Working Paper

CHARTING AN AMBITIOUS U.S. NDC OF 51% REDUCTIONS BY 2030

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Key Messages

- New analysis shows that a comprehensive federal effort across all sectors and gases could deliver U.S. GHG emissions reductions of 51% below 2005 levels by 2030. This would put the U.S. on a trajectory to net-zero emissions in 2050, consistent with limiting global warming to 1.5°C.
- The electricity and transportation sectors are the biggest contributors to overall reductions by 2030—representing three-quarters of all reductions—but actions must be taken across all sectors to meet this target and to set the stage for subsequent reductions.
- Achieving these emissions reductions would require a broad federal approach that includes Congressional and Executive branch actions across all sectors and gases. While there are multiple policy pathways to achieve significant reductions, this scenario focuses specifically on substantial new investment via economic recovery packages and strong federal performance standards.
- This new analysis was conducted by the Center for Global Sustainability at the University of Maryland. The analysis was carried out using a version of the GCAM-USA modeling platform.
- These results do not incorporate potential additional actions by cities, states, and businesses. Such actions could increase overall ambition or serve as a backstop should this suite of federal actions not fully materialize. Additional opportunities for and impacts of such actions will be detailed in future analysis.

2021 is a critical year for climate ambition and action globally and in the United States. After four years without federal engagement, the Biden-Harris Administration has made climate a centerpiece of its policy agenda. President Biden campaigned on a commitment to achieve economy-wide decarbonization by 2050 and 100% clean electricity by 2035. Having recently formally re-joined the Paris Agreement, the administration has announced its intent to deliver a new national climate target to the international community, known as a nationally-determined contribution, or NDC, by April 22.

This new U.S. NDC will be critically important. The U.S. remains the world's second-largest greenhouse gas emitter and must lead the way in decarbonizing in order to achieve the goals of the Paris Agreement. The NDC will set the bar for domestic action, influencing federal and subnational policymaking. The NDC also has the potential to spur significant additional global action by sending a clear signal about the U.S. commitment to climate action and increasing pressure on other countries to put forward equally ambitious NDCs. A successful NDC will need to balance ambition with what is possible in the next nine years. Too ambitious an agenda risks eroding credibility; too little ambition risks undermining global efforts to marshal a strong global response to climate.

There is alignment between the Biden Administration and Congressional leadership that the U.S. must implement ambitious policies to confront climate change. While there are several different legislative and executive approaches that could achieve deep reductions by 2030, this analysis focuses on a mix of sector-specific measures that includes decade-long investments in clean technologies and ambitious new regulatory measures using existing authorities. Economy-wide climate legislation such as a limit or price on carbon and/or more ambitious state-level action could further accelerate progress and ensure that climate goals are met.

The analysis, conducted by the Center for Global Sustainability at the University of Maryland, constructs a set of policy options across all major emitting sectors and tests their implications using a version of GCAM-USA, a leading open-source modeling platform. Our analysis layers in a comprehensive package of sectoral policies in all 50 states and the District of Columbia, represented in GCAM-USA, to estimate high-ambition emission reduction potential for 2030. This working paper presents an overview of our approach and results; further details on the assumptions, modeling tools, and methodology are presented in the Technical Appendix, available at go.umd.edu/ChartingNDC-TechnicalAppendix.

We estimate that the combination of new clean energy investment policies and federal standards described here would reduce U.S. net greenhouse gas emissions by 51% by 2030, relative to 2005 levels.

Reaching this level of 51% reductions will require a multi-sector approach to mitigation. Only through a combination of actions across all sectors of the economy will it be possible to achieve highly ambitious reductions approaching 50% or more. At the same time, electricity generation and transportation stand out as particularly important in this time period of 2020-2030:

- Electricity sector reductions alone account for over half of the net economy-wide reductions relative to 2005 (28% of 51% overall reductions). U.S. climate ambition by 2030 hinges fundamentally on the ability to rapidly shift to zero-emissions electricity generation. This includes largely eliminating coal-fired electricity generation without carbon dioxide capture and storage (CCS) by 2030 and making major progress in reducing gas-fired electricity.
- The transportation sector is now the largest emitting sector in the U.S. In this analysis, transportation reductions account for about one-fifth of the total reductions to 2030 (11% of 51% overall reductions) but are also important to pave the way for deeper reductions beyond 2030. A combination of enhanced GHG performance standards on light- and heavy-duty vehicles, tax credits for electric vehicle (EV) purchases, and cash-for-clunker incentives could ensure the transition to electric vehicles and deliver major reductions in transportation emissions by 2030.

