# Investing in American Energy: Continued Progress Through Policy

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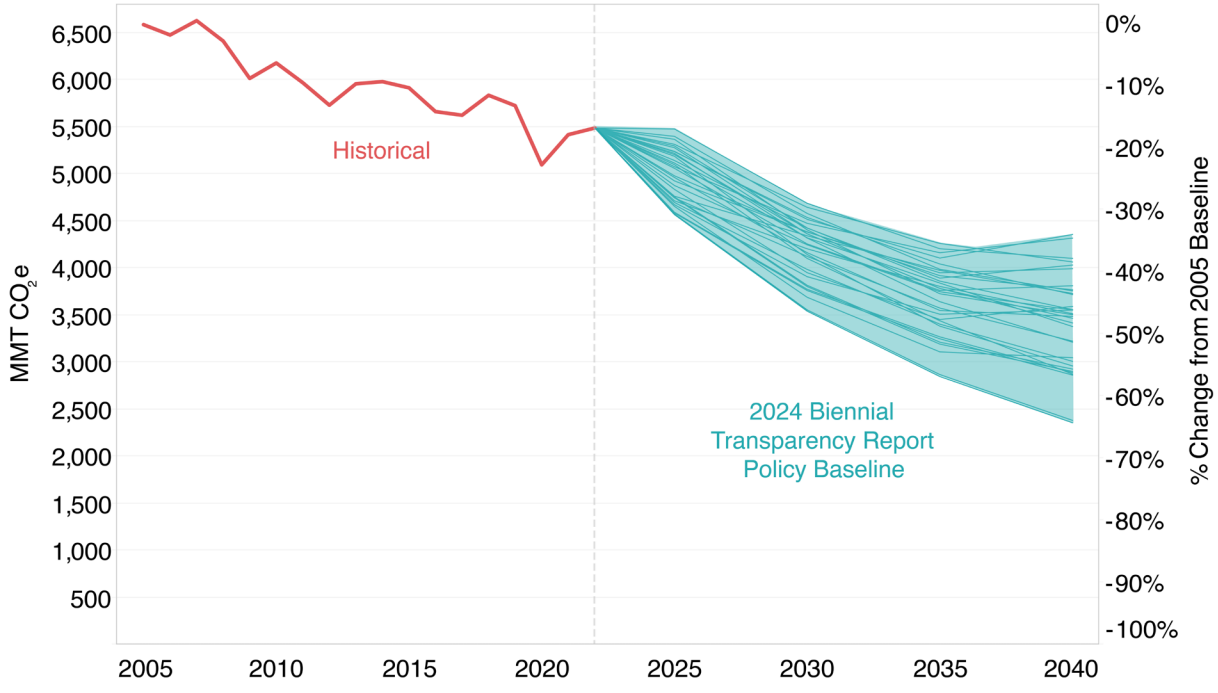
Office of Policy

The Bipartisan Infrastructure Law of 2021 (BIL) and Inflation Reduction Act of 2022 (IRA) together represent historic investments in modernizing the U.S. energy system. These investments have enabled the U.S. to onshore key supply chains, create high quality jobs, and drive energy innovation.[1,2,3] In 2023, the U.S. Department of Energy (DOE) released the Investing in American Energy report – its first comprehensive assessment of the economy-wide impacts of BIL and IRA – which showed that these two laws were projected to reduce net greenhouse gas (GHG) emissions by 35 - 41% in 2030 relative to 2005 levels.[4] This is nearly double the emissions reductions projected before the passage of these laws and represents significant progress toward U.S. goals to reduce GHG emissions by 50 - 52% below 2005 levels by 2030, 61 - 66% below 2005 levels by 2035, and achieve net-zero GHG emissions by 2050.[5,6,7]

Since the passage of BIL and IRA, critical additional federal policies and measures have been enacted that are poised to get the United States even closer to its emissions reduction goals. Among these policies are Environmental Protection Agency (EPA) GHG emissions standards for fossil fuel-fired power plants, EPA GHG standards for light-, medium-, and heavy-duty vehicles, updated National Highway Traffic Safety Administration (NHTSA) Corporate Average Fuel Economy (CAFE) standards for cars and light trucks and fuel efficiency standards for heavy duty pickup trucks and vans, and updated DOE efficiency standards for appliances and equipment.[8,9,10,11,12] There have also been several new state policies, including clean electricity standards (CES) in Minnesota and Michigan, clean fuel standards in Washington, and energy storage targets in Maryland.[13,14,15,16,17]

