg.colorado.gov/sites/default/files/2019a_1261_signed.pdf.
[102] See https://leg.colorado.gov/sites/default/files/2019a_1261_signed.pdf.

EDF also adjusted Rhodium Group's emissions projections to account for recently announced retirement dates of coal-fired units.[103]

Note that Rhodium Group's emissions projections for Colorado do not precisely account for the requirements of SB 19-236 that qualifying retail utilities reduce carbon dioxide emissions 80% from 2005 levels by 2030, although the coal unit adjustments and assumption that the replacement energy would be carbon-free should capture many of the expected reductions.[104]

EDF adjusted Rhodium Group's emissions data to account for Colorado's rules designed to reduce emissions of hydrofluorocarbons ("HFCs").[105]

[103] EDF adjusted Rhodium Group's emissions projections to account for the recently adopted retirement dates of coal-fired units as outlined in the Colorado APCD's August 20, 2020 Request for Hearing Document Package, available at: https://cdphe.colorado.gov/ozone-and-your-health/regional-haze. In addition, we adjust for the more recent decision that Craig 3, Rawhide, and Ray D Nixon will retire at the end of 2028. See https://coloradosun.com/2020/11/23/three-coal-plants-shut-down-colorado/. Note that the Rhodium Group assumes Craig 1 retires at the beginning of 2025, whereas the APCD indicates it will retire at the end of 2025. The impact of this closure on 2025 emissions is less than 1 MMT CO_2e. In the L-shaped scenario, Rhodium Group's model retires the Rawhide plant at the end of 2020 as it finds this retirement to be economic. EDF's adjustment assumes all replacement capacity is zero-emission.

[104] See https://leg.colorado.gov/sites/default/files/documents/2019A/bills/2019a_236_enr.pdf.

[105] APCD, Memorandum of Notice, Regulation Number 22, February 20, 2020. See https://drive.google.com/drive/folders/1irIUGWl4j4BOkkq4J1g54hscK7ov_BS8.

Connecticut

Figure 13: Connecticut Economy-Wide Gross GHG Emissions and Targets[106]

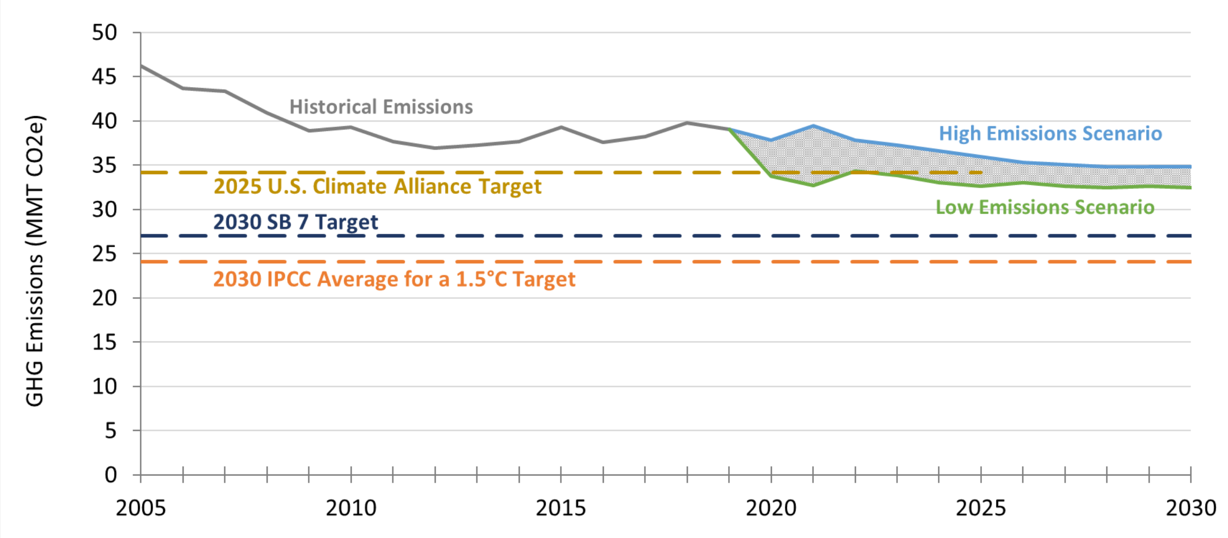

Table 8: Emissions Gaps in Connecticut, 2025 - 2030

Connecticut				
Target Year	Target	Target Emissions (MMT CO_2e)	Remaining Gap (High Emissions)	Remaining Gap (Low Emissions)
2025	26% below 2005 (U.S. Climate Alliance)	34	2	-2
2030	45% below 2001 (SB 7)[107]	27	8	5
2030	45% below 2010 net emissions (IPCC)	24	11	8

[106] The 2030 SB7 target is based on 2001 emissions. 2001 emissions are not available in Rhodium Group's U.S. Climate Service data, so this target is based on Connecticut's 2001 emissions as reported in the state's 2017 greenhouse gas inventory. See https://portal.ct.gov/DEEP/Climate-Change/CT-Greenhouse-Gas-Inventory-Reports.
[107] See https://www.cga.ct.gov/2018/act/pa/pdf/2018PA-00082-R00SB-00007-PA.pdf.

Delaware

Figure 14: Delaware Economy-Wide Gross GHG Emissions and Targets

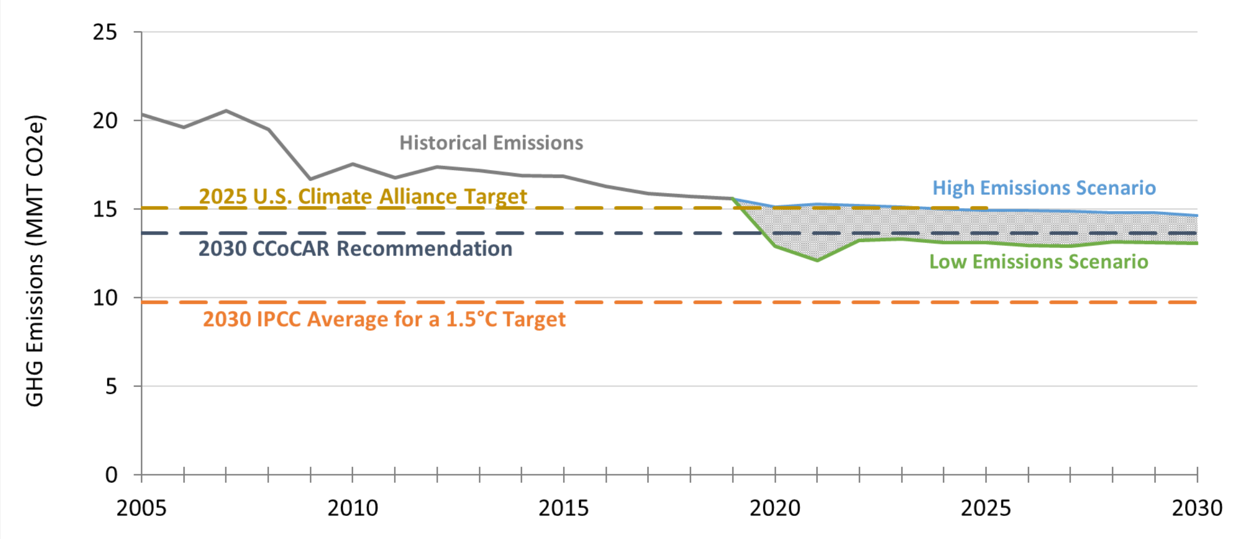

Table 9: Emissions Gaps in Delaware, 2025 - 2030

Delaware				
Target Year	Target	Emissions Target (MMT CO_2e)	Remaining Gap (High Emissions)	Remaining Gap (Low Emissions)
2025	26% below 2005 (U.S. Climate Alliance)	15	-0.1	-2
2030	30% below 2008 (CCoCAR Recommendation)[108]	14	1	-1
2030	45% below 2010 net emissions (IPCC)	10	5	3

Note: negative values indicate that the state's emissions are projected to be below the target for that year.

[108] See http://www.dnrec.delaware.gov/energy/Documents/The%20Climate%20Framework%20for%20Delaware.pdf.

Hawaii

Figure 15: Hawaii Economy-Wide Gross GHG Emissions and Targets

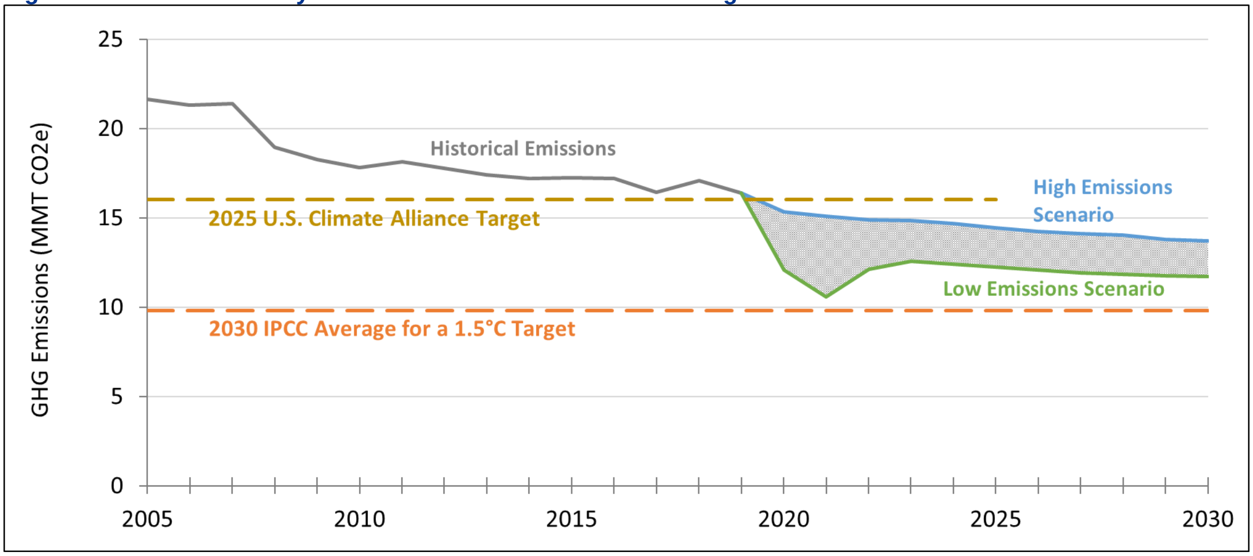

Table 10: Emissions Gaps in Hawaii, 2025 - 2030

Hawaii				
Target Year	Target	Emissions Target (MMT CO_2e)	Remaining Gap (High Emissions)	Remaining Gap (Low Emissions)
2025	26% below 2005 (U.S. Climate Alliance)	16	-2	-4
2030	45% below 2010 net emissions (IPCC)	10	4	2

Note: negative values indicate that the state's emissions are projected to be below the target for that year.

Illinois

Figure 16: Illinois Economy-Wide Gross GHG Emissions and Targets

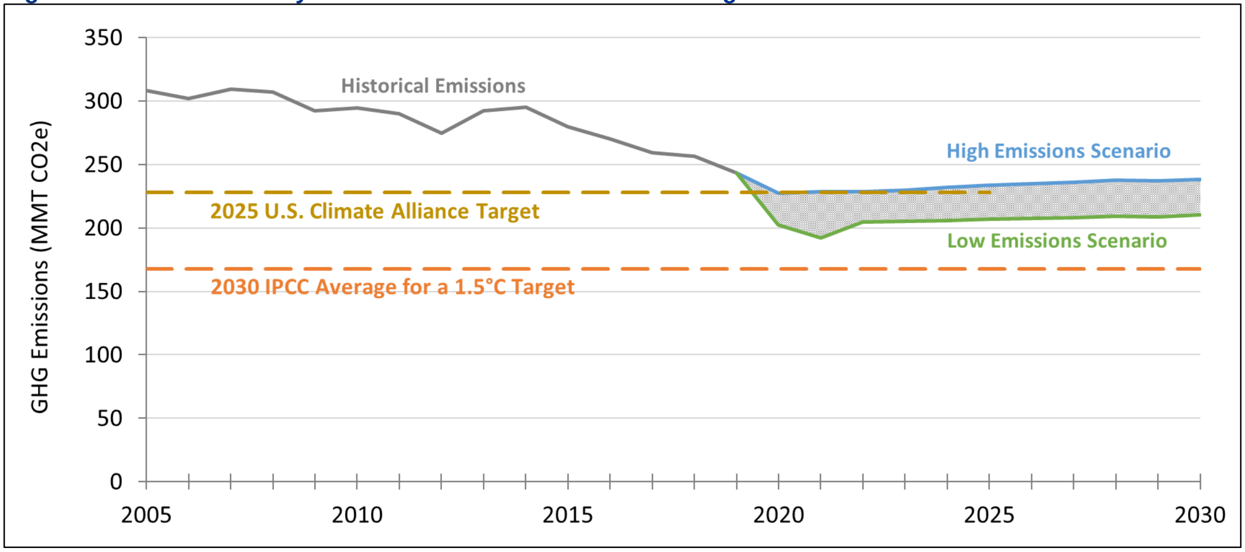

Table 11: Emissions Gaps in Illinois, 2025 - 2030

Illinois				
Target Year	Target	Emissions Target (MMT CO_2e)	Remaining Gap (High Emissions)	Remaining Gap (Low Emissions)
2025	26% below 2005 (U.S. Climate Alliance)	228	6	-21
2030	45% below 2010 net emissions (IPCC)	168	71	43

Note: negative values indicate that the state's emissions are projected to be below the target for that year.

