TURNING CLIMATE COMMITMENTS INTO RESULTS:

An Update on State-level Climate Targets

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TABLE OF CONTENTS

EXECUTIVE SUMMARY

Environmental Defense Fund (EDF) has conducted an updated analysis of the greenhouse gas emissions projections for each U.S. state and territory that has committed to reduce their emissions consistent with the U.S. Nationally Determined Contribution submitted under Article 4 of the Paris Climate Agreement: at least 26% to 28% by 2025 and 50% to 52% by 2030, as compared to 2005 levels. Collectively, the evaluated states account for nearly 41% of total U.S. greenhouse gas emissions. EDF released a similar study in December 2020 which found that the states that had, as of that date, committed to comparable climate action were far off-track to meet their commitments.

This analysis used data from Rhodium Group's U.S. Climate Service modeling released in August of 2022, which incorporates projected emission reductions from policies in place as of June 2022 as well as projected greenhouse gas abatement driven by the Inflation Reduction Act. EDF adjusted the data to reflect the projected impact from additional significant policies finalized by March of 2023 as well as to incorporate EDF's estimates of oil and gas methane emissions. While federal and state policies enacted in the previous two years have shifted economy-wide projections in a favorable direction since the prior analysis, the 24 evaluated states[1] that have committed to reduce emissions in line with scientific recommendations continue to fall well short of achieving their goals. Collectively these states are on track to reduce net emissions by 20% to 23% by 2025 — falling short of the minimum 26% reduction they have committed to achieve — and leaving a total gap of 159 MMT CO_2e[2] to 216 MMT CO_2e. By 2030, the same 24 states are projected to reduce net emissions by 27% to 39% — far short of their 50% reduction commitment — leaving a gap of 339 MMT CO_2e to 617 MMT CO_2e.

In addition to assessing states' progress toward 2025 and 2030 targets, EDF also evaluated the projected trajectory and associated cumulative greenhouse gas emissions from leadership states between 2020 and 2030. We find that these states are likely to far exceed an emissions "budget" over the decade aligned with their commitments to limit warming to 1.5°C, overshooting the budget by 28% and emitting over 5 billion MT CO_2e between 2020 and 2030 in excess of a greenhouse gas emissions budget consistent with their climate commitments.

The potential impact of these 24 climate leadership states delivering on these commitments is significant. Not only do they account for a sizeable amount of U.S. greenhouse gas pollution, but **if these states were to collectively meet their emission reduction targets, together they would close the nationwide emissions gap — the difference between projected emissions and the U.S. Nationally Determined Contribution — by 43% in 2030, bringing the U.S. significantly closer to meeting its commitments under the Paris Agreement.**

We conclude by identifying the essential policy tools that states can enact to secure the emission reductions they have committed to achieve. Importantly, we note that these policy tools are often under the direct control of the governors who have made these commitments. Much like the existing authority under the federal Clean Air Act that provides the Environmental Protection Agency with many tools to directly regulate greenhouse gas pollution, state air pollution control agencies are already charged with reducing and mitigating air pollution in their state and frequently have ample existing authority to control and abate air pollution, *including directly regulating and limiting greenhouse gases.* State air regulators have strong expertise regarding both the sources of climate pollution within their state, as well as methods to prevent or mitigate that pollution and are often already monitoring greenhouse gas emissions from a wide variety of sources. We underscore the critical importance of governors delivering on their promises by using this authority to pursue enforceable requirements for sources across all the major emitting sectors. Such requirements should be designed to limit greenhouse gas pollution at a pace and scale consistent with achieving state climate commitments.

1 EDF's analysis evaluates emissions projections from 23 states and Puerto Rico, which have all committed to reducing greenhouse gas emissions in line with the goals of the Paris Agreement. This group is referred to as 24 states throughout the report.

2 Greenhouse gas emissions are presented using a carbon dioxide equivalent metric to sum emissions of carbon dioxide, methane, N_2O, HFCs, PFCs, NF3, and SF6. Unless otherwise noted, throughout this report we use carbon dioxide equivalence values with a 100-year time horizon (CO_2e100) from IPCC's Fourth Assessment Report.

INTRODUCTION

Now more than halfway through President Joe Biden's first term, the federal government has reengaged forcefully to address climate change. President Biden formally rejoined the Paris Agreement,[3] established an ambitious and necessary target to reduce greenhouse gas (GHG) emissions 50%-52% by 2030[4] as the U.S. Nationally Determined Contribution (NDC), and is developing regulations to reduce emissions across numerous economic sectors, including new proposed EPA rules to cut pollution from passenger cars and trucks,[5] methane from oil and gas operations, and carbon pollution from fossil fuel power plants. Last year, Congress passed the single most consequential federal climate legislation in U.S. history: the Inflation Reduction Act (IRA). The Congressional Budget Office (CBO) estimates that the IRA provides nearly $400 billion toward investments in a wide range of climate solutions including clean energy technologies and pollution mitigation programs reaching nearly all major emitting sectors including electricity, transportation, buildings, and industry — in addition to resources for climate adaptation and workforce transition.

The urgency to cut climate-warming pollution continues to grow as communities across the country and the globe suffer from increasingly severe climate change-fueled impacts. In 2022, the U.S. experienced 18 weather and climate disasters exceeding $1 billion, with total disaster costs exceeding $165 billion.[6] The U.S. also experienced historic drought, with more than 60% of the contiguous U.S. experiencing drought at some point during 2022. The Intergovernmental Panel on Climate Change (IPCC) released its Synthesis Report for the Sixth Assessment Report (AR6 Synthesis Report) in February 2023, which indicates human activity has already increased average global temperatures by an estimated 1.07°C, that this warming "has led to widespread adverse impacts and related losses and damages to nature and people," and that "[v]ulnerable communities who have historically contributed the least to current climate change are disproportionately affected." The findings in the AR6 Synthesis Report reaffirm the urgency of acting now to slash climate pollution to ensure a safer and healthier future for people and planet. In spite of this heightened urgency, preliminary estimates[7] indicate that 2022 annual U.S. emissions likely *increased* roughly 1.3% relative to 2021 emission levels.

EDF's updated emissions gap report focuses on the key metric for ensuring a safer climate future: whether we are reducing climate pollution at the pace and scale necessary to curb the worst impacts of climate change. While attention is often given to point-in-time targets (e.g., reaching a 50% reduction by 2030 and net-zero emissions by 2050), and indeed the emission "gaps" relative to states' 2025 and 2030 targets is a significant focus of this analysis, *the emissions trajectory towards these targets* will determine the resulting climate damages. Rapid action to reduce emissions of short-lived gases (e.g., methane pollution) plays a central role in slowing and limiting near-term warming, while rapid action to reduce emissions of long-lived gases (e.g., carbon dioxide pollution), which can stay in the atmosphere for centuries, is crucial for limiting the overall amount of warming we will experience. Given the near-term impact of methane pollution and the cumulative build-up of carbon pollution, the path we take to achieving future emission reduction targets is even more important than "hitting" a particular emissions level in a specific year.

In addition, the biggest GHG emitters are also the biggest sources of local air pollution — like particulates, smog-forming contaminants, and air toxics[8] — that is often most concentrated in communities of color and in communities with significant low-income populations.[9] Achieving deep cuts in climate pollution 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.

3 The White House, Paris Climate Agreement. https://www.whitehouse.gov/briefing-room/statements-releases/2021/01/20/paris-climate-agreement

4 The White House, FACT SHEET: President Biden Sets 2030 Greenhouse Gas Pollution Reduction Target Aimed at Creating Good-Paying Union Jobs and Securing U.S. Leadership on Clean Energy Technologies, https://www.whitehouse.gov/briefing-room/statements-releases/2021/04/22/fact-sheet-president-biden-sets-2030-greenhouse-gas-pollution-reduction-target-aimed-at-creating-good-paying-union-jobs-and-securing-u-s-leadership-on--clean-energy-technologies.

5 Environmental Protection Agency, Regulations for Greenhouse Gas Emissions from Passenger Cars and Trucks, https://www.epa.gov/regulations-emissions-vehicles-and-engines/regulations-greenhouse-gas-emissions-passenger-cars-and.

6 National Oceanic and Atmospheric Administration, 2022 U.S. billion-dollar weather and climate disasters in historical context, https://www.climate.gov/news-features/blogs/2022-us-billion-dollar-weather-and-climate-disasters-historical-context.

7 Rhodium Group, https://rhg.com/research/us-greenhouse-gas-emissions-2022/.

8 Several of these pollutants also contribute to climate change.

9 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/.

FEDERAL INVESTMENT IN CLIMATE ACTION

Over the past two years, the federal government has made significant investments to lower the costs and incentivize increased deployment of clean energy technologies. These investments have come primarily via two major pieces of legislation: the Inflation Reduction Act (IRA) and the Infrastructure Investment and Jobs Act (IIJA).

The IIJA, which became law in 2021, invests hundreds of billions of dollars in infrastructure investment to accelerate deployment of clean energy and reduce climate pollution. New funding is provided for programs focused on public transit, zero-emission vehicles, energy efficiency, manufacturing, grid modernization and transmission, among many others.

The IRA, which became law in 2022, marks the most significant federal investment ever in climate mitigation by providing nearly $400 billion in funding for a wide range of GHG mitigation efforts and clean energy technologies. This includes substantial investment in a range of sector-specific opportunities including clean electricity via tax credits for technologies such as solar, wind, energy storage, energy efficiency, and geothermal; clean transportation, including via new consumer tax credits for zero-emission light-duty vehicles, funding for zero-emission trucks and buses including school and transit buses; industrial and manufacturing decarbonization to ensure more electric vehicles, wind and solar equipment, and lower-carbon heavy industrial materials are made in the U.S.; and nearly $21 billion to support climate-friendly agriculture. The IRA also includes funding set aside to enable investments in tribes and in low-income and rural communities and in communities transitioning away from fossil fuel-dependent economies; and investments to advance environmental justice, including $60 billion to address air pollution, improve energy efficiency in affordable housing, and expand air quality monitoring, among other programs. Finally, the IRA establishes the Methane Emission Reduction Program, which charges oil and gas polluters for wasting methane gas.

In addition to the range of direct federal investments in clean solutions outlined above, Congress also affirmed the critical role of further regulatory action in two key ways. First, the historic modernization of the federal Clean Air Act reinforced and expanded the Environmental Protection Agency's authority to protect communities from climate and air pollution. Second, Congress underscored the importance of further *state* regulatory action, providing $5 billion for the Climate Pollution Reduction Grant (CPRG) program, created to provide states, cities and tribes resources to plan and *implement* regulatory policies to reduce greenhouse gas emissions. This funding can be a critical tool for states to develop enforceable regulations, the cost of which will be driven down by the clean energy incentives included in the IRA and IIJA. Together, such regulations and incentives can dramatically accelerate cuts to climate pollution and improve air quality, especially in communities who are disproportionately impacted by multiple sources of climate and air pollution.

Importantly, two-thirds of the nearly $400 billion in energy and climate funding (between 2022-2031) from the IRA comes in the form of tax credits.[10] These credits are uncapped, meaning the funding will scale with deployment, with states that are able to deploy more of the clean technologies supported by the IRA ultimately benefiting the most. In addition, around 40% of the total projected IRA funding comes specifically from tax credits *for clean electricity*. Notably, as discussed below, those clean electricity tax credits drive the majority of the reductions; accelerated clean electricity deployment driven by the lower technology costs for zero-emission electricity generation accounts for *75% of the projected economy-wide GHG abatement from the IRA in 2030.*[11]

With these federal investments now in place resulting in a significant reduction in the cost to states of achieving deep GHG emission reductions, the U.S. must ratchet-up state and federal regulatory and policy adoption to ensure that pollution declines fast enough to meet the U.S. NDC.

10 Published estimates of the energy and climate funding from the IRA vary. Most are based on the scoring from the Congressional Budget Office (CBO) but some estimates are based on earlier CBO scoring (Energy Innovation - $369bn, https://energyinnovation.org/wp-content/uploads/2022/08/Modeling-the-Inflation-Reduction-Act-with-the-US-Energy-Policy-Simulator_August.pdf) or have categorized energy and climate funding differently (Rhodium Group - $383bn, https://rhg.com/research/us-decarbonization-priorities-in-the-wake-of-the-inflation-reduction-act or Committee for a Responsible Federal Budget - $391bn, https://www.crfb.org/blogs/cbo-scores-ira-238-billion-deficit-reduction).

11 https://rhg.com/research/climate-clean-energy-inflation-reduction-act/.

MODELING FEDERAL CLIMATE INVESTMENTS

Federal investments in the IRA are expected to significantly cut GHG pollution levels by dramatically lowering the cost of the transition to a clean energy future — creating an unprecedented opportunity for states to meet their commitments at a lower cost than ever before. Several groups have modeled the impact of the IRA and IIJA, consistently showing that these two laws have the potential to significantly reduce economy-wide emissions. However, as shown in Figure 1, there is a significant range in projected emission reductions both within and across different modeling efforts.[12] This variation between models is driven by several factors. While all are economically optimizing, the scope and detail of the models vary. Some models, for instance, will account for constraints to transmission or model supply chain and infrastructure constraints. In addition, as guidance on many of the IRA incentives is still being developed different modeling groups have made different assumptions as to how the IRA will work in practice. Finally, there is also variation in some of the core assumptions that are inputs to these models. Different groups draw on different sources for technology cost assumptions or fossil fuel price projections.

Rhodium Group's analysis[13] projects that with the IRA in place, U.S. emissions could fall to 32%-42% below 2005 levels by 2030, compared to a 24%-35% reduction projected before the IRA was passed. EPRI's modeling finds that the IRA, combined with other policies and technology trends, has the potential to reduce U.S. economy-wide emissions 32%-33% below 2005 levels by 2030. The Princeton-led REPEAT Project estimates that U.S. emissions have the potential to fall 42% below 2005 levels by 2030, 15% lower than before the IRA was in place. Energy Innovation modeling estimates that with the IRA in place, the U.S. is projected to draw down emissions 37-41% below 2005 levels by 2030. The potential impacts of these investments are incorporated into this analysis through Rhodium Group's updated state-level emissions projections.[14]

While the projected pollution cuts associated with the IRA and IIJA indicate that these investments are a key step toward meeting U.S. goals, it is important to underline the uncertainty around the pollution cuts that can be attributed to these laws. The projected emission reductions are the product of economic models which generally assume a high degree of responsiveness to economic incentives. This means they provide an indication of the emissions trajectories that would result from very effective cost minimization, given a set of fixed assumptions.

In practice, however, the sectors which account for the greatest potential emission reductions due to IRA incentives are subject to market frictions and constraints that will prevent these sectors from making cost-optimizing decisions predicted in economic models, absent additional policy intervention. This is particularly relevant for the electric power sector, which plays a central — and outsized — role in these projections: as noted above, 75% of the projected 2030 economy-wide abatement from the IRA in the Rhodium Group analysis comes directly from anticipated uptake of the clean electricity tax credits. For example, the National Renewable Energy Laboratory recently released a study in which it provided the caveat, in relation to central modeled post-IRA GHG emissions scenario ("Mid case"), that it "most closely represents the power sector evolution that would occur *if all economically optimal* investment and retirement opportunities were executed (emphasis added)."[15] Since the IRA and IIJA do not guarantee emissions outcomes consistent with the modeled impact, and the power sector is not structured in a way that ensures economically optimized behavior, these projections are potentially relatively optimistic — particularly given the outsized role of power sector abatement in the economy-wide projections.

12 Projected economy-wide emission reductions from 2005 levels by 2030, including with IRA investments, include: EPRI 32-33% https://www.epri.com/research/products/000000003002026229, Princeton REPEAT 37-41% https://repeatproject.org/docs/REPEAT_2023_Preview.pdf, and Rhodium Group 32-42% https://rhg.com/research/climate-clean-energy-inflation-reduction-act.

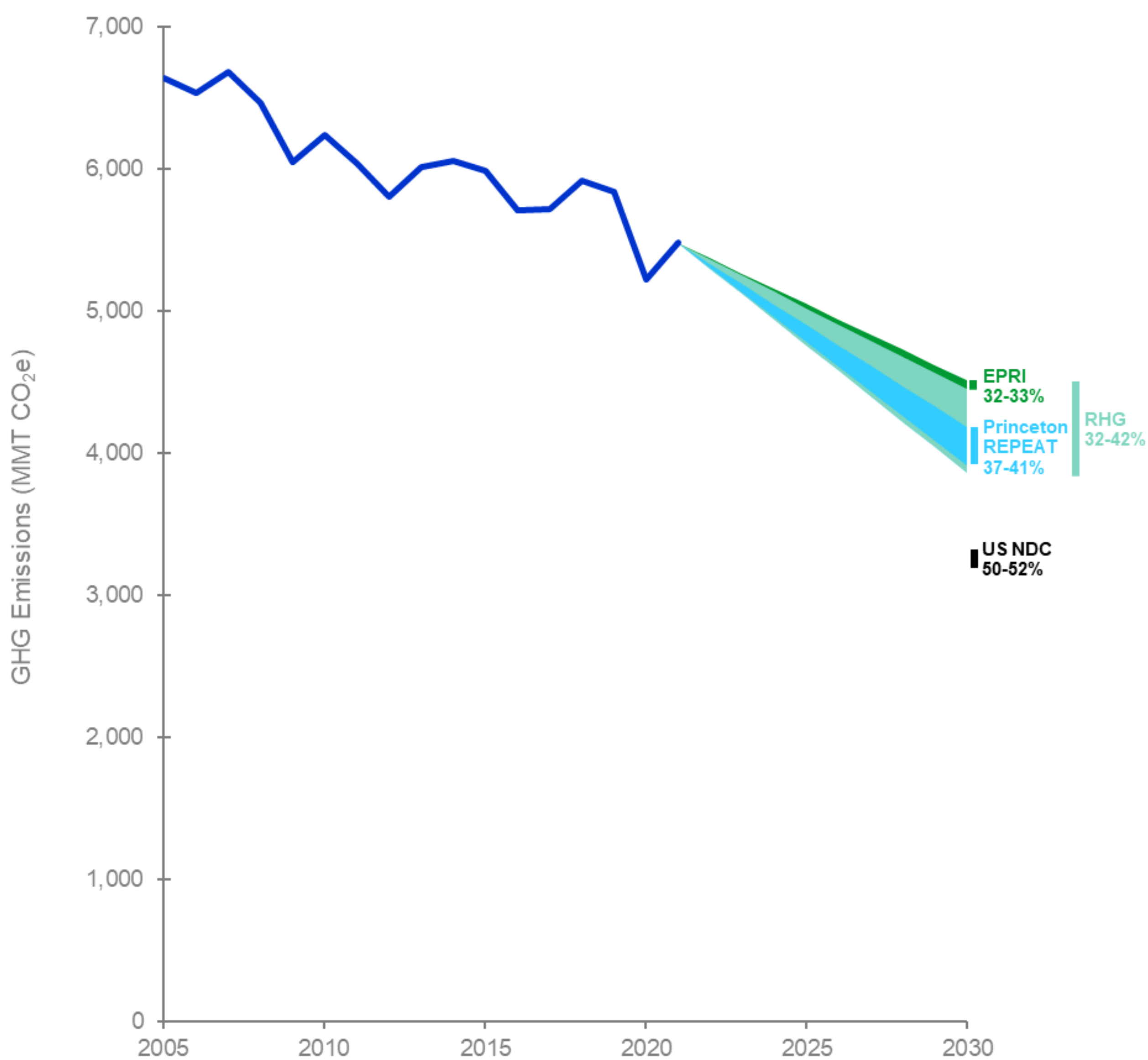
13 See for example Rhodium Group, "A Turning Point for US Climate Progress: Assessing the Climate and Clean Energy Provisions in the Inflation Reduction Act" August 2022. https://rhg.com/research/climate-clean-energy-inflation-reduction-act.

14 https://rhg.com/research/climate-clean-energy-inflation-reduction-act/.

15 Steinberg, Daniel C., et al. Evaluating Impacts of the Inflation Reduction Act and Bipartisan Infrastructure Law on the US Power System. No. NREL/TP-6A20-85242. National Renewable Energy Lab (NREL), Golden, CO (United States), 2023.

Given the uncertainty of GHG emissions reductions achieved via IRA and IIJA incentives, **a key variable [16] in determining whether the U.S. succeeds in capturing the full abatement potential of the IRA is whether complementary state and federal regulatory policies are adopted to require cuts in climate pollution consistent with the U.S. NDC.** Doing so would both increase deployment and investment in technologies incentivized by the IRA and IIJA at the *scale* necessary to reduce economy-wide pollution consistent with the U.S. NDC, and significantly increase the *certainty* of achieving those pollution cuts. **In other words, states now have a crucial role to play in both realizing the promise of federal investments in the IRA and IIJA — locking in the projected reductions — and helping to close the remaining gap for the U.S. to achieve its climate goals.**

Figure 1: Range of Post-IRA Economy-Wide Projected Emission Reductions[17]



16 There are a range of other variables, including but not limited to ensuring that new clean electricity projects can connect to the electric grid in a timely fashion and that the electric grid has the transmission capacity necessary to deliver clean electricity from generation facilities to load centers.

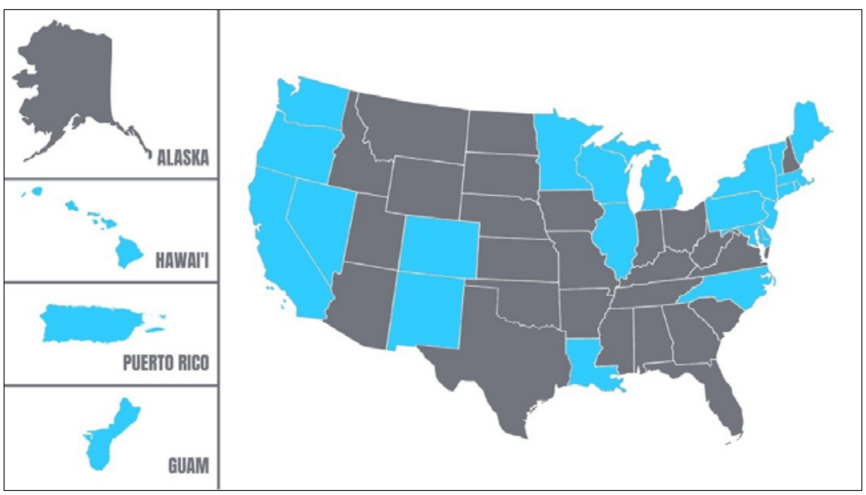
17 Figure 1 shows an illustrative linear pathway between 2020 and projected reduction levels in 2030 but does not represent the emissions trajectories that are projected to occur over the decade.

THE CRITICAL ROLE OF STATES

States have been in the position of climate leadership for years, making their own commitments to cut economy-wide GHG pollution in line with scientific recommendations in response to federal inaction. As of mid-2023, 25 states [18] have commitments to reducing economy-wide GHG emissions consistent with the U.S. NDC and what science indicates is necessary to avoid the worst impacts of climate change. All 25 are members of the U.S. Climate Alliance, 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 and 50% to 52% below 2005 levels by 2030. U.S. Climate Alliance emissions reduction targets are also consistent with the U.S. NDC, submitted under the Paris Agreement to reduce global GHG emissions. Moreover, members of the U.S. Climate Alliance also explicitly commit 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 temperature increase to 1.5°C. [19] By focusing on both near- and long-term emission reductions, leadership state governors — alongside a number of legislatures — have importantly elevated emissions-based metrics for evaluating success and affirmed that climate change is fundamentally a pollution problem that requires swift and sustained declines in greenhouse emissions. [20]

Even with significant recent federal and state progress, GHG pollution cuts remain behind the pace and scale necessary for the U.S. to meet its NDC. Analysis produced as the NDC was under development in early 2021 noted that subnational actors — states, municipalities, and corporate leaders — would have a key role in achieving an ambitious and credible target. [21] This remains true two years later, as new analyses demonstrate that high-ambition state action will still be critical to close the gap that remains between projected emissions and the U.S. commitments under the Paris Agreement. [22] For instance, Rhodium Group's Pathways to Paris analysis [23] shows that, under a "federal action only" scenario, U.S. net emissions are projected to be 38% to 48% below 2005 levels by 2030. However, under a "joint action scenario" — in which climate-leading states adopt a suite of emission reduction policies ***on top of*** high-ambition federal actions — U.S. net emissions are projected to be 41% to 51% below 2005 levels by 2030, **indicating that ambitious state action could drive an additional 3% reduction in national emissions.**[24] Moreover, these modeling results demonstrate that state-level action to cut GHG pollution could be determinative in meeting the U.S. NDC.

Figure 2: U.S. States and Territories with Climate Commitments



18 Including Puerto Rico. We note that Guam also joined the USCA in February 2023; emissions data for Guam was not available at the time of publication and thus it is not included in this analysis.

19 See https://unfccc.int/files/essential_background/convention/application/pdf/english_paris_agreement.pdf.

20 See https://assets.bbhub.io/dotorg/sites/28/2021/04/All-In-Climate-Strategy-for-50_April-2021.pdf

21 https://www.edf.org/sites/default/files/documents/Recapturing%20U.S.%20Leadership%20on%20Climate.pdf

22 See https://energyinnovation.org/wp-content/uploads/2022/12/Closing-The-Emissions-Gap-Between-IRA-And-NDC-Policies-To-Meet-The-Moment.pdf; https://rhg.com/wp-content/uploads/2023/03/Pathways-to-Paris-Post-IRA-Policy-Action-to-Drive-US-Decarbonization.pdf; and https://www.edf.org/sites/default/files/documents/Recapturing%20U.S.%20Leadership%20on%20Climate.pdf.

23 https://rhg.com/wp-content/uploads/2023/03/Pathways-to-Paris-Post-IRA-Policy-Action-to-Drive-US-Decarbonization.pdf.

24 Since state action is being stacked on top of a high ambition federal scenario in this analysis, 3% is probably understating the potential impact of state policy as it assumes federal action has done the heavy lifting already. In a scenario where that level of federal action doesn't materialize or if the policies are not as effective as expected, the state level impact would be considerably higher.

