March 2022

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Pledges to Policy

Evaluating North Carolina's Progress on Critical Climate Targets

Governor Cooper has committed North Carolina to reducing greenhouse gas emissions 40% from 2005 levels by 2025, and at least 50% from 2005 levels by 2030. With eight years remaining, the state is not currently on track to reach it’s emissions targets.

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Executive Summary

In 2017, Governor Cooper signaled his intent for North Carolina to lead in the effort to combat the climate crisis by joining the U.S. Climate Alliance,[1] a bipartisan coalition of states committed to implementing policies that advance the goals of the Paris Agreement. In doing so, Governor Cooper committed the state to reducing greenhouse gas (GHG) emissions by at least 26% from 2005 levels by 2025 and 50% by 2030.[2] Since then, Cooper has reaffirmed and built on that commitment by issuing Executive Order 80[3] in 2018 and Executive Order 246[4] in January of this year. These orders formally established GHG emission reduction targets of 40% by 2025 and 50% by 2030 from 2005 levels, respectively.

To evaluate whether North Carolina is on track to deliver these climate commitments, EDF conducted an analysis based on historic and projected state-level GHG emissions data from the Rhodium Group's U.S. Climate Service. The projections estimate emissions through 2030 based on state and federal policies in place as of May 2021. EDF's analysis finds that under current policies, North Carolina is projected to achieve a 27% reduction in economy-wide GHG emissions by 2025, and that emissions will level off or potentially increase from 2025 levels by 2030, depending on future costs and economic trends. Assuming that the state achieves the 70% emission reduction targets set for the electric power-sector by 2030 without delays, as required by HB 951, the state could achieve a 28% to 38% reduction in economy-wide emissions by 2030, well short of the 50% target laid out in EO 246. The divergence in projected emissions from the state's goals shows that, unless new climate and clean energy policies are urgently adopted, North Carolina will fail to meet its emissions reduction targets.

The North Carolina Department of Environmental Quality (DEQ) released its own projection for 2030 emissions as part of its GHG inventory[5] in January 2022 and similarly found a gap between projected emissions and the state's targets. These two analyses demonstrate that even while there is considerable uncertainty in future emissions trajectories, it is clear the state will need additional policies to meet their targets. With 2030 rapidly approaching, the state will need to swiftly implement strong measures to close the emissions gap.

"...unless new climate and clean energy policies are urgently adopted, North Carolina will fail to meet its emissions reductions targets."

1 See https://governor.nc.gov/news/north-carolina-joins-14-states-bipartisan-us-climate-alliance.
2 See http://www.usclimatealliance.org/.
3 See https://governor.nc.gov/media/967/open.
4 See https://governor.nc.gov/media/2907/open.
5 North Carolina Greenhouse Gas Inventory (1990 – 2030). Available at: https://deq.nc.gov/media/27070/download?attachment.

Introduction

In the wake of former President Trump's announcement to withdraw the U.S. from the Paris Agreement, Governor Cooper joined with 14 other states in the U.S. Climate Alliance, committing to reducing greenhouse gas (GHG) emissions by at least 26% from 2005 levels by 2025 and 50% by 2030. Following this commitment, Governor Cooper issued Executive Order 80 in 2018, committing the state to reduce GHG emissions 40% from 2005 levels by 2025, and Executive Order 246 in 2022, expanding that target to 50% by 2030 and net-zero by 2050. These Executive Orders and subsequent processes also identified pathways to help meet these targets, including: zero-emission vehicle sales targets; development of a Clean Energy Plan (CEP), which recommended a 70% reduction of carbon dioxide (CO2) emissions from the electric power sector from 2005 levels by 2030 and net-zero power sector emissions by 2050; development of a Clean Transportation Plan; and development of a Deep Decarbonization Pathways Analysis to identify solutions beyond the power and transportation sectors.[6] In late 2021, the carbon reduction target identified in the state's Clean Energy Plan was codified in HB 951, requiring the North Carolina Utilities Commission (NCUC) to take all reasonable steps to reduce emissions from public utilities in line with the CEP goal.[7]