In December 2024, the U.S. submitted its Biennial Transparency Report (BTR) to the United Nations Framework Convention on Climate Change (UNFCCC).[18] **The BTR shows that, with these additional policies, the U.S. is now on a path to reduce net GHG emissions by 29 - 46% in 2030, 36 - 57% in 2035, and 34 - 64% in 2040, relative to 2005 levels.**




**Net Greenhouse Gas Emissions (2005-2040).** Historical values are from the EPA's 2024 Inventory of U.S. Greenhouse Gas Emissions and Sinks. Projected values are from the 2024 BTR, including results from multiple models and sensitivities as described in the BTR.

**This report builds on the 2023 *Investing in American Energy* report with updated modeling that includes the impacts of many of these new federal and state policies on the future of the U.S. energy system**.[i]

To model these impacts, this report uses OP-NEMS, a customized version of the National Energy Modeling System (NEMS).[19] OP-NEMS was one of three energy system models used in the 2024 BTR to inform energy-related $CO_2$ emissions. The current NEMS modeling framework does not include non-$CO_2$ emissions.

This report includes two core scenarios:

1. A new **2024 Policy Baseline**, which represents BIL and IRA, as well as federal and state policies and standards that have been enacted by May 2024. This is the most comprehensive representation of current federal policies in NEMS to date.
2. A new **Enhanced Policy** scenario, which illustrates how extending and enhancing clean energy policies can bring the U.S. even closer to its climate commitments while enabling energy cost savings for American households and businesses.

These two new scenarios are compared to the **2023 Policy Baseline**, which represents BIL, IRA, and other enacted policies as of November 2023. This scenario is based on the 2023 Moderate scenario from last year's report and has been adjusted with updated macroeconomic trends and technology costs to better compare technological and policy changes.

This report also includes three sensitivity scenarios on the 2024 Policy Baseline and one sensitivity scenario on the Enhanced Policy scenario. More information on the scenarios and sensitivities can be found in the technical appendix.[ii]

Changes in macroeconomic conditions impact this year's updated modeling. Projections of power sector technology costs are higher, driven by higher interest rates and supply chain constraints.[20] In addition, investments in domestic supply chains driven by BIL and IRA lead to higher projections of domestic economic activity and energy consumption. In the absence of additional policy, these factors combined would have led to lower levels of clean energy deployment and higher levels of emissions. However, the results of this modeling show that because of additional policy action over 2024, the U.S. remains poised to make significant progress toward meeting its climate commitments. Looking to the future, there are significant additional opportunities for further progress, many of which can be implemented at the state level and through coordination across subnational regions.

## DOE economy-wide analysis shows that current U.S. policies are poised to deliver additional benefits beyond BIL and IRA.