Other energy-sector actions to electrify buildings and scale electrification and CCS in industry will lead to reductions by 2030 and will be important to set the stage for deeper reductions beyond 2030. Important reductions can also be obtained from prioritizing non-CO_2 gases, such as strong standards on oil and gas methane, actions to reduce nitrous oxide from agricultural production, and progress to phase out production and consumption of hydrofluorocarbons (HFC)s. Finally, substantial new investment in protecting and building the U.S. land-sector sink is critical. In this analysis, this investment not only avoids projected decline in the land-sector but also grows the sink to absorb 1 gigaton of carbon dioxide by 2030.

The results presented here are based on assumptions about key driving forces such as technological change, oil and gas prices, economic growth and the recovery from COVID-19, and the physical character of the U.S. land-use sink. None of these can be predicted with certainty a decade out. The results are also derived from only a single modeling platform. The precise results here should therefore be interpreted as indicative rather than predictive. Faster technological advances would potentially deepen reductions; slower technological advances would lower reductions. More robust economic growth than assumed here would put upward pressure on energy demands and emissions. Increasing evidence that the land use sink is degrading would lead to less ambitious reductions. Alternate assumptions applied in a different modeling platform could lead to a different final result, although we view it as unlikely that the result would diverge significantly from the results presented here.

The results presented here are consistent with results from other studies. America's Pledge analyses found 49% reductions based on an all-in approach that combined ambitious federal action with increased efforts by cities, states, and businesses.[4, 5] A study from Climate Analytics and the Asia Policy Institute estimated that the implementation of President Biden's Clean Energy Plan, combined with strong subnational action, would lead to reductions between 38% to 54%.[6] A study by Columbia University and Rhodium Group estimated a 45% reduction in CO_2 emissions through a national carbon tax and other energy system changes.[7] A study by Resources for the Future found that a carbon tax could reduce energy system emissions 50% by 2030.[8] Three additional analyses included in the Stanford Energy Modeling Forum 32 found carbon pricing similar to the RFF study could achieve carbon emissions reductions between 50% and 60% by 2030.[9]

This study assumes only federal measures to reduce emissions. In reality, the federal government is not the only driver of U.S. climate ambition. Cities, states, businesses, and other subnational actors have carried the mantle of climate leadership over the last four years. Subnational actions can both backstop and bolster federal efforts.[10, 11] In addition to subnational engagement, recent technological trends that were largely unanticipated a decade ago are driving changes in the U.S. energy sector. For the past few years, wind and solar have comprised the majority of new electric capacity installations, competing with natural gas to drive out coal generation. And automakers increasingly see electric vehicles as the way of the future. Both rapidly evolving technological progress and steady progress from subnational actors create additional momentum for climate action.

This study has demonstrated how a strong program of climate actions can put the U.S. on track to 50% reductions by 2030 and net-zero emissions by mid-century. Such a program would demonstrate a renewed U.S. commitment to the rest of the world and accelerate the ongoing process of ratcheting up ambition globally. The policy platform presented here represents one of many potential policy combinations that might put the U.S. on a path toward reductions in this range. Regardless, all approaches depend fundamentally on the ability to implement ambitious actions and a durable commitment to maintain and enhance them over the coming decade.

The Technical Appendix is available at go.umd.edu/ChartingNDC-TechnicalAppendix.