EVALUATING PROGRESS TOWARD STATE 2025 AND 2030 GHG TARGETS

EDF completed an analysis based on data from Rhodium Group's U.S. Climate Service comparing business-as-usual (BAU) gross [25] emissions projections [26,27] for each state that has set a concrete greenhouse gas reduction target — either through statute, executive order, or both. All of the evaluated states have committed to reduce GHG emissions at least 26% to 28% below 2005 levels by 2025 and at least 50% to 52% below 2005 levels by 2030. These targets provide common benchmarks for each state and allow for assessment of their progress in aggregate toward the shared goal.[28] In addition to evaluating progress against aggregate targets, in Appendix 1 we assess progress toward near-term targets that states have set through statute and executive order. These analyses indicate the "emissions gap" between projected emissions and state-level emission reduction commitments.

Rhodium Group develops scenarios for emissions through to 2035 based on state and federal policies that are currently in place, as well as a range of assumptions for macroeconomic factors and energy costs.[29] These scenarios provide a range of potential emissions outcomes under current policy. It is important to note that, while actual emissions are likely to be within this range, the projections are subject to significant uncertainty and may be relatively optimistic. In particular, while the emissions projections indicate that federal IRA and IIJA investments offer significant GHG abatement potential, the extent to which this potential will be fully realized is uncertain as discussed above. [30]

Our analysis finds that few states with climate commitments are projected to meet the 2025 target. The 24 states with emission reduction commitments that we evaluated are expected to reduce emissions by 606 to 663 million metric tons of carbon dioxide equivalent (MMT CO_2e) from 2005 levels by 2025 — leaving a gap of 159 to 216 MMT CO_2e to meet their minimum reduction goal of 26% below 2005 levels — and emitting 7% to 9% over their target level.[31, 32]

25 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).

26 BAU emissions shown in this report reflect state and federal policies in place as of March 2023.

27 To sum greenhouse gas emissions of different gas species (such as carbon dioxide and methane), a metric is required to compare the climate impacts of emissions. The standard metric used is carbon dioxide equivalence (CO_2e) with a 100-year time horizon (CO_2e100), which requires a Global Warming Potential multiplier for non-CO_2 gasses to represent the amount of CO_2 that would have the same climate impact (using radiative forcing as a proxy) over the following 100 years as the one-time amount of emissions of the non-CO_2 gas. We acknowledge that CO_2e is an imperfect metric, and that CO_2e represented on a 100-year time horizon, by itself, only conveys long-term climate impacts of emissions. Reporting greenhouse gas emissions using two time horizons, 20- and 100-year, to convey climate impacts over all timescales would be the better practice (Ocko et al. 2017). 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 AR6. We assess the implications of two time horizons and updated GWP values in Appendix 6, and note that updated GWP-100 values do not change the main conclusions of this report.

28 Target emissions for 2025 and 2030 in this analysis were calculated based on percent reductions (26% reduction from 2005 gross emissions and 50% reduction from 2005 net emissions, respectively) from historical emissions as provided by the Rhodium Group U.S. Climate Service. Target emission levels are presented in gross emissions. For more information about the calculations used to estimate targets, see Appendix 5.

29 For more information on Rhodium Group's emissions scenarios, see Rhodium Group's 2022 Taking Stock report and technical appendix, https://rhg.com/research/taking-stock-2022, as well as Rhodium Group's report evaluating the emissions impact of the IRA, https://rhg.com/research/climate-clean-energy-inflation-reduction-act.

30 See Modeling Federal Climate Policies for more information on abatement potential from the IRA and IIJA.

31 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 2022, available at: https://rhg.com/wp-content/uploads/2022/07/Taking-Stock-2022_US-Emissions-Outlook.pdf and Rhodium Group's 2022 report, A Turning Point for US Climate Progress, available at: https://rhg.com/wp-content/uploads/2022/08/A-Turning-Point-for-US-Climate-Progress_Inflation-Reduction-Act.pdf. Note that we have adjusted Rhodium Group's data in some instances. Information about these adjustments is available in Appendix 4.

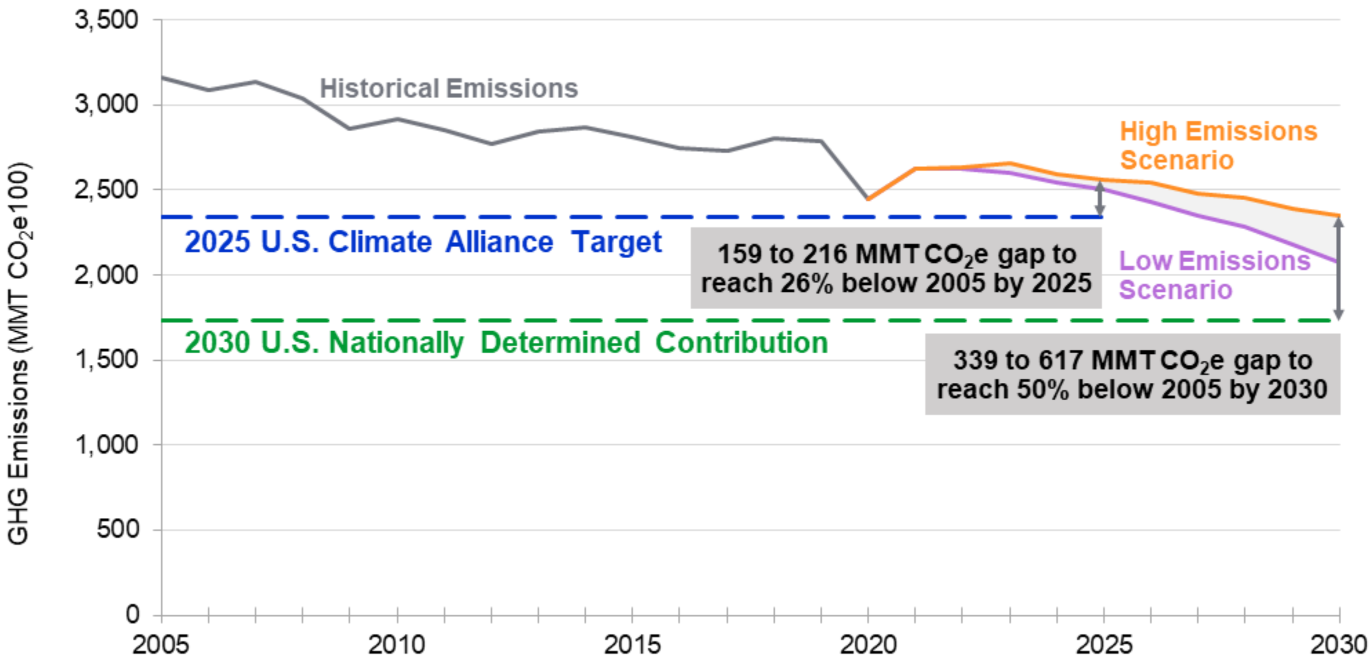
32 Note that the IPCC has updated GWP values in its Sixth Assessment Report (AR6), and that a 100-year time horizon is biased towards long-term climate impacts. However, in order for our analysis to be consistent with and comparable to the Rhodium Group and EPA data familiar to state-level decision makers, 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 6.

EDF's analysis shows that aggregate net emissions from the states evaluated are expected to be only 20% to 23% below 2005 levels by 2025 [33] — still short of the minimum 26% reduction in climate pollution these states have committed to achieve.

As shown in Figure 3, the gaps widen significantly when looking at the 2030 benchmark consistent with the U.S. NDC. Under current state and federal policies, the states evaluated are projected to reduce emissions by 815 to 1,092 MMT CO_2e from 2005 levels by 2030 — leaving a gap of 339 to 617 MMT CO_2e to the goal of reducing 50% below 2005 levels — and emitting 20% to 36% in excess of their target.

Emission projections show that aggregate net emissions in the states included in this analysis are expected to be only 27% to 39% below 2005 levels by 2030 — falling well short of the minimum 50% reduction in climate pollution.

Figure 3: Total GHG Emissions from Leadership States, 2005 to 2030[34]



Source: EDF analysis based on Rhodium US Climate Service data

33 In providing an expected emissions level, we use Rhodium Group's central emissions scenario to represent a mid-range case for purposes of presenting illustrative statistics. However, we also present emissions as a range throughout this report to emphasize that future emissions trajectories are highly uncertain and depend heavily on macroeconomic factors and fuel and clean energy costs. For more information about Rhodium Group's future emissions scenarios, see Appendix 3.

34 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 4.

THE IMPORTANCE OF RAPID ACTION

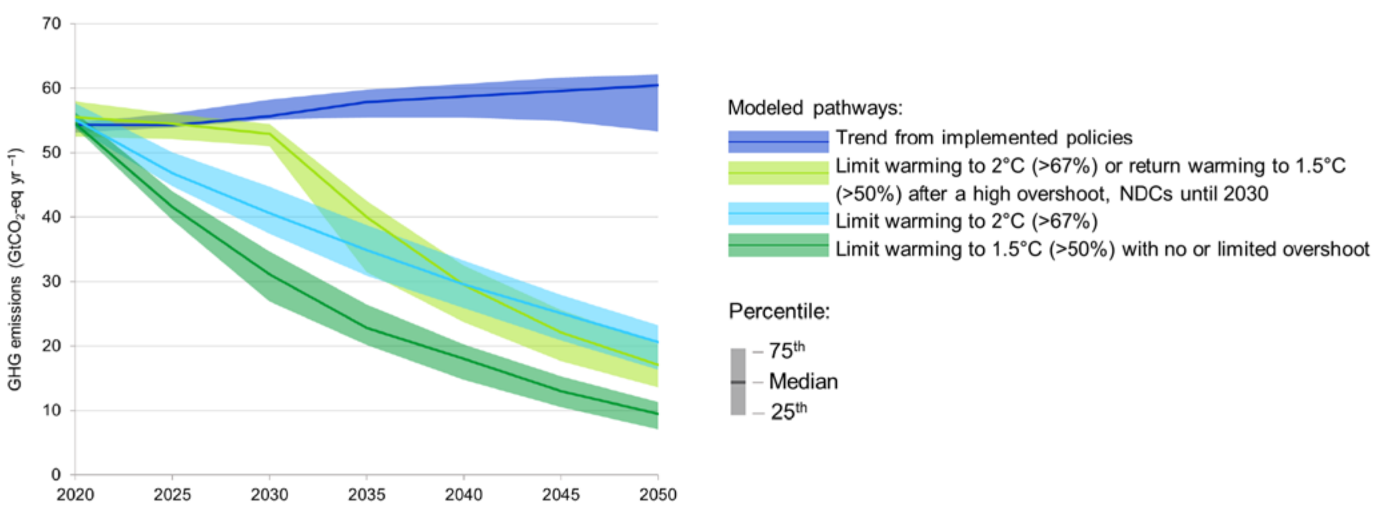
In addition to evaluating progress on meeting emission reduction targets in 2025 and 2030, it is critical to assess the emissions pathway toward these milestone years. Rapid action to reduce GHG emissions has both near- and long-term benefits. For example, reducing emissions of short-lived climate pollutants (e.g., methane) — which largely govern the rate of warming — is crucial for slowing and limiting near-term warming and associated damages. Additionally, reducing emissions of long-lived climate pollutants (e.g., carbon dioxide) — which largely govern the maximum amount of warming — is crucial for limiting the overall amount of warming we will experience. This is because long-lived climate pollutants can last for centuries in the atmosphere, thus committing us to warming for generations to come. Therefore, rapid action is critical both to curb the near-term warming impacts of short-lived GHGs and to limit cumulative damages from long-lived GHGs that accumulate in the atmosphere and continue to warm the climate for hundreds of years.

U.S. Climate Alliance members have committed to taking actions necessary to help limit global average temperature rise to 1.5°C. In its Sixth Assessment Report, [35] the IPCC assessed modeled emissions pathways (shown in Figure 4 below), including those that limit global average temperature increase to 1.5°C [36] with no or limited overshoot [37]— demonstrating the rapid pace of emissions cuts necessary.

To evaluate progress on this commitment, EDF analyzed the projected emissions pathway toward milestone years and the cumulative quantity of climate pollution that leadership states are projected to add to the atmosphere over the decade. While annual emissions of short-lived climate pollutants generally dictate their climate impact, for long-lived climate pollutants (such as CO_2), the cumulative amount of emissions over time is a more important determinant of warming than the amount emitted in any single year. Therefore, we must ensure that total reductions in CO_2 over time align with assessments of carbon budgets that estimate the cumulative amount of CO_2 that can be emitted while staying below a particular temperature target.[38]

We compare states' cumulative GHG emissions between 2020 and 2030 to levels consistent with a declining, linear emissions trajectory based on the average of pathways assessed by IPCC to limit warming to 1.5°C. Our analysis finds that states lag well behind the pace of reductions aligned with their science-based climate goals. To deliver on their commitments and secure the strongest possible future, states must put policies in place that not only meet targets in 2025 and 2030, but also accelerate near-term reductions and limit cumulative climate pollution.

Figure 4: Global GHG Emissions of Modeled Pathways[39]



35 See Summary for Policymakers of the Working Group III contribution to IPCC Sixth Assessment Report, available at: https://www.ipcc.ch/report/ar6/wg3/downloads/report/IPCC_AR6_WGIII_SPM.pdf.

36 This category includes modeled emissions pathways that "limit warming to 1.5°C in 2100 with a likelihood of greater than 50%, and reach or exceed warming of 1.5°C during the 21st century with a likelihood of 67% or less." Id, pg. 25.

37 IPCC defines "limited overshoot" as "exceeding 1.5°C global warming by up to about 0.1°C and for up to several decades." Id.

38 IPCC Special Report on Global Warming of 1.5°C. Available at https://www.ipcc.ch/sr15/chapter/chapter-2/.

39 Adapted from Figure SPM.4 in the Summary for Policymakers of the WG III contribution to AR6. Data source: Kriegler, E.; Krey, V.; Byers, E. (2022): Data for Figure SPM.4 - Summary for Policymakers of the Working Group III Contribution to the IPCC Sixth Assessment Report. MetadataWorks, 04 April 2022. 10.48490/ys3e-mq98. For more information on modeled emissions pathways, see Summary for Policymakers, pgs. 25-27.

EVALUATING CUMULATIVE GHG EMISSIONS THROUGH 2030

Our cumulative analysis shows that leadership states are significantly overshooting cumulative emissions budgets [40] aligned with their commitment to do their part in limiting warming to 1.5°C. **Current emission projections show that the 24 states evaluated in this analysis are projected to overshoot a near-term pathway consistent with their climate commitments by 28% — adding over 5 billion MT CO_2e [41] to the atmosphere in excess of a target trajectory between 2020 and 2030.** These results suggest that even for states who are making significant progress toward meeting target levels in milestone years (such as 2025 and 2030), lacking firm annual pollution limits or an enforceable emissions budget leads to significantly more total pollution than the emission budget implied by an average path towards the Paris Agreement goals.

Figure 5 and Figure 6 below show the projected cumulative emissions for evaluated states over the decade, under a relatively optimistic reduction scenario. The area beneath the IPCC-based average 1.5°C target pathway represents the cumulative quantity of emissions under the target trajectory, while the area between the target trajectory and the BAU GHG emissions (in the case of Figure 5, the central emissions scenario [42]) indicates the cumulative quantity of excess emissions that are projected to occur. While the states' cumulative emissions budget under persistent reductions [43] consistent with a 1.5°C pathway [44] is 18,385 MMT CO_2e between 2020 and 2030, [45] the states are, collectively, projected to **overshoot this budget by 5,180 MMT CO_2e in the central emissions case, shown in Figure 5 — emitting 28% more than their science-based goals.**

Figure 6 below summarizes the excess cumulative emissions across scenarios, underscoring the profound implications for total GHG pollution. This chart captures a wide range of emissions outcomes for evaluated states depending on economic drivers and policy implementation (shown in the red bar), making clear that in all scenarios, current measures will reduce fewer emissions cumulatively over the decade than needed for a trajectory consistent with a 1.5°C pathway. **Across the emissions scenarios, leadership states are projected to collectively emit between 4.8 and 6.2 billion MT CO_2e in excess of a 1.5°C target trajectory over the decade.** This excess climate pollution is well over the amount of total *combined* climate pollution from the two largest emitting U.S. sectors (transportation and power generation) in 2021. Under the high emissions scenario, excess climate pollution from leadership states is projected to be 6.2 billion MT CO_2e over the decade — more than the U.S. emitted economy-wide in 2021. Collectively, these charts illustrate that 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.

40 In this section, we evaluate the cumulative emissions of all GHGs that climate commitments states are projected to emit over time. This is a simplified approach to assess the emissions trajectory.

41 CO_2e based on the GWP-100 metric from IPCC's Fourth Assessment Report. This is a simplified approach to assess the emissions trajectory of the sum of all greenhouse gases. Appendix 7 illustrates how one could evaluate emissions target trajectories separated by gas species if data is available.

42 Rhodium Group provides emissions projections under three modeling scenarios that reflect varying inputs on fuel prices, clean technology costs, and macroeconomic growth. In this figure, we show projected emissions under the central emissions scenario as one emissions trajectory within the potential range of projections. However, it is important to note that the central emissions scenario does not represent the middle value of the emissions range; as shown in Figure 6, it is closer to the low emissions scenario than to the high emissions scenario. In addition, the three emissions scenarios provided by Rhodium Group reflect abatement potential from federal investments, which is subject to uncertainty as described in Modeling Federal Climate Policies.

43 As discussed previously, the overall amount of long-lived climate pollutants emitted over time is a more important determinant of long-term warming than the amount emitted in any single year. Thus, even if annual emissions of carbon dioxide do not decline linearly year-over-year, states must reduce the emissions of long-lived pollutants consistent with the overall cumulative emissions under such a pathway.

44 All pathways assessed by IPCC to limit warming to 1.5°C with no or limited overshoot assume immediate action after 2020; the average of these pathways includes near-term emission reductions of 24% below 2020 levels by 2025 and 43% below 2020 levels by 2030, with a linear decline between those benchmarks. Data used to calculate these benchmarks is available at: https://ipcc-browser.ipcc-data.org/browser/dataset?id=3878.

45 EDF calculated the U.S. Climate Alliance cumulative emissions budget by applying the rate of reduction implied by the average of IPCC pathways that limit warming to 1.5°C (24% below 2020 levels by 2025; 43% below 2020 levels by 2030) to U.S. Climate Alliance net emissions. This is one simplified method of deriving a downscaled 1.5°C consistent pathway, and it does not take into account the more complicated task of evaluating what a fair and equitable distribution of global emissions would be.

Figure 5: Cumulative GHG Emissions from Leadership States, 2020 to 2030

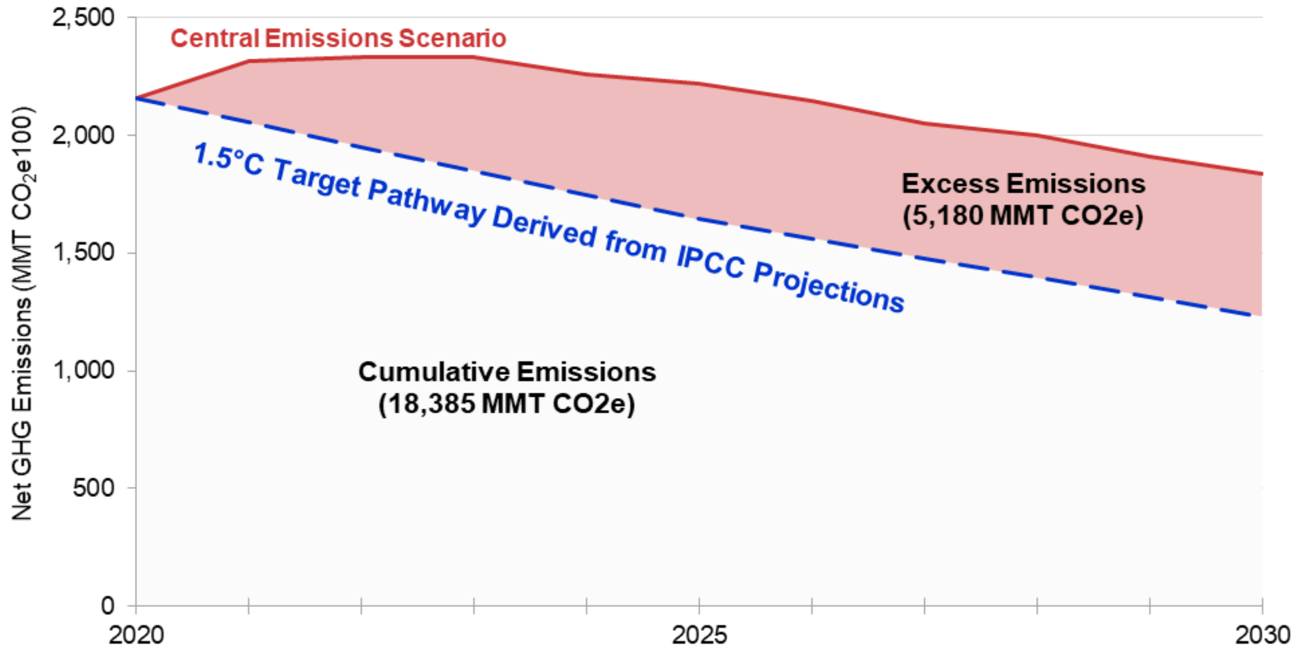
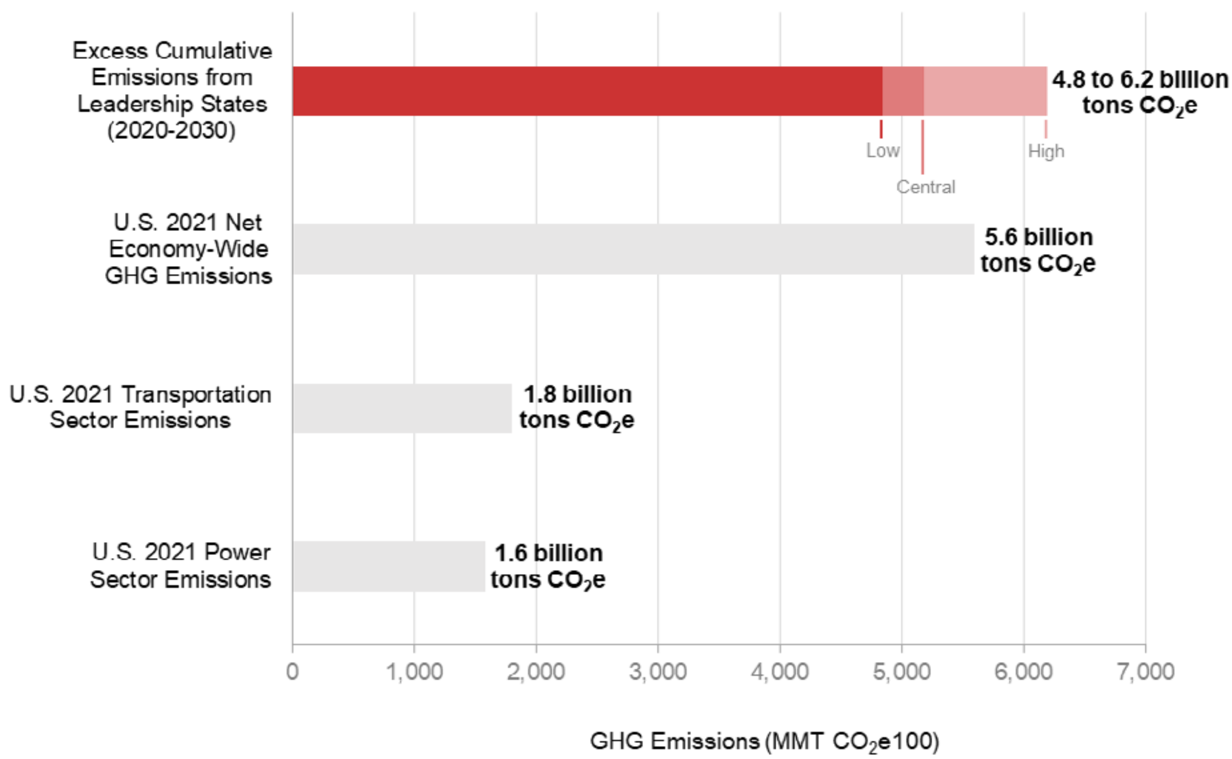


Figure 6: Projected Excess Cumulative GHG Emissions from Leadership States, 2020 to 2030 [46, 47]



46 U.S. Climate Alliance excess emissions from 2020 to 2030 are estimated relative to the near-term emissions trajectory from the average of pathways assessed by the IPCC to limit global warming to 1.5°C with limited or no overshoot. Emissions pathways assessed by the IPCC are shown in Figure 4; the average pathway for a 1.5°C target is applied to U.S. Climate Alliance net emissions in Figure 5.

47 For comparison purposes, we show 2021 U.S. emissions from the transportation and power sectors, as well as U.S. economy-wide net emissions, as provided by EPA in the 1990-2021 U.S. Greenhouse Gas Emissions and Sinks Inventory Report, available at: https://www.epa.gov/system/files/documents/2023-04/US-GHG-Inventory-2023-Main-Text.pdf. See Table ES-5 for U.S. GHG emissions by economic sector.

To minimize both short- and long-term climate impacts 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 GHGs are emitted as a result. **To achieve their climate commitments, states must establish an immediate and persistent reduction trajectory that delineates the cumulative emissions allowable over time.** It is critical to create a reduction trajectory consistent with the CO_2 budget from which the U.S. Climate Alliance targets were derived. [48] Avoiding the worst impacts of climate change will require securing as many reductions as possible as early as possible to stay within the estimated GHG budgets.

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

IMPACT ON U.S. EMISSIONS

The states and territories evaluated in this report make up a significant portion of the U.S. in terms of size and economic output — leadership states represent 54% of the U.S. population and 58% of the U.S. economy.[49] They are also responsible for a sizable portion of the country's GHG emissions — making up 41% of total U.S. emissions.[50] While the IRA and IIJA provide important federal investments to help buy down the cost of climate action, additional state-level climate action is critical to ensure necessary reductions are achieved toward the U.S. NDC. Because the IRA and IIJA rely heavily on these incentives and do not establish limits on overall GHG emissions or require other specific actions to reduce pollution, a key variable in determining whether the U.S. succeeds in both locking in the projected reductions from the IRA and further closing this gap is whether states adopt regulatory policies that ensure climate pollution is cut to required levels. This would also maximize the potential for states to capture the full abatement potential of federal investments.