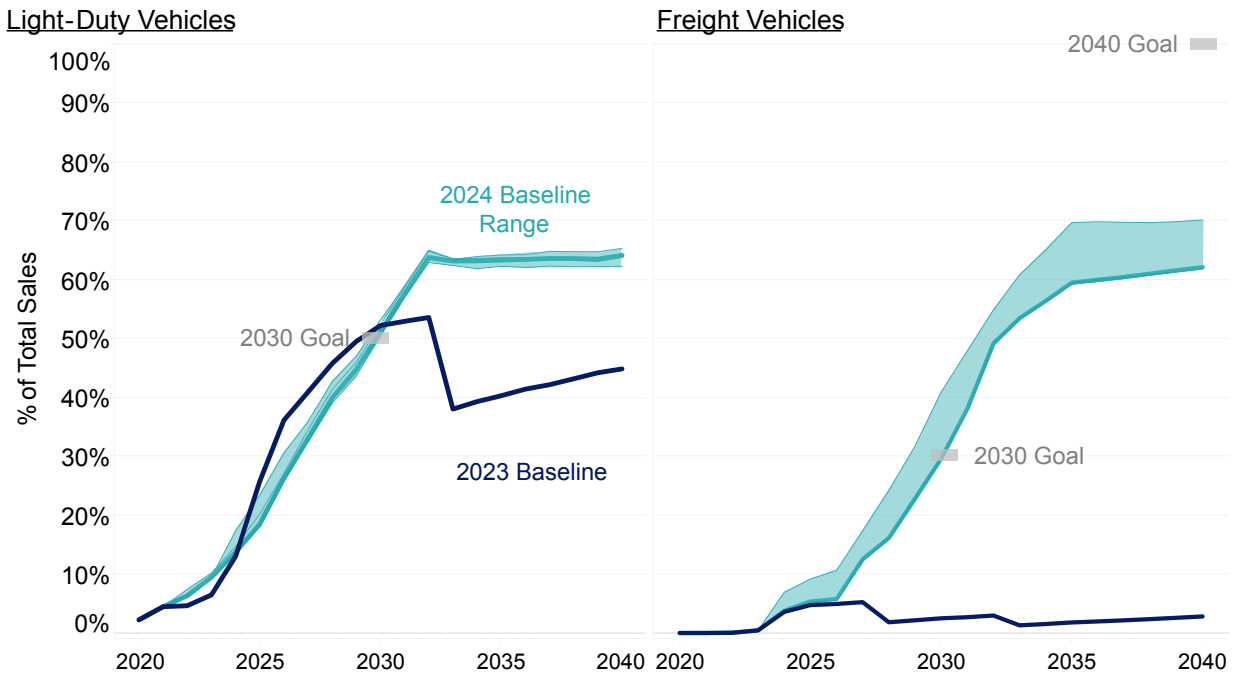
**The U.S. is now on the road to significantly higher and sustained clean vehicle sales in the 2030s, including 33-39x higher clean freight vehicle sales in 2035 compared to last year's projections.** Compared to last year's report, American industries are expanding faster than expected and bringing supply chains back to the United States. DOE's updated analysis reflects higher expected levels of economic activity, which translates to up to 1.5 million more light-duty vehicles sold across all technologies in 2030 compared to last year's projections.[iii] In 2024, the EPA finalized GHG standards for light-duty vehicles (LDV), medium-duty vehicles (MDV), and heavy-duty vehicles (HDV). In addition, NHTSA updated fuel efficiency standards, which outline how far vehicles must be able to travel on a single gallon of fuel. With these additional policies, the zero-emissions LDV sales share is projected to reach 50 - 53% in 2030 and 62 - 64% in 2035 in the 2024 Policy Baseline Range, achieving and maintaining the national target of 50% sales in 2030.[21] By providing longer term policy certainty, these updated standards can lead to a significant, sustained increase in zero-emissions vehicles sales shares from the 2023 Policy Baseline projections, as shown in the figure below. Furthermore, in the 2024 Policy Baseline Range, the share of zero-emissions freight vehicle sales is projected to reach 30 -

[i] This report does not include the impacts of policies on non- $CO_2$ emissions or non-energy $CO_2$ emissions (e.g., process emissions). For example, this report does not include the impact of the EPA New Source Performance Standards for the oil and gas sectors, which are projected to reduce emissions by 130 million metric tons $CO_2$ eq. per year starting in 2029.

[ii] Technical appendix

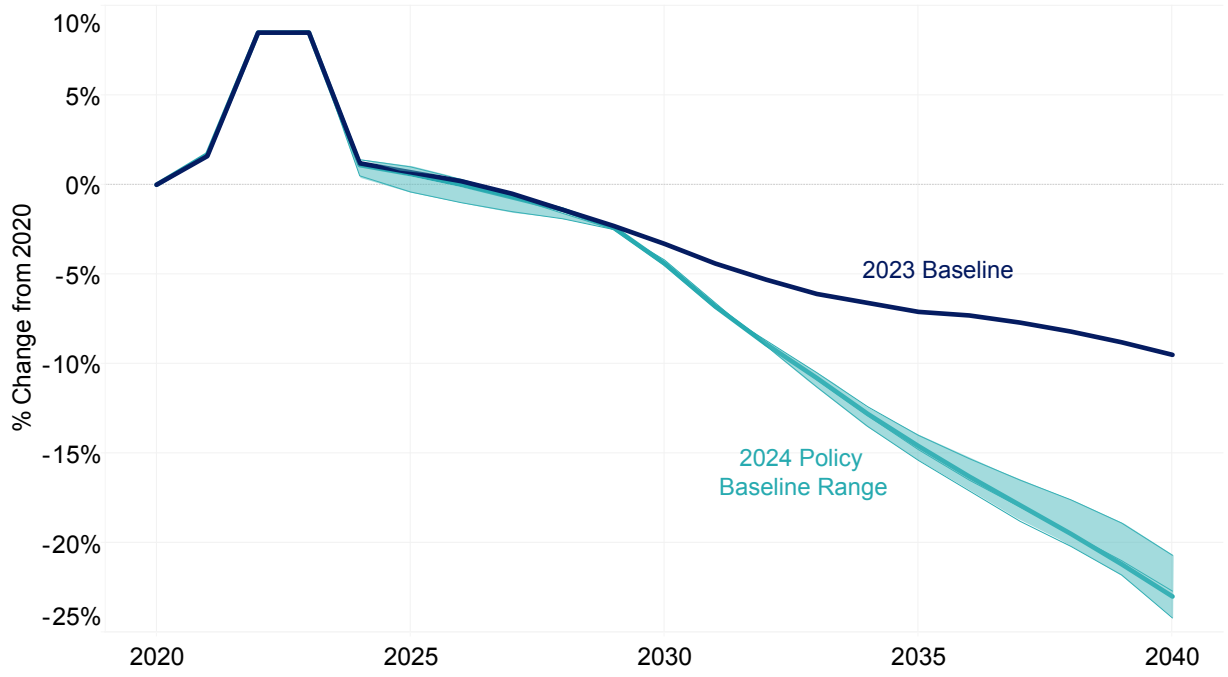
[iii] The exception to this is a sensitivity case with low oil and gas supply (high oil and gas costs), which dampen vehicle sales.