Together, these GHG reduction commitments are aligned with the scope of ambition needed to avoid the worst impacts of climate change,[8] and these initial steps mark meaningful progress toward climate leadership in the state. They signal to other states and the international community that leaders across the U.S. recognize the need for ambitious action to address the global threat of climate change. Building on these foundational goals to fully meet the Governor's commitments has never been more essential, as multiple studies have shown that state-led action to reduce emissions will be necessary to meet the U.S. Nationally Determined Contribution (NDC) for 2030.[9]

Achieving emissions levels consistent with the state's 2025 and 2030 targets are within reach; however, our analysis shows that the 2030 target in particular will require additional policy actions. After 2025, emissions are not projected to continue declining and may even increase in the long-term as energy demand drives emissions higher in the future. The state is also not on track to meet the goals of EO 246 for 2030, even when assuming the state achieves emission reductions from electricity generation consistent with HB 951. Governor Cooper will need to secure additional policies to put the state firmly on a path towards achieving its GHG goals. It is crucial that the state begins to deliver on these targets immediately and, as importantly, that the reductions the state achieves result in a permanently decarbonized economy.

The stakes for the climate couldn't be higher: the Intergovernmental Panel on Climate Change (IPCC) found that the average of modeled emission pathways limiting warming to 1.5°C show required GHG emission reductions of 45% below 2010 levels by 2030, with emissions continuing to decline dramatically through 2050.[10] Consistent with emission reduction pathways likely needed to limit warming to 1.5°C, President Biden announced an NDC under the Paris Agreement to reduce U.S. GHG emissions by 50-52% below 2005 levels by 2030 – a target aligned with findings from a recent IPCC report and necessary to secure a safer climate. Analyses have shown that reducing emissions from electricity generation by at least 80% by 2030 is critical to achieving the Biden administration's commitment to a 50-52% reduction in emissions across the economy by 2030.

Because the majority of climate change results from the cumulative buildup of GHGs in the atmosphere over time, immediate and persistent reductions are essential to limiting the most catastrophic impacts of climate change. Moreover, the biggest sources of GHG emissions are also the biggest sources of local air pollution – like particulates, smog-forming contaminants, and air toxics[11] – that is often most concentrated in communities of color and low-income communities because polluting facilities have been unjustly sited near them and as a result of discriminatory practices like redlining.[12] Achieving deep cuts in GHG emissions in an effective and equitable manner can improve health outcomes for millions of Americans who are disproportionately harmed by both climate impacts and local air pollution.

6 See https://files.nc.gov/ncdeq/climate-change/clean-energy-plan/NC_Clean_Energy_Plan_OCT_2019_.pdf. The Clean Transportation Plan and Deep Decarbonization Pathways required by EO246 are due May 2023 and January 2023, respectively.

7 https://www.ncleg.gov/Sessions/2021/Bills/House/PDF/H951v6.pdf

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

9 See https://climatenexus.org/international/international-cooperation/ndc-nationally-determined-contribution/

10 See Summary for Policymakers of IPCC Special Report on Global Warming of 1.5°C. Available at: https://www.ipcc.ch/sr15/chapter/spm/. Note that model emissions pathways consistent with limiting warming to 1.5°C include reducing net carbon dioxide emissions to 45% below 2010 levels by 2030 and reaching net zero around 2050. Half of pathways consistent with limiting warming to 1.5°C show a reduction of 40 to 50% below 2010 levels by 2030 for the sum of all greenhouse gas emissions, using the standard carbon dioxide-equivalent metric with a 100-year GWP.