Under an optimistic business-as-usual (BAU) scenario, inclusive of the projected abatement from the IRA and IIJA,[51] U.S. net emissions are projected to fall approximately 20% from 2005 levels by 2025 and 36% by 2030, leaving sizeable gaps between BAU emissions and U.S. climate targets. But if climate leadership states were to successfully reduce emissions in line with their established targets, collectively they would shrink the remaining U.S. emissions gap by 41% in 2025 and 43% in 2030 — bringing the country meaningfully closer to these crucial targets."

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Immediate and sustained action would not only close a sizeable portion of the gap to the U.S. NDC in 2030 but would also achieve significant cumulative emission reductions. Figure 7 shows that these states alone could reduce U.S. economy-wide emissions by over 1.7 billion MT CO_2e between 2024 and 2030 if they were to achieve reductions in line with a rapid trajectory toward their 2030 commitments.[52]

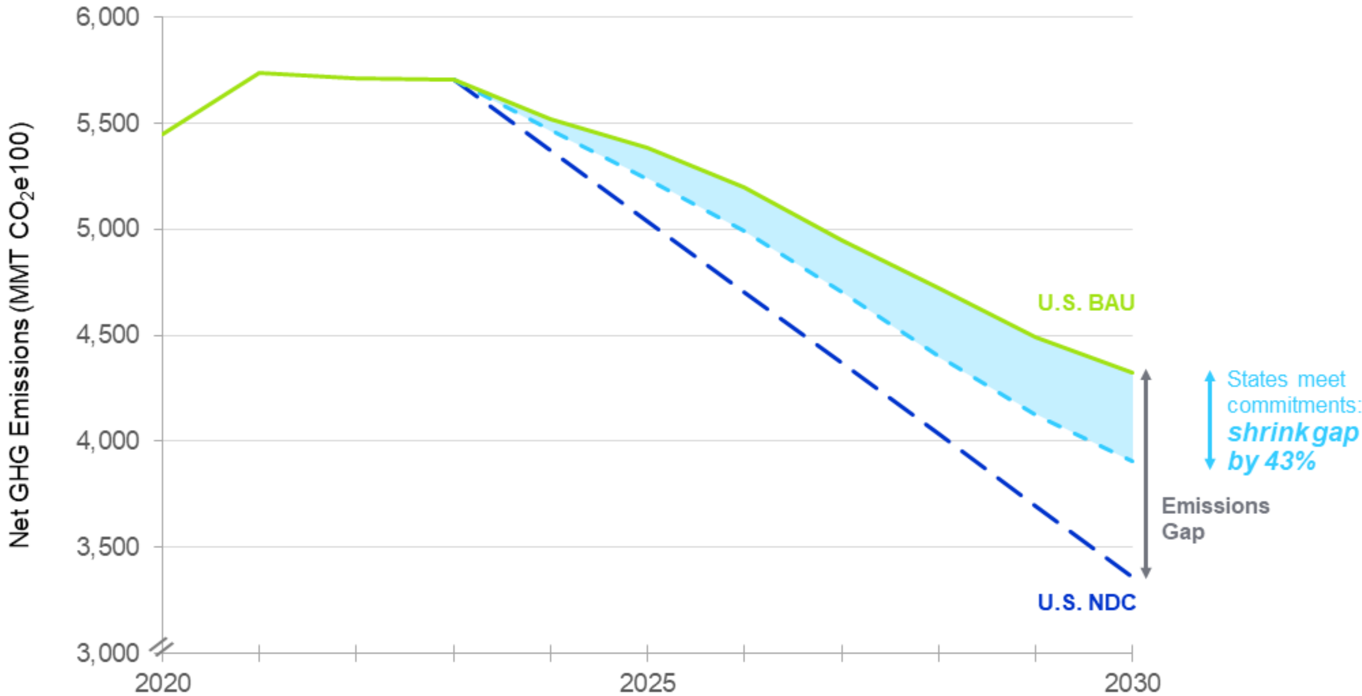
49 See U.S. Climate Alliance 2022 Fact Sheet, available at: https://static1.squarespace.com/static/5a4cfbfe18b27d4da21c9361/t/6321f6519adb5028800a2b9e/1663170130030/USCA+2022+Fact+Sheet.pdf. We note that Guam joined the Alliance in February 2023 and the data provided is not yet updated to reflect Guam's membership.

50 Id.

51 We present emissions as a range throughout this report to emphasize that future emissions trajectories are highly uncertain and depend heavily on assumed macroeconomic conditions and fuel and clean energy costs. For more information about Rhodium Group's future emissions scenarios, see Appendix 3.

52 Figure 7 shows U.S. economy-wide historical and projected emissions under the central emissions scenario, based on Rhodium Group's U.S. Climate Service. The figure depicts an illustrative target trajectory for the U.S. to meet its NDC by reducing emissions on a linear path beginning in 2024. If the U.S. Climate Alliance were to reduce emissions consistent with a linear decline from 2024 to 2030 – consistent with the rapid action these states have committed to achieve – they would, collectively, reduce 1,749 MMT CO_2e over this period.

Figure 7: National Emission Reductions if Leadership States Meet 2030 Commitment [53, 54]



53 U.S. BAU emissions projected are based on the central emissions scenario 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 4.

54 The shaded area between the U.S. BAU trajectory and the U.S. Climate Alliance target trajectory shows the cumulative reductions that Alliance members would achieve by reducing emissions on persistent path beginning in 2024.

RECOMMENDATIONS

EDF's updated analysis reaffirms the importance of comprehensive state climate action to deliver critical GHG emission reductions that state leaders have committed to achieve. Newly adopted policy, including historic federal investments in clean energy and climate mitigation, are expected to significantly cut U.S. GHG pollution by lowering the cost of clean technologies. However, even with these critical investments, a significant gap remains between projected GHG emissions and NDC target levels. The states evaluated remain collectively behind on adopting policies to meet their commitments — accounting for over 40% of the nationwide emissions gap to the U.S. NDC. In addition, leadership states are failing to drive the rapid reductions needed to minimize cumulative emissions and avoid the worst near- and long-term impacts of climate change.

States have the authority and the opportunity to drive down emissions; the urgency and the scale of the problem demands their leadership. With federal investments making clean energy technology cheaper than ever before, states have an unprecedented opportunity to lock in emission reductions at significantly lower cost. Below, we identify key policy recommendations for states to set binding, science-based climate targets and adopt enforceable policies that make progress at the pace and scale that the intensifying climate crisis demands.

Setting Targets at the State Level

In addition to their climate commitments through U.S. Climate Alliance membership, many states have made additional commitments through legislation or by executive order to reduce climate pollution in their state. Across state-specific climate targets, there is considerable variation in timeline, level of ambition, and scope (e.g., economy-wide or sector-specific). Several factors are critical in setting targets that enable states to reduce climate pollution consistent with scientific recommendations.

First, states should focus on timelines that achieve early and deep reductions. Scientific assessments indicate that rapid action to curb climate pollution is needed to avert the worst impacts of climate change. As outlined in The Importance of Rapid Action, early reductions in short-lived pollutants (e.g., methane pollution) are crucial to slow and limit the rate of warming, while early reductions in long-lived pollutants (e.g., carbon pollution) are crucial to limit the cumulative climate pollution in the atmosphere and the associated amount of warming. A focus on near-term targets is also essential because delayed action will make it increasingly difficult for states to meet longer-term reduction targets, such as achieving net-zero emissions by mid-century. The U.S. Climate Alliance emphasizes the importance of near-term action by committing to achieve significant reductions by 2025 and 2030.

Second, states should focus on not only reduction targets in specific years, like 2025, 2030, and 2050, but also on the declining path needed between present-day emissions and target-year emissions levels. Reducing emissions on a persistent, declining trajectory is critical to keep cumulative climate pollution in check, as shown in Evaluating Cumulative GHG Emissions Through 2030. For example, Colorado's 2019 Climate Action Plan requires reductions in statewide climate pollution and directs the state to take action consistent with Colorado doing its part in keeping warming below 1.5°C [55] — indicating the state must limit cumulative pollution consistent with scientific recommendations, in addition to achieving targets on time in 2025, 2030, and 2050. The Colorado legislature reaffirmed this mandate in the 2021 Environmental Justice Act and again in 2023 with SB23-016, first calling for the state to secure reductions in climate pollution over time that align with global carbon budgets [56] and requiring state air regulators to adopt rules that reduce total cumulative emissions over time; [57] and then in 2023 establishing additional economy-wide climate pollution reduction targets for 2035, 2040, and 2045, which further emphasizes the importance of reducing GHG emissions on a persistent, declining trajectory. [58] Yet EDF's analysis shows that, despite the clear mandate to regulate climate pollution — consistent with state law and climate science — Colorado is projected to far overshoot the necessary pathway and cause excess climate pollution to build up in the atmosphere. In the following section, we discuss policy tools that Colorado and other states must enact in order to control cumulative

55 C.R.S. § 25-7-102(2)(c).

56 2021 Environmental Justice Act, pg. 4, available at: https://leg.colorado.gov/sites/default/files/2021a_1266_signed.pdf.

57 C.R.S. § 25-7-105(1)(e)(I).

58 C.R.S. § 25-7-102(2)(g).

build-up of long-lived climate pollutants in line with their commitments.

Third, states should set targets that are mandatory, and include clear timelines for regulatory action. Some states have set statutory targets through legislation with concrete requirements to achieve the targeted reductions, while others have set voluntary targets in statute (that don't include a mandate to act), or through an executive order.[59] Binding targets will place requirements directly on emitters, or direct regulatory agencies to promulgate regulations to meet the state's emission reduction targets. Non-binding targets 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 to ensure compliance with the state's statutory GHG emission limits no later than four years after the effective date of the statute.[60] Conversely, Minnesota's 2007 Next Generation Energy Act — while it requires the development of a climate change action plan and directs the state to develop a regional approach to reducing GHG emissions — stopped short of directing any agencies to put regulations in place that would secure the reductions necessary to meet the targets. Sixteen years after Minnesota's targets were put in place the state remains far off track; and in 2023 the state updated its targets[61] — still without providing clear requirements or a timeline for adopting the regulations necessary to achieve them.

Mandatory targets demonstrate the state has a clear commitment to deliver guaranteed emissions reductions underpinned by binding, regulatory authority. As states consider implementation of IRA and IIJA programs, mandatory targets can help inform development of a state's comprehensive plan to pursue federal funding and strengthen a state's funding applications, including for competitive grant programs.

To date, 10 states have established binding, economy-wide climate targets.[62] All of these have either been adopted or significantly enhanced since 2019, and nearly all include economy-wide targets consistent with the U.S. NDC. **While the legislatures in these states have taken important action to require economy-wide climate pollution reductions, even absent such action many governors have significant authority to take concrete steps to enact regulations capable of delivering the reductions necessary to meet their commitments.** For example, former Governors Kate Brown in Oregon[63] and Tom Wolf in Pennsylvania[64] have demonstrated in recent years that existing authority can be deployed to make meaningful progress on emissions control regulations for greenhouse gases.

Fourth, states should establish separate emission reduction targets for methane and carbon dioxide. Limiting damages from climate change over the next few decades as well as over the next century requires immediate cuts to emissions of both short- and long-lived climate pollutants. The most prominent short-lived climate pollutant, methane, has a more pronounced warming effect on the climate over several decades after it is emitted.[65] Carbon dioxide can remain in the atmosphere for hundreds of years,[66] so CO_2 emissions entering the atmosphere over the next decade will continue to warm the planet for centuries to come. In order to address climate change damages over all timescales, it is critical to reduce emissions of both gases as quickly as possible.

Targets that aggregate all greenhouse gases require a metric to compare the climate impacts of different pollutants over a specific timescale — masking the impact of pollutants over other timescales. For example, using a 100-year Global Warming Potential (GWP) metric masks the near-term

59 More information about state-specific targets between 2025 and 2030 is available in Appendix 1.

60 https://legislation.nysenate.gov/pdf/bills/2019/S6599.

61 https://wdoc.house.leg.state.mn.us/leg/LS93/HF2310.4.pdf, pg. 415.

62 See Appendix 2 for more information on binding, economy-wide climate targets.

63 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.

64 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.oa.pa.gov/Policies/eo/Documents/2019-07.pdf.

65 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. https://www.ipcc.ch/site/assets/uploads/2018/02/WG1AR5_Chapter08_FINAL.pdf.

66 Id.

warming impact of methane,[67] which is over 80 times more potent than carbon dioxide on a 20-year timescale in terms of its warming effect on the atmosphere.[68] Conversely, while using the 20-year GWP is a suitable proxy for capturing near-term climate impacts of greenhouse gases, it has the unintended consequence of deemphasizing long-term climate impacts, and thus could downplay the importance of carbon dioxide reductions.

Therefore, **to place equal emphasis on the importance of reducing emissions of both gases, EDF recommends establishing separate targets for methane and carbon dioxide that align with states' overall reduction targets.** Targets for both gases should ensure that emissions decline on a timeline consistent with the trajectory needed to limit warming as much as possible.[69]

The Right Policy Toolkit

1. Use existing authority to limit pollution. 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. In many cases, state regulators have opportunities to act comprehensively in tackling GHG pollution under state air pollution control statutes.

Example: Oregon's Climate Protection Program. After years of climate obstructionism by a group of anti-climate action legislators, former Oregon Governor Kate Brown took a bold step towards limiting climate pollution through existing authority by directing the state's environmental regulators to establish a program to cut climate pollution from the state's major emitters at least 45% below 1990 levels by 2035 and at least 80% below 1990 levels by 2050. The resulting Climate Protection Program went into effect on January 1, 2022, and places a declining cap on GHG emissions from transportation fuels and natural gas fuel usage — roughly half of Oregon's current emissions. The program makes Oregon one of only three states in the nation with an enforceable, declining limit on emissions from transportation and natural gas fuel usage. The Climate Protection Program, alongside Oregon's clean electricity standard, is an important step towards ensuring Oregon will slash emissions from major polluting sectors.

However, gaps remain — for example, large industrial emitters are exempt from the limit on climate pollution and are instead required to implement best available emissions reduction (BAER) orders, with no requirement to achieve emissions reductions consistent with Oregon's climate goals. Oregon's approach also lacks an economy-wide backstop capable of ensuring that Oregon will achieve its overarching emission reduction targets — the Climate Protection Program and clean electricity standard will drive important progress in key sectors of Oregon's economy, but without an economy-wide backstop there is uncertainty about whether Oregon's suite of climate policies will be enough to drive the persistent, cumulative reductions in climate pollution that are necessary to avoid the most dangerous impacts of climate change.

2. Establish a declining, enforceable limit on greenhouse gas pollution as an emissions "backstop." An enforceable emissions limit is essential to provide a backstop for other complementary policies — guaranteeing the targeted emission reductions will be achieved regardless of the performance of other individual climate programs and policies. Emission limits can be source-based, sector-based, or applied across multiple sectors. When designing a limit, it is critical for regulators to ensure that allowable emissions under the limit do not exceed target levels and decline rapidly in line with scientific recommendations.

67 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).

68 Forster, P., T. Storelvmo, K. Armour, W. Collins, J.-L. Dufresne, D. Frame, D.J. Lunt, T. Mauritsen, M.D. Palmer, M. Watanabe, M. Wild, and H. Zhang, 2021: The Earth's Energy Budget, Climate Feedbacks, and Climate Sensitivity. In Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Masson-Delmotte, V., P. Zhai, A. Pirani, S.L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M.I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T.K. Maycock, T. Waterfield, O. Yelekçi, R. Yu, and B. Zhou (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 923–1054, doi:10.1017/9781009157896.009.

69 IPCC, 2018: Summary for Policymakers. In: Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty [Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, and T. Waterfield (eds.)]. In Press. https://archive.ipcc.ch/pdf/special-reports/sr15/sr15_spm_final.pdf.

The most straightforward and effective means of providing a backstop on emissions would be to adopt a binding, declining emissions limit across all major sources of climate pollution in the state. The key advantage of a multi-sector program is that it can be designed to guarantee emission reductions consistent with statewide targets — ensuring the level of *cumulative* emission reductions is aligned with a 1.5°C pathway — and will achieve those reductions in the most cost-effective manner. Moreover, multi-sector limits foster innovation — even in hard-to-decarbonize sectors — by incentivizing all industries under the limit to find ways to reduce their emissions, creating opportunities for them to *over-perform* relative to current expectations. While maximizing the coverage of an emissions limit increases the effectiveness of the backstop for securing reductions consistent with statewide targets, states can also craft backstops at the sector or source level — providing certainty over emissions outcomes, even if complementary policies or programs focused on technology deployment or emissions intensity do not achieve the estimated reductions in absolute emissions.

Example: Washington's Climate Commitment Act. In May 2021, the Climate Commitment Act (CCA) became law in Washington state, setting an enforceable limit on all major sources of GHG emissions that declines in line with the state's goals of at least a 45% reduction in climate pollution from 1990 levels by 2030, 70% from 1990 levels by 2040, and 95% from 1990 levels by 2050. The law establishes a multi-sector cap-and-invest program to enforce the emissions limit, while taking crucial steps to improve local air quality in overburdened communities. [70] By putting all major emissions sources under a declining, enforceable cap, the state creates the greatest possible certainty that it will meet its pollution reduction targets. Alongside the enforceable limit on climate pollution, the new law requires expanded air pollution monitoring and new requirements to improve local air pollution in communities that face a disproportionate share of environmental harms. By ensuring that climate and local air pollution decline together and that a substantial portion of new revenues raised through the program are invested directly into communities most in need of those investments, the law provides a framework for climate policy in other states that will ensure emission reductions while centering communities overburdened by pollution. The cap-and-invest program went into effect in January, and the state has conducted its first two allowance auctions, raising over $850 million in revenues for the state to reinvest in key climate and clean air programs — a clear indication of confidence in the state's emissions market and strong demand for allowances among covered entities.

3. Pair pollution limits with policies that catalyze development and deployment of clean technologies.

Enforceable limits on climate pollution can work hand-in-hand with measures needed to accelerate clean technology deployment while providing the greatest possible certainty that states will reach the needed emission reductions. If other measures deliver — or overdeliver — on targeted reductions, then there is less pressure on the backstop to drive emissions cuts; but if other programs deliver fewer reductions than expected, the backstop is the state's "insurance policy" to reduce emissions at the pace required. By the same token, if a comprehensive suite of performance- and technology-based strategies collectively achieve reductions sufficient to meet state climate goals, a well-designed backstop that creates greater confidence in those outcomes could drive additional reductions.

Example: California's 2022 Climate Change Scoping Plan. The Scoping Plan finds that, while California has adopted a suite of policies driving emission reductions and clean technology uptake, a significant gap remains to meet the state's 2030 climate target. Moreover, the Scoping Plan finds that California needs to accelerate the existing 2030 target to a 48% emission reduction in order to be on track to achieve net-zero GHG emissions by 2045. The Scoping Plan acknowledges that California's numerous policy tools vary in terms of the certainty they provide for achieving targeted emission reductions. For example, estimated GHG abatement from sectoral policies is subject to uncertainty factors (such as the rate of deployment of clean technologies and fuels) that may impact their ability to achieve anticipated emission reductions. This uncertainty is exactly what makes California's cap-and-trade program — which sets an enforceable, declining cap on emissions — critical to the success of the state's climate goals. The GHG emissions cap acts as a backstop on cumulative pollution levels, while complementary performance standards help

70 See https://www.edf.org/sites/default/files/documents/Washington_state_cap_invest_law.pdf.

drive reductions in key sectors and catalyze the technology and systems changes necessary to support statewide decarbonization. **Notably, the relative role of the cap-and-trade program compared to sector-based policies as the "primary driver" for emission reductions is less important than the role the cap plays in ensuring the state's emissions do not exceed target levels.** The emissions cap should act as the backstop — mitigating uncertainty of sectoral measures — to ensure California's suite of climate policies achieves definite, enforceable reductions in cumulative pollution over the decade consistent with the state's goals. As California works to implement the Scoping Plan, the state must calibrate the emissions cap to fully close the gap between expected abatement from sectoral policies and the necessary emission cuts envisioned in the Scoping Plan.

4. Consider an approach that puts a price on pollution. If well designed, pairing an enforceable pollution limit with a price on pollution can drive two critical outcomes: first, it can secure the desired level of emission reductions by constraining the total amount of emissions entering the atmosphere; second, it can create a price signal that incentivizes investments in clean energy technologies necessary to decarbonize the economy, while raising revenue to further invest in pollution reductions. Climate policies that price pollution can facilitate faster progress by keeping the costs low for consumers and creating a financial incentive to decarbonize more quickly. A price on pollution can also generate substantial benefits for communities most vulnerable to climate impacts and other environmental harms by reinvesting revenues into projects to reduce pollution and support clean energy in these communities. Thus, in addition to guaranteeing emission reductions, this type of policy supports highly cost-effective reductions that can accelerate early action and drive deeper investment in the state.

Example: Regional Greenhouse Gas Initiative. Eleven states currently participate in the Regional Greenhouse Gas Initiative, a regional carbon market limiting pollution from power plants. RGGI operates by establishing GHG pollution limits from the power sector across these states, and then auctioning the limited supply of allowances via quarterly auction. This means that polluters in participating states must pay for each ton of CO_2 they emit, thereby creating an incentive to transition to zero-emission clean electricity faster and raising revenues that are returned to states to support critical priorities, including clean energy deployment, saving ratepayers money, and advancing equity and environmental justice. The combination of a pollution limit and price on carbon has led RGGI states to cut CO_2 from power plants by nearly 50% since the start of the program in 2009, or 10% more than all non-RGGI states.[71] At the same time, RGGI states have experienced significant declines in electricity prices in the same period — an average price decline of 3.2% compared to an average increase of 7.7% for non-RGGI states.[72] As an example of the impacts of revenue investment, in 2020 RGGI states reinvested $196 million of auction proceeds into programs to further reduce carbon emissions and help save residential customers money on energy bills. RGGI estimates these investments will collectively save customers more than $2 billion on energy bills and avoid 6.7 million tons of additional CO_2 over the life of the investments.[73]

5. Ensure environmental and economic benefits are directed to disproportionately impacted communities. Pollution impacts are most often concentrated in communities of color and low-income communities.[74] Cutting GHG emissions deeply, quickly, and equitably — actions consistent with rapid and persistent emission reductions — can help improve health outcomes, especially in communities that are disproportionately harmed by local pollution impacts. While climate policies frequently target many of the same air pollution sources that burden these communities, this must be an explicit part of any future policy. This is because policies that focus on aggregate GHG pollution reductions do not guarantee those reductions keep

71 Note that these figures are for the ten states that have been consistent members of RGGI and do not include VA and PA. Acadia Center. "Regional greenhouse gas initiative: findings and recommendations for the third program review." 2023. https://acadiacenter.wpenginepowered.com/wp-content/uploads/2023/04/AC_RGGI_2023_Layout_R6.pdf.

72 Ibid

73 The Regional Greenhouse Gas Initiative. "The investment of RGGI proceeds in 2020." https://www.rggi.org/sites/default/files/Uploads/Proceeds/RGGI_Proceeds_Report_2020.pdf.

74 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/.

pace in communities most harmed by cumulative pollution. Well-designed strategies for limiting GHG pollution can be tailored to improve local pollution impacts by requiring emissions sources in disproportionately impacted communities to cut pollution directly, for example meeting a facility-specific GHG limit. In addition, limits on GHG pollution can directly support clean energy deployment and economic benefits for the most overburdened and underserved populations by directing program benefits to these communities. A robust public engagement process to identify, design, and implement policies is a critical step to ensure benefits from GHG reduction policies, including improvements in local air quality, are directed to communities that are disproportionately impacted by pollution from the fossil-fuel economy. These provisions are a critical component to an emission cap framework. Policies and investments should also support communities and workers impacted by the transition from fossil fuels.

Example: New York's Climate Leadership and Community Protection Act.

In 2019, New York adopted the Climate Leadership and Community Protection Act (CLCPA), which sets binding targets to reduce statewide emissions by at least 40% below 1990 levels by 2030 and achieve net-zero emissions by 2050. Alongside these ambitious, mandatory GHG pollution reductions, the CLCPA establishes a requirement that at least 35% — with a goal of 40% — of the benefits of the law go to disadvantaged communities. The CLCPA also established the state's Climate Justice Working Group (CJWP) comprised of Environmental Justice communities across New York. The CJWG developed criteria to identify disadvantaged communities, which in turn will inform how benefits and investments resulting from the CLCPA are directed. The CJWG also advised the Climate Action Council in developing its Scoping Plan to recommend how the state should implement the CLCPA to achieve its climate and environmental justice priorities. Together, these provisions underpin efforts to ensure that New York's GHG pollution regulations and policies directly benefit communities that have been and continue to be most impacted by pollution, climate change, and lack of public and private investment.

CONCLUSION

Climate leadership states, which account for a sizable portion of the country's emissions, have a major opportunity — and responsibility — to drive national climate progress forward. While federal clean energy investments from the IRA and IIJA help buy down the cost of climate action, additional state-level climate action is critical to both secure those reductions from federal investments and bring the country closer to its NDC. EDF's updated analysis finds that if these states were to successfully reduce their emissions in line with their goals, they could cut the U.S. emissions gap in 2030 by nearly half.

However, EDF's analysis finds that the majority of states who have committed to cutting emissions consistent with the U.S. NDC and Paris Climate Agreement will need to put additional policies in place to close the "emissions gap" between business-as-usual projections and their targets of at least 26% reductions below 2005 levels by 2025. These gaps widen when looking ahead to the 2030 U.S. NDC of at least 50% reductions below 2005 levels. Finally, we evaluate states' projected cumulative emissions over the decade compared to a 1.5°C-aligned emissions budget — and find that leadership states are projected to significantly overshoot the cumulative emissions "budget" consistent with their commitments over this period. The divergence in projected emissions from these critical metrics shows that, even among climate leadership states and even after accounting for recent federal and state actions, nearly all states have yet to adopt policies that drive reductions commensurate with meeting their commitments.