41% in 2030 and 59 - 70% in 2035, making significant progress toward the U.S. commitment to a global target of 100% zero-emissions truck and bus sales by 2040 with an interim goal of 30% of sales by 2030.[22]




**Market Share of Zero-Emission Vehicles in Light-Duty and Freight Sectors (2020-2040).** Light-duty vehicle sales include cars and light trucks. Freight vehicle sales include light-medium-duty (Class 3), medium-duty (Class 4-6), and heavy-duty (Class 7-8) trucks. Zero-emissions vehicles include electric vehicles, plug-in hybrid vehicles, and fuel cell vehicles. The 2024 Policy Baseline Range represents the moderate scenario and three sensitivity scenarios.

**New appliance standards are poised to save energy, lower bills, and increase comfort in American households.** In the 2024 Policy Baseline Range, energy intensity in residential buildings is projected to decline 16 - 18% overall between 2020 and 2035. Additionally, total energy used for heating is projected to drop by 14 - 15% over the same period, compared to about 7% in last year's 2023 Policy Baseline, due to higher deployment of efficient electric heat pumps and water heaters. These declines are supported by the adoption of higher efficiency appliances driven by tax credits for energy efficiency improvements in residential buildings. The adoption of more efficient heaters is supported even after the credit expires by updated DOE appliance standards, which improve performance in energy-intensive appliances such as furnaces, boilers, water heaters, and refrigerators. Collectively, these measures support the U.S. contribution to the global commitment to double the rate of efficiency improvements through 2030.[23]

