ACHIEVING THE UNITED STATES' INTENDED NATIONALLY DETERMINED CONTRIBUTION

CENTER FOR CLIMATE AND ENERGY SOLUTIONS

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More than 180 nations representing more than 95 percent of global greenhouse gas emissions offered "intended nationally determined contributions" (INDCs) to the Paris Agreement reached in December 2015. The United States' INDC is an economy-wide target to reduce net greenhouse gas emissions 26 to 28 percent below 2005 levels by 2025. Available analyses suggest that the United States could reduce emissions by more than 22 percent with policies either already in place or soon anticipated. Options for achieving further reductions to meet the 2025 target may include additional policies, technological advances, and stronger action by cities and companies. Concerted efforts across multiple fronts could reasonably produce the reductions needed to meet the goal. Specifically, this paper looks at the progress that has been achieved since 2005, the effect existing and proposed policies will have by 2025 as well plausible steps to fill the gap.

WHAT'S HAPPENED SINCE 2005

As noted, the United States' INDC is set relative to a "base year" of 2005. As of the end of 2014, the latest year for which complete data are available, U.S. net emissions were around 9 percent below 2005 levels (see Figure 1).[1] A number of factors, both market- and policy-related, contributed to this decline. Electric power sector emissions fell 15 percent as a result of a shift from coal to natural gas, increased use of renewable energy, and a leveling of electricity demand.[2] Improved vehicle efficiency helped reduce transportation-related emissions by 8 percent, and the continued shift to a more service-oriented economy helped reduce industrial emissions by 5 percent.[3]

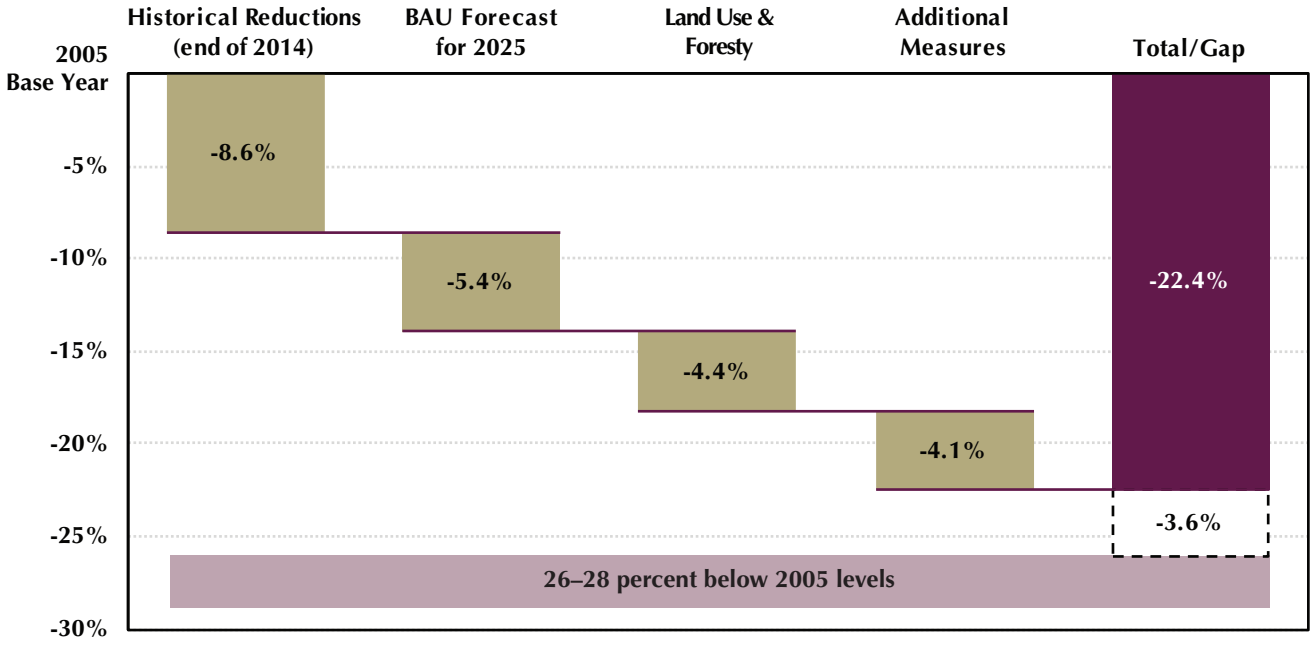
BUSINESS-AS-USUAL EMISSIONS FORECAST FOR 2025

Looking forward, our business-as-usual (BAU) forecast drawn from a number of analyses, and taking into account policies currently in place, projects an additional 5.4 percent reduction in net emissions by 2025 (Table 1).