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

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

Economy Wide Gap

EDF completed an analysis based on data from Rhodium Group's U.S. Climate Service, comparing business-as-usual (BAU) net[13] emissions projections[14,15] to Governor Cooper's emission reduction commitments. The benchmarks in this analysis evaluates the "emissions gap" between projected net GHG emissions and the EO 80 target of a 40% reduction by 2025 and the EO 246 target of a 50% reduction by 2030, relative to 2005 levels.[16]

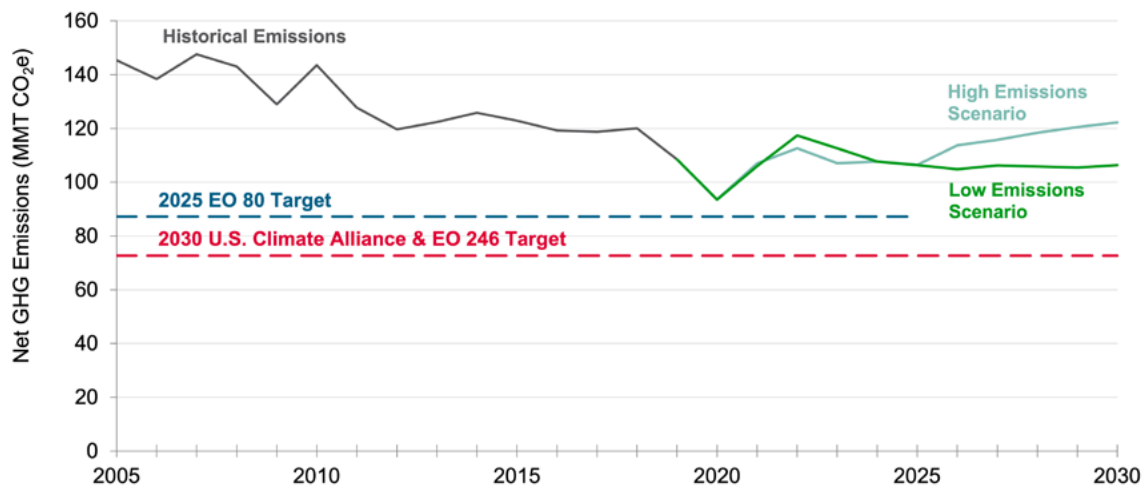
The results of this analysis show that without further emission reductions, the state is not likely to achieve the Governor's EO targets either for 2025 or 2030.

The figures and tables below show the results of this analysis for "high emissions" and "low emissions" scenarios. The high and low emissions scenarios reflect a range of possible fuel prices, technology costs, and economic trends. More information about these scenarios is available in the Appendix.

Earlier this year, the North Carolina DEQ released an updated greenhouse gas inventory,[17] which also projects emissions for future years under a business-as-usual scenario. Like our own analysis, the state's report found that North Carolina will need to take additional steps to achieve its emissions targets, estimating that emissions will fall to just 30% below 2005 levels by 2025 and 35% below 2005 levels by 2030.

While NC DEQ's and EDF's analysis differ in their projected emissions between now and 2030 due to differences in methodology, data sources, and assumptions, both conclude that absent additional action a substantial gap remains between BAU emissions and Governor Cooper's economy-wide targets.[18]

Figure 1: North Carolina Economy-Wide Net GHG Emissions and Targets, 2005 - 2030[19]



Source: EDF analysis based on Rhodium Group US Climate Service data

13 Net emissions, in contrast to gross emissions, account for emission sinks that absorb carbon dioxide from the atmosphere (e.g., uptake of carbon dioxide and storage in forests and soils). This analysis focuses on net emissions for comparability with the state's GHG inventory.

14 BAU emissions shown in this report reflect state and federal policies in place as of May 2021.

15 To sum up 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 (CO2e) with a 100-year time horizon, which requires a Global Warming Potential multiplier for non-CO2 gasses to represent the amount of CO2 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-CO2 gas. We acknowledge that CO2e is an imperfect metric, and that CO2e represented on a 100-year time horizon, by itself, only conveys long-term climate impacts of emissions. Reporting greenhouse gas emissions for using two time horizons, 20- and 100-year, to convey climate impacts over all timescales would be the better practice (Ocko et al. 2017; see appendix). Given that the emissions data reported by Rhodium Group's U.S. Climate Service are presented in CO2e 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 use GWP values from IPCC AR4 to retain consistency with Rhodium and the state's GHG inventory but note that newer values are provided in IPCC AR6. We note that updated GWP-100 values do not change the main findings of this report.