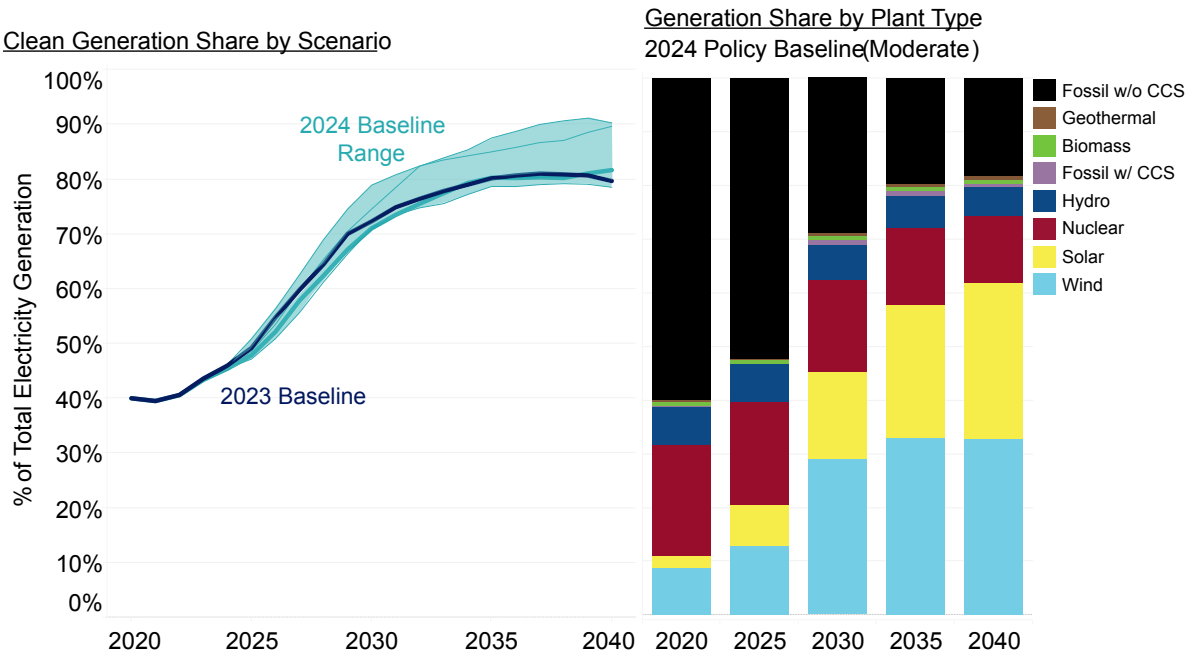



**Change in Energy Demand for Residential Heating (2020-2040).** Residential heating demand includes energy demand for space heating and water heating. The 2024 Policy Baseline Range represents the moderate scenario and three sensitivity scenarios.

**The share of clean electricity generation is poised to increase significantly.** Clean generation[iv] is projected to reach 71 - 79% in 2030 and 79 - 88% in 2035, compared to about 40% today. This doubling of the share of clean electricity generation is led by growth in wind and solar electricity generation, which are expected to grow about 5x and 14x between 2020 and 2035, respectively. These shifts in the power sector persist from the previous report, enabled through the combination of clean electricity incentives provided in the BIL and IRA, as well as EPA GHG standards for fossil fuel-fired power plants. This is despite higher technology cost assumptions due in part to higher interest rates and supply chain costs. In this updated analysis, total projected electricity load in 2030 changes from about 4,530 TWh in the 2023 Policy Baseline, to 4,420 – 4,790 TWh in the 2024 Policy Baseline Range. Electricity load in 2035 is projected to increase from 4,800 TWh in the 2023 Policy Baseline to 4,830 – 5,360 TWh in the 2024 Policy Baseline Range. Note, however, that these projections do not explicitly include the potential additional load growth from increased data center demand which recent analysis shows could grow rapidly in the next few years.[v,24]

[iv] Clean generation includes electricity generation from wind, solar, nuclear, hydro, biomass, geothermal, and fossil fuels with carbon capture and sequestration (CCS)

[v] Data centers are represented in the commercial buildings sector in OP-NEMS, as described in the following documentation from the U.S. Energy Information Administration: Commercial Demand Module of the National Energy Modeling System: Model Documentation 2022