Driven by factors including the Environmental Protection Agency's (EPA) Clean Power Plan and the extension of federal tax credits for wind and solar power, electric power sector emissions are expected to decline 18 percent from 2014 levels by 2025.[4] Additionally, new greenhouse gas standards for vehicles will reduce emissions from transportation. However, industrial activity is expected to grow—fueled by low prices for energy, particularly natural gas and natural gas liquids.[5] Across all economic sectors, the Energy Information Administration's (EIA) business-as-usual forecast, which assumes no policies beyond those currently in place, projects that energy-related carbon dioxide emissions will decrease 5.4 percent from 2014 levels by 2025.[6]

The EPA projects that non-CO_2 greenhouse gas emissions–methane, nitrous oxide, and fluorinated gases (hydrofluorocarbons (HFCs), perfluorocarbons and sulfur hexafluoride)—will increase around 7 percent from 2014 levels by 2025.[7] The primary driver for this growth is continued demand for HFCs, which are substitutes for ozone-depleting substances phased out under the Montreal Protocol, and are used in refrigeration, air conditioning, building insulation, and as firefighting agents.

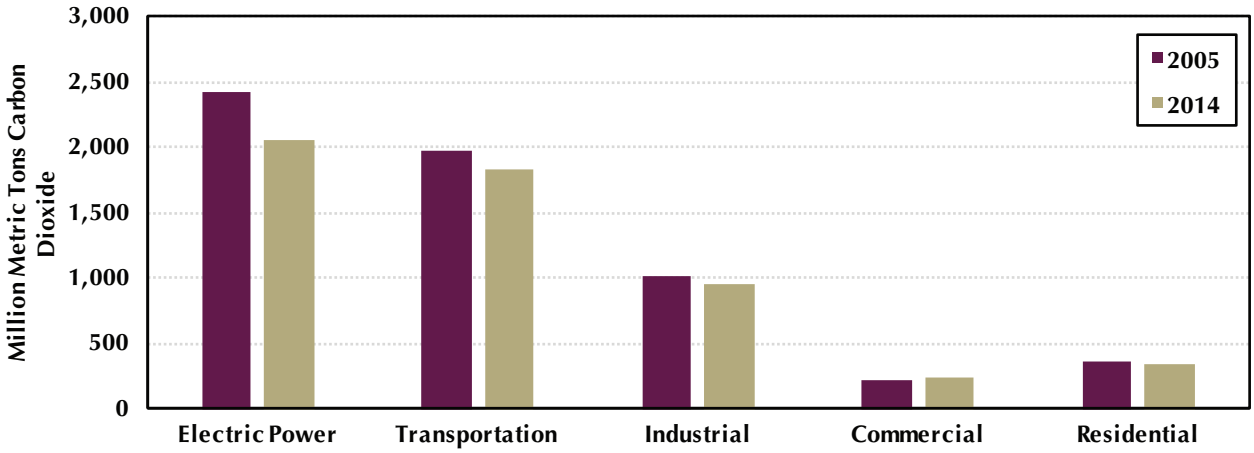
FIGURE 1: Progress Toward the U.S. Climate Goal for 2025



The U.S. goal under the Paris Agreement is a net reduction of greenhouse gas emissions of 26 to 28 percent below 2005 levels by 2025. The top line in this figure represents net U.S. emissions in 2005. From left to right, the bars represent emission reductions through 2014, projected reductions by 2025 under a business-as-usual (no new policies) scenario, potential reductions from the land use, land-use change and forestry (LULUCF) sector, and additional measures under the Climate Action Plan. In total, these would reduce emissions 22.4 percent from 2005 levels, leaving a "gap" of 3.6 percent.

Sources: EPA, EIA, State Department (2016)

FIGURE 2: Change in Emissions by Sector, 2005 and 2014



Source: EIA (2015)

Methane and nitrous oxide emissions are also expected to grow.

Carbon sinks like forests, soils, grasslands, and bodies of water absorb carbon dioxide from the atmosphere, thereby offsetting some portion of total greenhouse gas emissions. By conservative estimates, the U.S. carbon sink will increase slightly, mainly through net increases of forests (due to natural growth and government incentives), removing an additional 26 $MMtCO_2e$ from net U.S. emissions in 2025.[8] Additionally, voluntary, incentive-based programs announced by the U.S. Department of Agriculture (USDA) in April 2015 are expected to increase the carbon sink by more than 120 $MMtCO_2e$ by 2025.[9]

In total, under our business-as-usual scenario with a conservative estimate of carbon sink growth, net U.S. emissions are projected to be 5.4 percent below 2014 levels—or 14 percent below 2005 levels—in 2025.