Significant additional policy intervention is required to secure the reductions needed by the end of the decade. Putting in place binding limits on pollution, which guarantee that emissions fall at the pace and scale necessary, will be an essential part of leadership states delivering on their commitments. With historic federal investments available, leadership states have a golden opportunity to move from pledges to policy. They must take it.

APPENDIX 1: STATE-BY-STATE 2025 AND 2030 TARGET DATA

This appendix provides state-by-state business-as-usual GHG emissions projections as well as gaps between those projections and emission reduction targets for the states included in the analysis (those with gubernatorial climate commitments, [75] which includes 23 states and Puerto Rico [76]). Targets include the two benchmarks evaluated in this report for all jurisdictions (26% below 2005 levels by 2025 and 50% below 2005 levels by 2030), as well as any additional state-specific targets for this timeframe. This appendix presents GHG targets for years through 2030[77] as the analysis focuses on emissions within this timeframe. All economy-wide state-specific targets are outlined in Appendix 2, 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. [78] Carbon dioxide-equivalent emissions are based on the IPCC 4th Assessment Report (AR4) 100-year global warming potential (GWP). [79] Note that the IPCC has updated GWP values in its Sixth Assessment Report (AR6), 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. However, it is important to 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 substantively change the conclusions drawn by this analysis, because doing so would require emissions targets to also 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 6.

Target emissions in this analysis were calculated based on percent reductions from historical emissions as provided by Rhodium Group's 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 carbon removal from Rhodium Group's U.S. Climate Service data. More information about how emissions targets were estimated in this analysis is available in Appendix 5.

75 Joining the U.S. Climate Alliance is considered a gubernatorial climate commitment.

76 We note that Guam joined the U.S. Climate Alliance in February 2023, but data was not available at the time of publication to evaluate Guam's historic and projected emissions.

77 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 2.

78 Note that Rhodium Group uses a downscaling methodology to estimate state-level emissions based on the EPA Greenhouse Gas Inventory. Because of this, state-level estimates do not align exactly with state GHG inventory estimates.

79 For more information, see Rhodium Group's Taking Stock 2022, available at: https://rhg.com/wp-content/uploads/2022/07/Taking-Stock-2022_US-Emissions-Outlook.pdf and Rhodium Group's 2022 report, A Turning Point for US Climate Progress, available at: https://rhg.com/wp-content/uploads/2022/08/A-Turning-Point-for-US-Climate-Progress_Inflation-Reduction-Act.pdf.

California

Figure 8: California Economy-Wide GHG Emissions and Targets[80]

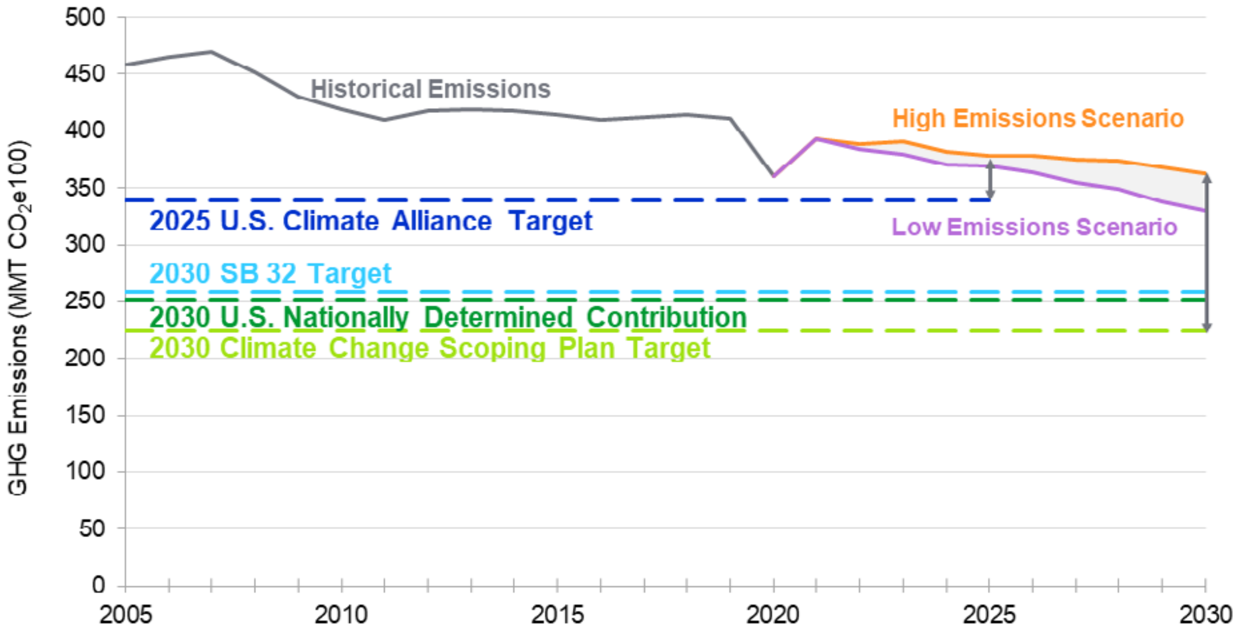


Table 1: Emissions Gaps in California, 2025 - 2030

California					
	Target Year	**Target**	**Target Emissions (MMT CO_2e)**	**Remaining Gap (High Emissions)**	**Remaining Gap (Low Emissions)**
Contribution to National or USCA Targets	2025	26% below 2005 (U.S. Climate Alliance)	339	40	30
	2030	50% below 2005 net emissions (U.S. NDC)	251	112	79
State Targets	2030	40% below 1990 (SB 32)	259	104	71
	2030	48% below 1990 (2022 Climate Change Scoping Plan)	224	139	106

While California has an economy-wide cap-and-trade program in place as a backstop on roughly 75% of emissions, Rhodium Group's modeling shows a gap to the state's 40% reduction by 2030 target. 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 stringency of the budget through 2030 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 of their original emissions target for the covered sources over the entire time horizon, the state's

80 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.

annual emissions in 2030 may exceed the statewide target for that year. Additionally, while the cap-and-trade program covers approximately 75% of the state's greenhouse gas emissions, approximately 25% of emissions are 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.

In addition to evaluating near-term targets codified in California law, we include the increased reduction target for 2030 outlined in the 2022 Climate Change Scoping Plan. The Scoping Plan finds that, in order for California to be on track to achieve net-zero GHG emissions no later than 2045, the state must accelerate near-term ambition — modeling a 48% reduction from 1990 levels by 2030, significantly greater than the minimum 40% reduction required by SB32. We include the 48% reduction target in the above analysis to assess California's progress on reducing emissions consistent with its near- and long-term climate goals.

Colorado

Figure 9: Colorado Economy-Wide GHG Emissions and Targets

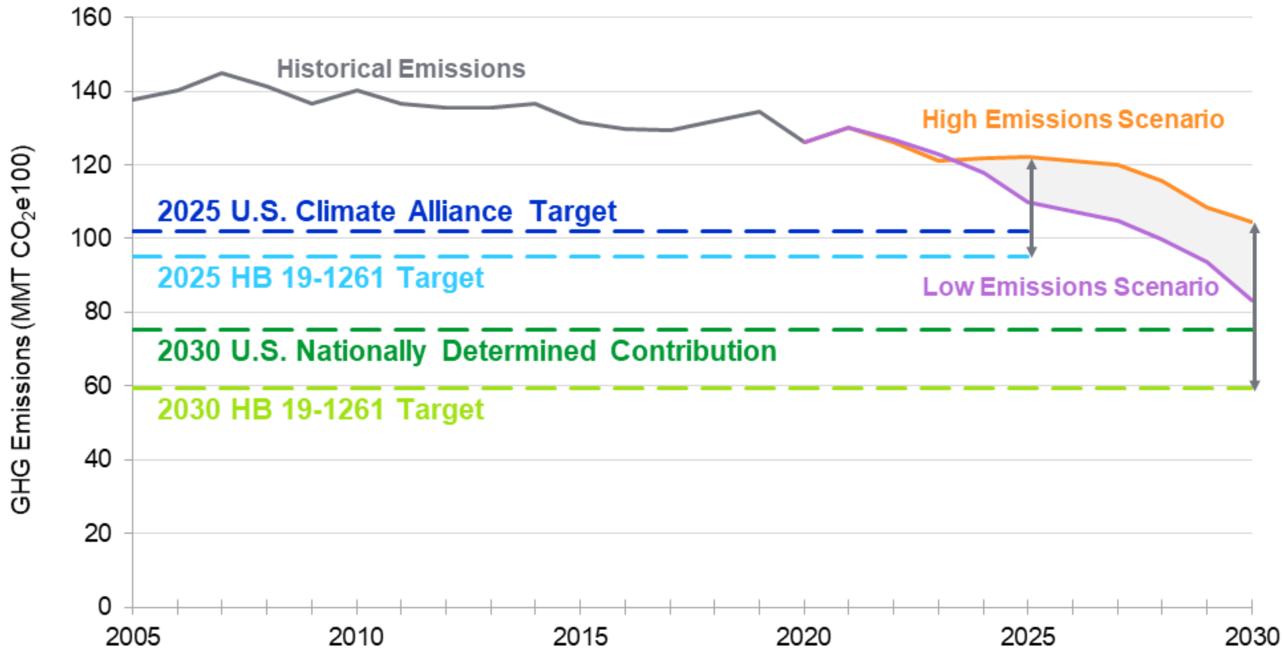


Table 2: Emissions Gaps in Colorado, 2025 - 2030

Colorado					
	Target Year	**Target**	**Target Emissions (MMT CO_2e)**	**Remaining Gap (High Emissions)**	**Remaining Gap (Low Emissions)**
Contribution to National or USCA Targets	2025	26% below 2005 (U.S. Climate Alliance)	102	20	8
	2030	50% below 2005 net emissions (U.S. NDC)	75	29	8
State Targets*	2025	26% below 2005 net emissions (HB 19-1261)	95	27	15
	2030	50% below 2005 net emissions (HB 19-1261)	59	45	24

**emissions figures include the impact of estimated state-level carbon dioxide removals*

Connecticut

Figure 10: Connecticut Economy-Wide GHG Emissions and Targets[81]

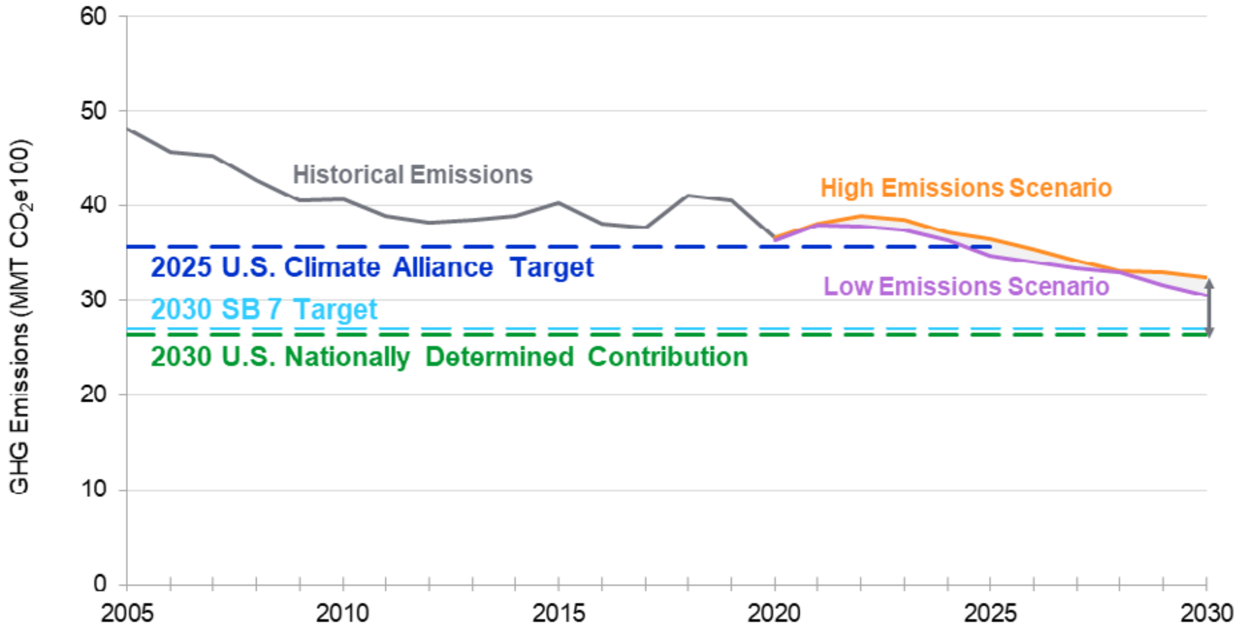


Table 3: Emissions Gaps in Connecticut, 2025 - 2030

Connecticut					
	Target Year	**Target**	**Target Emissions ($MMT\ CO_2e$)**	**Remaining Gap (High Emissions)**	**Remaining Gap (Low Emissions)**
Contribution to National or USCA Targets	2025	26% below 2005 (U.S. Climate Alliance)	36	1	-1
	2030	50% below 2005 net emissions (U.S. NDC)	26	6	4
State Targets	2030	45% below 2001 (SB7)	27	5	4

81 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.

Delaware

Figure 11: Delaware Economy-Wide GHG Emissions and Target

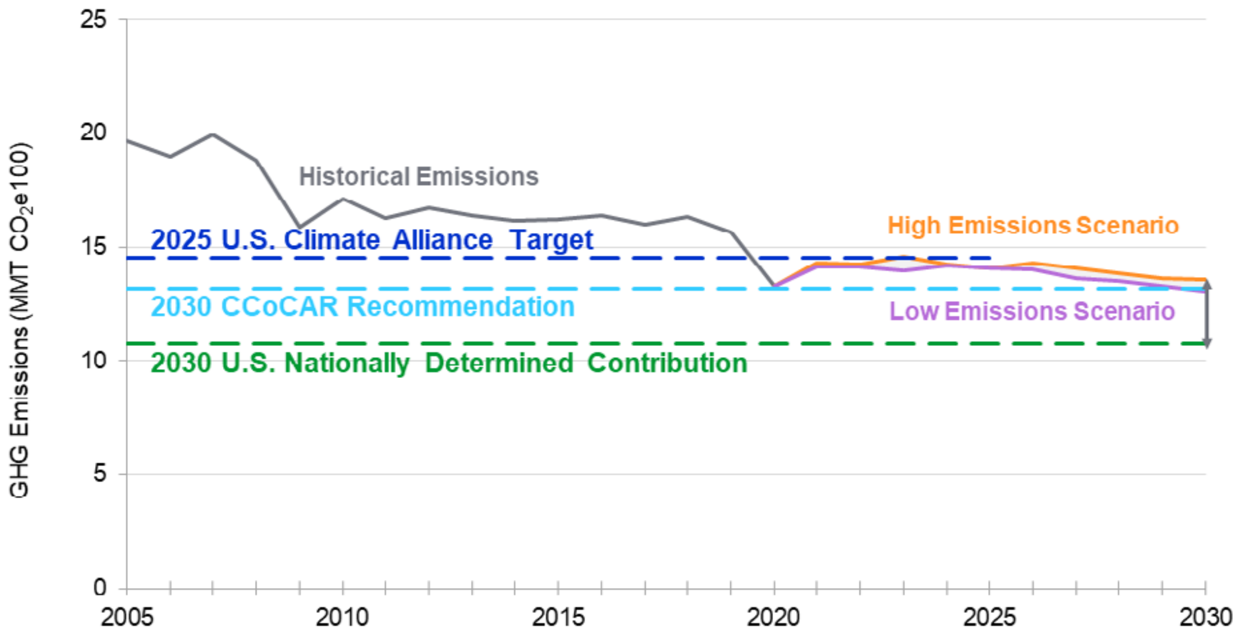


Table 4: Emissions Gaps in Delaware, 2025 - 2030

Delaware					
	Target Year	Target	Target Emissions ($MMT\ CO_2e$)	Remaining Gap (High Emissions)	Remaining Gap (Low Emissions)
Contribution to National or USCA Targets	2025	26% below 2005 (U.S. Climate Alliance)	15	0	0
	2030	50% below 2005 net emissions (U.S. NDC)	11	3	2
State Targets	2030	30% below 2008 (CCoCAR Recommendation)	13	0	0

Hawaii

Figure 12: Hawaii Economy-Wide GHG Emissions and Target

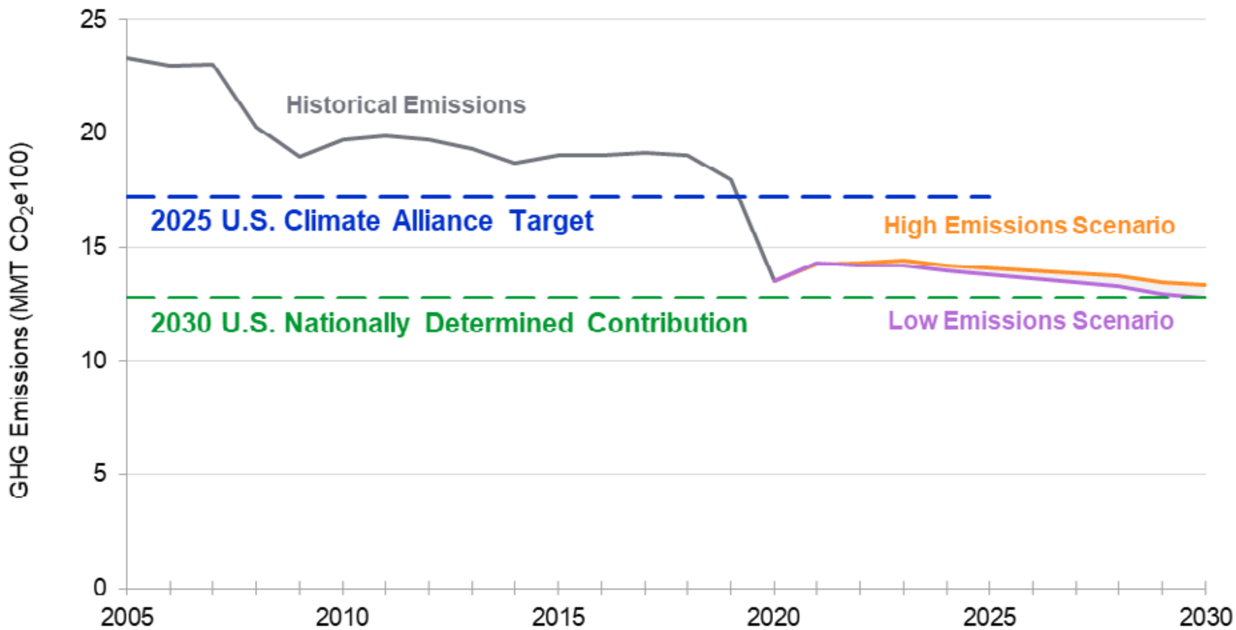


Table 5: Emissions Gaps in Hawaii, 2025 - 2030

Hawaii					
	Target Year	**Target**	**Target Emissions (MMT CO_2e)**	**Remaining Gap (High Emissions)**	**Remaining Gap (Low Emissions)**
Contribution to National or USCA Targets	2025	26% below 2005 (U.S. Climate Alliance)	17	-3	-3
	2030	50% below 2005 net emissions (U.S. NDC)	13	1	0

Illinois

Figure 13: Illinois Economy-Wide GHG Emissions and Target

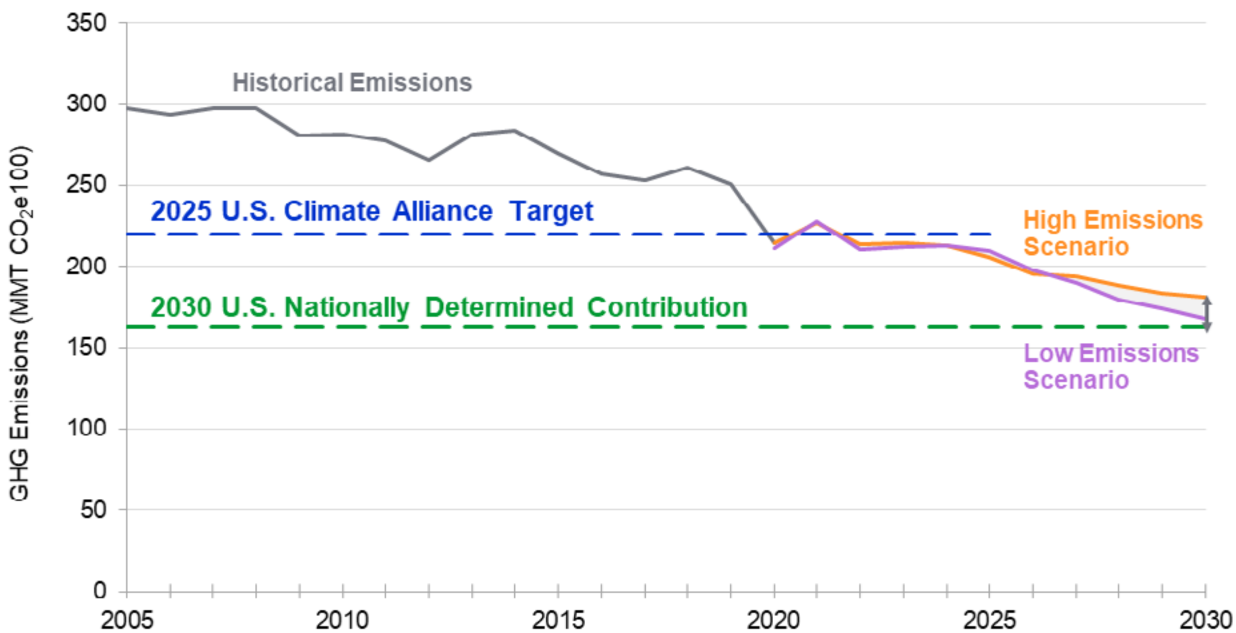


Table 6: Emissions Gaps in Illinois, 2025 - 2030

Illinois					
	Target Year	**Target**	**Target Emissions (MMT CO_2e)**	**Remaining Gap (High Emissions)**	**Remaining Gap (Low Emissions)**
Contribution to National or USCA Targets	2025	26% below 2005 (U.S. Climate Alliance)	220	-14	-11
	2030	50% below 2005 net emissions (U.S. NDC)	163	19	5

Louisiana

Figure 14: Louisiana Economy-Wide GHG Emissions and Target

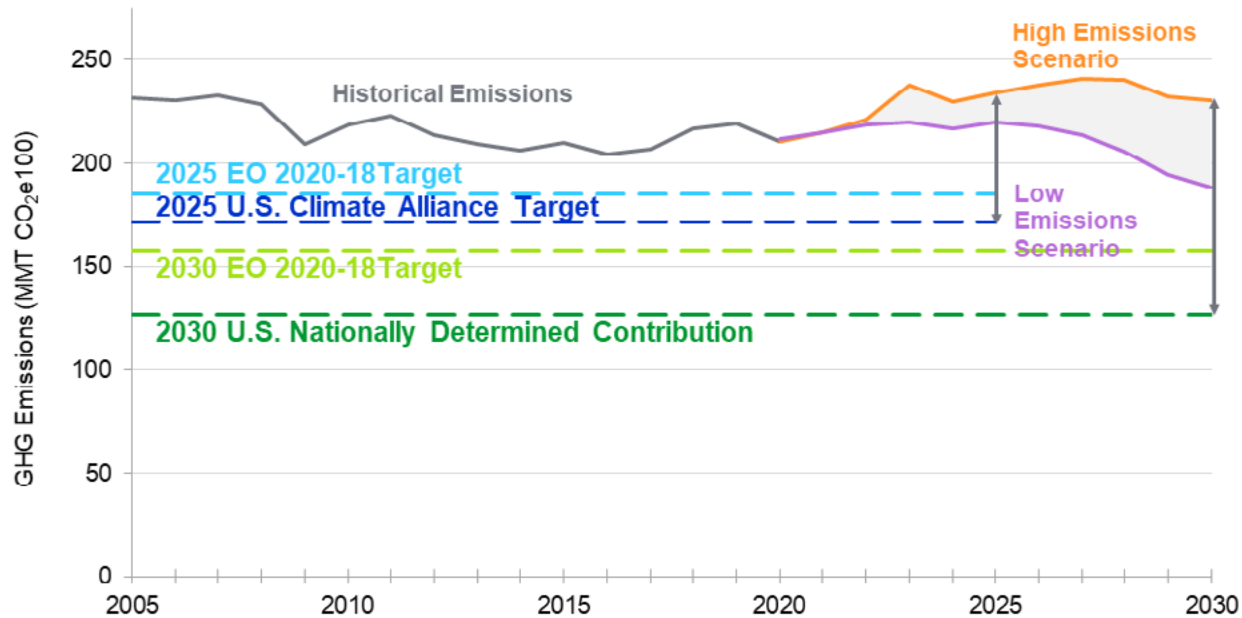


Table 7: Emissions Gaps in Louisiana, 2025 - 2030

Louisiana					
	Target Year	**Target**	**Target Emissions (MMT CO_2e)**	**Remaining Gap (High Emissions)**	**Remaining Gap (Low Emissions)**
Contribution to National or USCA Targets	2025	26% below 2005 (U.S. Climate Alliance)	172	63	48
	2030	50% below 2005 net emissions (U.S. NDC)	127	104	61
State Targets*	2025	26% below 2005 net emissions (EO 2020-18)	185	49	34
	2030	40% below 2005 net emissions (EO 2020-18)	158	73	30

**emissions figures include the impact of estimated state-level carbon dioxide removals*

Maine

Figure 15: Maine Economy-Wide GHG Emissions and Target[82]

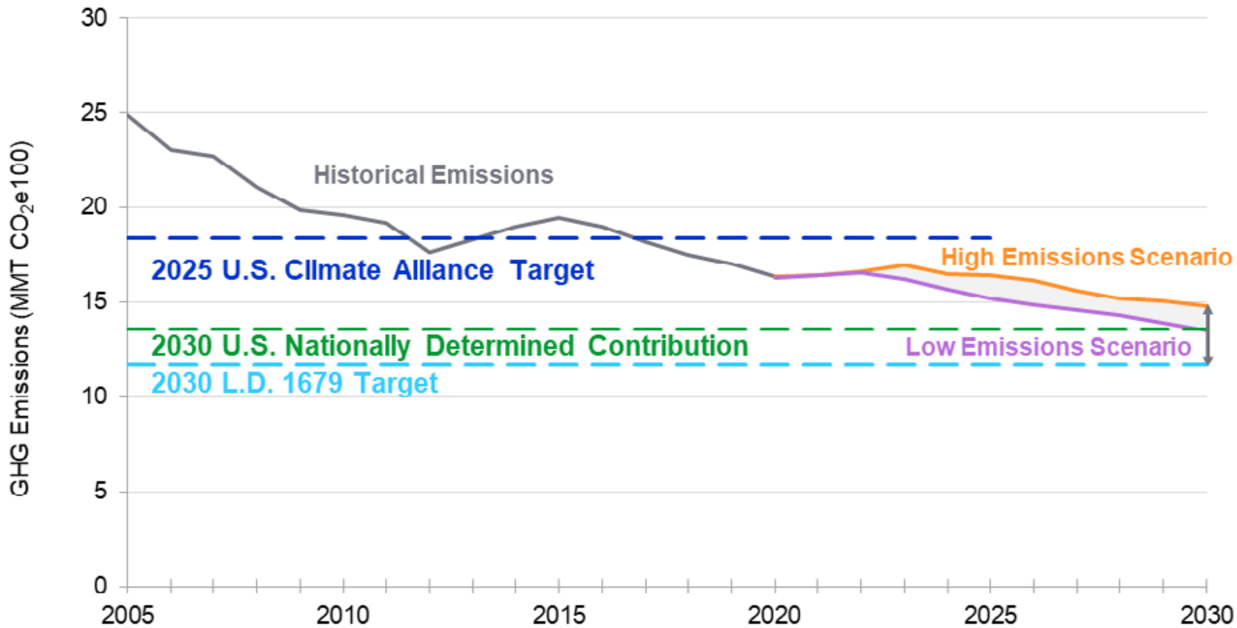


Table 8: Emissions Gaps in Maine, 2025 - 2030

Maine					
	Target Year	**Target**	**Target Emissions (MMT CO_2e)**	**Remaining Gap (High Emissions)**	**Remaining Gap (Low Emissions)**
Contribution to National or USCA Targets	2025	26% below 2005 (U.S. Climate Alliance)	18	-2	-3
	2030	50% below 2005 net emissions (U.S. NDC)	14	1	0
State Targets	2030	45% below 1990 (L.D. 1679)	12	3	2

82 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.