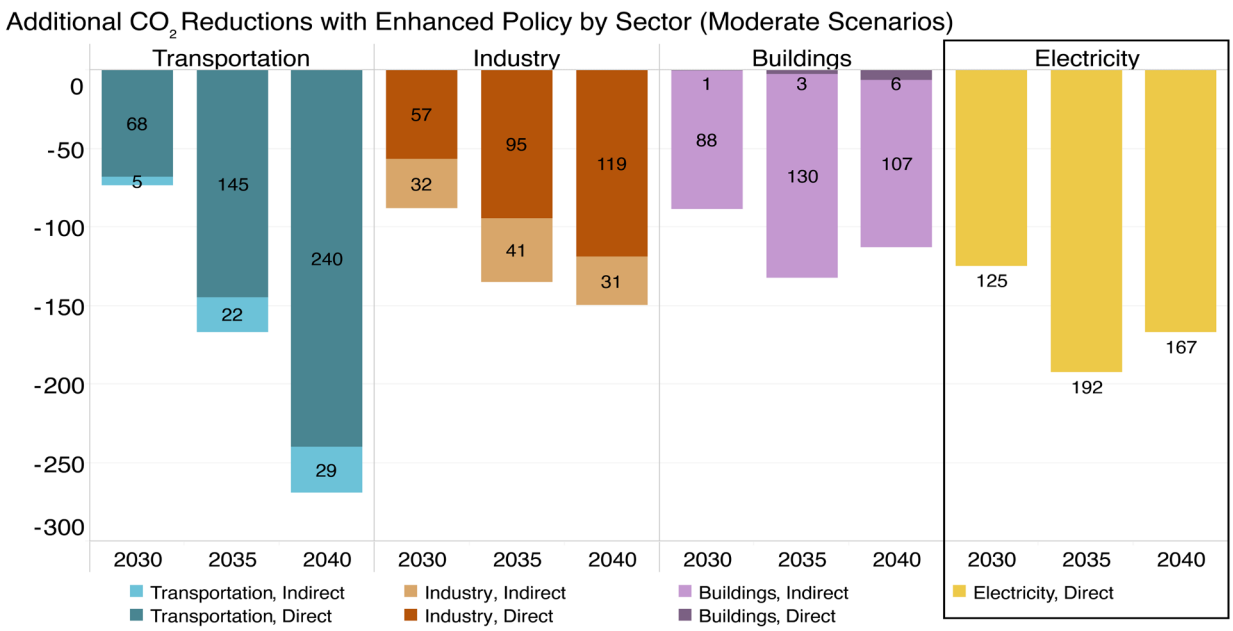



**Electricity Generation Share by Plant Type (2020-2040)**. Solar includes utility-scale solar thermal and photovoltaic technologies. Wind includes offshore wind and land-based wind. Hydro includes conventional hydropower. Nuclear includes light water reactors and small modular reactors. Biomass includes municipal waste and wood and biomass. Fossil with CCS includes coal plants and gas combined cycle plants with sequestration (95% capture). Fossil without CCS includes combined cycle plants without sequestration, distributed natural gas fuel cells, oil and natural gas steam, and combustion turbines. Storage is not included in this figure. Clean generation includes all plant types except fossil without CCS.

**Energy-related $CO_2$ emissions in the industrial sector are projected to decline 28 - 38% below 2005 levels in 2030 and 28 - 41% below 2005 levels in 2035.** According to DOE analysis, BIL and IRA have driven over $500 billion in investments in domestic energy supply chains, resulting in hundreds of new or expanded manufacturing facilities.[1] This increased economic activity, reflected in modeling results as increased shipments from the industrial sector, leads to higher industrial energy consumption compared to last year's report. Even with increases in energy consumption, significant emissions reductions still occur in the industrial sector, largely driven by reductions in electricity emissions. This underscores how measures that increase clean electricity generation enable economy-wide decarbonization.

## New policies can unlock additional benefits and further progress toward U.S. climate commitments.

In addition to policies currently in place, the United States has an opportunity to expand American leadership and ambition at all levels of government and across regions. Between now and 2040, there are policy measures in all sectors of the economy that can lead to significant additional GHG emissions reductions. The Enhanced Policy scenario aims to capture part of this potential by projecting the impacts of extending and enhancing clean energy policies. Results of the Enhanced Policy scenario suggest that U.S. $CO_2$ emissions can decline an additional 251-461 MMT $CO_2$ in 2030, 435-657 MMT $CO_2$ in 2035, and 532-750 MMT $CO_2$ in 2040, relative to the 2024 Policy Baseline. Note that this scenario also only includes policies that target energy-related $CO_2$ emissions, as the OP-NEMS modeling framework only represents $CO_2$ from the U.S. energy system.




**Additional $CO_2$ Emissions Reductions with Enhanced Policies, by Sector (2030-2040).** Additional emissions reductions represent the difference in energy-related $CO_2$ emissions between the Enhanced Policy Scenario and the 2024 Policy Baseline Scenario. Direct emissions (shown in darker shades) include emissions from fossil fuel combustion that occurs in each sector, and indirect emissions (shown in lighter shades) come from the production of purchased electricity. Indirect emissions for each end-use sector (transportation, industry, and buildings) sum to the total direct emissions in the electricity sector.

The highest potential for near-term additional emissions reduction is in the power sector, where emissions could decrease by an additional 125 MMT $CO_2$ beyond projections assuming current policy in 2030.[vi] There is significant direct emissions reduction potential with enhanced policies in the transportation and industrial sectors, particularly in the 2030s. In 2022, over 70% of electricity sales went to the buildings. Projections suggest that this share will remain high through 2040, indicating that additional gains in buildings efficiency can impact electricity emissions as well.