Louisiana

Figure 17: Louisiana Economy-Wide Gross GHG Emissions and Targets

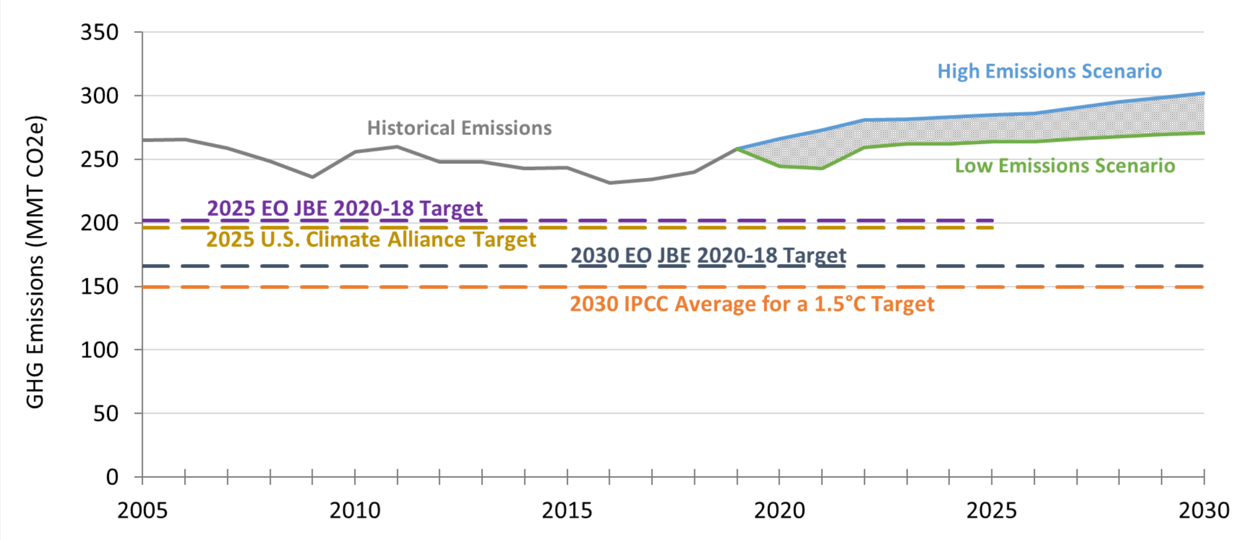

Table 12: Emissions Gaps in Louisiana, 2025 - 2030

Louisiana				
Target Year	**Target**	**Emissions Target (MMT CO_2e)**	**Remaining Gap (High Emissions)**	**Remaining Gap (Low Emissions)**
2025	26% below 2005 net emissions (EO JBE 2020-18)[109]	202	83	63
2025	26% below 2005 (U.S. Climate Alliance)	196	89	68
2030	40-50% below 2005 net emissions (EO JBE 2020-18)[110]	166	136	105
2030	45% below 2010 net emissions (IPCC)	150	152	121

Note that Louisiana is not an official member of the U.S. Climate Alliance but established a target by executive order to reduce net emissions by 26 to 28% below 2005 levels by 2025, 40 to 50% by 2030, and 100% by 2050.[111] For comparison to other states' emissions and targets, we include the U.S. Climate Alliance target (calculated in this analysis as a 26% reduction from 2005 gross emissions by 2025),[112] which is included in the aggregate totals presented in this report.

[109] See https://gov.louisiana.gov/assets/ExecutiveOrders/2020/JBE-2020-18-Climate-Initiatives-Task-Force.pdf. The numbers presented in the table and chart represent the low end of the target, or a 26% reduction from 2005 levels.
[110] See https://gov.louisiana.gov/assets/ExecutiveOrders/2020/JBE-2020-18-Climate-Initiatives-Task-Force.pdf. The numbers presented in the table and chart represent the low end of the target, or a 40% reduction from 2005 levels.
[111] See https://gov.louisiana.gov/assets/ExecutiveOrders/2020/JBE-2020-18-Climate-Initiatives-Task-Force.pdf.
[112] For more information about how gross and net targets are estimated in this analysis, see Appendix 6.

Maine

Figure 18: Maine Economy-Wide Gross GHG Emissions and Targets[113,114]

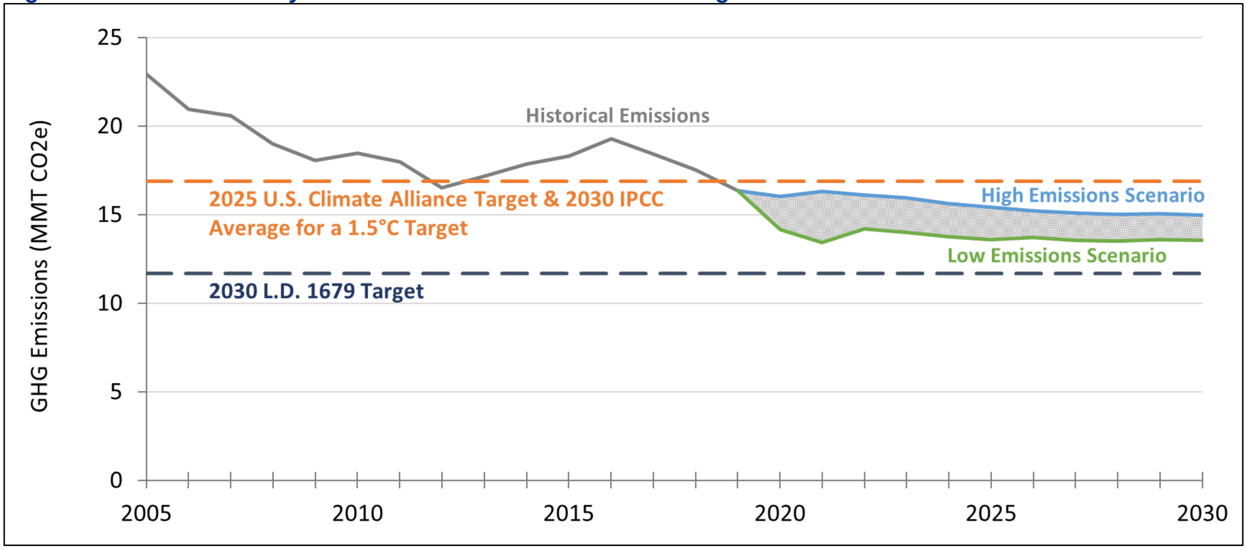

Table 13: Emissions Gaps in Maine, 2025 - 2030

Maine				
Target Year	Target	Emissions Target (MMT CO_2e)	Remaining Gap (High Emissions)	Remaining Gap (Low Emissions)
2025	26% below 2005 (U.S. Climate Alliance)	17	-2	-3
2030	45% below 2010 net emissions (IPCC)	17	-2	-3
2030	45% below 1990 (L.D. 1679)[115]	12	3	2

Note: negative values indicate that the state's emissions are projected to be below the target for that year.

113 The 2030 Act to Promote Clean Energy Jobs and to Establish the Maine Climate Council (L.D. 1679) target is based on 1990 emissions. 1990 emissions are not available in Rhodium Group's U.S. Climate Service data, so this target is based on 1990 emissions from Maine's Eighth Biennial Report on Progress toward Greenhouse Gas Reduction Goals. See https://www.maine.gov/dep/commissioners-office/kpi/details.html?id=606898.

114 While the 2025 U.S. Climate Alliance target and 2030 IPCC-based target are slightly different, the target emissions levels are too close to represent as separate lines on the chart. For more information about how gross and net targets are estimated in this analysis, see Appendix 6.

115 See https://legislature.maine.gov/legis/bills/bills_129th/billtexts/SP055002.asp.

Maryland

Figure 19: Maryland Economy-Wide Gross GHG Emissions and Targets

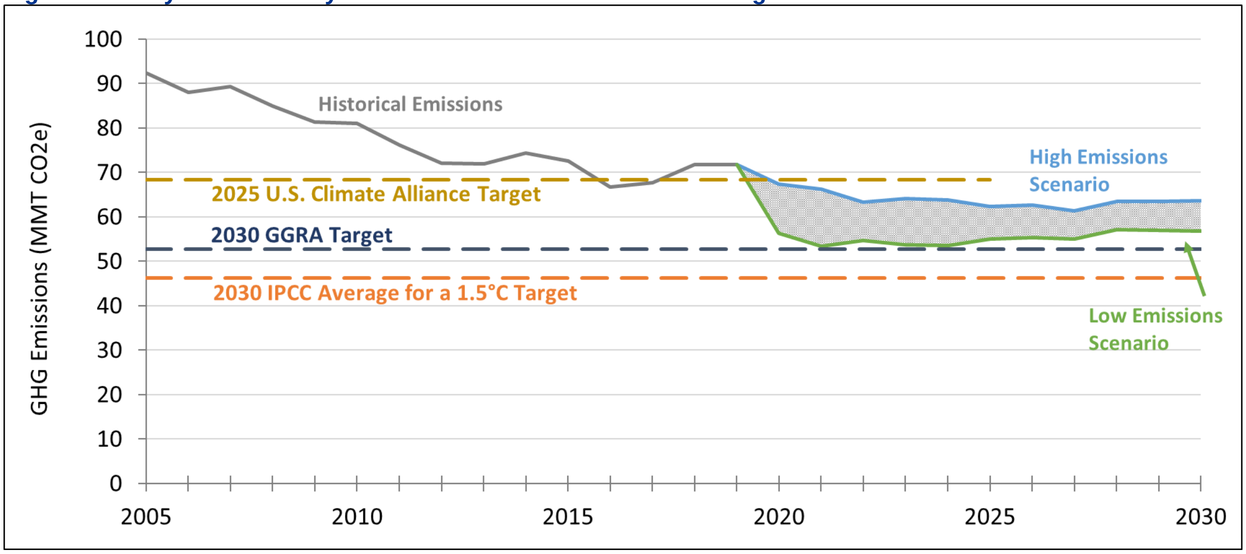

Table 14: Emissions Gaps in Maryland, 2025 - 2030

Maryland				
Target Year	Target	Emissions Target (MMT CO_2e)	Remaining Gap (High Emissions)	Remaining Gap (Low Emissions)
2025	26% below 2005 (U.S. Climate Alliance)	68	-6	-13
2030	40% below 2006 (2016 Greenhouse Gas Emissions Reduction Act)[116]	53	11	4
2030	45% below 2010 net emissions (IPCC)	46	17	11

Note: negative values indicate that the state's emissions are projected to be below the target for that year.

[116] See http://envirolaws.org/bills/final-language/SB323.2016.language.pdf.

Massachusetts

Figure 20: Massachusetts Economy-Wide Gross GHG Emissions and Targets

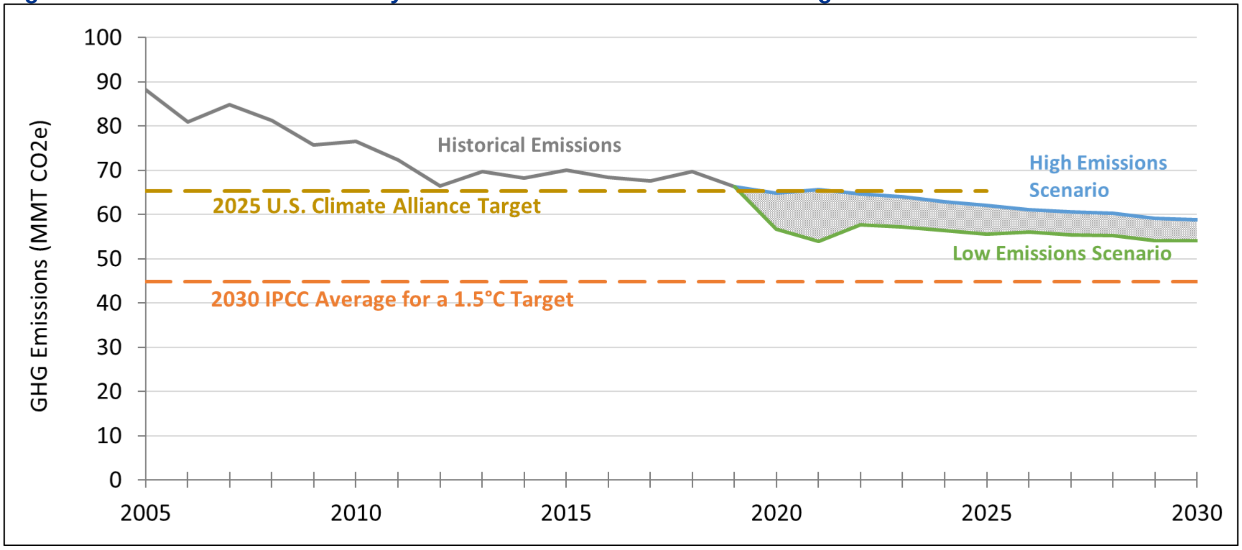

Table 15: Emissions Gaps in Massachusetts, 2025 - 2030

Massachusetts				
Target Year	Target	Emissions Target (MMT CO_2e)	Remaining Gap (High Emissions)	Remaining Gap (Low Emissions)
2025	26% below 2005 (U.S. Climate Alliance)	56	-3	-10
2030	45% below 2010 net emissions (IPCC)	54	14	9

Note: negative values indicate that the state's emissions are projected to be below the target for that year.

Michigan

Figure 21: Michigan Economy-Wide Gross GHG Emissions and Targets[117]

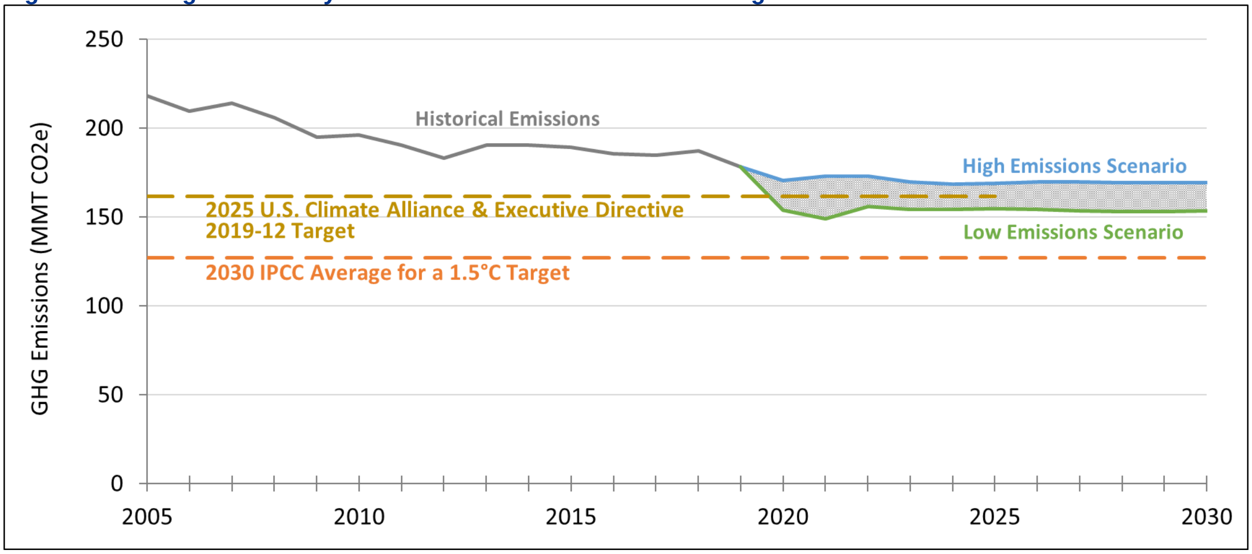

Table 16: Emissions Gaps in Michigan, 2025 - 2030

Michigan				
Target Year	Target	Emissions Target (MMT CO_2e)	Remaining Gap (High Emissions)	Remaining Gap (Low Emissions)
2025	26% below 2005 (U.S. Climate Alliance & Executive Directive 2019 - 12)[118]	161	8	-7
2030	45% below 2010 net emissions (IPCC)	127	42	26

Note: negative values indicate that the state's emissions are projected to be below the target for that year.

