AMERICA'S PLEDGE

Phase 1 Report

States, Cities, and Businesses in the United States Are Stepping Up on Climate Action

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Bloomberg Philanthropies

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Acknowledgments

This report is the product of the America's Pledge project, which is co-chaired by California Governor Edmund G. Brown Jr. and United Nations Secretary-General's Special Envoy for Cities & Climate Change Michael R. Bloomberg. America's Pledge is a new initiative which aims to assess the scope and scale of climate actions being taken by U.S. states, cities, businesses, and other non-federal actors, examine the factors contributing to the low-carbon transition currently underway across the country's most GHG-intensive economic sectors, and identify ways in which further non-federal climate action can help accelerate the U.S. transition to a low-carbon economy.

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Key Takeaways

As part of the Paris Agreement—the unprecedented global consensus among the world's nations to address climate change—the United States made a pledge to reduce its share of greenhouse gas (GHG) emissions. Then, in 2017, the Trump Administration announced its intent to pull the U.S. out of the Paris Agreement and to roll back the Clean Power Plan and many other practical efforts to reduce pollution in our communities, effectively walking away from America's climate pledge to the world.

In response, U.S. non-federal actors (sometimes referred to internationally as "non-state" or "sub-national" actors) such as states, cities, and businesses have emerged as the new face of American leadership on climate change, and are stepping up with commitments to reduce GHG emissions.

How will this affect emissions trends in the U.S. and our ability to deliver on America's pledge under the Paris Agreement? What is the full range of actions being taken across American society, and what more can we do?

California Governor Edmund G. (Jerry) Brown and United Nations Special Envoy for Cities & Climate Change Michael R. Bloomberg launched the America's Pledge initiative to answer these questions. As this **Phase 1** Report demonstrates:

1. Despite federal efforts to roll back policies and programs, climate action is robust and accelerating across an increasing swath of America. States, cities, and businesses constituting more than half of the U.S. economy have mobilized behind the U.S. pledge under the Paris Agreement. If these institutions were a separate country, they would make up the third largest economy in the world, larger than Japan or Germany.

2. An even larger subset of American states, cities, and businesses are taking concrete actions that reduce GHG emissions. They are embracing zero-emission vehicles (ZEVs), building efficiency upgrades, renewable energy generation, and a host of other low-carbon technologies. The potential effect of increasing the reach and ambition of these non-federal climate actions has not been adequately analyzed and taken into account in the Paris Agreement framework.

3. The low-carbon transition is taking off in several key sectors. Cleaner energy and electric transportation are emerging as not just emissions leaders, but cost leaders, as well. The cost of solar power and vehicle batteries have both dropped by about 80 percent since 2010. In August 2017, the Department of Energy announced that its "SunShot" target—to make solar power cost effective with conventional forms of energy—had been met three years early. Similarly, ZEVs are widely anticipated to be less expensive than conventional vehicles in the coming years.

4. Falling clean technology prices, emerging innovations, and actions by states, cities, and businesses have helped reduce U.S. net greenhouse gas emissions by 11.5 percent between 2005 and 2015, while the economy grew by 15 percent over that period. In the U.S., decarbonization and GDP growth can go hand in hand.

5. Given the stated policies of the present U.S. administration, currently committed non-federal efforts are not sufficient to meet the U.S. commitment under the Paris Agreement to reduce emissions 26-28 percent below 2005 levels. Over the next year, the America's Pledge initiative will analyze the potential range of incremental, not yet committed, actions by states, cities, and businesses, and compare that potential against this 26-28 percent short-term goal for 2025. But we cannot underscore strongly enough the critical nature of federal engagement to achieve the deep decarbonization goals the U.S. must undertake after 2025.

Across the U.S., governors, mayors, and business leaders are acting to fill the climate action void created by current federal climate policies. With public support, and effective collaboration strategies, they will drive U.S. climate action forward, from the bottom up. These efforts, however, must accelerate. Adoption of ZEVs, improvements in the energy performance of buildings, increased use of renewable energy and fuels, significant improvements in the carbon intensity of manufacturing, and deep cuts in emissions of greenhouse gases other than carbon dioxide (CO_2) like hydrofluorocarbons (HFCs) and methane must be pursued aggressively. Further action is also needed to restore our forests and agricultural sector to help remove and store carbon from the atmosphere.