Maryland

Figure 16: Maryland Economy-Wide GHG Emissions and Target

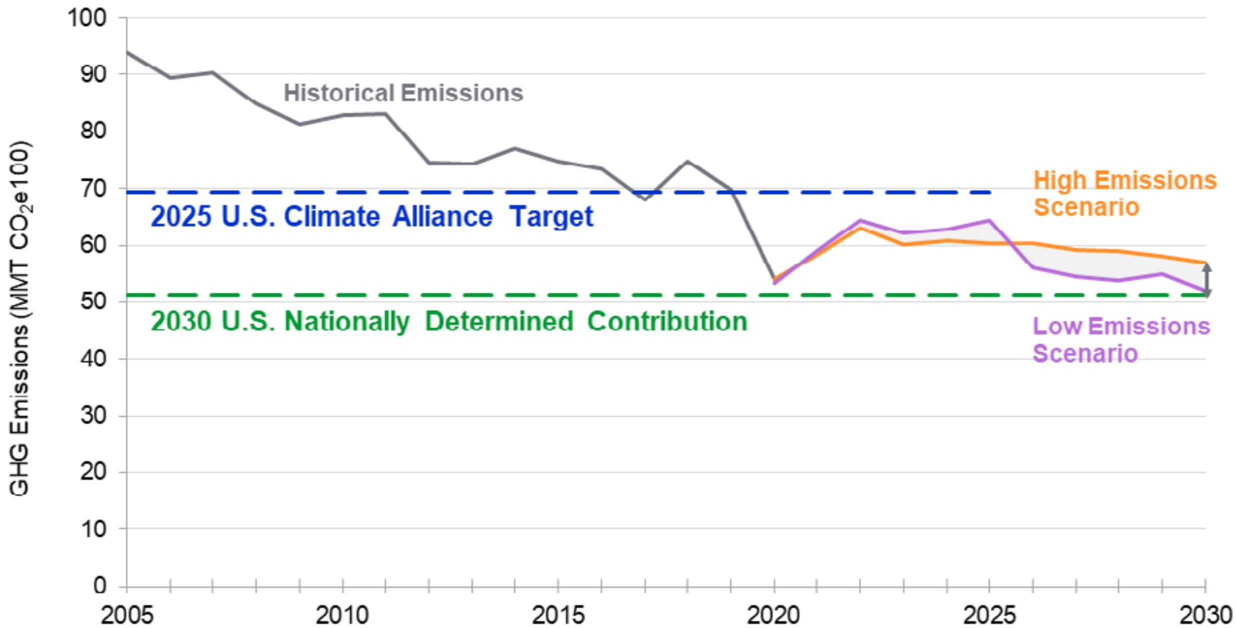


Table 9: Emissions Gaps in Maryland, 2025 - 2030

Maryland					
	Target Year	Target	Target Emissions (MMT CO_2e)	Remaining Gap (High Emissions)	Remaining Gap (Low Emissions)
Contribution to National or USCA Targets	2025	26% below 2005 (U.S. Climate Alliance)	69	-9	-5
	2030	50% below 2005 net emissions (U.S. NDC)	51	6	1

Massachusetts

Figure 17: Massachusetts Economy-Wide GHG Emissions and Target

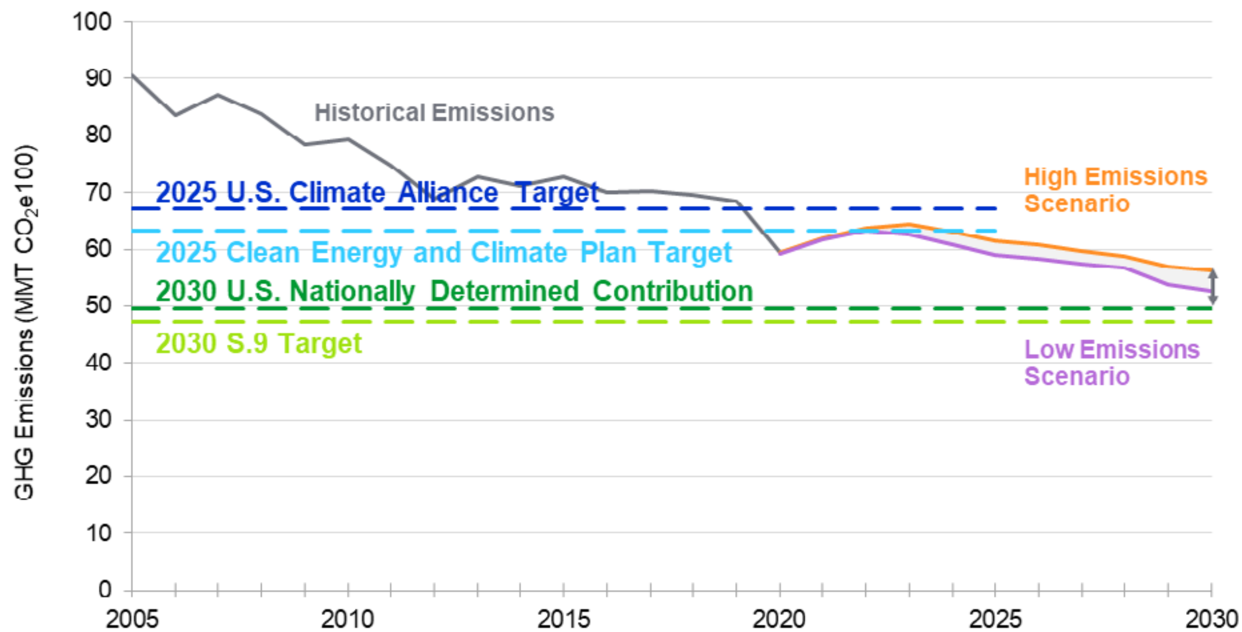


Table 10: Emissions Gaps in Massachusetts, 2025 - 2030

Massachusetts					
	Target Year	**Target**	**Target Emissions (MMT CO_2e)**	**Remaining Gap (High Emissions)**	**Remaining Gap (Low Emissions)**
Contribution to National or USCA Targets	2025	26% below 2005 (U.S. Climate Alliance)	67	-6	-8
	2030	50% below 2005 net emissions (U.S. NDC)	50	7	3
State Targets	2025	33% below 1990 (Clean Energy and Climate Plan for 2025 and 2030)	63	-2	-4
	2030	50% below 1990 (S.9)	47	9	5

Michigan

Figure 18: Michigan Economy-Wide GHG Emissions and Target[83]

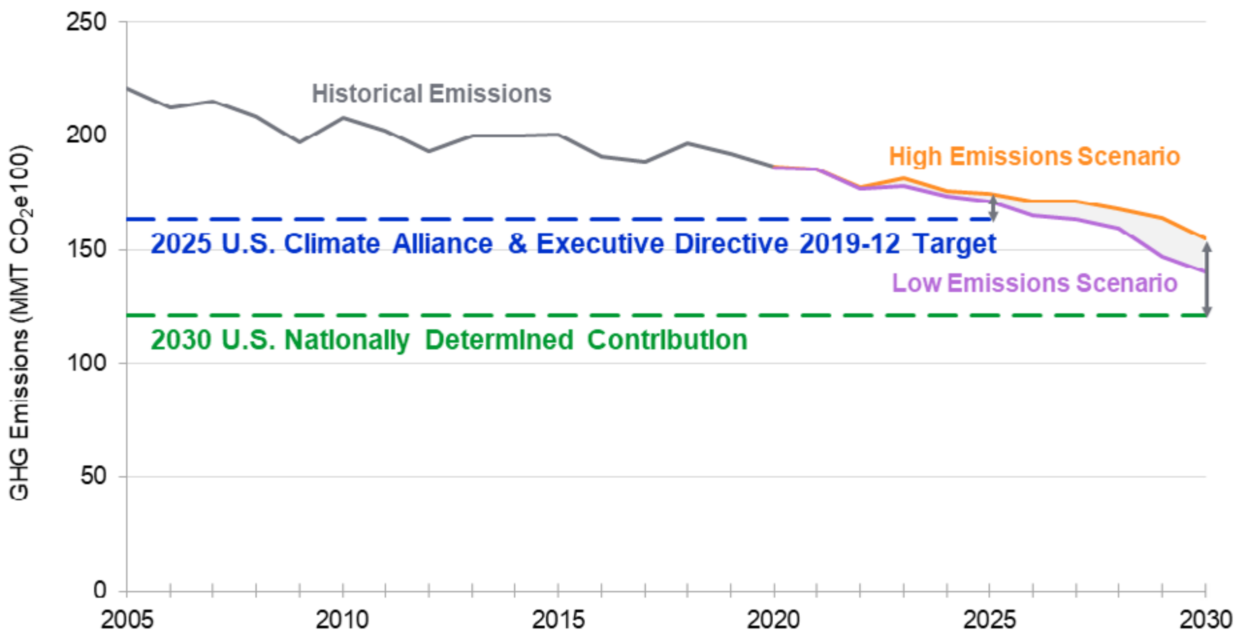


Table 11: Emissions Gaps in Michigan, 2025 - 2030

Michigan					
	Target Year	**Target**	**Target Emissions ($MMT\ CO_2e$)**	**Remaining Gap (High Emissions)**	**Remaining Gap (Low Emissions)**
Contribution to National or USCA Targets	2025	26% below 2005 (U.S. Climate Alliance)	163	11	8
	2030	50% below 2005 net emissions (U.S. NDC)	121	34	20
State Targets	2025	26% below 2005 (Executive Directive 2019 - 12)	163	11	8

83 Note that the 2025 EO 2019-12 target is equivalent to the U.S. Climate Alliance target.

Minnesota

Figure 19: Minnesota Economy-Wide GHG Emissions and Target

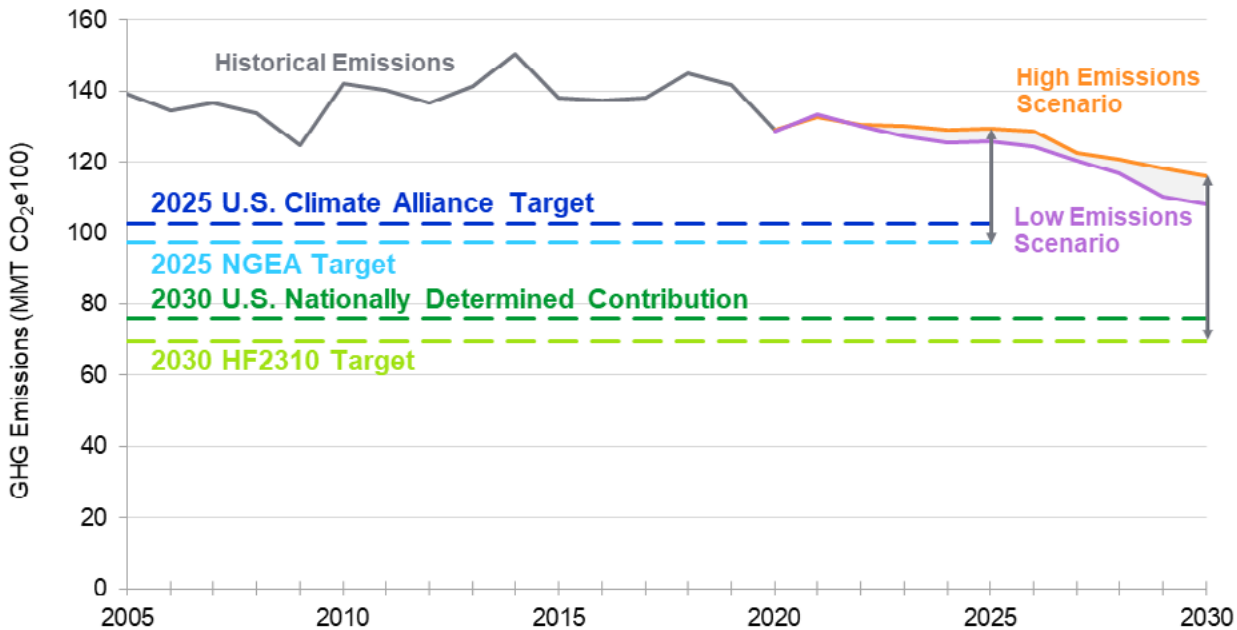


Table 12: Emissions Gaps in Minnesota, 2025 - 2030

Minnesota					
	Target Year	**Target**	**Target Emissions ($MMT\ CO_2e$)**	**Remaining Gap (High Emissions)**	**Remaining Gap (Low Emissions)**
Contribution to National or USCA Targets	2025	26% below 2005 (U.S. Climate Alliance)	103	27	23
	2030	50% below 2005 net emissions (U.S. NDC)	76	40	32
State Targets	2025	30% below 2005 (Next Gen Energy Act)	97	32	28
	2030	50% below 2005 (HF 2310)	69	46	39

Nevada

Figure 20: Nevada Economy-Wide GHG Emissions and Target

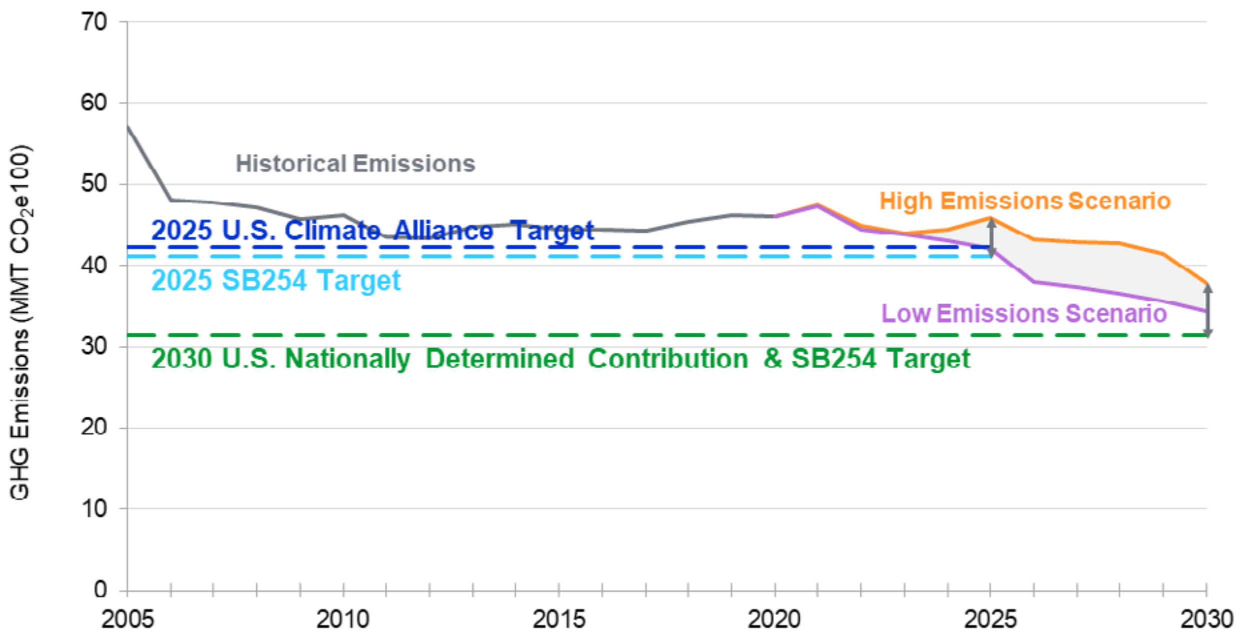


Table 13: Emissions Gaps in Nevada, 2025 - 2030

Nevada					
	Target Year	**Target**	**Target Emissions ($MMT\ CO_2e$)**	**Remaining Gap (High Emissions)**	**Remaining Gap (Low Emissions)**
Contribution to National or USCA Targets	2025	26% below 2005 (U.S. Climate Alliance)	42	4	0
	2030	50% below 2005 net emissions (U.S. NDC)	31	7	3
State Targets	2025	28% below 2005 (SB254)	41	5	1
	2030	45% below 2005 (SB254)	31	6	3

New Jersey

Figure 21: New Jersey Economy-Wide GHG Emissions and Target

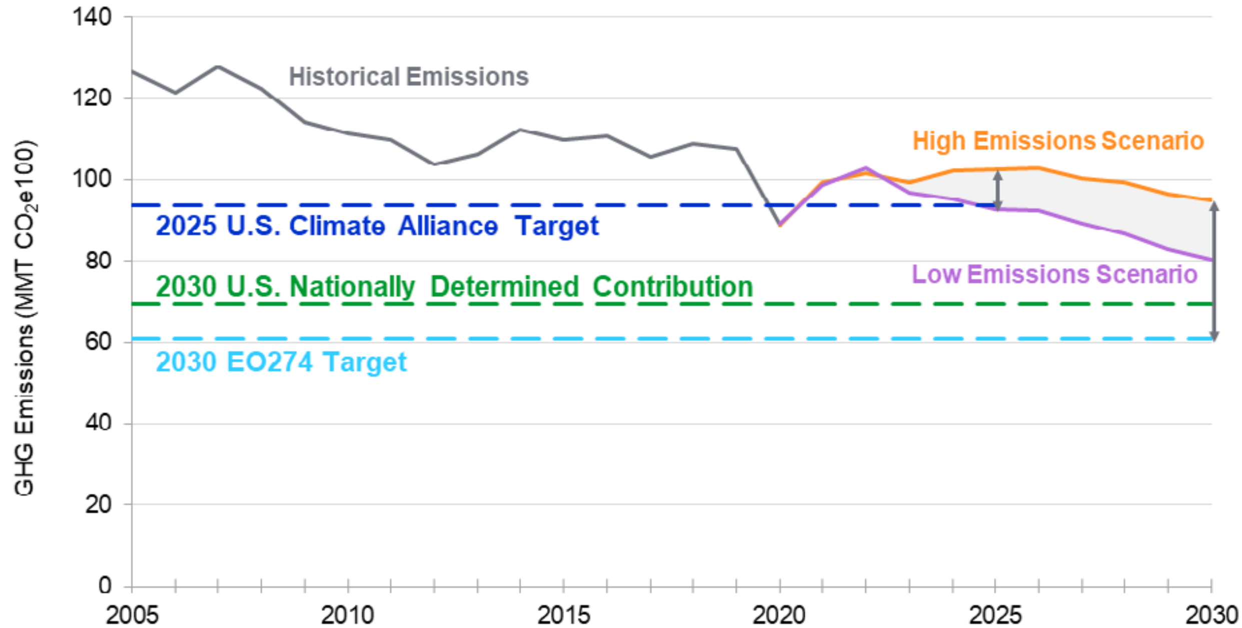


Table 14: Emissions Gaps in New Jersey, 2025 - 2030

New Jersey					
	Target Year	**Target**	**Target Emissions (MMT CO_2e)**	**Remaining Gap (High Emissions)**	**Remaining Gap (Low Emissions)**
Contribution to National or USCA Targets	2025	26% below 2005 (U.S. Climate Alliance)	94	9	-1
	2030	50% below 2005 net emissions (U.S. NDC)	69	26	11
State Targets	2030	50% below 2006 (EO 274)	61	34	20

New Mexico

Figure 22: New Mexico Economy-Wide GHG Emissions and Target

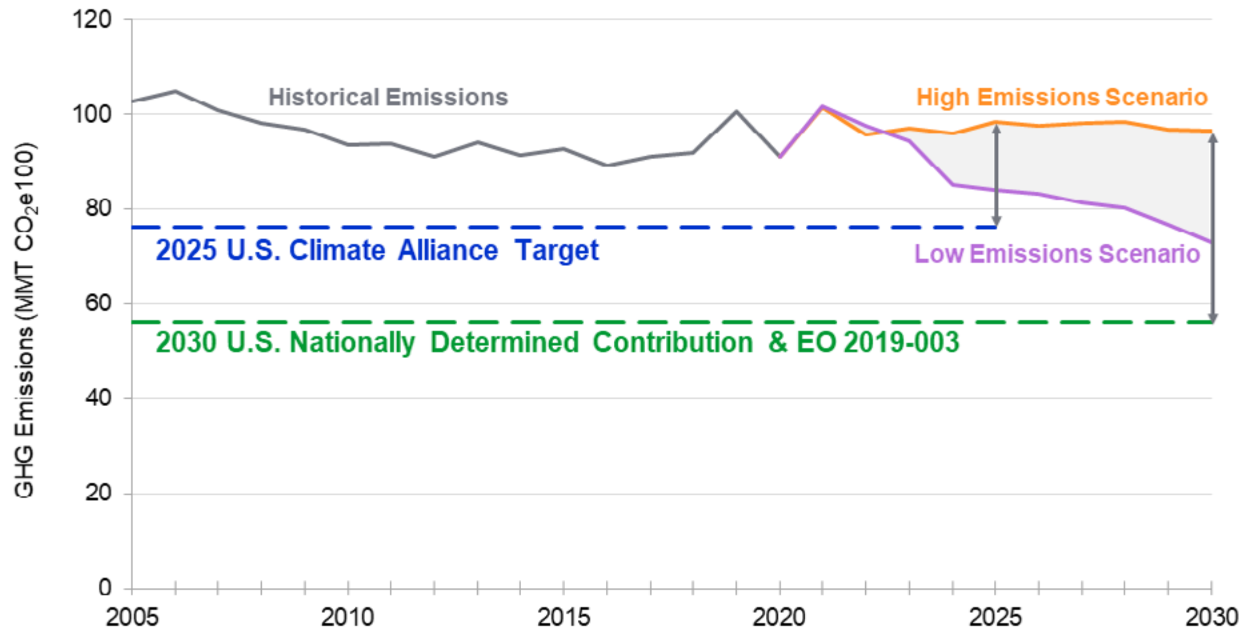


Table 15: Emissions Gaps in New Mexico, 2025 - 2030

New Mexico					
	Target Year	**Target**	**Target Emissions (MMT CO_2e)**	**Remaining Gap (High Emissions)**	**Remaining Gap (Low Emissions)**
Contribution to National or USCA Targets	2025	26% below 2005 (U.S. Climate Alliance)	76	22	8
	2030	50% below 2005 net emissions (U.S. NDC)	56	40	17
State Targets	2030	45% below 2005 (EO 2019-003)	57	40	16

New York

Figure 23: New York Economy-Wide GHG Emissions and Target[84]

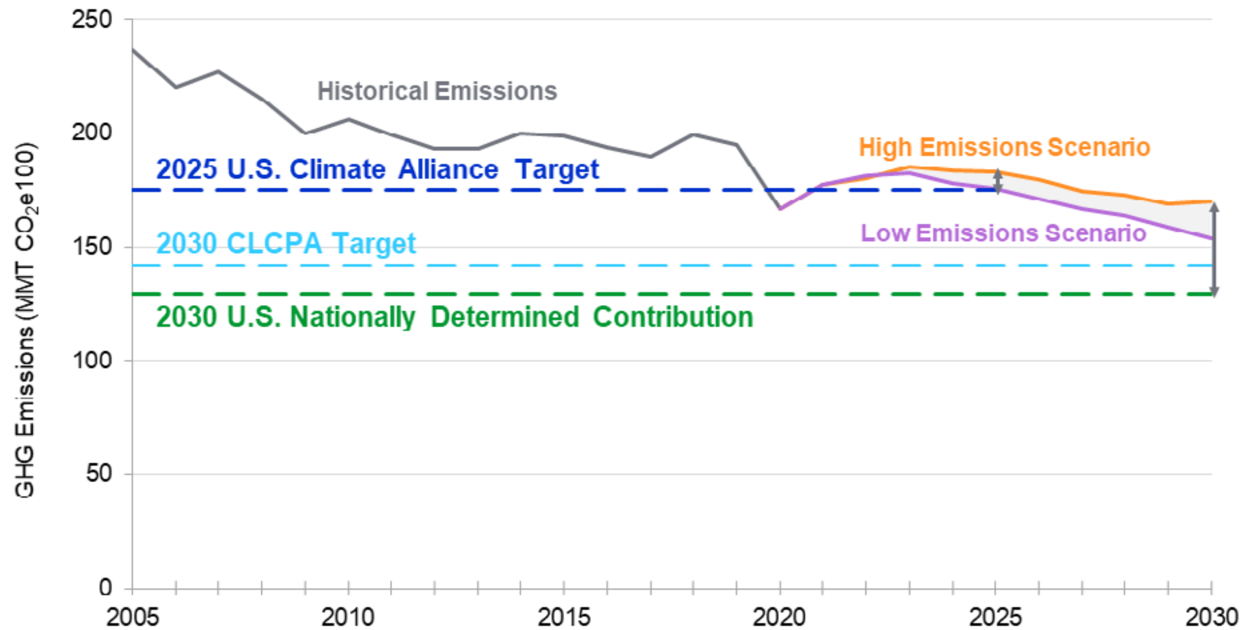


Table 16: Emissions Gaps in New York, 2025 - 2030

New York					
	Target Year	**Target**	**Target Emissions (MMT CO_2e)**	**Remaining Gap (High Emissions)**	**Remaining Gap (Low Emissions)**
Contribution to National or USCA Targets	2025	26% below 2005 (U.S. Climate Alliance)	175	8	1
	2030	50% below 2005 net emissions (U.S. NDC)	130	40	24
State Targets	2030	40% below 1990 (CLCPA)	142	28	12

84 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.