16 Target emissions for 2025 and 2030 in this analysis were calculated based on percent reductions (40% reduction from 2005 net emissions and 50% reduction from net emissions, respectively) from historical emissions as provided by the Rhodium Group U.S. Climate Service. Targets are presented in net emissions. For more information about the calculations used to estimate target emission levels and a comparison of different approaches, see the appendix.

17 North Carolina Greenhouse Gas Inventory (1990 – 2030). https://deq.nc.gov/media/27070/download?attachment.

18 We note that the state's GHG inventory includes estimates of emissions associated with imported electricity while EDF's estimates only account for in-state generation. As the targets are based on percentage reductions from a base year, the overall findings of the analysis are unchanged.

19 Based on data from Rhodium Group's U.S. Climate Service. Note that we have adjusted Rhodium Group's data. Information about these adjustments is available in the appendix.

Table 1: Emissions Gaps in North Carolina, 2025 - 2030[20]

North Carolina				
Target Year	**Target**	**Target Net Emissions (MMTCO2e)**	**Remaining Gap (High Emissions)**	**Remaining Gap (Low Emissions)**
2025	Net emissions 40% below 2005 (EO 80)	87	19	19
2030	Net emissions 50% below 2005 (U.S. Climate Alliance & EO 246)	73	50	34

20 Based on data from Rhodium Group's U.S. Climate Service. Note that we have adjusted Rhodium Group's data. Information about these adjustments is available in the appendix.

Progress in the Power Sector

In 2019, North Carolina's CEP included a goal to reduce power sector carbon emissions – those associated with the production of electricity within the state – by 70% relative to 2005 levels by 2030.[21] In late 2021 Governor Cooper signed bipartisan legislation, HB 951, enshrining this goal in law and requiring the NCUC to take all reasonable steps to achieve this level of emission reductions from facilities owned or operated by public utilities.

EDF estimates that achieving the targets established in the CEP and HB 951 would reduce annual emissions in the power sector by 16 to 17 MMTCO2e in 2030 relative to the BAU scenario.[22] Securing these reductions is not guaranteed by the statute, as actual reductions will depend on the adoption of new regulations and the resource mix determined to meet the requirements of HB 951, which are currently under development by the NC Utilities Commission.

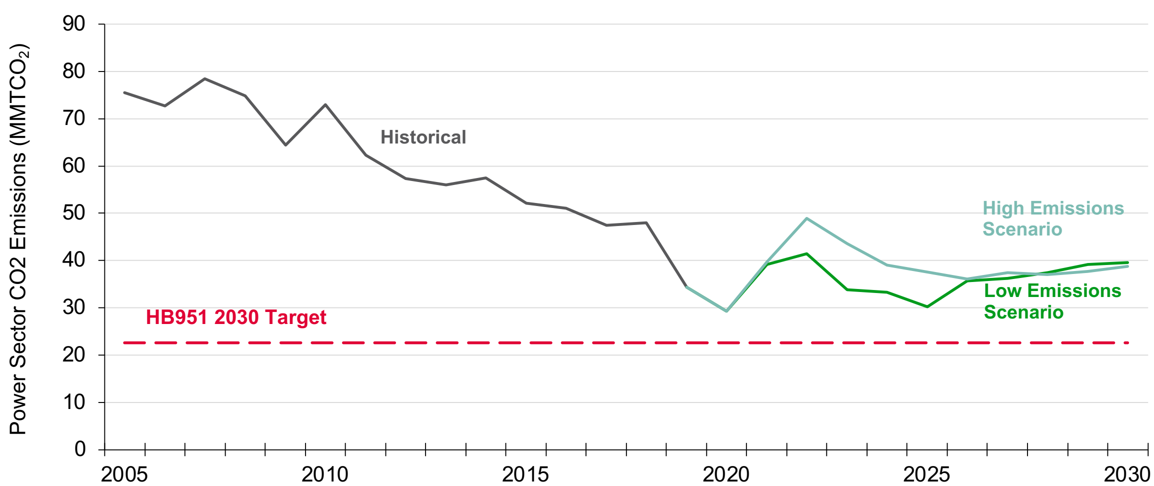
While there is not an existing path to achieve the goals of H951, EDF further assessed the impact of these reductions on the economy-wide emissions gap.