[117] Note that the 2025 EO 2019-12 target is equivalent to the U.S. Climate Alliance target.
[118] See https://www.michigan.gov/whitmer/0,9309,7-387-90499_90704-488740--,00.html. Note that this target is the equivalent to the U.S. Climate Alliance target.

Minnesota

Figure 22: Minnesota Economy-Wide Gross GHG Emissions and Targets

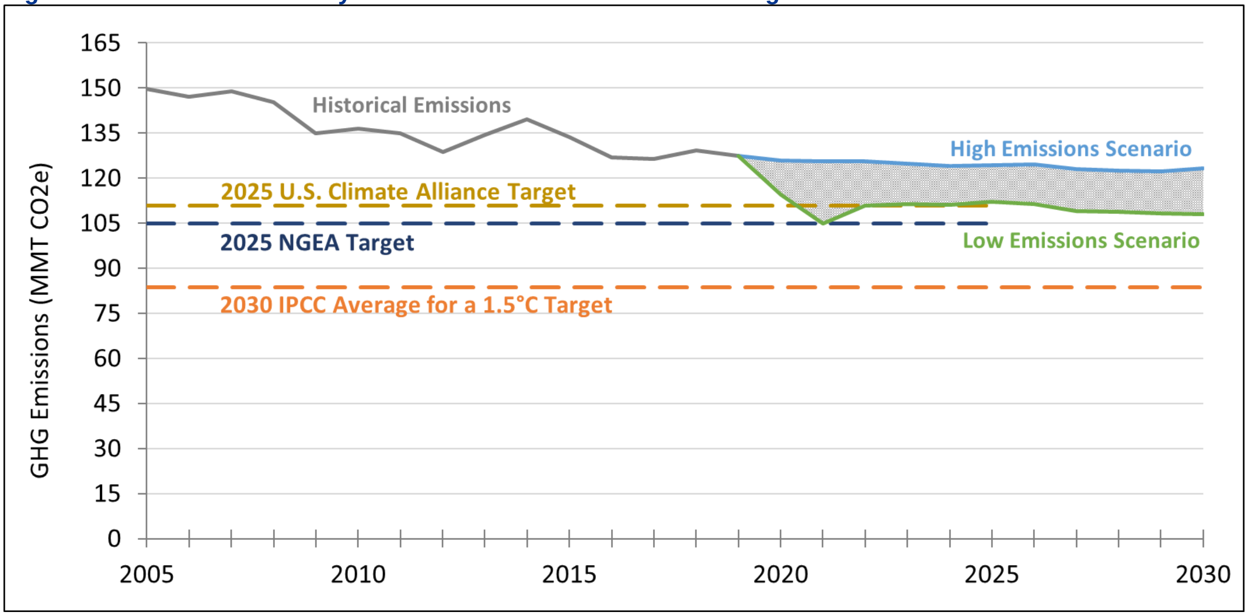

Table 17: Emissions Gaps in Minnesota, 2025 - 2030

Minnesota				
Target Year	Target	Emissions Target (MMT CO_2e)	Remaining Gap (High Emissions)	Remaining Gap (Low Emissions)
2025	26% below 2005 (U.S. Climate Alliance)	111	13	1
2025	30% below 2005 (Next Gen Energy Act)[119]	105	19	7
2030	45% below 2010 net emissions (IPCC)	84	40	24

[119] See https://www.revisor.mn.gov/statutes/cite/216H.02.

Montana

Figure 23: Montana Economy-Wide Gross GHG Emissions and Targets[120]

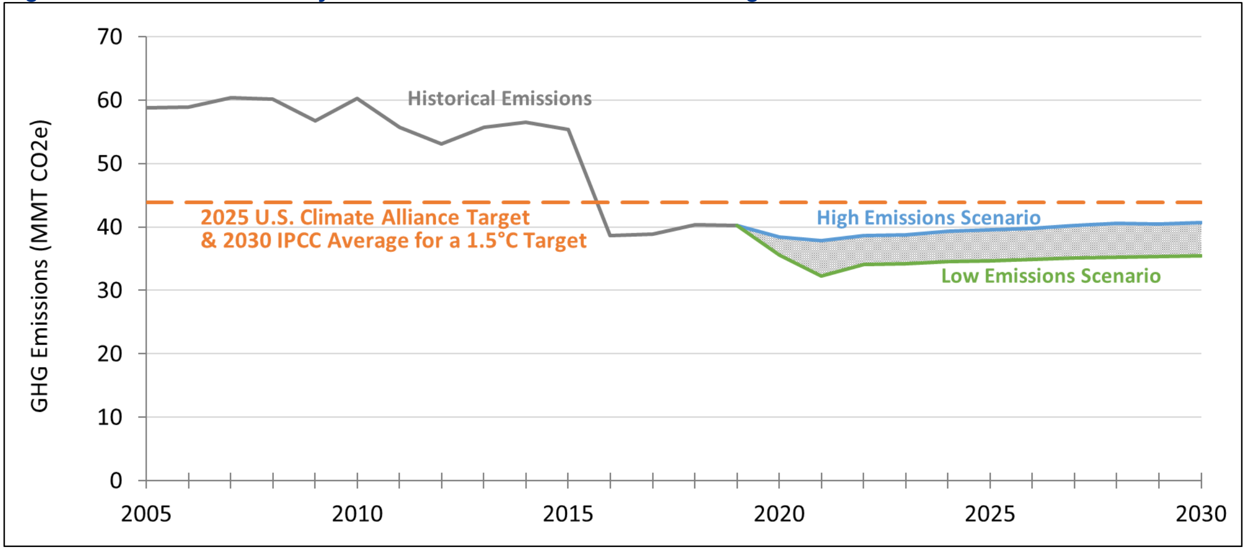

Table 18: Emissions Gaps in Montana, 2025 - 2030

Montana				
Target Year	Target	Emissions Target (MMT CO_2e)	Remaining Gap (High Emissions)	Remaining Gap (Low Emissions)
2025	26% below 2005 (U.S. Climate Alliance)	43.5	-4.0	-8.8
2030	45% below 2010 net emissions (IPCC)	43.9	-3.2	-8.5

Note: negative values indicate that the state's emissions are projected to be below the target for that year.

[120] While the 2025 U.S. Climate Alliance target and 2030 IPCC-based target are slightly different, the target emissions levels are too close to represent as separate lines on the chart. For more information about how gross and net targets are estimated in this analysis, see Appendix 6.

New Jersey

Figure 24: New Jersey Economy-Wide Gross GHG Emissions and Targets

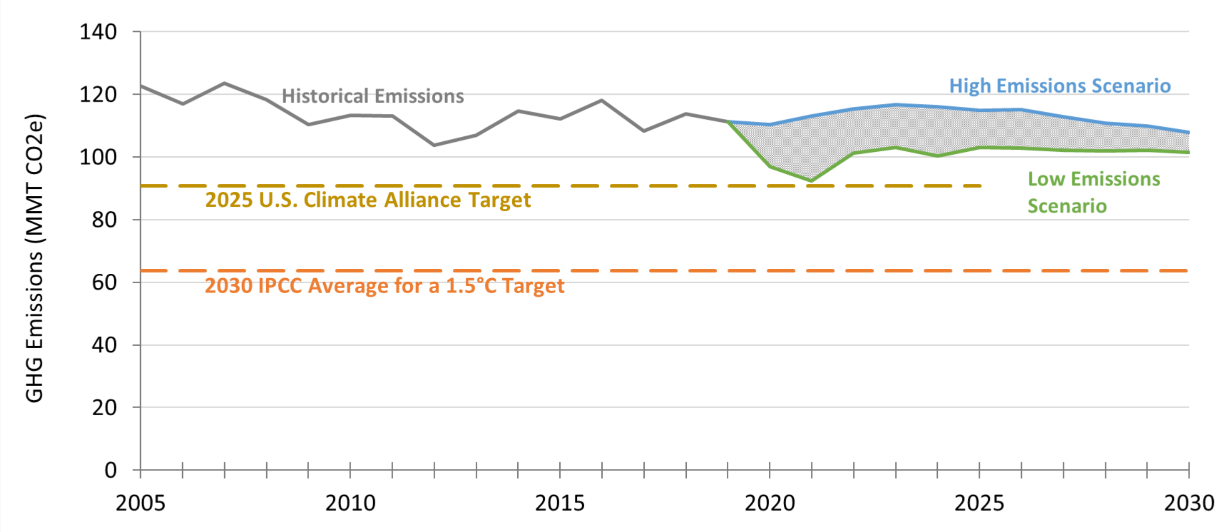

Table 19: Emissions Gaps in New Jersey, 2025 - 2030

New Jersey				
Target Year	Target	Emissions Target (MMT CO_2e)	Remaining Gap (High Emissions)	Remaining Gap (Low Emissions)
2025	26% below 2005 (U.S. Climate Alliance)	91	24	12
2030	45% below 2010 net emissions (IPCC)	64	44	38

New Mexico

Figure 25: New Mexico Economy-Wide Gross GHG Emissions and Targets

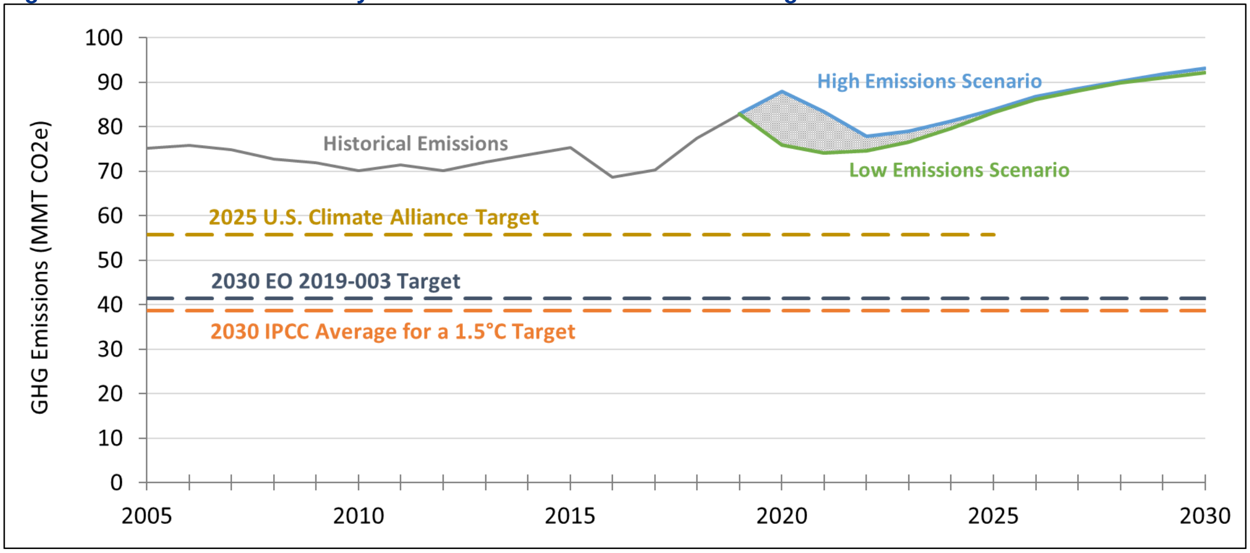

Table 20: Emissions Gaps in New Mexico, 2025 - 2030

New Mexico				
Target Year	Target	Emissions Target (MMT CO_2e)	Remaining Gap (High Emissions)	Remaining Gap (Low Emissions)
2025	26% below 2005 (U.S. Climate Alliance)	56	28	28
2030	45% below 2005 (EO 2019-003)[121]	41	52	51
2030	45% below 2010 net emissions (IPCC)	38	55	54

EDF replaced Rhodium Group's methane estimates for New Mexico's Oil & Gas sector based on a separate EDF analysis using site-level measurements and peer reviewed methods. Specifically, EDF estimated current methane emissions from the Oil & Gas sector using a combination of GHGRP and TROPOMI data. Historical methane emissions were back-projected using production data from Enverus. Future methane emissions were projected based on proprietary production data from Rystad Energy. EDF also adjusted Rhodium Group's data to subtract the emissions associated with out-of-state electric load served by the Four Corners plant. Since the facility is located on tribal lands, its generation emissions that don't serve in-state customers are not under New Mexico's jurisdiction to regulate directly.

[121] See https://www.governor.state.nm.us/wp-content/uploads/2019/01/EO_2019-003.pdf.

New York

Figure 26: New York Economy-Wide Gross GHG Emissions and Targets[122,123]

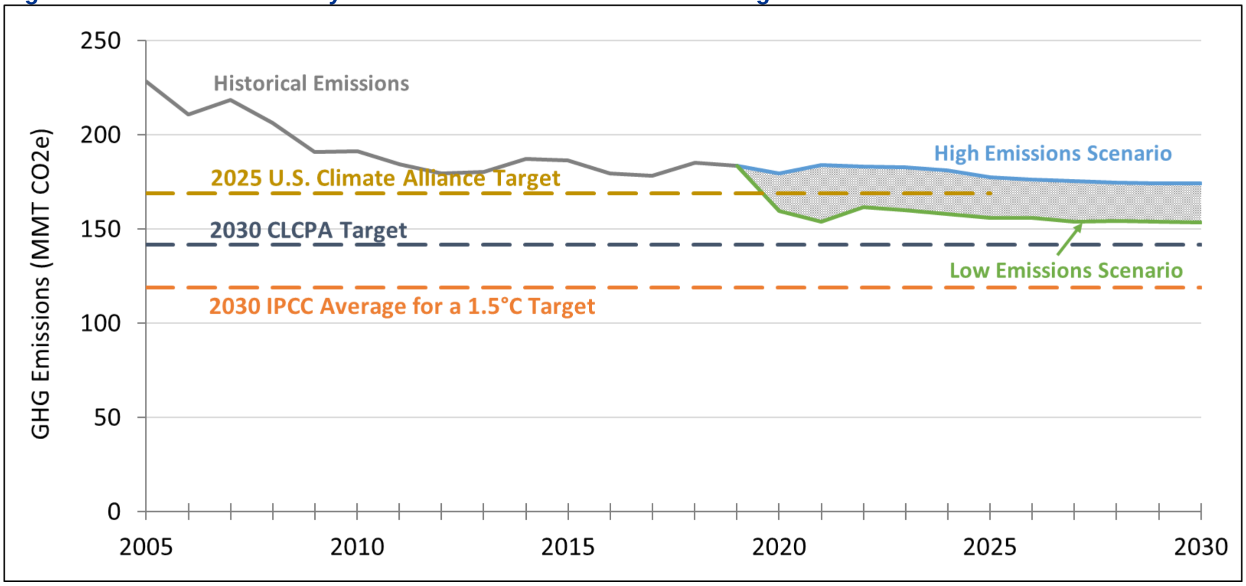

Table 21: Emissions Gaps in New York, 2025 - 2030

New York				
Target Year	**Target**	**Emissions Target (MMT CO_2e)**	**Remaining Gap (High Emissions)**	**Remaining Gap (Low Emissions)**
2025	26% below 2005 (U.S. Climate Alliance)	169	9	-13
2030	40% below 1990 (CLCPA)[124,125]	142	32	12
2030	45% below 2010 net emissions (IPCC)	119	55	35

Note: negative values indicate that the state's emissions are projected to be below the target for that year.