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Table 1. Policy Assumptions

Sector	Modeled Policy	Approach
Power	Renewable Energy Incentives	Investment tax credit extends through 2030 at 30% of development costs. Production tax credit extends through 2030 at 2.5 cents/KWh.
	Standards on existing coal	Federal regulations impose an equivalent of a carbon price starting at $5/ton in 2023, rising to $25/ton by 2035.
	Standards on existing gas	Federal regulations impose an equivalent of a carbon price starting at $10/ton in 2030, rising to $25/ton by 2035.
	Standards on new gas	All new gas plants are built with 90% CCS starting in 2025.
	Incentives for Carbon Capture and Sequestration	45Q tax credit for CCS projects is increased to $100/ton through 2030, achieving 154 $MTCO_2$ sequestration.
	Nuclear Retention Incentives	Incentives retain existing nuclear generation at 680 TWh in 2030.
Transport	Combustion Engine Performance	ICE GHG performance reaches 118gCO_2 /mi for new passenger cars and 160g/mi for new light trucks and SUVs by 2030.
	LDV ZEV incentives	For MY2021 through MY2025, EV credit is fixed at $7,000/new sales. Post-2025, EV sales increase such that by 2030 new EV sales reach 40%, and by 2035 new sales reach 90%. Additional cash for clunkers incentive is set at $5000/vehicle older than 15 years of age.
	M/HDV ZEV incentives	2030 ZEV sales reach 15% for Class 2b-3 trucks, 20% for Class 4-8 straight trucks, and 15% for Class 7-8 tractors.
Buildings	Electrification	Combination of appliance incentives and standards leads to 58% of appliances stock being electrified. New sales of electrified appliances are consistent with the National Renewable Energy Laboratory's Electrification Futures Study "High Electrification" scenario.
	Energy efficiency	High efficiency appliance standards and investments achieve reduced energy demand consistent with the Appliance Standards Awareness Project's A Powerful Priority report.
Industry	Energy efficiency	Efficiency increase to reduce overall energy demand by 1.7 EJ by 2030.
	Carbon Capture and Sequestration	45Q tax credit for CCS projects is increased to $100/ton through 2030, achieving 79 $MTCO_2$ sequestration.
Non-CO_2 emissions	Methane (CH_4)	Standards on oil and gas methane to address fugitive methane emissions. Incentives and standards for agricultural CH_4 emissions abatement consistent with economic potential from the EPA MAC report.
	Nitrous Oxide (N_2O)	Incentives for N_2O emissions abatement achieve 9.7% below 2015 levels by 2030, achieving economic abatement potential from the EPA MAC report.
	Hydroflourocarbons (HFCs)	Incentives and standards on HFC emissions leads to reduction of 77% below 2015 levels, achieving economic abatement potential from the EPA MAC report.
LULUCF	LULUCF	Substantial new investment to pay for reforestation and improved land management practices grow the land sector sink to achieve -1000 TCO_2e/year in LULUCF emissions (applying up to $35-40/ton price as proxy).

Notes: ICE: Internal Combustion Engine vehicles. LDV: Light Duty Vehicle. M/HDV: Medium and Heavy Duty Vehicle. ZEV: Zero Emission Vehicle. LULUCF: Land Use, Land-Use Change and Forestry. EPA MAC report: Global Non-CO_2Greenhouse Gas Emission Projections & Mitigation 2015-2050. (United States Environmental Protection Agency, Washington, DC 20005, 2019).