"...significant additional reductions will be needed to reach the target of EO 246"

We estimate that achieving the carbon dioxide reduction goals of HB 951 without delays could result in economy-wide emissions 28% to 38% below 2005 levels by 2030, **leaving a remaining 12% to 22% gap from baseline to reach the 2030 EO 246 target.**[23]

The state's GHG inventory included an estimate of emissions assuming implementation of HB 951 and found that the state would reach a 39% reduction from 2005 emissions by 2030 if the emission reduction targets of the law are achieved. Though we believe this estimate is at the high end of total achievable reductions across the economy, it shows that even in a best-case scenario for HB 951 implementation, significant additional reductions will be needed to reach the target of EO 246.

Figure 2: North Carolina Power Sector CO2 Emissions and Targets, 2005 - 2030[24]



Source: EDF analysis based on Rhodium Group US Climate Service data

21 https://files.nc.gov/ncdeq/climate-change/clean-energy-plan/NC_Clean_Energy_Plan_OCT_2019_.pdf

22 This analysis makes the simplifying assumption that the emission reduction requirements of HB 951 would apply to all electricity generated within the state, though the law only applies to generation from facilities owned and operated by public utilities. Because of this assumption, the results of this analysis overestimate reductions from achieving the targets in HB 951.

23 The remaining gap is equal to 18 MMTCO2e in the low emissions scenario and 33 MMTCO2e in the high emissions scenario to reach the 2030 EO 246 target.

24 Based on data from Rhodium Group's U.S. Climate Service.

Closing the Gap

North Carolina must implement additional policies to drive emission reductions to achieve the commitments made by Governor Cooper in Executive Orders 80 and 246. There are several near-term opportunities for accelerating the state's emissions reductions. First, the state should consider increasing the ambition of its power sector decarbonization policies to secure additional emission reductions. Numerous studies by EDF and others including Natural Resources Defense Council, America is All In, the University of Maryland have all concluded that power sector decarbonization is central to achieving a 50% economy-wide emissions reduction by 2030 relative to 2005 levels. These national-level studies consistently find that for the U.S. to decrease economy-wide emissions by at least 50% by 2030, the power sector will need to reduce its emissions by approximately 80%.[25] Low-carbon electricity can also unlock and accelerate emission reductions across other sectors like transportation, buildings, and industry by allowing these sectors to increasingly rely on clean electricity instead of burning fossil fuels.

However, the state will have to look beyond the power sector to achieve the Governor's targets. Together, the electric power and transportation sectors contribute nearly 70% of the state's emissions, with transportation recently surpassing the power sector by a few percentage points as the largest share of the state's emissions.[26] Based on data from the Rhodium Group, transportation will be responsible for 49 to 52 MMTCO2e, or 42% to 46%, of emissions in 2030. EO 246 takes an important step in setting a goal to reach 1,250,000 registered zero-emission vehicles by 2030, but North Carolina will need to rapidly implement a fulsome policy approach to deliver on these promises and secure additional transportation related emission reductions consistent with the 2030 target.