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[122] The 2030 CLCPA target is based on 1990 emissions. 1990 emissions are not available in Rhodium Group's U.S. Climate Service data, so this target is based on 1990 emissions from NYSERDA's Greenhouse Gas Inventory. See https://www.nyserda.ny.gov/About/Publications/EA-Reports-and-Studies/Greenhouse-Gas-Inventory.

[123] As noted above, target emissions for state policies are calculated based on percent reductions from historical data using the IPCC 4th Assessment Report (AR4) 100-year global warming potential (GWP). The target emissions presented here differ from the limits recently proposed by New York, which use a 20-year GWP. For more information about New York's proposed rule, see https://www.dec.ny.gov/regulations/121052.html. More information about the GWP values used in this analysis can be found in Appendix 7.

[124] See https://legislation.nysenate.gov/pdf/bills/2019/S6599.

[125] Note that, because target emissions for this analysis were calculated based on percent reductions from historical emissions as provided by the Rhodium Group U.S. Climate Service, the target emissions here differ from the baseline established in New York's proposed rule to establish statewide emission limits. The state baseline also uses a 20-year GWP while estimates presented in this analysis use a 100-year GWP. For more information about New York's proposed emission limits, see https://www.dec.ny.gov/regulations/121052.html. More information about how target emissions were estimated for this analysis is available in Appendix 6.

Nevada

Figure 27: Nevada Economy-Wide Gross GHG Emissions and Targets

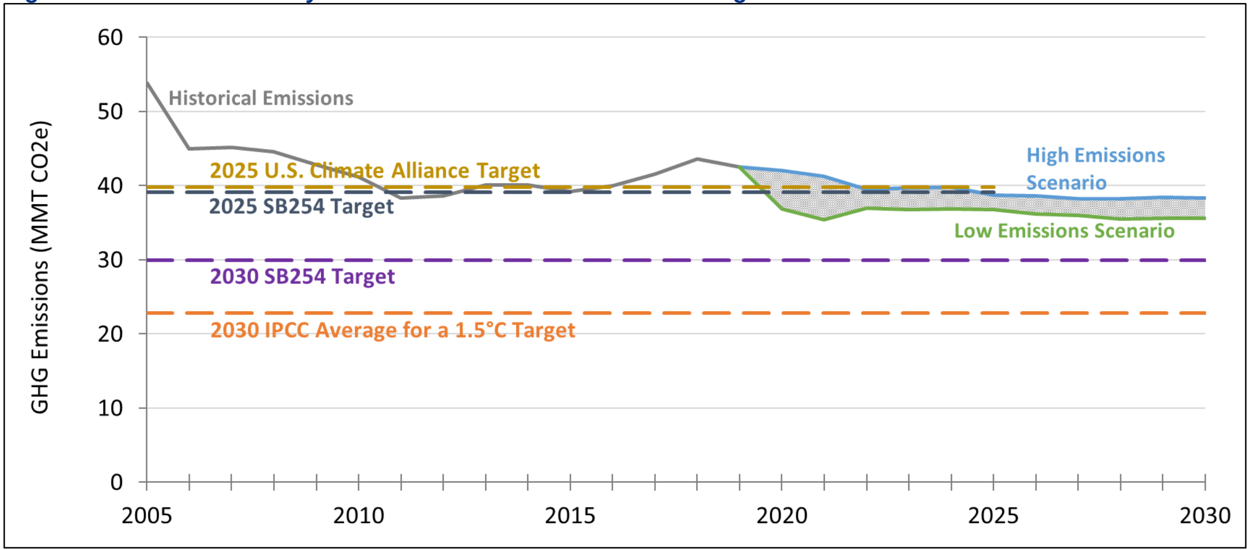

Table 22: Emissions Gaps in Nevada, 2025 - 2030

Nevada				
Target Year	Target	Emissions Target (MMT CO_2e)	Remaining Gap (High Emissions)	Remaining Gap (Low Emissions)
2025	26% below 2005 (U.S. Climate Alliance)	40	-1	-3
2025	28% below 2005 net emissions (SB 254)[126]	39	-0.4	-2
2030	45% below 2005 net emissions (SB 254)	30	8	6
2030	45% below 2010 net emissions (IPCC)	23	16	13

Note: negative values indicate that the state's emissions are projected to be below the target for that year.

[126] See: https://trackbill.com/bill/nevada-senate-bill-254-an-act-relating-to-greenhouse-gas-emissions-requiring-the-state-department-of-conservation-and-natural-resources-to-issue-an-annual-report-concerning-greenhouse-gas-emissions-in-this-state-and-providing-other-matters-properly-relating-thereto/1719120/.

North Carolina

Figure 28: North Carolina Economy-Wide Gross GHG Emissions and Targets

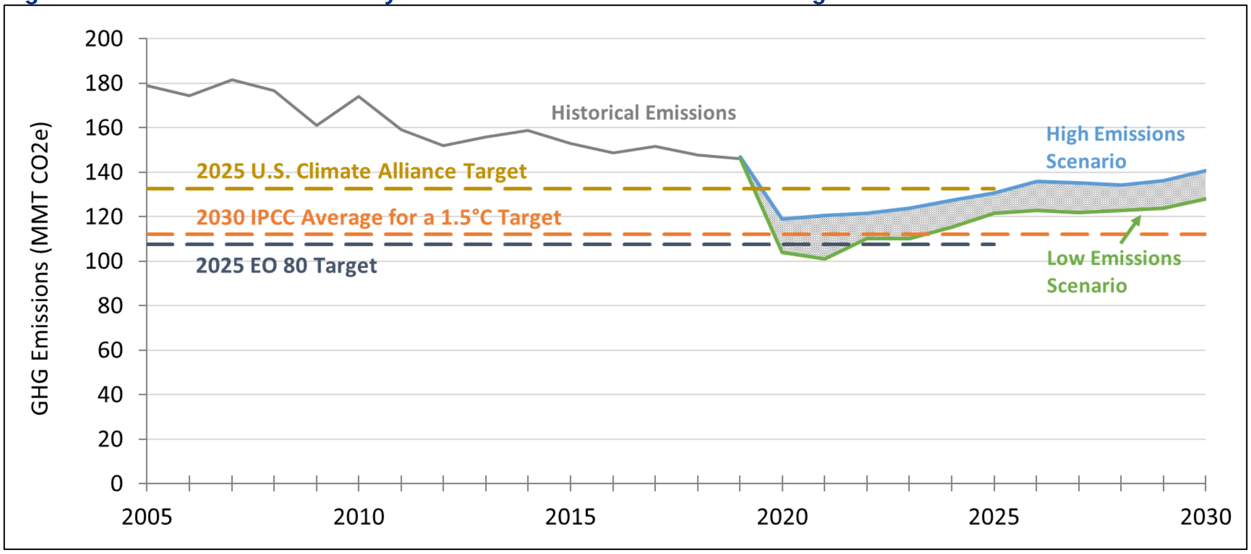

Table 23: Emissions Gaps in North Carolina, 2025 - 2030

North Carolina				
Target Year	Target	Emissions Target (MMT CO_2e)	Remaining Gap (High Emissions)	Remaining Gap (Low Emissions)
2025	26% below 2005 (U.S. Climate Alliance)	133	-2	-11
2025	40% below 2005 (EO 80)[127]	107	23	14
2030	45% below 2010 net emissions (IPCC)	112	29	16

Note: negative values indicate that the state's emissions are projected to be below the target for that year.

[127] See https://files.nc.gov/ncdeq/climate-change/EO80--NC-s-Commitment-to-Address-Climate-Change---Transition-to-a-Clean-Energy-Economy.pdf.

Oregon

Figure 29: Oregon Economy-Wide Gross GHG Emissions and Targets[128,129]

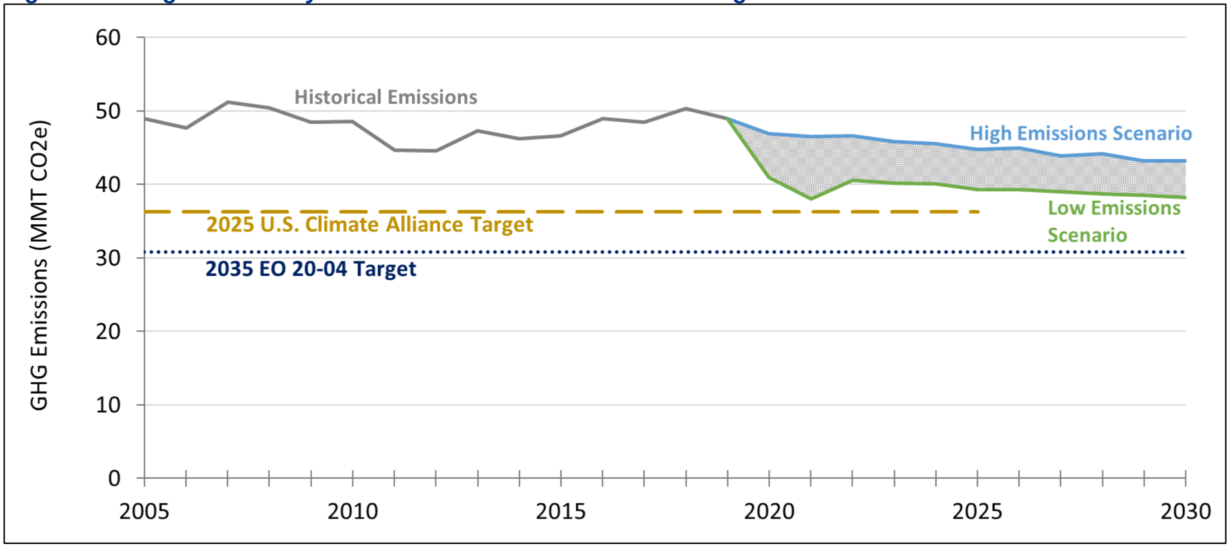

Table 24: Emissions Gaps in Oregon, 2025 - 2035

Oregon				
Target Year	Target	Emissions Target (MMT CO_2e)	Remaining Gap (High Emissions)	Remaining Gap (Low Emissions)
2025	26% below 2005 (U.S. Climate Alliance)	36	9	3
2035	45% below 1990 (EO 20-04)[130]	31		

Note: Emissions gaps are not presented for the 2035 target because projected emissions data are only available through 2030.

[128] The 2035 EO 20-04 target is based on 1990 emissions. 1990 emissions are not available in Rhodium Group's U.S. Climate Service data, so this target is based on 1990 emissions from Oregon's greenhouse inventory. See https://www.oregon.gov/deq/aq/programs/Pages/GHG-Inventory.aspx.

[129] Based on data from Rhodium Group's U.S. Climate Service, which apportions estimates of US sinks to states based on activity data from RHG-NEMS, Oregon's net emissions are negative in 2010 and are projected to be negative in 2030, meaning emissions sinks in the state exceed gross emissions and a 2030 net emissions target cannot be calculated. Because the U.S. Climate Alliance target is based on gross emissions for purposes of this analysis, the state still shows a gap to meet this target. By striving to achieve gross emission reductions, Oregon plays an important role in reducing its overall contribution to global atmospheric levels of greenhouse gas emissions. We include the state's 2035 target here for illustrative purposes, but as Rhodium Group's U.S. Climate Service data are only available through 2030, the gap for this target is not estimated. For more information about Rhodium Group's downscaling methodology, see Rhodium Group's Taking Stock 2020: Technical Appendix, available at: https://rhg.com/wp-content/uploads/2020/07/Taking-Stock-2020-Technical-Appendix.pdf.

[130] See https://www.oregon.gov/gov/Documents/executive_orders/eo_20-04.pdf.

Pennsylvania

Figure 30: Pennsylvania Economy-Wide Gross GHG Emissions and Targets

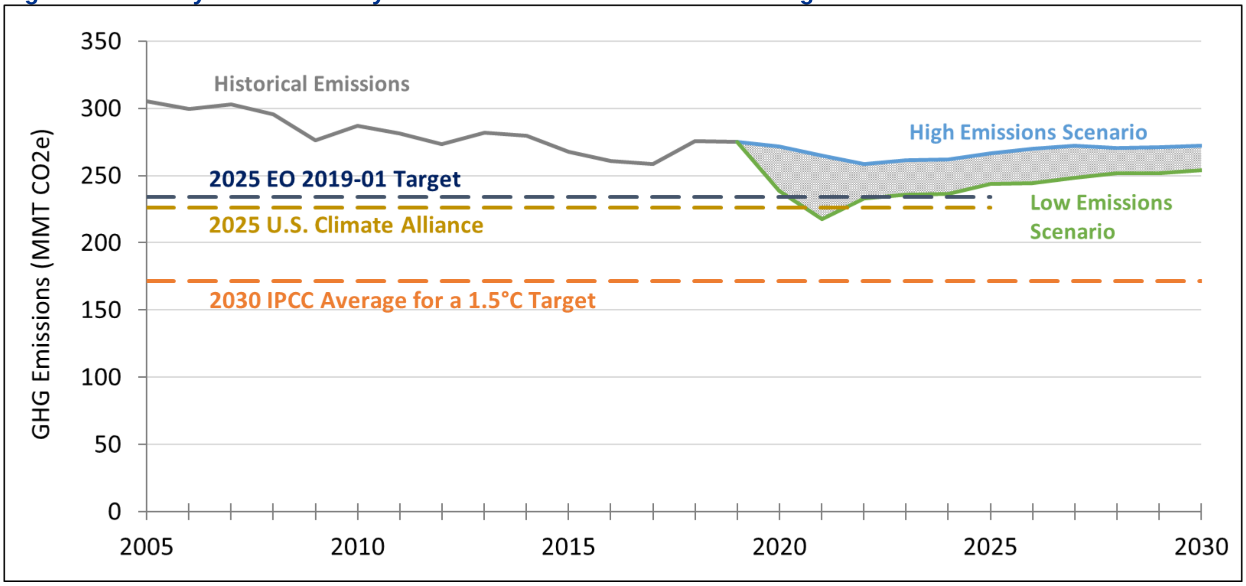

Table 25: Emissions Gaps in Pennsylvania, 2025 - 2030

Pennsylvania				
Target Year	Target	Emissions Target (MMT CO_2e)	Remaining Gap (High Emissions)	Remaining Gap (Low Emissions)
2025	26% below 2005 net emissions (EO 2019-01)[131]	234	32	9
2025	26% below 2005 (U.S. Climate Alliance)	226	40	18
2030	45% below 2010 net emissions (IPCC)	171	101	82

[131] See https://www.oa.pa.gov/Policies/eo/Documents/2019-01.pdf.