North Carolina

Figure 24: North Carolina Economy-Wide GHG Emissions and Target[85]

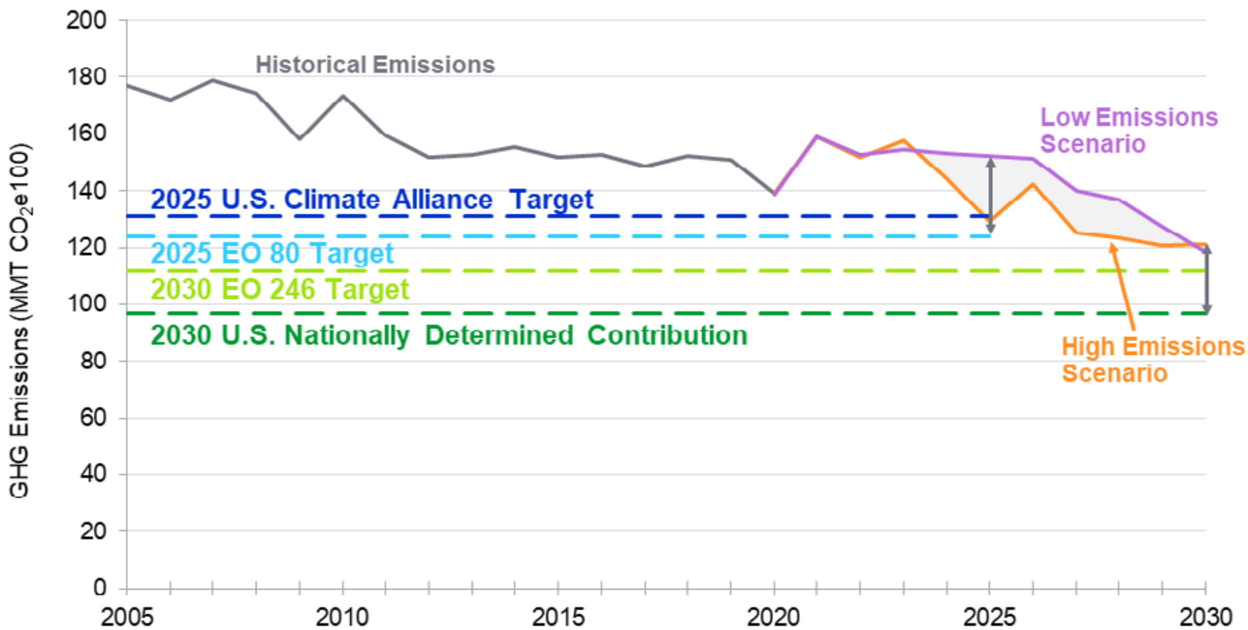


Table 17: Emissions Gaps in North Carolina, 2025 - 2030

North Carolina					
	Target Year	**Target**	**Target Emissions (MMT CO_2e)**	**Remaining Gap (High Emissions)**	**Remaining Gap (Low Emissions)**
Contribution to National or USCA Targets	2025	26% below 2005 (U.S. Climate Alliance)	131	-2	21
	2030	50% below 2005 net emissions (U.S. NDC)	97	24	22
State Targets*	2025	40% below 2005 net emissions (EO 80)	124	5	28
	2030	50% below 2005 net emissions (EO 246)	112	9	7

**emissions figures include the impact of estimated state-level carbon dioxide removals*

85 Note that emissions projections in North Carolina show higher emissions under the low emissions scenario than under the high emissions scenario for most of the time period presented. This trend is due to interactions between the inputs into Rhodium Group's modeling. For example, relatively higher natural gas prices—used as an input in the low emissions scenario—have the effect of allowing relatively more coal generation to remain competitive in this scenario. See https://rhg.com/wp-content/uploads/2022/08/A-Turning-Point-for-US-Climate-Progress_Inflation-Reduction-Act.pdf, pg. 5. This trend underscores that the emissions scenarios represent potential emissions trends, given specific inputs, but significant uncertainty remains around how individual variables impact emissions outcomes.

Oregon

Figure 25: Oregon Economy-Wide GHG Emissions and Target

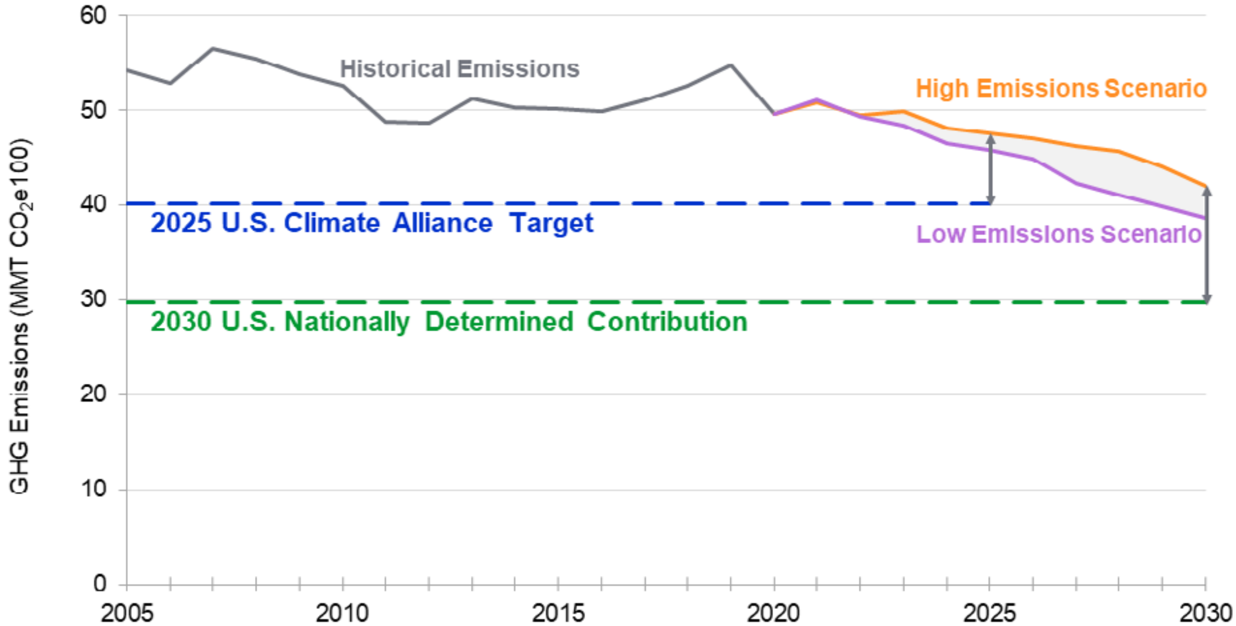


Table 18: Emissions Gaps in Oregon, 2025 - 2030

Oregon					
	Target Year	**Target**	**Target Emissions ($MMT\ CO_2e$)**	**Remaining Gap (High Emissions)**	**Remaining Gap (Low Emissions)**
Contribution to National or USCA Targets	2025	26% below 2005 (U.S. Climate Alliance)	40	7	6
	2030	50% below 2005 net emissions (U.S. NDC)	30	12	9

Pennsylvania

Figure 26: Pennsylvania Economy-Wide GHG Emissions and Target

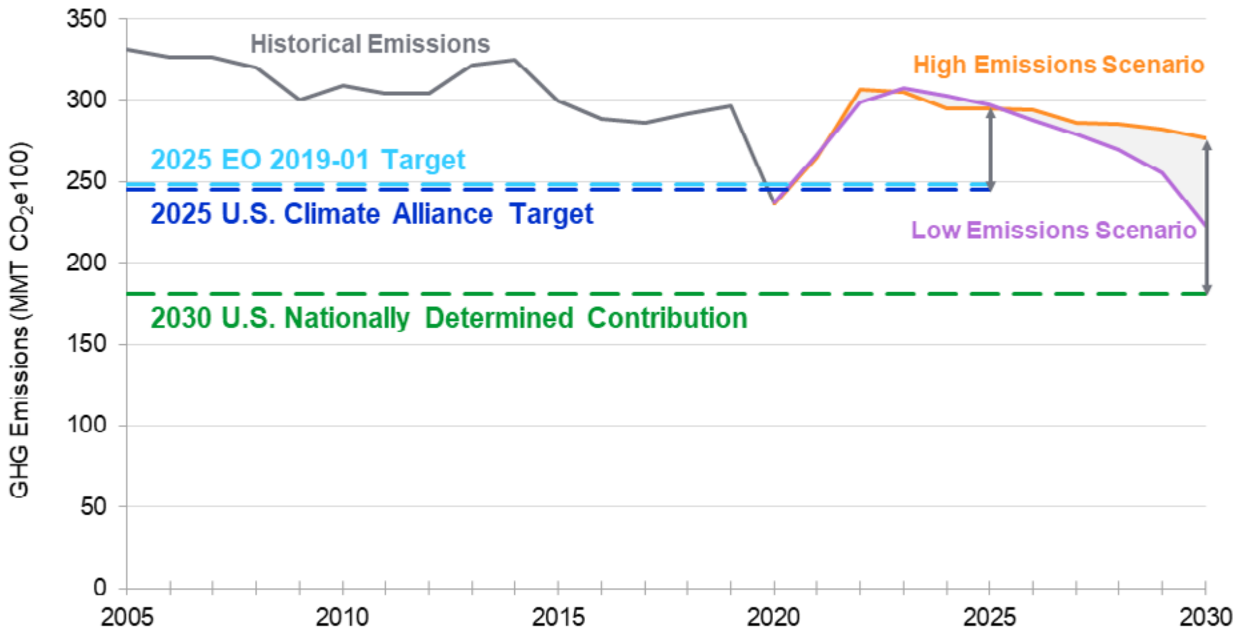


Table 19: Emissions Gaps in Pennsylvania, 2025 - 2030

Pennsylvania					
	Target Year	Target	Target Emissions ($MMT\ CO_2e$)	Remaining Gap (High Emissions)	Remaining Gap (Low Emissions)
Contribution to National or USCA Targets	2025	26% below 2005 (U.S. Climate Alliance)	245	50	52
	2030	50% below 2005 net emissions (U.S. NDC)	181	95	42
State Targets*	2025	26% below 2005 net emissions (EO 2019-01)	248	46	49

**emissions figures include the impact of estimated state-level carbon dioxide removals*

Puerto Rico

Figure 27: Puerto Rico Economy-Wide GHG Emissions and Target

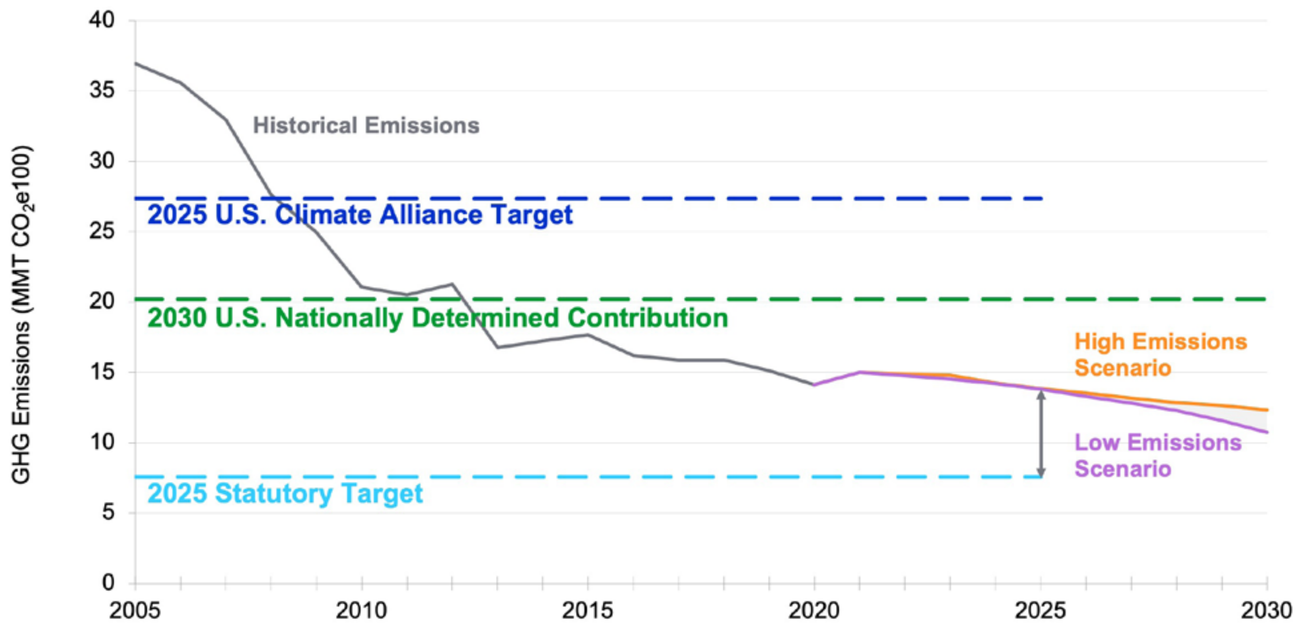


Table 20: Emissions Gaps in Puerto Rico, 2025 - 2030

Puerto Rico					
	Target Year	**Target**	**Target Emissions ($MMT CO_2e$)**	**Remaining Gap (High Emissions)**	**Remaining Gap (Low Emissions)**
Contribution to National or USCA Targets	2025	26% below 2005 (U.S. Climate Alliance)	27	-13	-14
	2030	50% below 2005 net emissions (U.S. NDC)	20	-8	-9
State Targets	2025	50% below 2019 (Statute)	8	6	6

Rhode Island

Figure 28: Rhode Island Economy-Wide GHG Emissions and Target

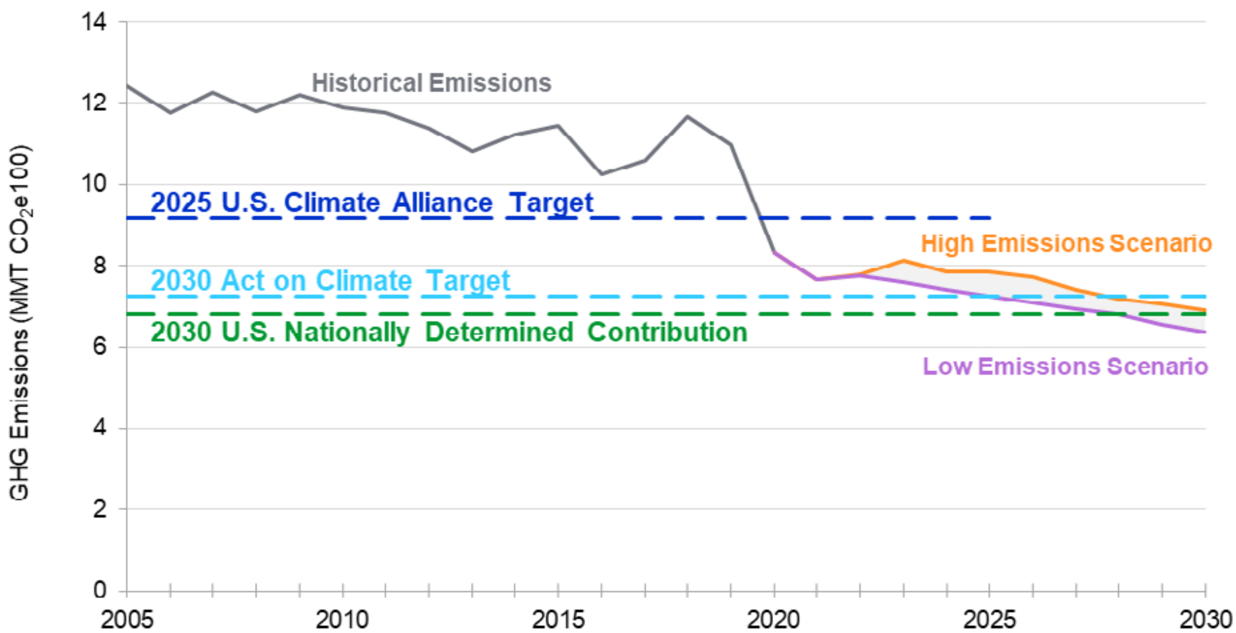


Table 21: Emissions Gaps in Rhode Island, 2025 - 2030

Rhode Island					
	Target Year	**Target**	**Target Emissions ($MMT\ CO_2e$)**	**Remaining Gap (High Emissions)**	**Remaining Gap (Low Emissions)**
Contribution to National or USCA Targets	2025	26% below 2005 (U.S. Climate Alliance)	9	-1	-2
	2030	50% below 2005 net emissions (U.S. NDC)	7	0	0
State Targets	2030	45% below 1990 (2021 Act on Climate)	7	0	-1

Vermont

Figure 29: Vermont Economy-Wide GHG Emissions and Target[86]

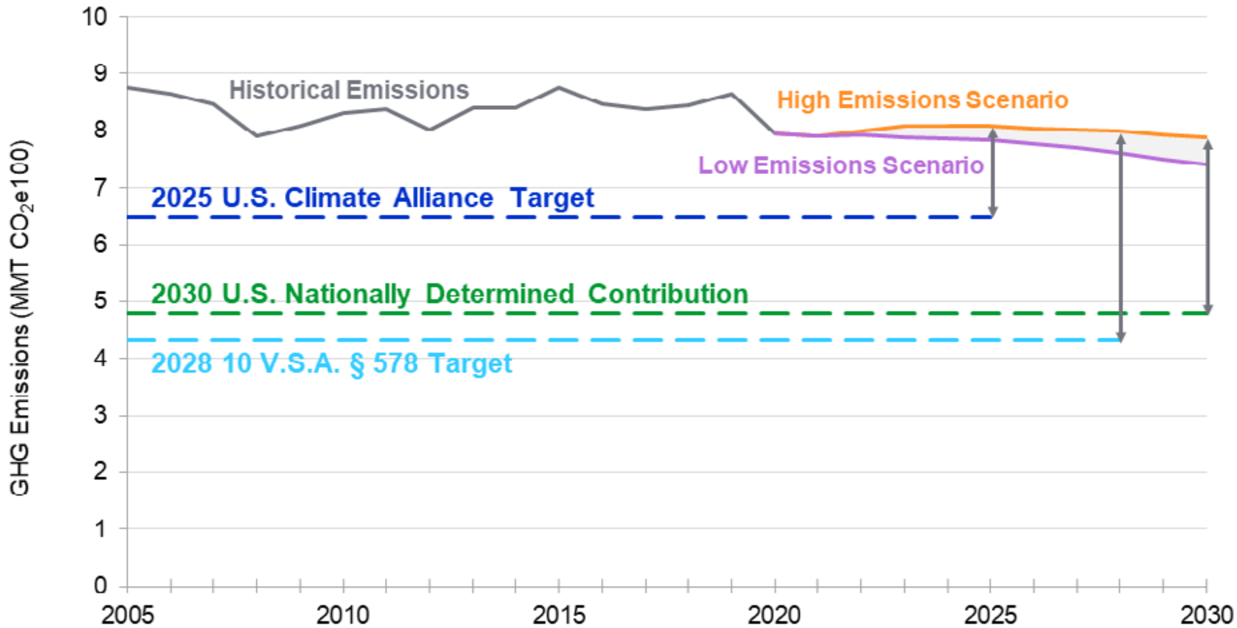


Table 22: Emissions Gaps in Vermont, 2025 - 2030

Vermont					
	Target Year	**Target**	**Target Emissions (MMT CO_2e)**	**Remaining Gap (High Emissions)**	**Remaining Gap (Low Emissions)**
Contribution to National or USCA Targets	2025	26% below 2005 (U.S. Climate Alliance)	6	2	1
	2030	50% below 2005 net emissions (U.S. NDC)	5	3	3
State Targets	2028	50% below 1990 (10 VSA § 578)	4	4	3

86 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.

Washington

Figure 30: Washington Economy-Wide GHG Emissions and Target[87]

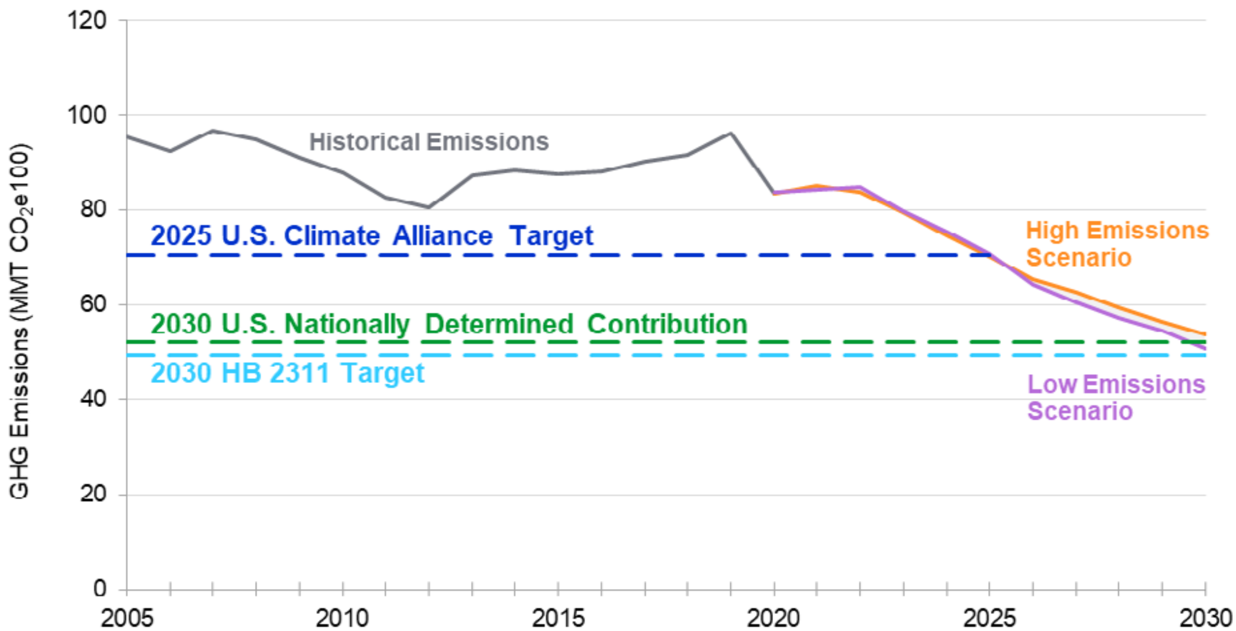


Table 23: Emissions Gaps in Washington, 2025 - 2030

Washington					
	Target Year	**Target**	**Target Emissions (MMT CO_2e)**	**Remaining Gap (High Emissions)**	**Remaining Gap (Low Emissions)**
Contribution to National or USCA Targets	2025	26% below 2005 (U.S. Climate Alliance)	71	0	0
	2030	50% below 2005 net emissions (U.S. NDC)	52	2	-2
State Targets	2030	45% below 1990 (HB 2311)	50	4	1

87 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.

Wisconsin

Figure 31: Wisconsin Economy-Wide GHG Emissions and Target

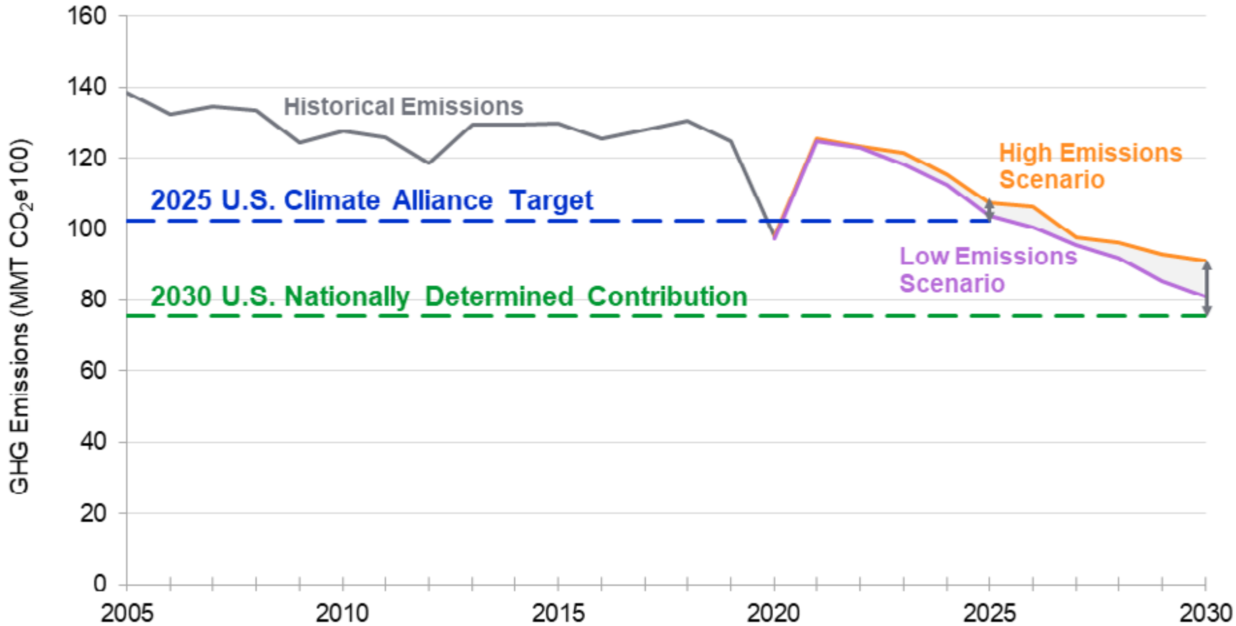


Table 24: Emissions Gaps in Wisconsin, 2025 - 2030

Wisconsin					
	Target Year	**Target**	**Target Emissions ($MMT\ CO_2e$)**	**Remaining Gap (High Emissions)**	**Remaining Gap (Low Emissions)**
Contribution to National or USCA Targets	2025	26% below 2005 (U.S. Climate Alliance)	102	5	1
	2030	50% below 2005 net emissions (U.S. NDC)	76	15	5

APPENDIX 2: STATE COMMITMENTS TO REDUCE ECONOMY-WIDE GHG EMISSIONS

The table below details state commitments to reduce economy-wide GHG emissions. 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 evaluated states have also committed to the U.S. Climate Alliance targets [88] of reducing GHG emissions 26 to 28% below 2005 levels by 2025 and 50 to 52% below 2005 levels by 2030; these targets are only included in the table for states where they are the only targets.