This **Phase 1 Report** maps current non-federal climate policies and actions and identifies promising areas to step up near-term action. Our **Phase 2 Report** will aggregate and quantify the full range of potential U.S. non-federal action, including how these actions affect our ability to reach the U.S. emission target set for the Paris Agreement.

Executive Summary

Context

In December 2015, 195 countries reached an unprecedented consensus on a global policy framework known as the Paris Agreement. The agreement aims to limit global warming to well below 2 degrees Celsius, and perhaps to 1.5 degrees Celsius, which scientists agree represent dangerous thresholds for our planet. Almost all the parties to the agreement set individual national goals or targets for curbing their emissions by 2030 or sooner, known as Nationally Determined Contributions (NDCs). The U.S. pledged to reduce its emissions by 26-28 percent below 2005 levels by 2025. At the same time, actors such as states, tribal nations, cities, businesses, and universities from around the world brought forward thousands of their own commitments and contributions to the fight against climate change.

Strong leadership by the Obama Administration was essential to reaching the Paris deal, and recent actions by the Trump Administration have left people at home and abroad scrambling to understand what this means for U.S. climate leadership and emissions. Achieving the first NDC set by the U.S. was never going to be easy, and non-federal commitments have grown in importance since the 2016 national election.

In the absence of federal leadership, how much progress will the U.S. make towards the pledge it made for the Paris Agreement? And what does American climate leadership look like going forward, especially in the critical period leading up to 2020, when the Paris Agreement calls for deeper emissions cuts and accelerated action?

Progress towards the U.S. pledge in the next few years will largely depend on the ambition and follow through of non-federal actors and on related trends in the overall U.S. economy. While the current administration has created a leadership void, recent decisions by the President have helped galvanize non-federal leaders to step up and fill it. Just three days after Trump announced his decision to withdraw the U.S. from the Paris Agreement, an unprecedented coalition mobilized to take climate action. More than 1,200 U.S. states, tribal nations, cities, companies, and universities declared “We Are Still In,” pledging their support for the objectives of the Paris Agreement. As of the start of October 2017, this network of non-federal U.S. leaders has swelled and now includes more than 2,300 states, tribal nations, counties, cities,

businesses, nonprofits, universities, and colleges. Meanwhile, other coalitions formed before and at the time of the Trump announcement have also been energized to push forward urgently. These efforts constitute a new era of American climate action.

States, tribal nations, cities, businesses, and others must now carry the torch of climate leadership, and it is important that they have a roadmap and the tools at their disposal to do their part to help drive down U.S. emissions.

Scope and Scale of U.S. Non-Federal Action on Climate Change

The role of governors, mayors, and business leaders in shaping the U.S. climate agenda has grown in recent years, albeit in parallel to federal action during the Obama Administration. Building on a long history of cooperative federalism—whereby energy, transportation, and land use decisions are made at the local level—dozens of coalitions have formed to galvanize and support states, tribal nations, cities, and companies to formulate and execute ambitious climate targets. Examples include the Under2 Coalition for states, cities, and regions; the Global Covenant of Mayors for cities; and We Mean Business for companies. In addition, several coalitions have emerged with the explicit goal of supporting the objectives of the Paris Agreement. The U.S. Climate Mayors was established upon adoption of the Agreement in December 2015, and the U.S. Climate Alliance as well as We Are Still In formed in direct response to President Trump's announced intention to withdraw from the Paris Agreement (see Figure ES-1 on page 18).

Put in the context of the United Nations Framework Convention on Climate Change (UNFCCC), the combined Gross Domestic Product (GDP) of U.S. states and cities that have stated they remain committed to action in line with the emissions reductions goals of Paris Agreement would be larger than 195 out of 197 Parties to the Framework Convention—larger than the economies of either Japan or Germany.

Just as important as their publicly stated support for the Paris Agreement are the policies and actions to which states, tribal nations, cities, and businesses have committed, and are already implementing. As of October 1, 2017, a total of 20 U.S. states and 110 U.S. cities have enacted quantified GHG reduction targets (see Figure ES-2 on page 20). Some of these targets (such as those of larger states like California and New York) are as ambitious as the most ambitious NDCs submitted by parties to the Paris Agreement. These targets are an important step, and like country NDCs, it will be important to increase both ambition and follow through to meet the goals of the Paris Agreement. In addition, more than 1,300 businesses with U.S. operations, representing

$25 trillion in market capitalization and accounting for 0.9 gigatons (Gt) carbon dioxide equivalent (CO_2e) of GHG emissions per year have voluntarily adopted GHG targets. Many other states, cities, and businesses have enacted other policies and actions to promote renewable energy, energy efficiency, low-carbon mobility, and other climate actions (see Figure ES-3 on page 22).