Puerto Rico

Figure 31: Puerto Rico Economy-Wide Gross GHG Emissions and Targets[132]

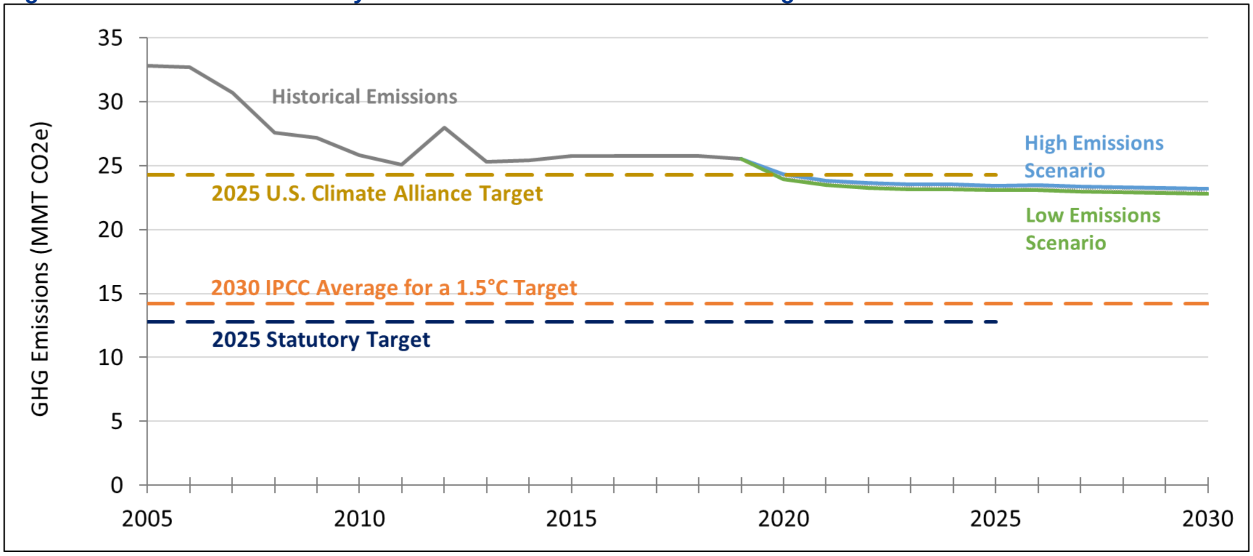

Table 26: Emissions Gaps in Puerto Rico, 2025 - 2030

Puerto Rico				
Target Year	Target	Emissions Target (MMT CO_2e)	Remaining Gap (High Emissions)	Remaining Gap (Low Emissions)
2025	26% below 2005 (U.S. Climate Alliance)	24	-1	-1
2025	50% below 2019 (Statute)[133,134]	13	11	10
2030	45% below 2010 net emissions (IPCC)	14	9	9

[132] Rhodium Group's estimates for Puerto Rico are in line with EPA's Inventory of U.S. Greenhouse Gas Emissions and Sinks for all U.S. Territories. EPA's inventory report is available at https://www.epa.gov/sites/production/files/2020-04/documents/us-ghg-inventory-2020-main-text.pdf.
[133] See http://extwprlegs1.fao.org/docs/pdf/pue188837.pdf.
[134] We assumed a target year of 2025 and base year of 2019 based on the statute's requirement to reduce emissions 50% over five years. See https://www.ncsl.org/research/energy/greenhouse-gas-emissions-reduction-targets-and-market-based-policies.aspx.

Rhode Island

Figure 32: Rhode Island Economy-Wide Gross GHG Emissions and Targets

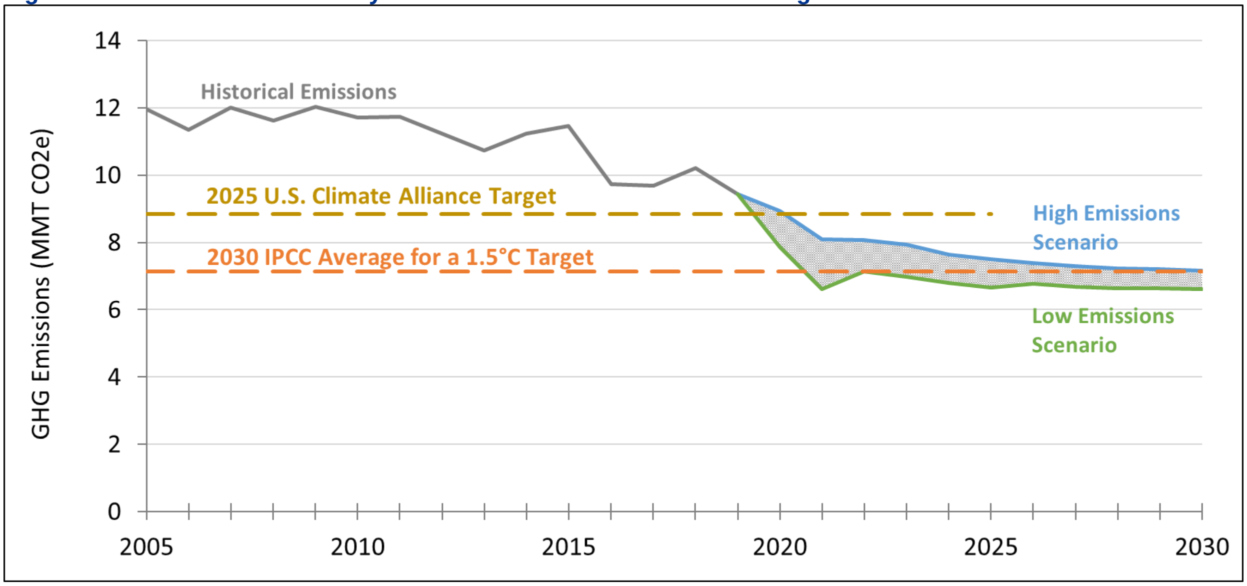

Table 27: Emissions Gaps in Rhode Island, 2025 - 2030

Rhode Island				
Target Year	Target	Emissions Target (MMT CO_2e)	Remaining Gap (High Emissions)	Remaining Gap (Low Emissions)
2025	26% below 2005 (U.S. Climate Alliance)	9	-1	-2
2030	45% below 2010 net emissions (IPCC)	7	0.02	-1

Note: negative values indicate that the state's emissions are projected to be below the target for that year.

Vermont

Figure 33: Vermont Economy-Wide Gross GHG Emissions and Targets[135,136]

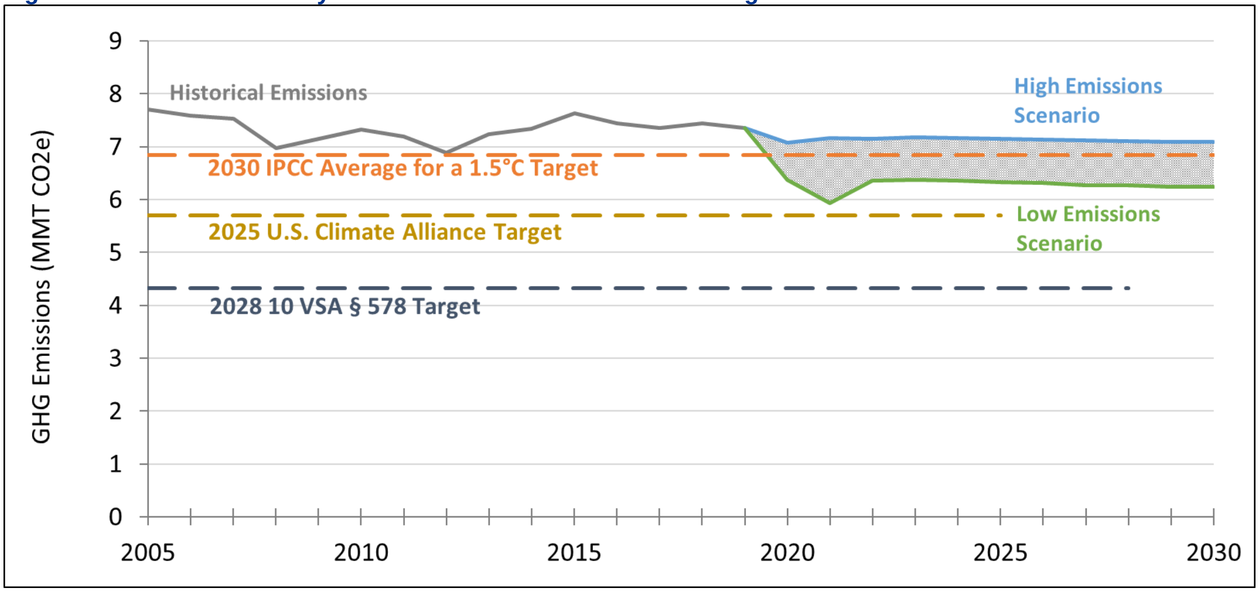

Table 28: Emissions Gaps in Vermont, 2025 - 2030

Vermont				
Target Year	Target	Emissions Target (MMT CO_2e)	Remaining Gap (High Emissions)	Remaining Gap (Low Emissions)
2025	26% below 2005 (U.S. Climate Alliance)	6	1	1
2028	50% below 1990 (10 VSA § 578)[137]	4	3	2
2030	45% below 2010 net emissions (IPCC)	7	0.2	-1

Note: negative values indicate that the state's emissions are projected to be below the target for that year.

[135] The 2030 10 VSA § 578 target is based on 1990 emissions. 1990 emissions are not available in Rhodium Group's U.S. Climate Service data, so this target is based on Vermont's 1990 emissions as reported in the state's Greenhouse Gas Emissions Inventory Update and Forecast. See https://dec.vermont.gov/sites/dec/files/aqc/climate-change/documents/_Vermont_Greenhouse_Gas_Emissions_Inventory_and_Forecast_1990-2016.pdf.

[136] The 2030 IPCC-based target is higher than the 2025 U.S. Climate Alliance target for Vermont because the 2030 target is based on net emissions while the 2025 target is based on gross emissions, and the state has large LULUCF sinks relative to its total gross emissions. For more information about how emissions targets were estimated in this paper, see Appendix 6.

[137] See https://legislature.vermont.gov/statutes/section/10/023/00578.

Virginia

Figure 34: Virginia Economy-Wide Gross GHG Emissions and Targets

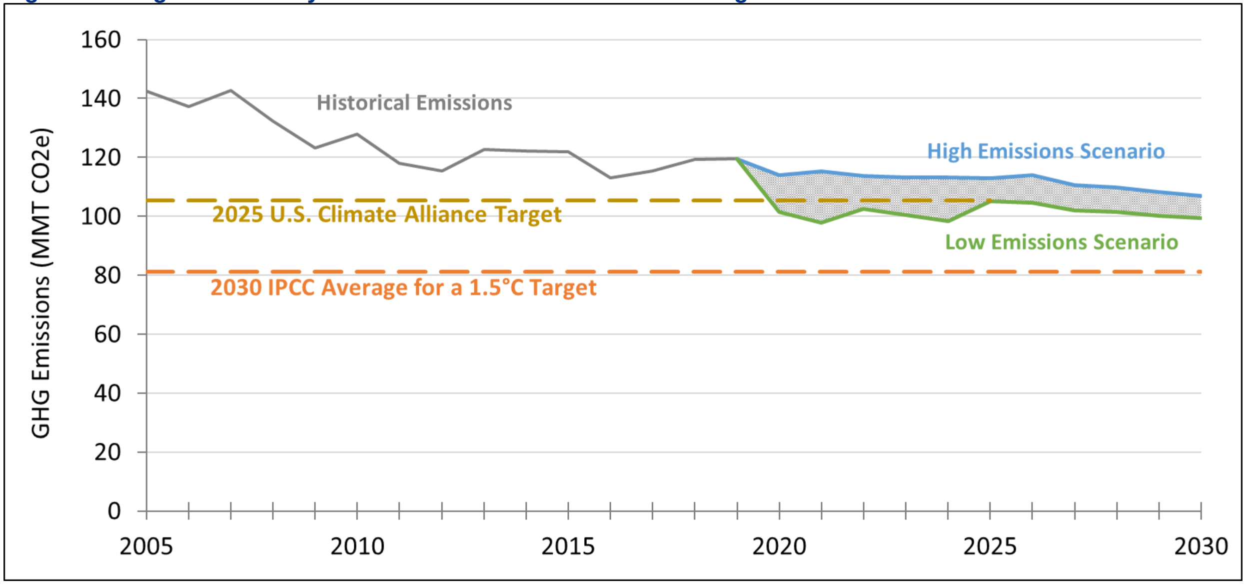

Table 29: Emissions Gaps in Virginia, 2025 - 2030

Virginia				
Target Year	Target	Emissions Target (MMT CO_2e)	Remaining Gap (High Emissions)	Remaining Gap (Low Emissions)
2025	26% below 2005 (U.S. Climate Alliance)	105	7	-0.4
2030	45% below 2010 net emissions (IPCC)	81	26	18

Note: negative values indicate that the state's emissions are projected to be below the target for that year.