Table 25: Commitments to Reduce Economy-Wide GHG Emissions[89]

State	Target Year	Target	Commitment	Legal Foundation
California	2020	Reduce to 1990	Binding	2006 statute
	2030	40% below 1990	Binding	2016 statute
	2030	48% below 1990	Non-Binding	2022 Climate Change Scoping Plan
	2045	85% below 1990	Binding	2022 statute
	2045	Net zero GHG emissions, and net negative GHG emissions thereafter	Binding	2022 statute
Colorado	2025	26% below 2005	Binding	2019 statute
	2030	50% below 2005	Binding	2019 statute
	2035	65% below 2005	Binding	2023 statute
	2040	75% below 2005	Binding	2023 statute
	2045	90% below 2005	Binding	2023 statute
	2050	Net-zero GHG emissions	Binding	2023 statute

88 We note that, while Virginia is included in this table to reflect the statutory net-zero emissions goal, the state is no longer a member of the U.S. Climate Alliance. In addition, Virginia's emissions projections are not evaluated in this report because the state no longer has near-term climate commitments.

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

State	Target Year	Target	Commitment	Legal Foundation
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
Guam[90]	2025	26-28% below 2005	Non-binding	Membership in U.S. Climate Alliance
	2030	50-52% below 2005	Non-binding	Membership in U.S. Climate Alliance
Hawaii	2045	Net-zero GHG emissions	Non-binding	2018 statute
Illinois	2025	26-28% below 2005	Non-binding	Membership in U.S. Climate Alliance
	2030	50-52% below 2005	Non-binding	Membership in U.S. Climate Alliance
Louisiana	2025	26-28% below 2005	Non-binding	2020 Executive Order
	2030	40-50% below 2005	Non-binding	2020 Executive Order
	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

90 Guam joined the U.S. Climate Alliance in February 2023. Data was not available at the time of publication to evaluate Guam's progress toward these commitments.

State	Target Year	Target	Commitment	Legal Foundation
Maryland	2020	25% below 2006	Binding	2016 statute
	2031	60% below 2006	Binding	2022 statute
	2045	Net-zero GHG emissions	Binding	2022 statute
Massachusetts	2020	25% below 1990	Binding	2008 statute
	2030	50% below 1990	Binding	2021 statute
	2040	75% below 1990	Binding	2021 statute
	2050	85% below 1990	Binding	2021 statute
	2050	Net-zero GHG emissions	Binding	2021 statute
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
	2030	50% below 2005	Non-binding	2023 statute
	2050	Net-zero GHG emissions	Non-binding	2023 statute
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

State	Target Year	Target	Commitment	Legal Foundation
New Jersey	2020	Reduce to 1990	Non-binding	2019 statute
	2030	50% below 2006	Non-binding	2021 Executive Order
	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
	2030	50% below 2005	Non-binding	2022 Executive Order
	2050	Net-zero GHG emissions	Non-binding	2022 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

State	Target Year	Target	Commitment	Legal Foundation
Puerto Rico[91]	2025	50% below 2019	Not included in legal analysis [92]	2019 statute
Rhode Island [93]	2020	10% below 1990	Binding	2021 statute
	2030	45% below 1990	Binding	2021 statute
	2040	80% below 1990	Binding	2021 statute
	2050	Net-zero GHG emissions	Binding	2021 statute
Vermont	2025	26% below 2005	Binding	2020 statute
	2030	40% below 1990	Binding	2020 statute
	2050	80% below 1990	Binding	2020 statute
Virginia	2045	Net-zero GHG emissions	Non-binding	2020 statute
Washington	2030	45% below 1990	Binding	2020 statute & 2021 statute
	2040	70% below 1990	Binding	2020 statute & 2021 statute
	2050	95% below 1990	Binding	2020 statute & 2021 statute
	2050	Net-zero GHG emissions	Non-binding	2020 statute
Wisconsin	2025	26-28% below 2005	Non-binding	Membership in U.S. Climate Alliance
	2030	50-52% below 2005	Non-binding	Membership in U.S. Climate Alliance

91 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.

92 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.

93 While Rhode Island does not include clear requirements on emitters or direct specific regulatory agencies to promulgate regulation, the legislation includes an enforceability provision.

APPENDIX 3: PROJECTED EMISSIONS AND UNCERTAINTIES

EDF's analysis uses historic and projected emissions data from Rhodium Group's U.S. Climate Service modeling, released in August 2022.[94] The emissions projections incorporate projected abatement from policies in place as of June 2022[95] as well as projected abatement driven by the IRA and IIJA. In addition, EDF made adjustments to Rhodium Group's oil and gas methane estimates and adjusted state emissions projections to reflect the projected impact of additional significant policies finalized by March 2023.[96]

Rhodium Group employs a downscaling methodology to estimate state-level emissions based on the 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. [97] 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.[98]

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

- **The High Emissions** scenario is based on data from Rhodium Group's high emissions scenario. This scenario represents a likely upper bound for potential emissions trajectories. Actual emissions under business-as-usual are likely to be below this estimate.
- **The Low Emissions** scenario is based on data from Rhodium Group's low emissions scenario. This scenario provides a likely lower bound for potential emissions trajectories. Actual emissions under business-as-usual are likely to be above this estimate.
- **The Central Emissions** scenario is based on data from Rhodium Group's central emissions scenario. Rhodium Group constructs the high and low emissions scenarios to show bounds of uncertainty around the central case over the costs of fossil fuels and clean technologies, as well as macroeconomic trends.

Rhodium Group produces different emissions trajectories to account for the uncertainty in future technology and fuel costs as well as macroeconomic trends. Actual emissions are expected to fall between the high and low estimates. When referring to emissions projections as a single number, we are reporting emissions under the central emissions scenario. Otherwise, we cite an emissions range throughout this report to emphasize that future emissions trajectories are highly uncertain and depend heavily on the pace of economic growth and the future costs of technologies and fuels. Specifically, Rhodium Group evaluates three major sources of uncertainty:

- **Energy Markets:** Rhodium Group considers a range of energy market variables that shape emissions outcomes, including natural gas and oil resource availability and prices.
- **Technology Cost and Performance:** Rhodium Group estimates ranges for key technology cost and performance variables, including capital and operating costs for clean electricity generators and battery costs for light-duty electric vehicles.

94 https://rhg.com/research/climate-clean-energy-inflation-reduction-act/.

95 For more information, see Rhodium Group's 2022 Taking Stock report, available at: https://rhg.com/wp-content/uploads/2022/07/Taking-Stock-2022_US-Emissions-Outlook.pdf.

96 EDF's adjustments to Rhodium Group's data are described in more detail in Appendix 4.

97 For more information about Rhodium Group's U.S. Climate Service data methodology, see https://rhg.com/wp-content/uploads/2022/07/Taking-Stock-2022_US-Emissions-Outlook.pdf.

98 Note that the IPCC has updated GWP values in its Sixth Assessment Report (AR6), 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.

- **Economic:** Rhodium Group's emissions range is bounded by a high and a low economic growth scenario.

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 2022 report and the accompanying Technical Appendix,[99] as well as Rhodium Group's updated report evaluating the potential impacts of the IRA.[100]

Rhodium Group also provides a high and low estimate for carbon dioxide removals in the Land Use, Land Use Change, and Forestry (LULUCF) sector. In this analysis, the high emissions scenario uses the low sequestration estimate for LULUCF and the low emissions scenario uses the high sequestration estimate for LULUCF; the central emissions scenario uses the average between the low and high sequestration estimates.

99 https://rhg.com/research/taking-stock-2022/.

100 https://rhg.com/research/climate-clean-energy-inflation-reduction-act/.

APPENDIX 4: 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 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. 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.

EDF replaced Rhodium Group's methane estimates for oil and natural gas systems based on a separate EDF analysis using site-level measurements and peer-reviewed methods. Specifically, EDF estimated current upstream methane emissions from the oil and gas sector using a combination of EPA Greenhouse Gas Reporting Program and Alvarez et al. 2018 data. [101] Downstream methane emissions from the oil and gas sector are estimated using Greenhouse Gas Inventory data, disaggregated to the state level and adjusted to account for underestimations using Zimmerle et al.[102] and Weller et al.[103] Historical methane emissions were back-projected using production data from Enverus. Future methane emissions were projected based on proprietary production data from Rystad Energy. To incorporate this analysis, EDF replaced Rhodium Group's central emissions projections for oil and gas methane and scaled the low and high emissions projections in proportion to EDF's modeling.

In addition, while EDF did not conduct a state-by-state analysis of Rhodium Group's data, in some instances we adjusted state-level emissions projections to account for recently adopted policies:

Washington

EDF adjusted Washington's GHG emissions projections to account for estimated abatement from the state's Cap-and-Invest program. While the Climate Commitment Act was adopted in 2021, directing the Department of Ecology to develop regulations to establish an enforceable, declining cap on climate pollution from the state's major-emitting sectors, the program was not included in Rhodium Group's 2022 emissions modeling because the implementing rules were under development at that time. The Cap-and-Invest regulations were finalized in 2022 and the program went into effect in January 2023; EDF conducted an analysis to estimate the projected abatement from the program and adjusted Rhodium Group's emissions projections accordingly.

To estimate the GHG abatement impact of the program, EDF identified the covered emissions from regulated sectors and fuels and applied a modeled cap starting in 2023 based on the emission allowance "budget" published by the Department of Ecology.[104] EDF's analysis uses emissions and fuel use projections from Rhodium Group's U.S. Climate Service to estimate the GHG emissions that are covered by the cap. We apply the modeled cap to GHG pollution from the power sector,[105] industrial sector,[106] and carbon

101 Alvarez, R. A., Zavala-Araiza, D., Lyon, D. R., Allen, D. T., Barkley, Z. R., Brandt, A. R., ... & Hamburg, S. P. (2018). Assessment of methane emissions from the US oil and gas supply chain. Science, 361(6398), 186-188. https://www.science.org/doi/full/10.1126/science.aar7204.

102 Zimmerle, D. J., Williams, L. L., Vaughn, T. L., Quinn, C., Subramanian, R., Duggan, G. P., ... & Robinson, A. L. (2015). Methane emissions from the natural gas transmission and storage system in the United States. Environmental science & technology, 49(15), 9374-9383. https://pubs.acs.org/doi/abs/10.1021/acs.est.5b01669.

103 Weller, Z. D., Hamburg, S. P., & von Fischer, J. C. (2020). A national estimate of methane leakage from pipeline mains in natural gas local distribution systems. Environmental science & technology, 54(14), 8958-8967. https://pubs.acs.org/doi/abs/10.1021/acs.est.0c00437.

104 We use the emission allowance budget values published by the Department of Ecology for 2023 through 2026. See Table 210-1 of the Climate Commitment Act Program Rule, available at: https://ecology.wa.gov/DOE/files/26/26a23125-3016-4416-99b7-5361c30ac343.pdf. For emissions budget values after 2026, we extrapolate the annual emissions cap to align with the reduction trajectory published in Section 173-446-210 of the regulation.

105 EDF assumed generation-based power sector GHG emissions; emissions from imported electricity are not included in this analysis.

106 Industrial fuel consumption emissions and process emissions are included under the modeled emissions cap.

pollution from covered buildings and transportation fuels.[107, 108,109]

EDF's analysis estimates the cumulative amount of GHG pollution over time that is allowed under the program cap. We note that annual GHG emissions in a particular year may vary from EDF's estimates due to the program's allowance banking feature. While annual emissions levels in Washington may differ from modeled levels, the program is designed to control the cumulative amount of GHG pollution emitted over time — dictated by the total amount of emission allowances beneath the linear, declining cap.

Oregon

EDF adjusted Oregon's GHG emissions projections to account for the estimated abatement from the state's Climate Protection Program (CPP), for which regulations were finalized in 2021. The CPP places an enforceable, declining cap on GHG emissions from transportation and natural gas fuel usage, including in the residential and industrial sectors.

To estimate the GHG abatement impact of the program, EDF identified the covered emissions from regulated fuels and applied a modeled cap starting in 2022 based on the emissions caps published by the Department of Environmental Quality.[110] EDF's analysis uses emissions and fuel use projections from Rhodium Group's U.S. Climate Service to estimate the GHG emissions that are covered by the cap. We apply the modeled cap to covered transportation,[111] buildings,[112] and industrial fuels.[113, 114]

Colorado

EDF adjusted GHG emissions projections to account for the estimated abatement from the state's GHG abatement laws and regulations on-the-books as of March 2023. EDF conducted an analysis of the abatement potential for three recently adopted policies that were not included in Rhodium Group's 2022 modeling: emission reduction targets for natural gas utilities, GHG intensity standards for certain industrial manufacturers, and a transportation planning standard. For more information on EDF's abatement analysis for Colorado policies, read the comments we submitted for consideration at the Colorado Air Quality Control Commission meeting in September 2022.

In many cases, the policies and regulations leave significant uncertainty over the magnitude of GHG emissions abatement that will be required and/or the trajectory on which abatement will occur. Due to this uncertainty, EDF constructed low and high abatement scenarios that capture the range of reductions that is projected to occur under current policy. Throughout this analysis, we apply the Low Abatement Scenario to Rhodium Group's high emissions estimates and the High Abatement Scenario to Rhodium Group's low emissions estimates to capture the likely upper and lower bounds of emissions under key uncertainties from economic conditions and emissions abatement.

107 EDF used Rhodium Group data to estimate the carbon pollution attributable to buildings and transportation fuel use in Washington that are covered by the emissions cap. For transportation fuels, we assume that carbon emissions from diesel, gasoline, natural gas, and residual fuel oil are covered by the program. We assume that carbon emissions from jet fuel, aviation, and lubricants are not covered. For buildings fuels, we assume that commercial and residential fuels (natural gas, diesel, LPG, kerosene, gasoline, and residual fuel oil) are covered under the emissions cap. Due to data availability, the modeled cap only includes carbon emissions from covered fuels; transportation fuel emissions of HFCs, CH_4, and N_2O, totaling approximately 1 MMT CO_2e, are excluded from the modeled emissions cap. HFC emissions in the buildings sector are also excluded from the modeled cap.

108 Waste emissions are covered under the program beginning in 2031. EDF analyzed abatement potential from these emissions sources after 2030; however, in this report we present emissions from 2005 to 2030 and thus the impact of emissions abatement from waste is not shown in the results.

109 Several emissions sources and sectors are excluded from the modeled emissions cap, including: oil and gas methane emissions, emissions from the LULUCF sector, agriculture emissions, and waste to energy for municipal solid waste management.

110 Emissions caps are published in Table 2 of Section 340-271-9000, available at: https://secure.sos.state.or.us/oard/displayDivisionRules.action?selectedDivision=6597.

111 EDF used Rhodium Group data to estimate the carbon pollution attributable to transportation fuels in Oregon that are covered by the emissions cap. We assume that carbon emissions from diesel, gasoline, natural gas, and residual fuel oil are covered by the program. We assume that carbon emissions from jet fuel, aviation, and lubricants are not covered. Due to data availability, the modeled cap only includes carbon emissions from covered fuels; transportation fuel emissions of HFCs, CH_4, and N_2O are excluded from the modeled emissions cap.

112 We assume that commercial and residential fuels (natural gas, diesel, LPG, kerosene, gasoline, and residual fuel oil) are covered under the emissions cap. HFC emissions in the buildings sector are excluded from the modeled cap.

113 We assume that industrial fuels (natural gas, distillate, motor gasoline, residual, LPG) are covered under the cap, and coal and pet coke are not covered.

114 Several emissions sources and sectors are excluded from the modeled emissions cap, including: power sector emissions, oil and gas methane emissions, emissions from the LULUCF sector, and agriculture and waste emissions. This analysis does not include the impact of the Best Available Emissions Reduction standard for stationary industrial sources. Rhodium Group's emissions projections separately reflect the estimated abatement impact of Oregon's clean electricity standard.

APPENDIX 5: METHODOLOGY FOR ESTIMATING GHG EMISSIONS TARGETS

Target emissions for 2025 and 2030 in this analysis were evaluated based on percent reductions (26% reduction by 2025 and 50% reduction by 2030, both below 2005 net emissions). The historical emissions data utilized in the evaluation comes from Rhodium Group's U.S. Climate Service.

Baseline emissions and emissions targets are presented in terms of gross emissions throughout this report, unless otherwise noted. This category includes the GHG emissions attributable to transportation, electricity generation, oil and gas systems, industry, buildings, agriculture, and waste, as provided by Rhodium Group's U.S. Climate Service. We note that the Land Use, Land Use Change, and Forestry (LULUCF) sector includes both emissions sources and sinks, consistent with EPA's GHG Inventory methodology.[115] Therefore, the total GHG emissions presented in this report, unless otherwise noted as "net emissions," exclude some sources of emissions in the LULUCF sector.

There are multiple methods for downscaling the U.S. Climate Alliance commitments — to reduce collective net GHG emissions by 26 to 28% by 2025 and 50 to 52% by 2030 — to emission target levels for individual Alliance members. In this analysis, the 2025 U.S. Climate Alliance target is represented as a 26% reduction from 2005 gross emissions by 2025. We use 26% to represent the minimum reduction needed to "meet" the target. Given the 2025 timeline, it is reasonable to focus on gross emissions as nearly all achievable reductions over the next two years will be reductions in gross emissions.[116]

To provide a benchmark for the 2030 target, we estimate the level of gross [117] emission reductions for climate leadership states to collectively achieve a 50% reduction in net emissions by 2030.[118] In order to convert this net emissions target to gross emissions for the purposes of presenting the 2030 target 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., 50% reduction from 2005 net 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.[119] This provides the gross emissions level needed to achieve the net emissions target in the target year. Given projected carbon removals in 2030 under the central emissions scenario, the evaluated states would need to collectively reduce gross emissions by an estimated 45% by 2030 in order to achieve the 50% net emission reduction target. We apply a 45% gross emission reduction to each state in order to measure state-level progress on reducing emissions consistent with state 2030 commitments.

These 2025 and 2030 benchmarks provide an indication of the scale of emission reductions required from individual states in order for the U.S. Climate Alliance to achieve its commitments consistent with the U.S. NDC. The downscaled benchmarks used in this report should be viewed as one possible method for evaluation of state-level efforts to reduce emissions and are not an attempt to prescribe appropriate burden-sharing between states or intended to reflect how individual states are calculating their own targets.

Finally, some state-specific 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.

115 See https://www.epa.gov/system/files/documents/2023-04/US-GHG-Inventory-2023-Main-Text.pdf.

116 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.

117 Excluding the impact of carbon removals and LULUCF.

118 This aligns with Climate Action Tracker's methodology for evaluating progress on NDCs. For example, Climate Action Tracker estimates the U.S. NDC of a 50 to 52% net emission reduction below 2005 levels by 2030 is equivalent to a 44 to 47% gross emission reduction, when excluding the impact of emissions and sinks from LULUCF. See https://climateactiontracker.org/countries/usa/targets/.

119 When converting net emissions targets into gross emissions target levels, we use the central emissions projection for carbon removals in the target year. The central estimate is the average between Rhodium Group's high and low sequestration estimates for the LULUCF sector.

APPENDIX 6: 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. [120] This is consistent with the methodology used in EPA's Inventory of Greenhouse Gas Emissions and Sinks.[121]

The IPCC has updated GWP values in its Sixth Assessment Report (AR6), 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, [122] which is over 80 times more potent than carbon dioxide on a 20-year timescale in terms of its warming effect on the atmosphere according to AR6. Given that warming over all timescales matters, EDF recommends separately reporting emissions by different gas species whenever possible, and reporting carbon dioxide-equivalent emissions using both 20-year and 100-year time horizons, as this more adequately captures climate impacts in both the near- and long-term than using GWP-100 alone.[123]

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 AR6 values) would adjust both the targets and the emissions trajectories, and therefore would not alter the conclusions of this analysis: that climate leadership states face significant gaps to meeting their commitments.

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 AR6 GWP values, and one using 20-year AR6 GWP values.[124]

Table 26 below compares these different GWP values by gas.

120 For more information about Rhodium Group's U.S. Climate Service data methodology, see https://rhg.com/research/taking-stock-2022/.

121 See https://www.epa.gov/system/files/documents/2023-04/US-GHG-Inventory-2023-Main-Text.pdf.

122 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).

123 Id.

124 Emissions were estimated on a CO_2-equivalent basis using AR6 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-CF4 are the species of HFC and PFC, respectively, with the most emissions, so we use the GWP for HFC-134a and PFC-CF4 as proxies for all HFCs and PFCs in the absence of data for individual species.

Table 26: Summary of Relevant Global Warming Potential Values from IPCC AR4 and AR6 [125, 126]

Global Warming Potential Values			
Greenhouse Gas	**AR4 100-year GWP**	**AR6 100-year GWP**	**AR6 20-year GWP**
Carbon Dioxide (CO_2)	1	1	1
Methane (CH_4) (fossil methane)[127]	25	27 (30)	81 (83)
Nitrous Oxide (N_2O)	298	273	273
Nitrogen Trifluoride (NF_3)	17,200	17,400	13,400
HFC-134a[128]	1,430	1,530	4,140
PFC-CF4[129]	7,390	7,380	5,300
Sulfur Hexafluoride (SF_6)	22,800	25,200	18,300

The following figures show GHG emissions for New Mexico using the 100-year AR4 GWP values, the 100-year AR6 GWP values, and the 20-year AR6 GWP values to provide a comparison of results. New Mexico'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 32 below shows GHG emissions for New Mexico 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.

125 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.

126 Forster, P., T. Storelvmo, K. Armour, W. Collins, J.-L. Dufresne, D. Frame, D.J. Lunt, T. Mauritsen, M.D. Palmer, M. Watanabe, M. Wild, and H. Zhang, 2021: The Earth's Energy Budget, Climate Feedbacks, and Climate Sensitivity. In Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Masson-Delmotte, V., P. Zhai, A. Pirani, S.L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M.I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T.K. Maycock, T. Waterfield, O. Yelekçi, R. Yu, and B. Zhou (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 923–1054, doi:10.1017/9781009157896.009.

127 Throughout this report, we use 100-year GWP values for fossil and non-fossil methane to estimate CO_2e emissions. We apply non-fossil methane GWP values to methane emissions in the agriculture and waste sector, as provided by Rhodium Group's U.S. Climate Service data. For all other methane emissions, including in the oil and gas, industry, and transport sectors, we apply fossil methane GWP values to estimate CO_2e emissions.

128 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.

129 PFC data are provided by Rhodium Group as total PFC emissions. PFC-CF4 is the species of PFC with the most emissions so we use the GWP for PFC-CF4 as a proxy for all PFCs in the absence of data for individual species.