Figure 1. Projected U.S. greenhouse gas emissions by sector and source to 2030

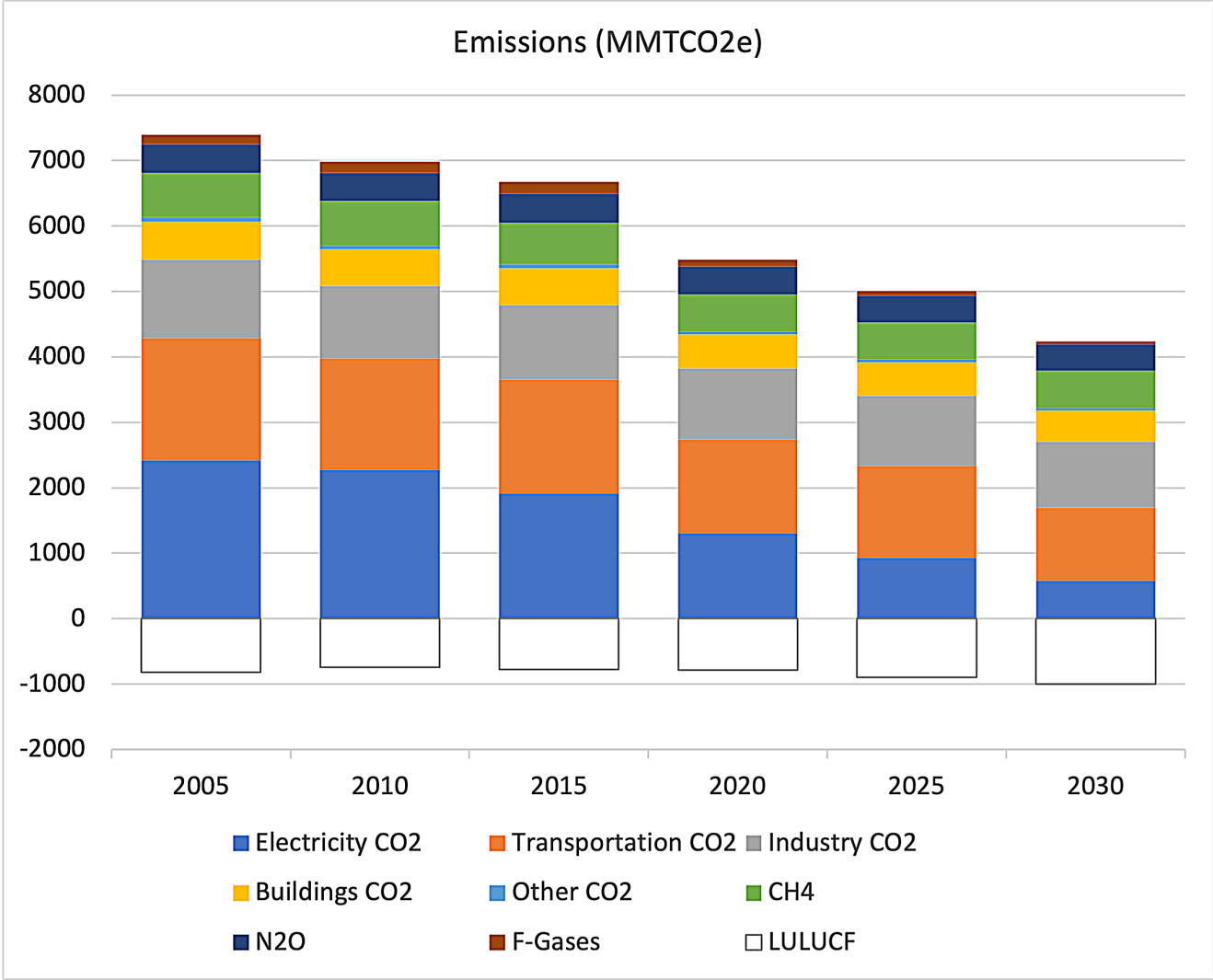

Table 2. Projected U.S. Greenhouse gas emissions by sector and source, 2005-2030 ($MMTCO_2e$)

Sector/GHG	Emissions 2005 ($MMTCO_2e$)	Emissions 2019 ($MMTCO_2e$)	Emissions 2030 ($MMTCO_2e$)	Reduction from 2005 to 2030 ($MMTCO_2e$)	Reduction relative to 2005 (%)	Contribution to economy-wide 51% reduction relative to 2005 (%)
Electricity CO_2	2416	1630	577	-1839	-76%	28%
Transport CO_2	1866	1852	1115	-751	-40%	11%
Industry CO_2	1199	1140	1010	-189	-16%	3%
Buildings CO_2	585	577	478	-107	-18%	2%
Other CO_2	65	72	34	-31	-48%	0%
CH_4	680	660	572	-108	-16%	2%
N_20	432	458	404	-28	-7%	0%
F-Gases	148	185	42	-106	-72%	2%
LULUCF	-815	-789	-1000	-185	23%*	3%
Net GHG Total	6577	5787	3232	-3344	-51%	-51%

Notes: LULUCF: Land Use, Land-Use Change, and Forestry. LULUCF changes from the 2005 level are positive because 2005 emissions and 2030 emissions are both negative. This change represents further reductions in net emissions.

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