Washington

Figure 35: Washington Economy-Wide Gross GHG Emissions and Targets[138,139]

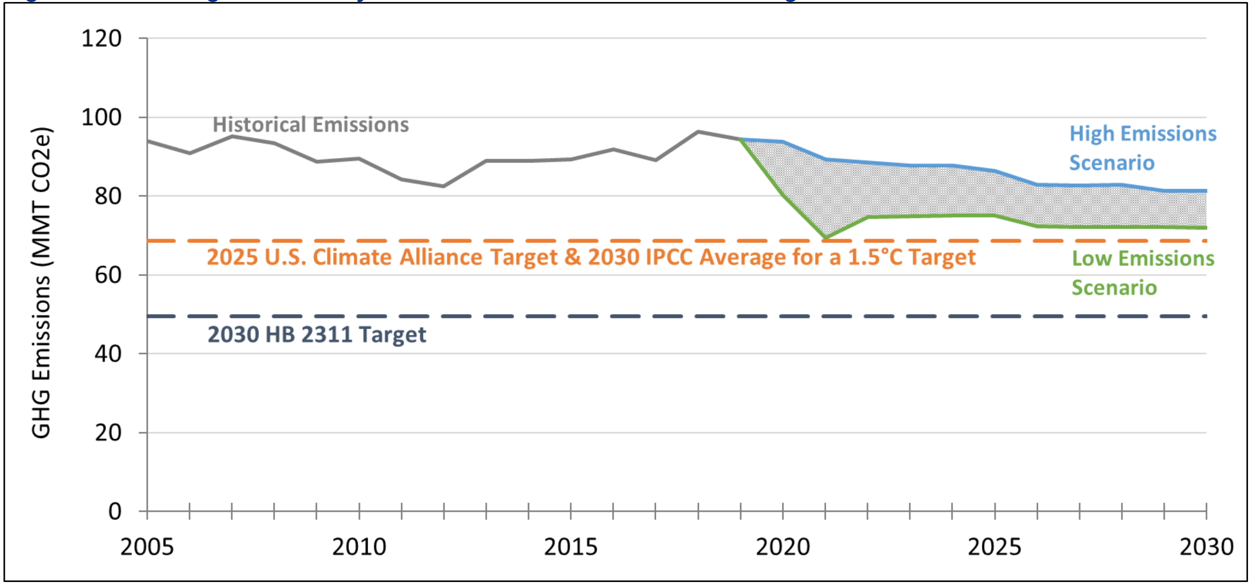

Table 30: Emissions Gaps in Washington, 2025 - 2030

Washington				
Target Year	Target	Emissions Target (MMT CO_2e)	Remaining Gap (High Emissions)	Remaining Gap (Low Emissions)
2025	26% below 2005 (U.S. Climate Alliance)	69	17	6
2030	45% below 2010 net emissions (IPCC)	69	13	3
2030	45% below 1990 (HB 2311)[140]	50	32	22

Note: negative values indicate that the state's emissions are projected to be below the target for that year.

[138] The 2030 HB 2311 target is based on 1990 emissions. 1990 emissions are not available in Rhodium Group's U.S. Climate Service data, so this target is based on Washington's 1990 – 2015 Greenhouse Gas Emissions Inventory report. See https://fortress.wa.gov/ecy/publications/documents/1802043.pdf.
[139] The 2025 U.S. Climate Alliance target and 2030 IPCC average for a 1.5°C target are shown as a single line on this chart because the 2030 net emissions target does not differ enough from the 2025 U.S. Climate Alliance gross emissions target to present as a separate line. For more information about how emissions targets were estimated in this paper, see Appendix 6.
[140] See http://lawfilesext.leg.wa.gov/biennium/2019-20/Pdf/Bills/Session%20Laws/House/2311-S2.SL.pdf#page=1.

Wisconsin

Figure 36: Wisconsin Economy-Wide Gross GHG Emissions and Targets

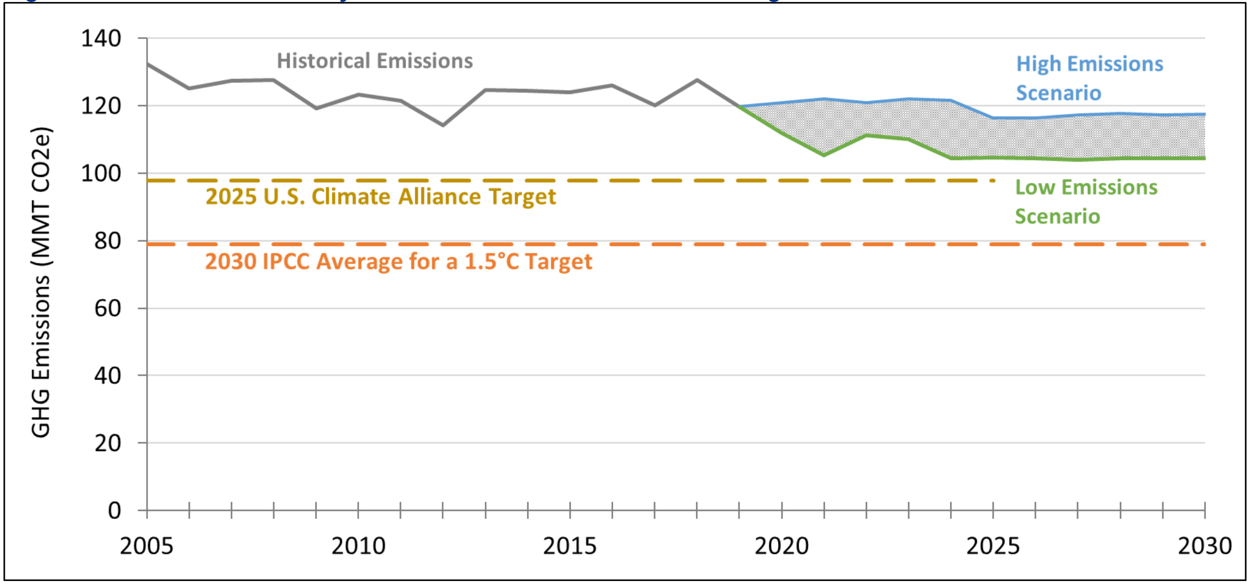

Table 31: Emissions Gaps in Wisconsin, 2025 - 2030

Wisconsin				
Target Year	Target	Emissions Target (MMT CO_2e)	Remaining Gap (High Emissions)	Remaining Gap (Low Emissions)
2025	26% below 2005 (U.S. Climate Alliance)	98	19	7
2030	45% below 2010 net emissions (IPCC)	79	39	26

Appendix 2: States Currently Deploying or Considering Enforceable GHG Emission Caps to Meet Reduction Targets

State	Regulatory Efforts Designed to Cap GHG Emissions		
	Power Sector	Transportation	Multi-Sector Initiatives
California			Economy-wide Cap-and-Trade[141]
Connecticut	RGGI	TCI	
Delaware	RGGI	TCI	
Maine	RGGI		Comprehensive planning underway to implement 2019 legislation setting mandatory reduction targets, presenting an opportunity to establish multi-sector limits.
Maryland	RGGI	TCI	
Massachusetts	RGGI and state-specific limits in 310 Code. Mass. Regs. § 7.74	TCI	
Nevada			Evaluating policies to meet emissions goals, including economy-wide market mechanisms.
New Hampshire	RGGI		
New Jersey	RGGI	TCI	Multi-sector regulatory effort underway at DEP to implement legislatively mandated reduction targets.
New Mexico			New Mexico's 2020 climate report outlines that NMED and EMNRD will evaluate the adoption of a comprehensive market-based program to reduce greenhouse gas pollution consistent with achieving at least 45% (below 2005 levels) by 2030.
New York	RGGI		Comprehensive planning underway to implement the Climate Leadership and Community Protection Act, which set mandatory reduction targets, presenting an opportunity to establish multi-sector limits.

141 California's cap-and-trade program includes GHG emissions from transportation, electricity, industrial, agricultural, waste, residential and commercial sources. The allowance budget is calibrated to meet the 2030 GHG target. Altogether, the emissions covered by the Cap-and-Trade program total approximately 80 percent of all GHG emissions in California.

Oregon			DEQ and EQC are developing regulations to cap and reduce emissions from stationary sources, transportation fuels, and all other liquid and gaseous fuels per Executive Order 20-04.
Pennsylvania	RGGI rulemaking underway at EQB	TCI	
Rhode Island	RGGI	TCI	
Vermont	RGGI	TCI	
Virginia	RGGI (joining 2021)	TCI	
Washington			Clean Air Rule, though currently not being implemented, provides a binding regulatory framework to cap and reduce emissions from stationary sources; Oil Refinery Standards require oil refineries to reduce GHG emissions 10% by 2025.

The Regional Greenhouse Gas Initiative (RGGI) is the first market-based program in the United States to mandate greenhouse gas emission reductions by capping and reducing carbon dioxide emissions from the power sector.

The Transportation and Climate Initiative (TCI) is a regional collaboration of 12 Northeast and Mid-Atlantic states (and Washington, D.C.) seeking to improve transportation systems, develop a clean energy economy, and reduce carbon emissions from transportation.[142] In December 2018, nine of these states, and Washington, D.C., formally announced their intent to design a regional low-carbon transportation policy that would cap and reduce carbon dioxide emissions from the combustion of transportation fuels, and invest value inherent in the market-based program into low-carbon and more resilient transportation infrastructure.[143] No states have adopted regulations yet to implement this program design.

[142] See https://www.transportationandclimate.org/content/about-us.
[143] See https://www.georgetownclimate.org/files/Final_TCI-statement_20181218_formatted.pdf.

Appendix 3: State Commitments to Reduce Economy-Wide GHG Emissions

The table below details state commitments to economy-wide GHG emission reduction targets. Binding commitments refer to statutory reduction targets that are accompanied by a mandatory directive to an agency to develop comprehensive implementing regulations to achieve the necessary reductions. All states, except for Louisiana, have also committed to the U.S. Climate Alliance target of reducing GHG emissions 26 to 28% below 2005 levels by 2025, though it is only included in the table for states where it is the only target.

State	Commitments to Reduce Economy-Wide GHG Emissions[144]			
	Target Year	Target	Commitment	Legal Foundation
California	2020	Reduce to 1990	Binding	2006 statute
	2030	40% below 1990	Binding	2016 statute
	2045	Carbon neutrality	Non-binding	2018 Executive Order
	2050	80% below 1990	Non-binding	2005 Executive Order
Colorado	2025	26% below 2005	Binding	2019 statute
	2030	50% below 2005	Binding	2019 statute
	2050	90% below 2005	Binding	2019 statute
	2050	Net-zero GHG emissions	Non-binding	2019 statute
Connecticut	2020	10% below 1990	Non-binding	2008 statute
	2030	45% below 2001	Non-binding	2018 statute
	2050	80% below 2001	Non-binding	2008 statute
Delaware	2030	30% below 2008	Non-binding	2014 Executive Target
Hawaii	2045	Net-zero GHG emissions	Non-binding	2018 statute
Illinois	2025	26-28% below 2005	Non-binding	2019 Executive Order
Louisiana	2025	26-28% below 2005	Non-binding	2020 Executive Order
	2030	40-50% below 2005	Non-binding	2020 Executive Order

[144] This table presents climate commitments to reduce economy-wide greenhouse gas emissions. Sector-specific commitments are not included.

	2050	Net-zero GHG emissions	Non-binding	2020 Executive Order
Maine	2030	45% below 1990	Binding	2019 statute
	2050	80% below 1990	Binding	2019 statute
	2050	Net-zero GHG emissions	Non-binding	2019 Executive Order
Maryland	2020	25% below 2006	Binding	2016 statute
	2030	40% below 2006	Binding	2016 statute
Massachusetts	2020	25% below 1990	Binding	2008 statute
	2050	80% below 1990	Binding	2008 statute
	2050	85% below 1990	Non-binding	2020 Executive Order
	2050	Net-zero GHG emissions	Non-binding	2020 Executive Order
Michigan	2025	26-28% below 2005	Non-binding	2019 Executive Order
	2050	Carbon neutrality	Non-binding	2020 Executive Order
Minnesota	2025	30% below 2005	Non-binding	2007 statute
	2050	80% below 2005	Non-binding	2007 statute
Montana	2025	26-28% below 2005	Non-binding	2019 Executive Order
	2050	Net-zero GHG emissions	Non-binding	2020 Executive target
Nevada	2025	28% below 2005	Non-binding	2019 statute
	2030	45% below 2005	Non-binding	2019 statute
	2050	Zero or near-zero GHG emissions	Non-binding	2019 statute
New Jersey	2020	Reduce to 1990	Non-binding	2019 statute
	2050	80% below 2006	Binding	2019 statute
New Mexico	2030	45% below 2005	Non-binding	2019 Executive Order
New York	2030	40% below 1990	Binding	2019 statute
	2050	85% below 1990	Binding	2019 statute
	2050	Net-zero GHG emissions	Binding	2019 statute

North Carolina	2025	40% below 2005	Non-binding	2018 Executive Order
Oregon	2020	10% below 1990	Non-binding	2007 statute
	2035	45% below 1990	Non-binding	2020 Executive Order
	2050	75% below 1990	Non-binding	2007 statute
	2050	80% below 1990	Non-binding	2020 Executive Order
Pennsylvania	2025	26% below 2005	Non-binding	2019 Executive Order
	2050	80% below 2005	Non-binding	2019 Executive Order
Puerto Rico[145]	2025	50% below 2019	Not included in legal analysis[146]	2019 statute
Rhode Island	2020	10% below 1990	Non-binding	2014 statute
	2035	45% below 1990	Non-binding	2014 statute
	2050	80% below 1990	Non-binding	2014 statute
Vermont	2012	25% below 1990	Non-binding	2005 statute
	2028	50% below 1990	Non-binding	2005 statute
	2050	75% below 1990	Non-binding	2005 statute
Virginia	2025	26-28% below 2005	Non-binding	Membership in U.S. Climate Alliance
Washington	2030	45% below 1990	Non-binding	2020 statute
	2040	70% below 1990	Non-binding	2020 statute
	2050	95% below 1990	Non-binding	2020 statute
	2050	Net-zero GHG emissions	Non-binding	2020 statute
Wisconsin	2025	26-28% below 2005	Non-binding	Membership in U.S. Climate Alliance

145 We assumed a target year of 2025 and base year of 2019 based on the statute's requirement to reduce emissions 50% over five years. See https://www.ncsl.org/research/energy/greenhouse-gas-emissions-reduction-targets-and-market-based-policies.aspx.

146 Puerto Rico's statute was not included in EDF's legal analysis of state targets for purposes of determining whether they are binding or non-binding.