While electricity and transportation represent the largest share of the state's emissions and significant additional progress in both sectors is essential to achieve Governor Cooper's GHG reduction commitments, the state can and should also look to opportunities outside of these two sectors to reduce emissions. Emissions from industry - including both combustion of fossil fuels and industrial process emissions - are projected to increase to 23.91 MMTCO2e in 2030, accounting for over 24% of projected total net statewide emissions. By 2030, this means that the industrial sector will contribute exactly the same level of emissions that the electricity sector is projected to contribute if HB 951 is fully and effectively implemented.[27] While some reductions will be achieved through federal rules phasing out hydrofluorocarbons (HFCs),[28] the state can act to reduce emissions relative to projections, for example by adopting regulations or incentives encouraging electrification. Energy use by commercial and residential buildings also represents a substantial share of statewide emissions, with just under 11 MMTCO2e in 2018, a number projected to remain nearly constant through 2030. The state can reduce emissions and save residents money by supporting programs that increase building energy efficiency and encourage increased electrification.

The state's forthcoming Deep Decarbonization Pathways Analysis to evaluate approaches that take a comprehensive, economy-wide view and identify additional sector-specific pathways to reduce emissions will be an important piece of the puzzle. It is critical that the state determine the most viable pathway to reduce emissions in line with those targets and expeditiously take all available action to do so.

25 http://blogs.edf.org/climate411/2021/06/10/the-key-to-reaching-bidens-new-climate-goal-an-enforceable-clean-electricity-standard-that-slashes-pollution/

26 North Carolina Greenhouse Gas Inventory (1990 – 2030). https://deq.nc.gov/media/27070/download?attachment.

27 In the state's inventory, industrial emissions are separated into process emissions and combustion of fossil fuels, which are grouped together as "Residential, Commercial, and Industrial" emissions from combustion to produce. See https://deq.nc.gov/energy-climate/climate-change/greenhouse-gas-inventory.

28 https://www.epa.gov/climate-hfcs-reduction/final-rule-phasedown-hydrofluorocarbons-establishing-allowance-allocation

Photo credit

Conclusion

North Carolina is experiencing the climate crisis now, and the costs to the state[29] will continue to grow in the coming decades.[30] Damaging storms and flooding events are more frequent and severe, rising sea levels threaten the iconic coast and the communities who live and work there, and more extreme heat days put the safety of agricultural workers at risk. These evident climate impacts are already incurring damaging effects on North Carolinians' health and the state's economy. To reduce these impacts, North Carolina's leaders must take action now to accelerate progress toward reducing emissions.

"Success requires moving from setting these targets to deploying policies to drive decarbonization."

Setting ambitious climate targets is a necessary first step and helps outline the scope of the challenge faced. States that have established these targets are far ahead of states where leadership has ignored the urgency of climate change and failed to demonstrate a commitment to act. North Carolina has kicked off a series of important pledges and plans, but the true test of climate leadership is found not in plans and pledges, but in delivering results. Success requires moving from setting these targets to deploying policies to drive decarbonization.

Governor Cooper has the opportunity over the next three years to put in place policies that can successfully reduce statewide emissions by at least 50% by 2030. Doing so would cement the state as a critical, bipartisan leader on climate action in the U.S. and globally. To date, the Governor has acted to establish climate targets consistent with what is necessary, worked with the legislature to put in place a framework for significantly reducing emissions from the power sector, and set goals and is developing plans for reducing the state's transportation emissions.

To build upon this foundation, North Carolina should move rapidly to implement a suite of policies to begin realizing emissions reductions in line with the goals of Executive Orders 80 and 246. Immediate next steps could include raising the scope of ambition for power-sector reductions, moving forward on a comprehensive policy package in addition to ZEV sales targets to reduce transportation emissions, and taking an economy-wide approach to reduce emissions from other large contributors, such as the industrial sector. Securing policies that can guarantee emissions reductions over time in line with the goals Governor Cooper has set forth will leave a lasting impact on the state – both for communities and residents currently bearing the impacts of climate change, and ensuring that future generations of North Carolinians are left with a healthier, climate-safe future.