LAND USE AND FORESTRY

In its latest *Greenhouse Gas Inventory*, the United States reported that in 2014 the U.S. carbon sink offset 11 percent of gross U.S. emissions; 88 percent of the carbon sequestration was from net additions to forest biomass.[10]

Over the past two years, improved data and modeling by EPA, USDA and the National Oceanographic and Atmospheric Administration (NOAA) have resulted in significantly higher estimates of future carbon sequestration. The government's new "Optimistic Carbon Sink" scenario projects an additional 293 $MMtCO_2e$ of carbon sequestration in 2025.[11] The changes include a new Forest Carbon Accounting Framework, accounting for carbon stock changes in soils on federal grasslands, and improved estimates of land cover changes. However, conditions such as high population growth, leading to increased housing starts and forest conversion, could limit sequestration gains.

Adding the optimistic carbon sink scenario to the business-as-usual scenario described above results in a projected net emissions reduction of 18.4 percent below 2005 levels in 2025 (Figure 1).

ADDITIONAL MEASURES

During the balance of 2016, the administration expects to finalize additional measures in the Climate Action Plan that, in aggregate, could reduce emissions an additional 4.1 percent by 2025. Key measures, summarized in Table 2, include:

- More stringent fuel economy standards for medium- and heavy-duty trucks, finalized in August 2016, could reduce emissions around 0.5 percent in 2025 with more significant reductions later, according to several projections.[12, 13]
- Policies, initially proposed in 2014, to reduce methane emissions in the oil and gas sector and from landfills and coal mines could reduce emissions 2 percent by 2025.[14, 15, 16, 17, 18]
- Measures to reduce HFCs through EPA's Significant New Alternatives Policy (SNAP) program, and to leverage federal government purchasing power to promote cleaner alternatives, could reduce emissions 1.7 percent by 2025.[19, 20]

These additional measures, combined with the business-as-usual and optimistic carbon sink scenarios described above, are expected to reduce U.S. emissions

TABLE 1: COMPONENTS OF THE BUSINESS-AS-USUAL (BAU) FORECAST FOR 2025

EMISSION CATEGORIES	EFFECT IN 2025 (MMTCO2E)	% CHANGE*
EIA forecast for energy-related CO_2 emissions (2014–2025)**	-293	-4.4%
EPA forecast for non-CO_2 GHGs (2014–2025)	+79	+1.2%
Projected change in carbon sink	-146	-2.2%
Total	-360	-5.4%

Note that net emissions are equal to total greenhouse gas emissions (carbon dioxide, methane, and nitrous oxide, and fluorinated gases) minus withdrawals to carbon sinks.
*Based on 2005 base year net emissions as reported in the Inventory of *U.S. Greenhouse Gas Emissions and Sinks, 1990 - 2013* (EPA, 2015).

** Includes the EPA's Clean Power Plan and Congressional tax credits for wind and solar.

Sources: EPA, EIA, State Department (2015)

TABLE 2: Additional Measures in the Climate Action Plan

POLLUTANT	ADDITIONAL MEASURES
Carbon dioxide	• Full implementation of Phase II heavy-duty vehicle economy standards • Finalization of proposed, new, or updated appliance and efficiency standards • Increased efficiency of new and existing residential and commercial buildings • Reduction in industrial energy demand in several subsectors • Additional state actions in the electricity sector • Enhanced federal programs that lead to greater efficiencies in industry and transportation, including greater biofuel deployment and commercial aviation efficiency
Methane & Nitrous oxide	• Methane emissions reductions from a range of sectors, including landfills, coal mining, agriculture, and oil and gas systems • More efficient nutrient application techniques
Hydrofluorocarbons	• Unilateral reductions using EPA authority through the SNAP program and leveraging federal government purchasing power to promote cleaner alternatives

Source: State Department (2015)

around 22 percent below 2005 levels by 2025.

FILLING THE GAP

These calculations, based on available analyses, suggest a gap of around 240 $MMtCO_2e$ to achieve a 26 to 28 percent reduction in U.S. emissions by 2025. Further steps to fill this gap could include federal policies beyond those already initiated or in place, technological advances that lower the cost of emissions reduction, and stronger efforts by cities and businesses.