Appendix 4: Rhodium Group U.S. Climate Service Scenarios

Rhodium Group's U.S. Climate Service data includes four scenarios, each with a different emissions trajectory, to account for the uncertainty surrounding the pace of economic recovery from COVID-19. Actual emissions are expected to fall between the high and low estimates. We use Rhodium Group's V-shaped economic recovery scenario to represent a mid-range case for purposes of presenting illustrative statistics in some cases in this report. This does not reflect an expectation that actual emissions are more likely to be in line with the V-shaped recovery scenario compared to other potential scenarios. We present emissions as a range throughout this report to emphasize that future emissions trajectories are highly uncertain and depend heavily on the pace of economic recovery. For more details on these scenarios, as well as Rhodium Group's methodology for developing the emissions projections that are referenced throughout this report, see Rhodium Group's Taking Stock 2020 report[147] and the accompanying Technical Appendix.[148]

Below are descriptions, as provided by Rhodium Group in these reports, of the four emissions scenarios.

Scenario	Description
Pre-COVID	Rhodium Group's Pre-COVID scenario relies on EIA's AEO2019 reference case assumptions.
V-shaped Recovery	Rhodium Group's "V-shaped recovery scenario is the most optimistic in terms of COVID-19 infection rates and economic recovery. In this scenario, US economic output falls by 5.9% in 2020, in line with the IMF's core scenario in its April World Economic Outlook. We assume the virus is under control by the second half of the year and that there is a rapid recovery, with the US economy growing by 4.7% in 2021."
W-shaped Recovery	In Rhodium Group's "W-shaped recovery scenario, failure to control the virus leads to a second wave of lockdowns later this year. Economic growth falls by 7.6% in 2020 and rises by only 1.3% in 2021. This is fairly close to the OECD's "Double-hit scenario" in which the economy contracts by 8.5% in 2020 and grows by 1.9% in 2021. The US economy grows at 4.1% in 2022, slightly slower thereafter than in our V-shaped recovery scenario, leaving average 2022-2030 growth rates at roughly the same 1.9%."

[147] Available at: https://rhg.com/wp-content/uploads/2020/07/Taking-Stock-2020-The-COVID-19-Edition.pdf.
[148] Available at: https://rhg.com/wp-content/uploads/2020/07/Taking-Stock-2020-Technical-Appendix.pdf.

L-shaped Recovery	In Rhodium Group's "L-shaped scenario, the US economy goes in and out of lockdowns until an effective vaccine and treatment are widely available, leading to a delayed and anemic recovery. Like the W-shaped recovery, the US economy falls by 7.6% in 2020, but then sinks again in 2021 by 0.3%. Output 10 years after the COVID-19 crisis is still 7% below pre-crisis projections."

Appendix 5: Adjustments to Rhodium Group U.S. Climate Service Data

In general, this report uses historical and projected emissions data from Rhodium Group's U.S. Climate Service data to estimate baseline emissions (i.e., historical emissions and business-as-usual projections). Rhodium Group employs a downscaling methodology to estimate state-level emissions based on the 2020 EPA Greenhouse Gas Inventory using relevant metrics like state-level fuel consumption. Because of this, state-level emissions estimates do not align exactly with state GHG inventory estimates.[149] This methodology results in some uncertainty around state-level emissions estimates, especially for land-based carbon dioxide sinks. Rhodium Group's emissions data is reported in carbon dioxide-equivalent based on the IPCC 4th Assessment Report (AR4) 100-year global warming potential values.[150]

EDF did not conduct a state-by-state analysis of Rhodium Group's data, but we did adjust state-level emissions in some instances:

Colorado

EDF replaced Rhodium Group's methane estimates for Colorado's Oil & Gas sector based on a separate EDF analysis using site-level measurements and peer reviewed methods. Specifically, EDF estimated current methane emissions from the Oil & Gas sector using a combination of GHGRP and Alvarez et al. data. Historical methane emissions were back-projected using production data from Enverus. Future methane emissions were projected based on proprietary production data from Rystad Energy. EDF also adjusted Rhodium Group's emissions projections to account for recently announced retirements of coal-fired units.[151]

Note that Rhodium Group's emissions projections for Colorado do not precisely account for the requirements of SB 19-236 that qualifying retail utilities reduce carbon dioxide emissions 80% from 2005 levels by 2030, although the coal unit adjustments and assumption that the replacement energy would be carbon-free should capture many of the expected reductions.[152]

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[149] For more information about Rhodium Group's U.S. Climate Service data methodology, see https://rhg.com/wp-content/uploads/2020/07/Taking-Stock-2020-Technical-Appendix.pdf.

[150] Note that the IPCC has updated GWP values in its Fifth Assessment Report (AR5), and that a 100-year time horizon is biased towards long-term climate impacts. However, in order for our analysis to be consistent with and comparable to the Rhodium and EPA data familiar to state-level decision makers, we also employ GWP-100 values from IPCC AR4 in this report, and note that this does not reflect the latest science nor account for methane's large near-term impacts. However, the use of IPCC AR4 GWPs and a 100-year time horizon does not change the conclusions, because the targets would also need to be recalculated with different GWP values and/or 20-year time horizons. To show how our analysis would be adjusted based on the best available science of GWPs and different time horizons that capture both near- and long-term impacts, we provide an example in Appendix 7.

[151] EDF adjusted Rhodium Group's emissions projections to account for the recently adopted retirement dates of coal-fired units as outlined in the Colorado APCD's August 20, 2020 Request for Hearing Document Package, available at: https://cdphe.colorado.gov/ozone-and-your-health/regional-haze. In addition, we adjust for the more recent decision that Craig 3, Rawhide and Ray D Nixon will retire at the end of 2028. See https://coloradosun.com/2020/11/23/three-coal-plants-shut-down-colorado/. Note that the Rhodium Group assumes Craig 1 retires at the beginning of 2025, whereas the APCD indicates it will retire at the end of 2025. The impact of this closure on 2025 emissions is less than 1 MMT CO_2e. In the L-shaped scenario, Rhodium Group's model retires the Rawhide plant at the end of 2020 as it finds this retirement to be economic. EDF's adjustment assumes all replacement capacity is zero-emission.

[152] See https://leg.colorado.gov/sites/default/files/documents/2019A/bills/2019a_236_enr.pdf.

EDF adjusted Rhodium Group's emissions data to account for Colorado's rules designed to reduce emissions of hydrofluorocarbons ("HFCs").[153]

New Mexico

EDF replaced Rhodium Group's methane estimates for New Mexico's Oil & Gas sector based on a separate EDF analysis using site-level measurements and peer reviewed methods. Specifically, EDF estimated current methane emissions from the Oil & Gas sector using a combination of GHGRP and TROPOMI data. Historical methane emissions were back-projected using production data from Enverus. Future methane emissions were projected based on proprietary production data from Rystad Energy. EDF also adjusted Rhodium Group's data to subtract the emissions associated with out-of-state electric load served by the Four Corners plant. Since the facility is located on tribal lands, its generation emissions that don't serve in-state customers are not under New Mexico's jurisdiction to regulate directly.

[153] APCD, Memorandum of Notice, Regulation Number 22, February 20, 2020. See https://drive.google.com/drive/folders/1irIUGWl4j4BOkkq4J1g54hscK7ov_BS8.

Appendix 6: Methodology for Estimating GHG Emissions Targets

Target emissions for 2025 and 2030 in this analysis were calculated based on percent reductions (26% reduction from 2005 gross emissions and 45% reduction from 2010 net emissions, respectively) from historical emissions as provided by the Rhodium Group U.S. Climate Service. Baseline emissions and emissions targets are presented in gross emissions.

In order to convert net emissions targets to gross emissions for purposes of presenting these targets in terms of gross emissions, the net emissions target is estimated first by calculating the target percent reduction from the base year's net emissions (e.g., a 45% reduction from 2010 emissions by 2030). Then, the projected carbon dioxide removals for the target year, as provided by Rhodium Group's U.S. Climate Service, are added to the net emissions target. This provides the gross emissions level needed to achieve the net emissions target in the target year for a given state.

Some state targets are based on emissions prior to 2005, the first year that historical emissions data from Rhodium Group's U.S. Climate Service are available. When historical emissions are not available in Rhodium Group's U.S. Climate Service data, state-specific data sources (e.g., a state GHG inventory) are used for establishing baseline emissions.

In this analysis, the U.S. Climate Alliance target of a 26 to 28% reduction from 2005 emissions is represented as a 26% reduction from 2005 gross emissions by 2025. We use 26% to represent the minimum reduction need to "meet" the target. Given the 2025 timeline, it is reasonable to focus on gross emissions as nearly all achievable reductions over the next five years will be reductions in gross emissions.[154]

The 2030 IPCC-derived target that represents a trajectory consistent with the IPCC average pathway for 1.5°C is based on information presented in the Summary for Policymakers of the IPCC Special Report on Global Warming of 1.5°C.[155] Note that modeled emissions pathways consistent with limiting warming to 1.5°C include reducing net carbon dioxide emissions to 45% below 2010 levels by 2030 and reaching net zero around 2050. Half of pathways consistent with limiting warming to 1.5°C show a reduction of 40 to 50% below 2010 levels by 2030 for the sum of all greenhouse gas emissions, using the standard carbon dioxide-equivalent metric with a 100-year GWP. Therefore, we use a reduction of 45% below 2010 levels by 2030 for all GHGs in this analysis to represent a pathway consistent with limiting warming to 1.5°C. We refer to this benchmark as the IPCC average pathway for a 1.5°C target for 2030 throughout this report.

Table 32 below shows emissions gaps by region using different targets – comparing net emissions targets with gross emissions targets for 2025 and 2030 for the states

[154] Deploying carbon removal technologies at scale will take sustained investment and innovation. Nearly all reductions in the next five years are expected to come from reducing emissions at the source.
[155] Available at: https://www.ipcc.ch/sr15/chapter/spm/.

evaluated in this analysis. All emissions presented in the table represent the remaining gap between business-as-usual emissions and the target.

Table 32: Comparison of Emissions Gaps Using Gross and Net GHG Emission Targets, 2025 - 2030

Region	Remaining Emissions Gaps (MMT CO_2e)							
	26% Reduction in Net Emissions from 2005 by 2025		26% Reduction in Gross Emissions from 2005 by 2025		45% Reduction in Net Emissions from 2010 by 2030		45% Reduction in Gross Emissions from 2010 by 2030	
	High	Low	High	Low	High	Low	High	Low
Pacific	40	-29	85	15	113	60	185	132
Mountain West	40	22	48	30	103	86	115	98
New England	-13	-26	-3	-16	23	13	38	29
South Atlantic	-19	-45	-1	-27	77	48	106	77
Midwest	18	-48	45	-20	191	119	236	163
Mid-Atlantic	55	-1	73	17	200	155	228	183
Gulf Coast/ Caribbean	83	61	88	67	161	130	170	139
Total	**204**	**-65**	**336**	**66**	**869**	**610**	**1,079**	**820**

Note that positive numbers indicate an emissions gap while negative numbers, highlighted in green, indicate that the region is expected to meet the target. The emissions gap is the difference between the BAU projected emissions level and the target emissions for the given year.

This table shows that, in general, emissions gaps are smaller when using net emissions targets compared to gross emissions targets due to carbon dioxide sinks from the Land Use, Land-Use Change, and Forestry sector.

Appendix 7: Comparing GWP Values

Historical and projected emissions presented in this report are based on data from Rhodium Group's U.S. Climate Service, which reports emissions in carbon dioxide-equivalent based on the IPCC 4th Assessment Report (AR4) 100-year global warming potential (GWP) values.[156] This is consistent with the methodology used in EPA's 2020 Inventory of Greenhouse Gas Emissions and Sinks.[157]

The IPCC has updated GWP values in its Fifth Assessment Report (AR5), and therefore AR4 GWP values do not reflect the most up-to-date scientific research. Additionally, the 100-year GWP masks the near-term warming impact of methane,[158] which is 84 times more potent than carbon dioxide on a 20-year timescale in terms of its warming effect on the atmosphere. Given that warming over all timescales matters, EDF recommends reporting carbon dioxide-equivalent emissions using both 20-year and 100-year time horizons, as this adequately captures climate impacts in both the near- and long-term.[159]

However, in order to be consistent with the targets and data reported by Rhodium Group's U.S. Climate Service and EPA, we employ the AR4 GWP-100 values. We also note that updating the data presented in this report to reflect the latest science (both 20- and 100-year time horizons and AR5 values) would adjust both the targets and the emissions trajectories, and therefore the bottom line messages, and emissions gaps, still stand.

In this appendix, we illustrate how updating the data to reflect the latest science would impact the results of our analysis. We analyze three different state-level emissions projections: one using 100-year AR4 GWP values, one using the 100-year AR5 GWP values, and one using 20-year AR5 GWP values.[160]

Table 33 below compares these different GWP values by gas.

[156] For more information about Rhodium Group's U.S. Climate Service data methodology, see https://rhg.com/wp-content/uploads/2020/07/Taking-Stock-2020-Technical-Appendix.pdf.
[157] See https://www.epa.gov/sites/production/files/2020-04/documents/us-ghg-inventory-2020-main-text.pdf.
[158] Ocko, IB, SP Hamburg, DJ Jacob, DW Keith, NO Keohane, M Oppenheimer, JD Roy-Mayhew, DP Schrag, SW Pacala, Unmask temporal trade-offs in climate policy debates, *Science*, 356, 6337, p.492-493 (2017).
[159] Ocko, IB, SP Hamburg, DJ Jacob, DW Keith, NO Keohane, M Oppenheimer, JD Roy-Mayhew, DP Schrag, SW Pacala, Unmask temporal trade-offs in climate policy debates, *Science*, 356, 6337, p.492-493 (2017).
[160] Emissions were estimated on a CO_2-equivalent basis using AR5 GWP values for methane, nitrous oxide, and sulfur hexafluoride. HFC and PFC data are provided by Rhodium Group as total HFC and PFC emissions. HFC-134a and PFC-CH_4 are the species of HFC and PFC, respectively, with the most emissions, so we use the GWP for HFC-134a and PFC-CH_4 as proxies for all HFCs and PFCs in the absence of data for individual species.

Table 33: Summary of Relevant Global Warming Potential Values from IPCC AR4 and AR5[161,162]

Global Warming Potential Values			
Greenhouse Gas	AR4 100-year GWP	AR5 100-year GWP	AR5 20-year GWP
Carbon Dioxide (CO_2)	1	1	1
Methane (CH_4)	25	28	84
Nitrous Oxide (N_2O)	298	265	264
Nitrogen Trifluoride (NF_3)	17,200	16,100	12,800
HFC-134a[163]	1,430	1,300	37,10
PFC-CF_4[164]	7,390	6,630	4,880
Sulfur Hexafluoride (SF_6)	22,800	23,500	17,500

The following figures show GHG emissions for Pennsylvania using the 100-year AR4 GWP values, the 100-year AR5 GWP values, and the 20-year AR5 GWP values to provide a comparison of results. Pennsylvania's emissions and target data are shown to provide an illustrative example, and the state emits a significant amount of methane. Specific results would vary by state, but these example calculations are indicative of how updating data with different GWP values would impact overall results.