29 https://www.edf.org/sites/default/files/content/NC_Costs_of_Inaction.pdf
30 https://www.edf.org/media/new-report-details-near-term-costs-climate-change-across-north-carolinas-economy

Appendix

Methodology for Estimating GHG Emissions Targets

Target emissions for 2025 and 2030 in this analysis were calculated based on percent reductions (26% reduction from 2005 net emissions, 40% reduction from 2005 net emissions, and 50% reduction from 2005 net emissions) from historical emissions as provided by the Rhodium Group U.S. Climate Service. Baseline emissions and emissions targets are presented in net emissions.

In this analysis, the U.S. Climate Alliance target of a 26 to 28% reduction from 2005 emissions is represented as a 26% reduction from 2005 net emissions by 2025. We use 26% to represent the minimum reduction needed to "meet" the target. Similarly, we use a 50% reduction to represent the 2030 U.S. Climate Alliance target of 50 to 52% reduction.

EDF replaced Rhodium Group's methane estimates for North Carolina's Oil & Gas sector based on a separate EDF analysis using data from EPA's Inventory of Greenhouse Gas Emissions and Sinks[31] and peer reviewed methods. Specifically, EDF estimated current downstream methane emissions from the Oil & Gas sector using EPA data, disaggregated to the state level and adjusted to account for underestimations using Zimmerle et al.[32] and Weller et al.[33] Historical methane emissions were estimated using production data from Enverus. Future methane emissions were projected based on proprietary production data from Rystad Energy.

Rhodium Group Emission Projections

In this report, we present a range of emissions projections based on different scenarios as 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.

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. We present emissions as a range throughout this report to emphasize that future emissions trajectories are highly uncertain and depend heavily on the pace of economic 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 (EVs).

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

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's latest GHG 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.

31 https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks
32 https://pubs.acs.org/doi/abs/10.1021/acs.est.5b01669
33 https://pubs.acs.org/doi/abs/10.1021/acs.est.0c00437

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 2021 report[34] and the accompanying Technical Appendix.[35]

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.

Impact of Different Global Warming Potentials

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 equivalents based on the IPCC 4th Assessment Report (AR4) 100-year global warming potential (GWP) values. This is consistent with the methodology used in North Carolina DEQ's GHG inventory.[36] The IPCC provides updated GWP values in its Sixth Assessment Report (AR6),[37] 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,[38] which is more than 80 times more potent than carbon dioxide in the 20 years following emission in terms of its warming effect on the atmosphere. Given that warming over all timescales matters, EDF recommends reporting carbon dioxide-equivalent emissions using both 20-year and 100-year time horizons, to more adequately capture climate impacts in both the near- and long-term.[39] However, to be consistent with the targets and data reported by Rhodium Group's U.S. Climate Service and the state's inventory, 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.

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)	25	27	81
Nitrous Oxide (N_2O)	298	273	273
Nitrogen Trifluoride (NF_3)	17,200	17,400	13,400
HFC-134a[1]	1,430	1,530	4,140
PFC-CF_4[2]	7,390	7,380	5,300
Sulfur Hexafluoride (SF_6)	22,800	25,200	18,300

1 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.

2 PFC data are provided by Rhodium Group as total PFC emissions. PFC-CH4 is the species of PFC with the most emissions so we use the GWP for PFC-CH4 as a proxy for all PFCs in the absence of data for individual species.

34 Available at: https://rhg.com/wp-content/uploads/2021/07/Taking-Stock-2021-US-Greenhouse-Gas-Emissions-Outlook-Under-Current-Federal-and-State-Policy-1.pdf.

35 Available at: https://rhg.com/wp-content/uploads/2021/07/Taking-Stock-2021-Technical-Appendix.pdf.

36 North Carolina Greenhouse Gas Inventory (1990 – 2030). https://deq.nc.gov/media/27070/download?attachment.

37 See https://www.ipcc.ch/assessment-report/ar6/.

38 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).

39 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).