Figure 32: New Mexico Economy-Wide GHG Emissions and Targets Using AR4 100-year GWP

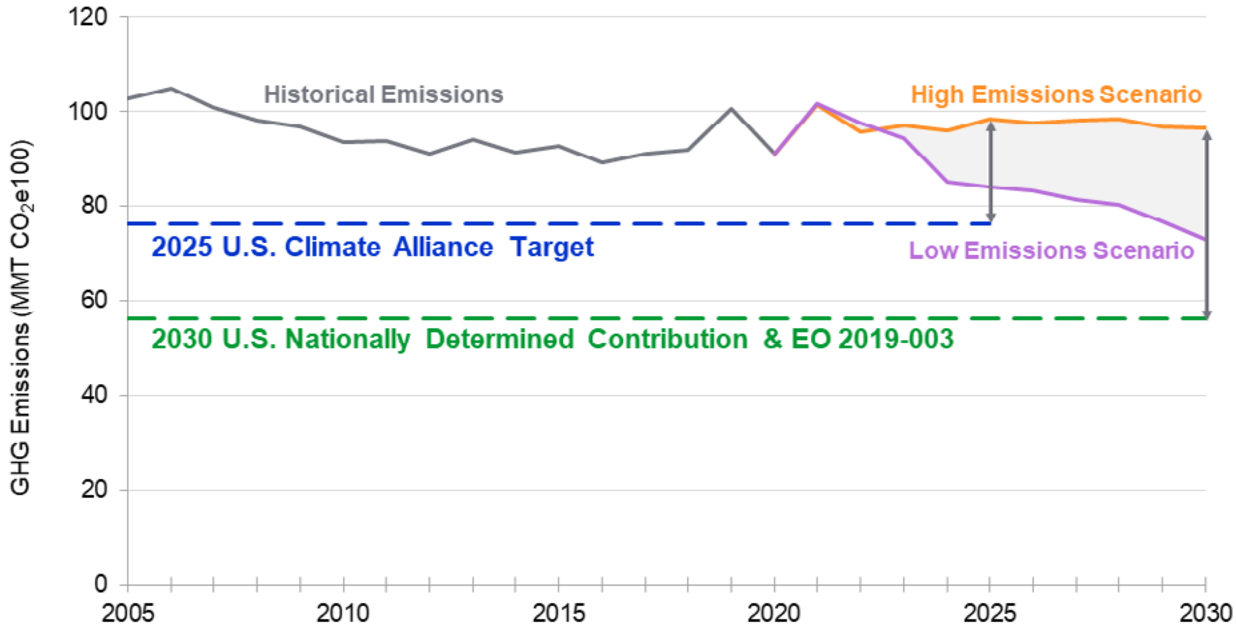
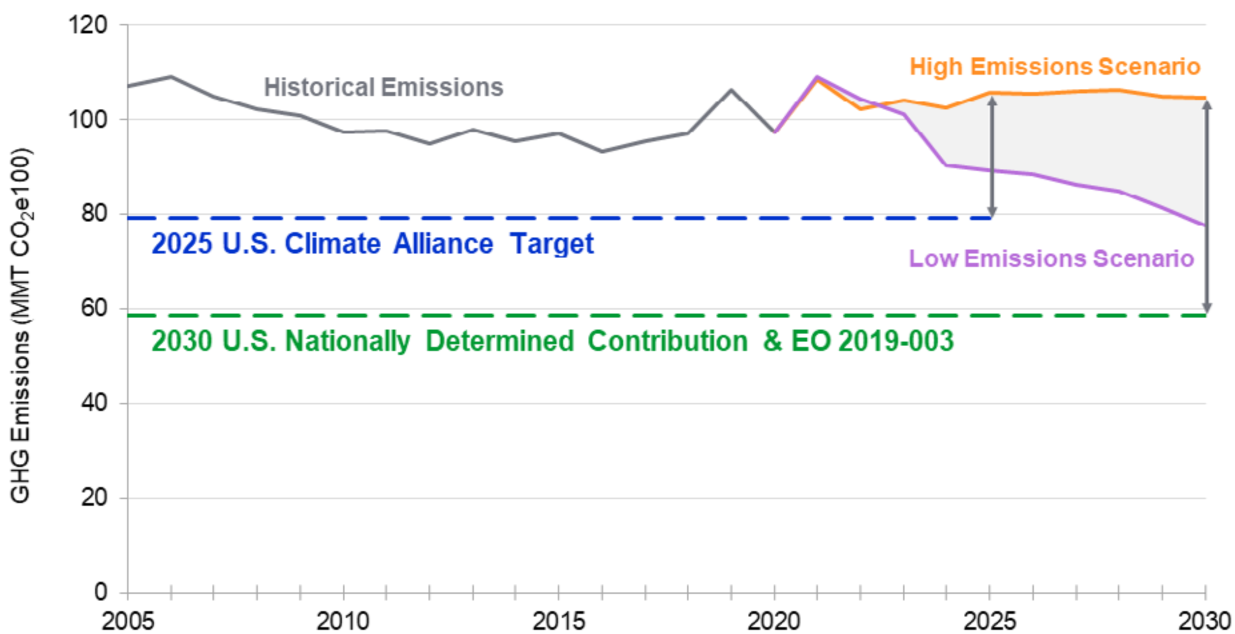


Figure 33 below shows GHG emissions for New Mexico using the AR6 100-year GWP values to estimate emissions on a carbon dioxide-equivalent basis.

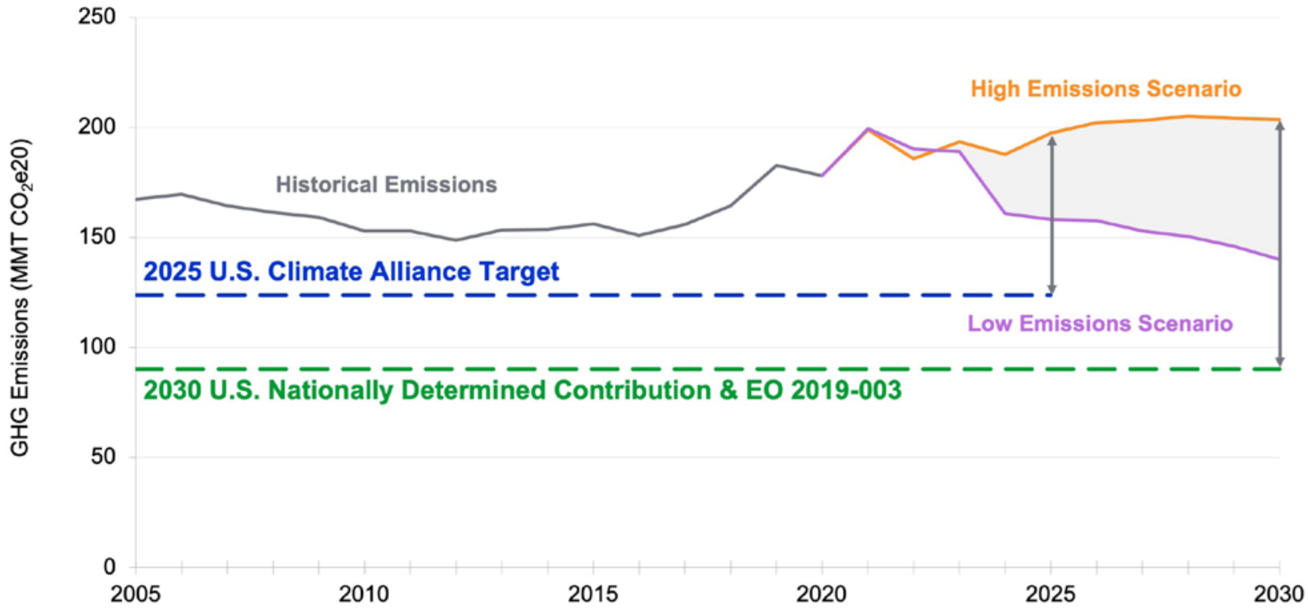
Figure 33: New Mexico Economy-Wide GHG Emissions and Targets Using AR6 100-year GWP



Using the AR6 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 AR6 100-year GWP, the emissions gaps are not significantly changed.

Figure 34 below shows GHG emissions for New Mexico using the AR6 20-year GWP values to estimate emissions on a carbon dioxide-equivalent basis.

Figure 34: New Mexico Economy-Wide GHG Emissions and Targets Using AR6 20-year GWP



Using AR6 20-year GWP values results in higher CO_2e values compared to estimates based on 100-year GWP values, because methane's GWP is three times higher over the 20-year time horizon. Business-as-usual emissions also do not fall by as much between 2005 and 2030 as most of the reductions seen in Figure 32 and Figure 33 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 AR6 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 AR6 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 7: COMPARING TARGET TRAJECTORIES FOR SHORT- AND LONG-LIVED CLIMATE POLLUTANTS

In Evaluating Cumulative GHG Emissions Through 2030, we analyze the cumulative GHG emissions that climate commitment states are projected to emit over the decade. We find these states are projected to collectively emit between 4.8 and 6.2 billion MT CO_2e[130] in the near-term in excess of a 1.5°C target trajectory [131] — underscoring that states committed to climate action are far behind on the necessary pace of GHG reductions.

Evaluating cumulative emissions of all GHGs is a simplified approach to assess the emissions trajectory over time. A cumulative emissions metric matches the characteristics of long-lived climate pollutants, like CO_2 and N_2O, which accumulate in the atmosphere and continue warming the planet for centuries after they are emitted. However, for short-lived pollutants like methane (CH_4), it is more important to reduce the annual amount of emissions because these pollutants have a potent warming impact over a shorter timescale.

This appendix illustrates that, while rapid action to reduce emissions is critical for both short- and long-lived pollutants, target trajectories vary by gas.

For example, Figure 35 and Figure 36 below illustrate global CO_2 and CH_4 emissions through 2100 under the average of pathways [132] assessed by the IPCC to limit warming to 1.5°C with no or limited overshoot.[133] The average trajectory shows CO_2 emissions declining on an immediate and rapid trajectory, reaching net-zero around mid-century and net negative thereafter.[134] In addition, the average trajectory shows CH_4 emissions declining on an immediate and steep trajectory, especially over the next decade, and achieving more modest reductions over the remainder of the century.

130 Using 100-year global warming potential values from the IPCC 4th Assessment Report to sum all GHG emissions on a carbon dioxide equivalent basis.

131 This target trajectory is based on modeled global emissions pathways assessed by the IPCC that "limit warming to 1.5°C in 2100 with a likelihood of greater than 50% and reach or exceed warming of 1.5°C during the 21st century with a likelihood of 67% or less." See https://www.ipcc.ch/report/ar6/wg3/downloads/report/IPCC_AR6_WGIII_SPM.pdf, pg. 25. All pathways assessed by IPCC to limit warming to 1.5°C with no or limited overshoot assume immediate action after 2020; the average of these pathways includes near-term emission reductions of 24% below 2020 levels by 2025 and 43% below 2020 levels by 2030, with a linear decline between those benchmarks. Data used to calculate these benchmarks is available at: https://ipcc-browser.ipcc-data.org/browser/dataset?id=3878. EDF calculated the U.S. Climate Alliance cumulative emissions budget by applying these near-term reductions to U.S. Climate Alliance net emissions.

132 Daniel Huppmann, Elmar Kriegler, Volker Krey, Keywan Riahi, Joeri Rogelj, Steven K. Rose, John Weyant, et al., IAMC 1.5°C Scenario Explorer and Data hosted by IIASA. Integrated Assessment Modeling Consortium & International Institute for Applied Systems Analysis, 2018. doi: https://doi.org/10.22022/SR15/08-2018.15429. url: https://data.ene.iiasa.ac.at/iamc-1.5c-explorer.

133 IPCC defines "limited overshoot" as "exceeding 1.5°C global warming by up to about 0.1°C and for up to several decades." See https://www.ipcc.ch/report/ar6/wg3/downloads/report/IPCC_AR6_WGIII_SPM.pdf, pg. 25.

134 Net negative emissions mean "[a] situation...when metric-weighted anthropogenic greenhouse gas (GHG) removals exceed metric-weighted anthropogenic GHG emissions." See IPCC, 2021: Annex VII: Glossary [Matthews, J.B.R., V. Möller, R. van Diemen, J.S. Fuglestvedt, V. Masson-Delmotte, C. Méndez, S. Semenov, A. Reisinger (eds.)]. In Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Masson-Delmotte, V., P. Zhai, A. Pirani, S.L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M.I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T.K. Maycock, T. Waterfield, O. Yelekçi, R. Yu, and B. Zhou (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 2215–2256, doi:10.1017/9781009157896.022. Pg. 2240.

Figure 35: Global CO_2 Emissions under the Average of 1.5 °C Target Pathways, 2020-2100

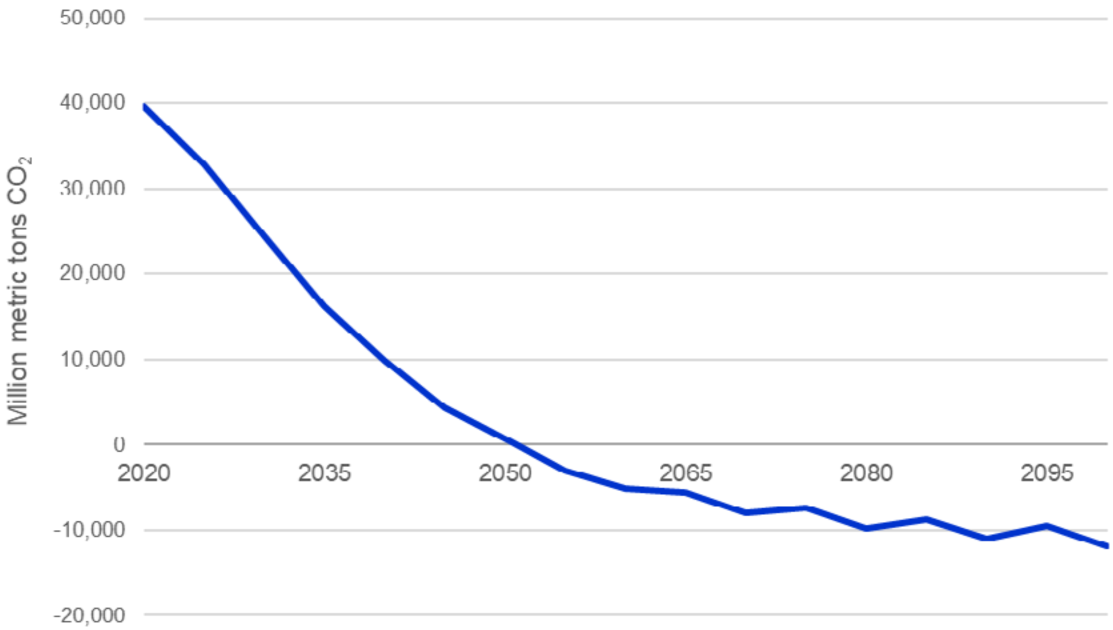
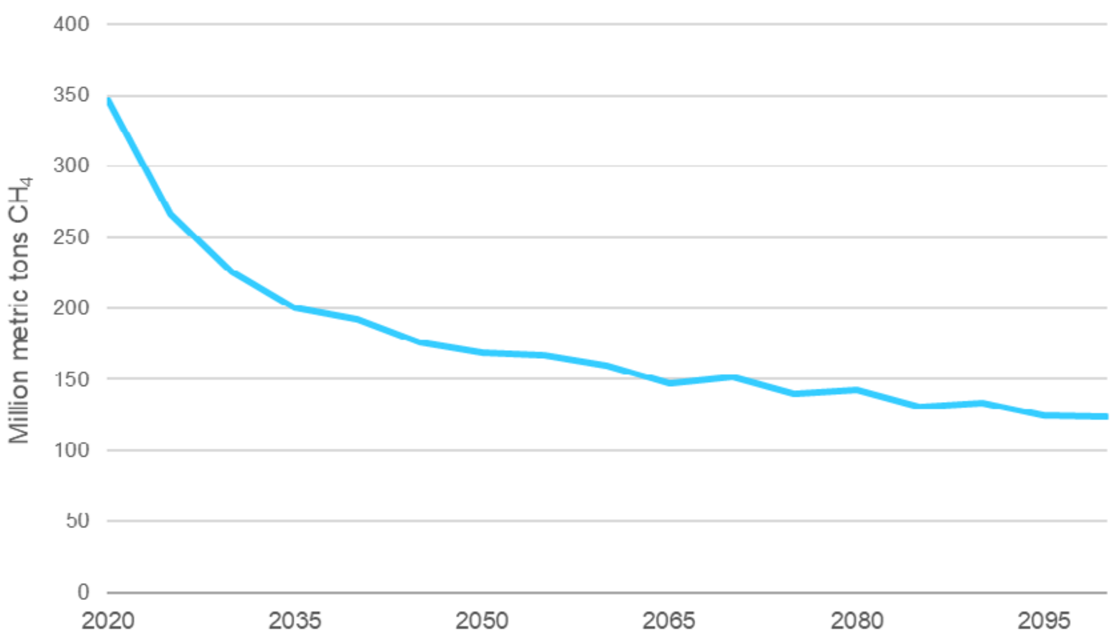


Figure 36: Global CH_4 Emissions under the Average of 1.5 °C Target Pathways, 2020-2100[135]

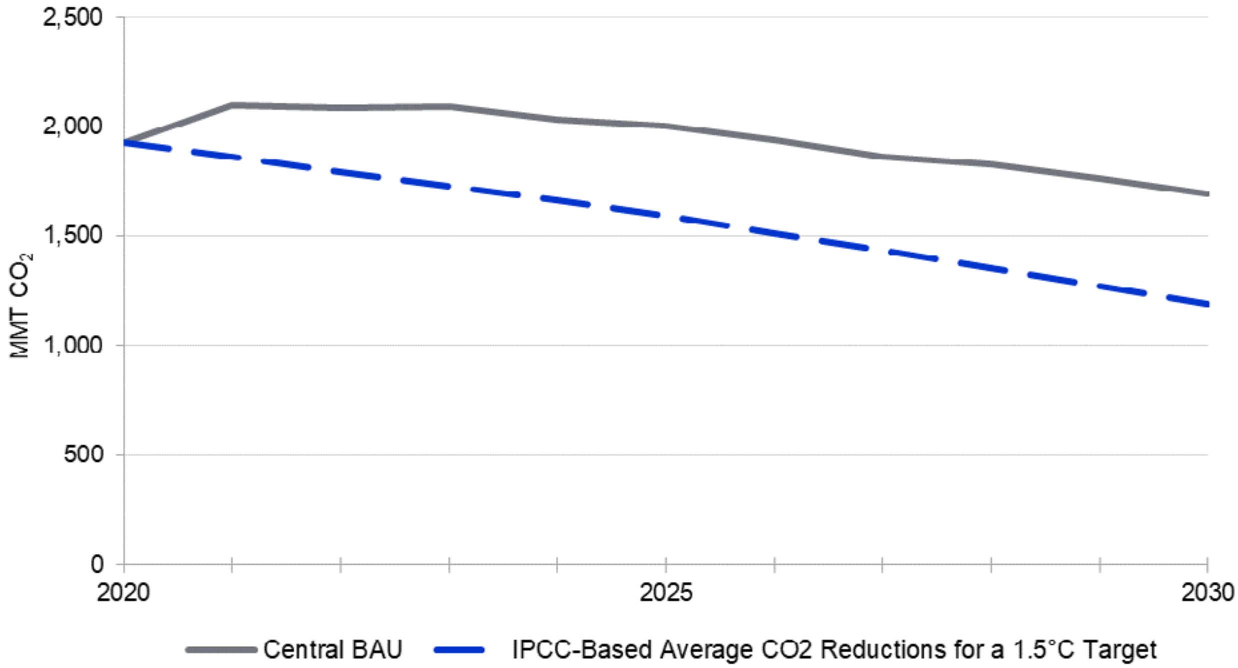


135 CH_4 emissions are shown in million metric tons of CH_4, without using GWP values to show carbon dioxide-equivalency.

Therefore, while both pollutants must decline rapidly in the near-term to avoid the worst impacts of climate change, the specific trajectories vary by gas. Because different pollutants cause warming over different timescales, and long-term target trajectories vary by gas, EDF recommends GHG abatement policies are tailored to the characteristics of the regulated pollutants.[136] This includes achieving immediate, rapid reductions in both short- and long-lived pollutants to reduce the warming impact of climate pollution over multiple timescales.

In Figure 37 through Figure 39 below, we downscale [137] global emissions pathways for CO_2, CH_4, and N_2O and apply near-term target trajectories to projected emissions from climate commitment states.[138]

Figure 37: Excess CO_2 Emissions from Evaluated States, 2020-2030



136 See Recommendations.

137 To downscale average global emissions trajectories for a 1.5 °C target, we calculate the pace of reductions of CO_2, CH_4, and N_2O and apply these percentage reductions to the projected emissions from U.S. Climate Alliance members. The average of modeled 1.5 °C emissions pathways shows CO_2 reductions of 17% by 2025 and 38% by 2030; CH_4 reductions of 23% by 2025 and 35% by 2030; and N_2O reductions of 15% by 2025 and 17% by 2030. All percentage reductions are below 2020 emissions levels. We apply a linear emissions decline between each benchmark.

138 Emissions projections for U.S. Climate Alliance members are shown here under Rhodium Group's central emissions scenario. The projections in this appendix include EDF's adjustments to Rhodium Group's oil and gas methane emissions but do not include EDF's adjustments for state-level policy abatement. Abatement estimates are not included because it is uncertain how the anticipated GHG abatement will be divided across different gases.

Figure 38: Excess CH_4 Emissions from Evaluated States, 2020-2030[139]

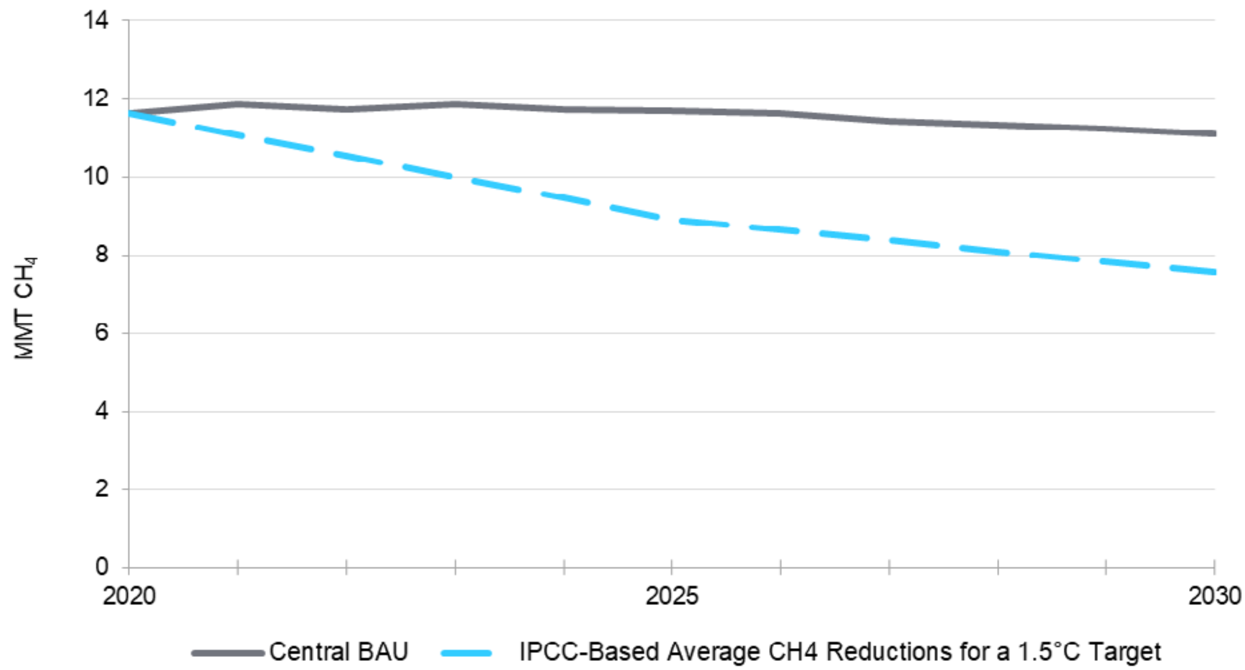
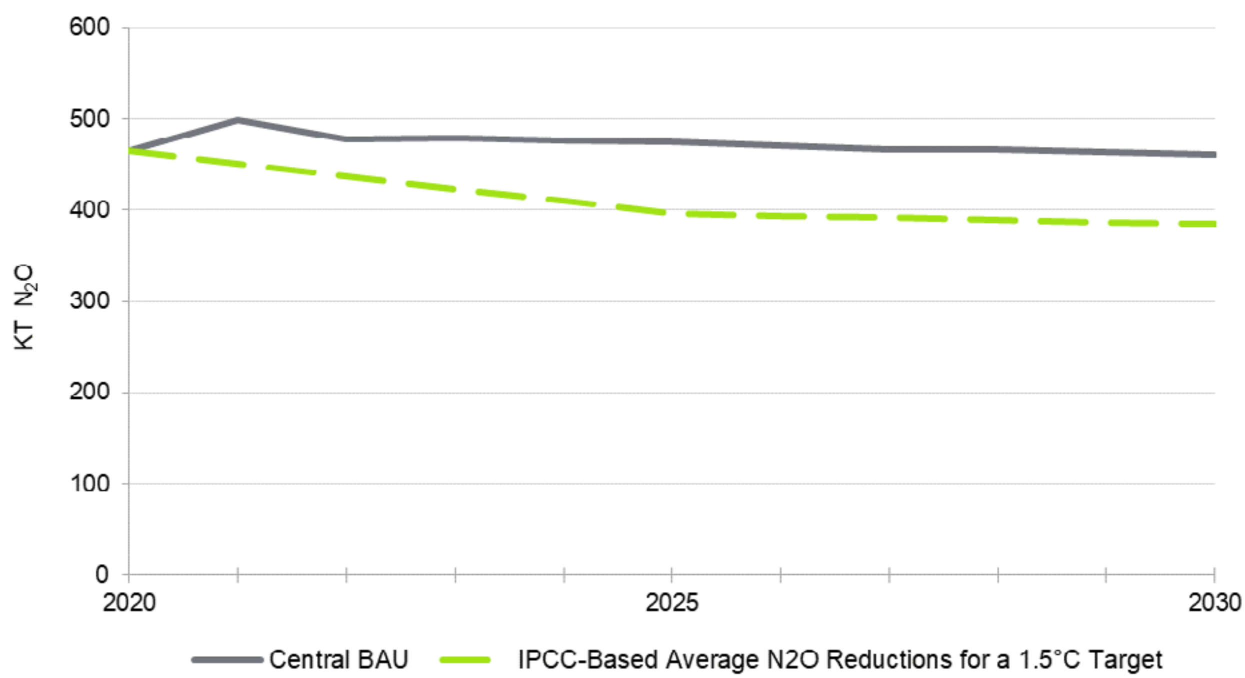


Figure 39: Excess N_2O Emissions from Evaluated States, 2020-2030[140]



139 CH_4 emissions are shown in million metric tons of CH_4, without using GWP values to show carbon dioxide-equivalency.

140 N_2O emissions are shown in kilotons of N_2O, without using GWP values to show carbon dioxide-equivalency.

Across all three pollutants, these states are significantly off track from their commitments to reduce GHG emissions in line with a 1.5°C target trajectory. For long-lived CO_2 and N_2O, climate commitment states are projected to overshoot a target emissions budget over this period (shown in Figure 37 and Figure 39) — leading to significantly greater cumulative emissions — and worsening the amount of climate damage we will experience in the near- and long-term. Moreover, climate commitment states are projected to emit CH_4 at significantly higher annual rates than consistent with a near-term trajectory for a 1.5°C target (shown in Figure 38) — accelerating the pace of warming and leading to more severe near-term impacts of climate change.

While we use a simplified approach to evaluating cumulative emissions of all GHGs in Evaluating Cumulative GHG Emissions Through 2030, this appendix shows that evaluating a target trajectory for separate gases would reach similar conclusions as the cumulative emissions analysis: that climate commitment states are far behind the pace of reductions consistent with their commitments to curb GHG emissions in line with a 1.5°C target. The impact of this delay is excess climate pollution that accelerates the rate and intensifies the overall amount of warming. Immediate, rapid, and persistent action to curb GHG emissions is essential for states to deliver on their climate commitments.