Figure 37 below shows GHG emissions for Pennsylvania using the AR4 100-year GWP values to estimate emissions on a carbon dioxide-equivalent basis. This reflects the approach used to estimate emissions throughout this report.

[161] Forster, P., V. Ramaswamy, P. Artaxo, T. Berntsen, R. Betts, D.W. Fahey, J. Haywood, J. Lean, D.C. Lowe, G. Myhre, J. Nganga, R. Prinn, G. Raga, M. Schulz and R. Van Dorland, 2007: Changes in Atmospheric Constituents and in Radiative Forcing. In: Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M.Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.
[162] Myhre, G., D. Shindell, F.-M. Bréon, W. Collins, J. Fuglestvedt, J. Huang, D. Koch, J.-F. Lamarque, D. Lee, B. Mendoza, T. Nakajima, A. Robock, G. Stephens, T. Takemura and H. Zhang, 2013: Anthropogenic and Natural Radiative Forcing. In: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.
[163] HFC data are provided by Rhodium Group as total HFC emissions. HFC-134a is the species of HFC with the most emissions so we use the GWP for HFC-134a as a proxy for all HFCs in the absence of data for individual species.
[164] PFC data are provided by Rhodium Group as total PFC emissions. PFC-CH_4 is the species of PFC with the most emissions so we use the GWP for PFC-CH_4 as a proxy for all PFCs in the absence of data for individual species.

Figure 37: Pennsylvania Economy-Wide Gross GHG Emissions and Targets Using AR4 100-year GWP

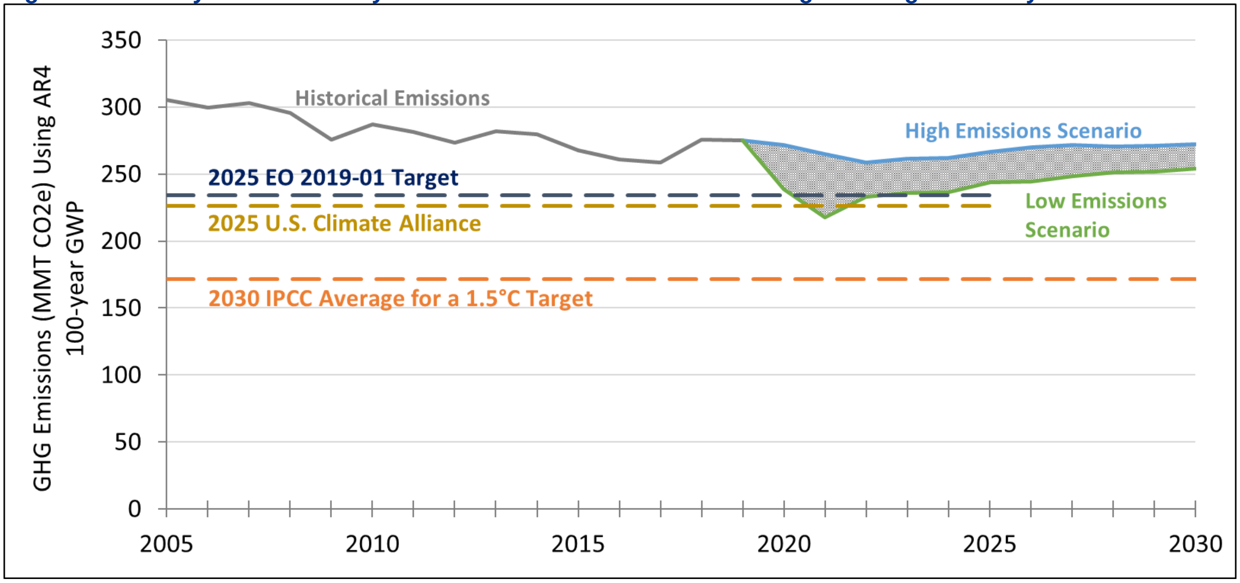
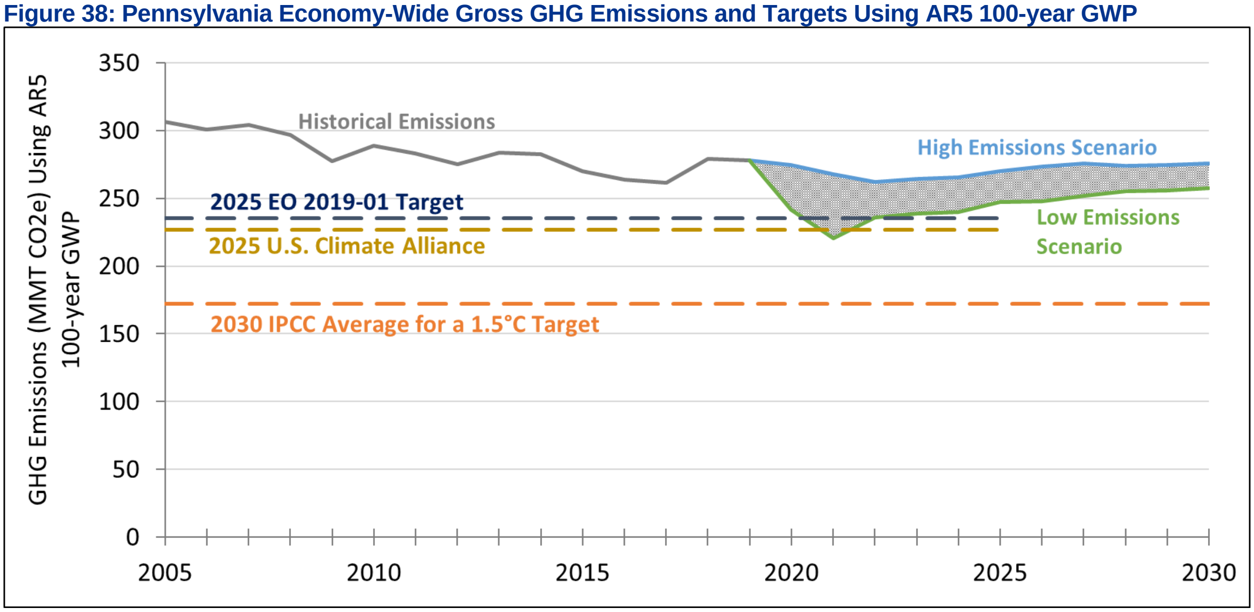


Figure 38 below shows GHG emissions for Pennsylvania using the AR5 100-year GWP values to estimate emissions on a carbon dioxide-equivalent basis.

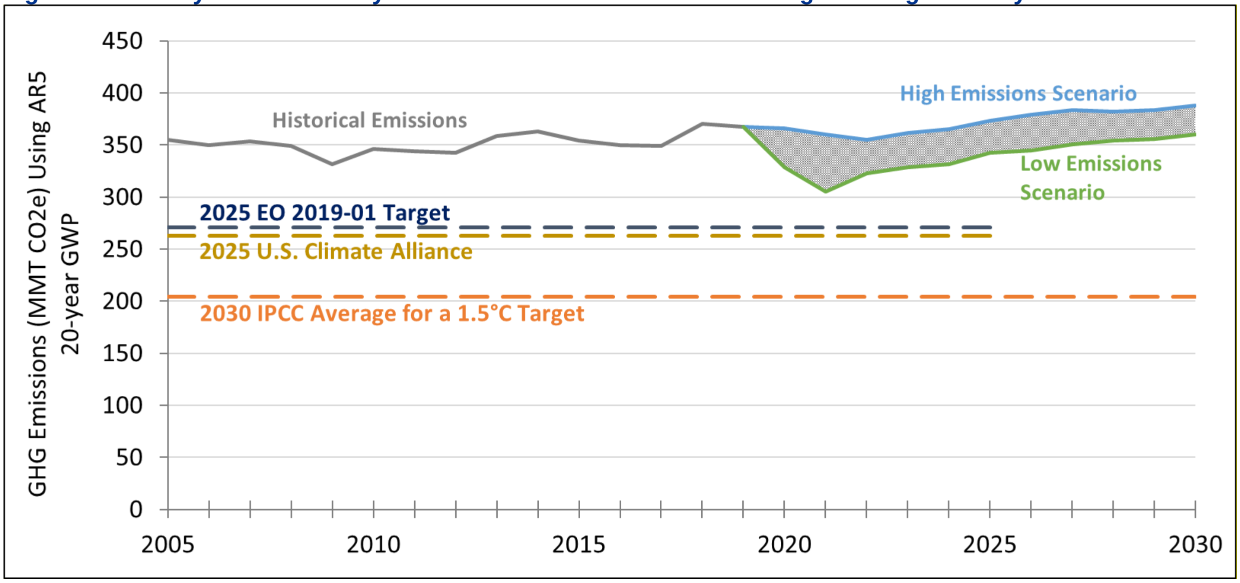
Figure 38: Pennsylvania Economy-Wide Gross GHG Emissions and Targets Using AR5 100-year GWP



Using the AR5 100-year GWP values slightly increases total emissions compared to the AR4 100-year GWP. However, the emissions targets increase as well because the baseline emissions are higher, so while the emissions gaps are slightly wider using the AR5 100-year GWP, the emissions gaps are not significantly changed.

Figure 39 below shows GHG emissions for Pennsylvania using the AR5 20-year GWP values to estimate emissions on a carbon dioxide-equivalent basis.

Figure 39: Pennsylvania Economy-Wide Gross GHG Emissions and Targets Using AR5 20-year GWP



Using AR5 20-year GWP values results in higher overall emissions estimates compared to estimates based on 100-year GWP values. Business-as-usual emissions also do not fall by as much between 2005 and 2030 as most of the reductions seen in Figures 37 and 38 above are from reductions in carbon dioxide. Methane emissions are projected to increase through 2030, and because the GWP value for methane is much higher on a 20-year timescale than a 100-year timescale, the contribution of methane to total emissions on a carbon dioxide-equivalent basis causes overall emissions to increase.

While the emissions targets also increase using the AR5 20-year GWP value, the emissions gaps are considerably wider compared to the 100-year GWP value estimates.

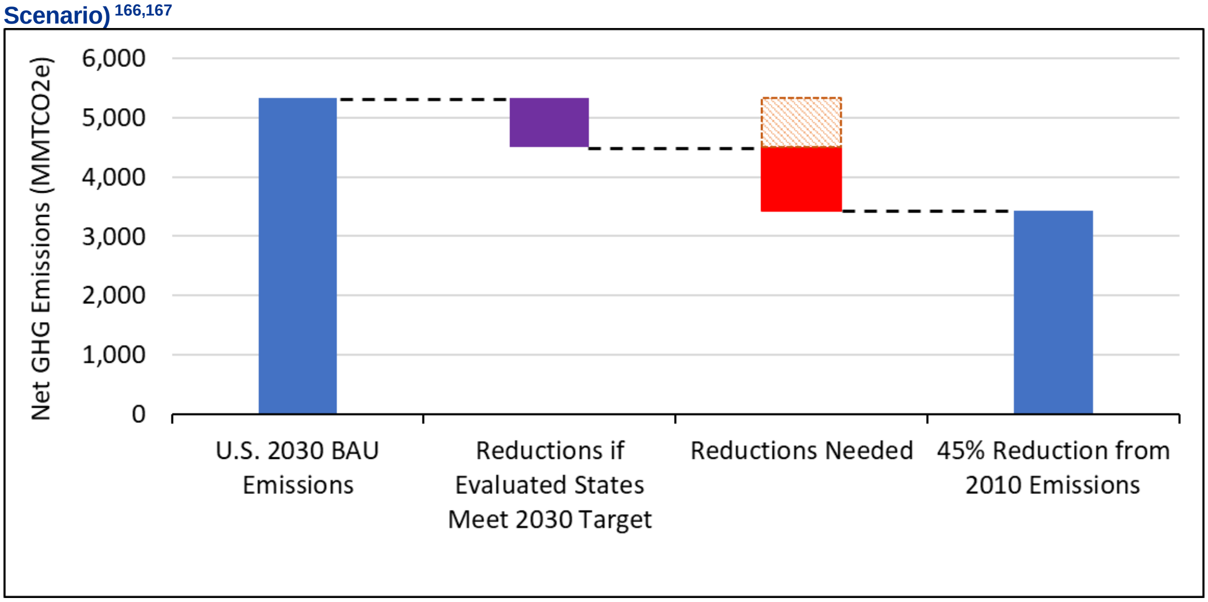
As shown in this appendix, using the more recent AR5 GWP values or using 20-year GWPs would not change the overall conclusions of this report – specifically that there are significant gaps between projected emissions and target emission levels.

Appendix 8: Impact on 2030 U.S. Emissions

Under a business-as-usual scenario, using the V-shaped recovery projections as an illustrative mid-range example,[165] U.S. emissions would fall only 20% from 2005 levels by 2025 and 15% from 2010 levels by 2030, leaving sizeable gaps between BAU emissions and the targets evaluated in this report. But if the states included in this analysis were to successfully reduce emissions in line with these targets, we found that they would reduce the total U.S. emissions gaps by 34% in 2025 and 43% in 2030 – bringing the country considerably closer to these crucial targets.

The impact of the states evaluated in this report meeting an emission reduction trajectory consistent with the IPCC average pathway for a 1.5°C target for 2030 is illustrated in Figure 40 below. The first column shows BAU emissions for the U.S. in 2030. The second column shows the amount of reductions that would be secured if the states included in this report meet the 2030 target, closing the gap to the 2030 target of 45% below 2010 levels by well over a third. The third column shows the amount of reductions needed to fully close the gap, and the last column illustrates the target for remaining U.S. emissions in 2030.

Figure 40: 2030 U.S. Emission Reductions if States Evaluated Meet 2030 Targets (V-Shaped Emissions Scenario) [166,167]



[165] We present emissions as a range throughout this report to emphasize that future emissions trajectories are highly uncertain and depend heavily on the pace of economic recovery. For more information about Rhodium Group's future emissions scenarios, see Appendix 4.
[166] Based on data from Rhodium Group's U.S. Climate Service. Note that we have adjusted Rhodium Group's data in some instances. Information about these adjustments is available in Appendix 5.
[167] This chart presents U.S. GHG emissions in net emissions as forecasted under Rhodium Group's V-shaped recovery scenario. The 45% reduction target is estimated in terms of net GHG emissions.