Examples of federal policy measures modeled in the power sector include extensions of CCS and clean electricity tax credits, enhanced GHG standards for power plants, and additional support for nuclear energy production. With these measures, clean generation could reach up to 91% in 2035, compared to up to 88% based on the 2024 Policy Baseline Range. These policies could further be adapted for the state level to meet ambitious renewable portfolio standards (RPS) and clean electricity standards (CES), which would lead to even greater emissions reductions than modeled in this analysis. As of December 2023, 28 states and the District of Columbia had an RPS and 11 states had a CES in place.[25]

In the transportation sector, potential federal level measures include extended incentives for clean vehicles sales and manufacturing, continued incentives for charging infrastructure, as well as enhanced fuel economy and GHG standards. There are also significant opportunities at the state level, including wider adoption of the Advanced Clean Truck rule, enhanced low-carbon fuel standards, and funding for transportation options such as public transit and biking that could provide more convenient and efficient alternatives to driving. With these additional actions, zero-emission light-duty sales could reach up to 92% in 2035, compared to up to 64% based on the 2024 Policy Baseline Range.

In the industrial sector, potential measures at all levels of government include extensions of incentives for technologies like CCS and clean hydrogen. Additional funding targeted at lowering upfront capital costs could support manufacturers in making the switch from gas-fired to electrified boilers. Tradeable emissions standards could also be

[vi] 125 MMT CO2 represents roughly 2% of net GHG emissions in 2005.

designed to further electrification, fuel switching to low-carbon fuels and feedstocks, and industrial decarbonization. Implementing these measures could result in up to 50% reductions in emissions in 2035 relative to 2005, compared to up to 41% based on current policies.

In the buildings sector, for non-electric energy consumption, potential measures at the federal level include the extension of energy efficiency tax credits and funding to incentivize American households to switch to energy-saving appliances. At the state and local level, the adoption of building performance standards can increase efficiency and energy cost savings. With these enhanced policies, residential energy intensity could decline up to 19% between 2020 and 2035, representing additional progress on savings currently projected. Enhancing policies at the state-level, such as rebate programs targeting appliances and weatherization, can further cost savings and emissions reductions.

Updated modeling shows benefits beyond emissions reductions, including significant reductions in energy costs for American households and businesses. Relative to last year's report, policies implemented since BIL and IRA are poised to save American households and businesses an additional $12 billion annually by 2035.[vii] On top of those savings, modeled policies in the Enhanced Policy scenario can drive further savings of more than $16 billion annually by 2035.[viii]

Additional policies at the nexus of economic sectors can amplify benefits from measures targeted at specific sectors. For example, transit-oriented development can increase convenience and reduce reliance on personal vehicles, and zoning reforms can reduce buildings and emissions footprints for American households while also supporting housing affordability.[26] These measures, as well as policies that target non-energy and non-$CO_2$ processes, are not modeled in the Enhanced Policy scenario but can contribute to even greater economic and climate benefits for American families.

## Current and potential future policies set the stage for the U.S. to meet its climate targets.

Since 2021, the United States has made several commitments to leading a just transition to a clean energy economy and tackling the climate challenge by setting a series of ambitious targets, including: [5,6,7,22, 21,27]

1. Reducing GHG emissions by 50 - 52% below 2005 levels in 2030
2. Reducing GHG emissions by 61 - 66% below 2005 levels in 2035
3. Achieving net-zero emissions by 2050 [7]
4. Reaching 100% carbon pollution-free electricity by 2035
5. Reaching 50% zero-emission light-duty vehicle sales by 2030
6. Enabling 100% zero-emission medium-duty and heavy-duty vehicle sales by 2040, with an interim goal of 30% zero-emission vehicle sales by 2030
7. Delivering 40% of the benefits from federal climate and energy investments to disadvantaged communities

Achieving these targets will require continued and enhanced economy-wide actions funded by public and private investments. With the passage of BIL and IRA, as well as the policies implemented since, the federal government has taken a leading role in supporting the clean energy economy over the past four years. There are only six years left for the U.S. to meet its 2030 U.S. GHG emissions target. Doing so will reap enormous economic and environmental benefits but will require leadership at all levels of government.

[vii] This is based on a comparison of electricity expenditures for residential and commercial consumers in the 2024 Policy Baseline (Moderate Scenario) to the 2023 Policy Baseline.

[viii] This is based on a comparison of electricity expenditures for residential and commercial consumers in the 2024 Enhanced Policy Scenario to the 2024 Policy Baseline (Moderate)

# Endnotes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