Current policies may produce greater emission reductions than projected. For instance, increased clean and renewable energy production (spurred by the Clean Power Plan and tax credit extensions for wind and solar) could drive meaningful cost reductions, leading to higher deployments and lower emissions than currently forecast.

Among the additional policy options at the federal level, comprehensive carbon-pricing legislation would be the most cost-effective means of driving further emission reductions, but congressional action cannot be counted on in time to significantly affect the emissions trajectory for 2025. However, additional measures could be taken under existing statutes. For instance, EPA could set greenhouse gas standards for major industrial sectors under section 111(d) of the Clean Air Act, the same section that underlies the Clean Power Plan. Some legal scholars contend that the recent Paris Agreement provides EPA a basis to invoke much broader authority to reduce emissions under section 115 of the Act.[21]

Technological advances could help fill the gap by lowering the cost of cleaner energy sources or energy efficiency improvements, or by opening other options for reducing emissions. Examples include:

- Over the next five to 10 years, battery storage technologies are expected to improve by a factor of 10 and transform the U.S. electric power grid.[22] Integrated in the right way, storage technology could reduce emissions from fossil-fuel "peaker" plants and support the integration of greater quantities of intermittent renewable generation.
- A promising design for a natural gas power plant with nearly 100 percent carbon capture will enter the demonstration phase next year and could be commercialized soon after.[23]
- Agricultural advances are leading to the develop-

TABLE 3: Key City Actions

POLICY	EXAMPLES
Benchmarking building energy consumption with an aim to achieving greater efficiency: In the United States, residential and commercial buildings account for 41 percent of total energy consumption, and 40 percent of carbon dioxide emissions.[25]	In 2011, the city of Philadelphia began benchmarking its buildings. Through energy reporting and other data collection, the city has already identified buildings with room for improvement in a sector responsible for 60 percent of the city's total emissions.[26]
Innovative financing: Helping cities and their residents and businesses retrofit to more energy-efficient appliances and equipment can reduce energy intensity.	Commercial and residential Property Assessed Clean Energy (PACE) programs provide a mechanism to finance a range of energy efficiency and renewable energy projects across a wide swath of U.S. municipalities.[27]
Improving passenger transport: Compact urban development, expanding public transportation opportunities, and/or improving vehicle efficiency can further reduce emissions.[28]	By expanding use of light rail and other forms of public transport, cities like Miami hope to reduce the number of private vehicles on congested roads.[29] Additionally, cities facilitating technological improvements for electric vehicle infrastructure, e.g. charging stations, would advance the adoption rate of electric vehicles, which would help EPA to set stricter standards in the post-2018 time period.

ment of more sustainable crops with the ability to sequester larger quantities of carbon dioxide in their root systems.[24]

Stronger efforts by municipalities also could help fill the gap. The 100 largest metropolitan regions represent 67 percent of the U.S. population and 75 percent of U.S. GDP. "Business-as-usual" projections rely on computer models that can reflect major policies and broad energy and technology trends, but are not refined enough to accurately capture smaller-scale actions at the local level. Better accounting of local actions now underway might show that, in the aggregate, they are already helping to fill the projected gap. A growing number of cities are actively exploring a wide range of policy approaches that could generate additional reductions by 2025 (Table 3).

Steps taken by businesses beyond regulatory requirements also may produce greater emission reductions than currently projected. More than 150 U.S. companies with a combined market capitalization in excess of $7 trillion joined the American Business Act on Climate Pledge and offered commitments such as reducing their greenhouse gas emissions through approaches as diverse as building renewable power to sustainable materials management or by providing financing for others to do so.[30] More rigorous accounting would be required to demonstrate whether these and other actions by companies produce emission reductions "additional" to those driven by policies and thereby help to fill the gap.

The United States has significantly reduced its greenhouse gas emissions over the past decade, and has put in place policies ensuring continued reductions in the years ahead. Cutting emissions 26 to 28 percent below 2005 levels by 2025 is a challenging goal. Political and economic shifts could compound the challenge or they could deliver unexpected reductions toward the goal. Notably, the EIA forecast in 2005 that energy-related carbon dioxide emissions would increase 16 percent by 2014, when in fact they decreased nearly 10 percent.[31] Many options remain untapped, and concerted efforts across multiple fronts could reasonably produce the necessary reductions.

ENDNOTES

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The Center for Climate and Energy Solutions (C2ES) is an independent nonprofit organization working to promote practical, effective policies and actions to address the twin challenges of energy and climate change.

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