Decarbonization of the U.S. Economy

Driven by a variety of factors, including action by states, cities, businesses, and others, economic growth and GHG emissions in the U.S. are decoupling. Between 2005 and 2015, the U.S. economy grew by 15 percent while net GHG emissions declined by 11.5 percent. This decoupling is significant, and key technology and economic trends have the potential to continue to drive decarbonization. However, the transition is far from complete, and the current administration's efforts to undo climate action and remove support for renewable energy will likely slow it. Existing and enhanced mobilization and collaboration by states, tribal nations, cities, businesses, and other non-federal actors are essential to ensure that the American economy continues to decarbonize at an accelerating rate, rather than allowing the low-carbon transition to stall.

The transition towards a low-carbon future is most advanced and pronounced in the *electricity sector*. Shifts in generation from coal to cleaner-burning natural gas and zero-carbon renewable sources like solar and wind have resulted from a complex interaction of factors including:

- the development of low-cost gas drilling technologies;
- state-level renewable energy policies;
- public mobilization against the pollution and health damages imposed by coal-fired power plants;
- decreasing costs of renewables;
- regulatory requirements for environmental controls for coal plants;
- low electricity demand growth;
- retirement of aging coal plants; and
- corporate decisions to procure renewable power through power purchase agreements, green tariffs, or other market mechanisms.

Regulatory innovation and renewable portfolio standards set by states and tribal nations, renewable energy targets set by cities, and renewable energy procurement by corporations have been among many driving forces behind this transition, and such actions have the potential to maintain and even accelerate the pace of change in the years ahead.

The power of this trend is suggested by U.S. investor Warren Buffett, who is shifting his attention to renewable energy investment opportunities. This spring, Buffett told his shareholders "we have a big appetite for wind and solar" but that "if you're tied to coal, then you've got problems."[1]

The *transportation sector* shows early signals of a transformation. Fuel economy standards have made new cars and trucks more efficient and automakers have established ambitious plans for electrification of their future fleets. Ten states have ZEV programs in place to encourage sales of EVs. Recent and projected declines in battery prices should accelerate the adoption of EVs. Coupled with the continued decarbonization of the power sector, transportation electrification has the potential to catalyze further climate progress and tipping points in market trends over the coming years. However, while the stage is being set for a possible transformation of this sector, emissions have been on an upswing in the last few years, due to an increase in total vehicle miles traveled (VMT), and have now surpassed electricity sector emissions as the largest sectoral source of GHGs in the United States.

In *other sectors* of the economy, the transition is just beginning, although there are early signs that indicate growing potential in some areas such as forestry, land use, and methane emissions from oil and natural gas infrastructure. At the same time, the federal administration is considering actions, such as providing increased support for baseload coal plants and imposing tariffs on solar panels, that could slow the transition in key sectors.

Implications for Emissions Pathways; Next Steps for America's Pledge

Under the Paris Agreement, the United States pledged to reduce its economy-wide emissions by 26 to 28 percent below 2005 levels by 2025. While the Obama Administration laid a strong foundation for acting on that commitment, it made clear in its November 2016 report, *United States Mid-Century Strategy for Deep Decarbonization*, that further policy measures at all levels of government would be needed to deliver on America's pledge under the Paris Agreement. For the next three years, that policy leadership will likely not come from the executive branch of the federal government. What does this imply?

A variety of factors will help maintain downward pressure on economy-wide U.S. emissions in the critical 2017-2020 period, including planned state, city, and corporate actions, falling clean technology prices, emerging innovations in technology and business models, the decarbonization trends in the economy described above, and growing public and private sector demand for action from across a wide swath of U.S. society. Yet despite these positive

trends, the need to maintain momentum in the U.S. toward its 2025 and longer-term climate targets calls for non-federal climate leadership to expand and accelerate. Additional policy interventions must be developed quickly through greater ambition and follow-through by non-federal actors like those discussed in this report.

Maintaining momentum will require non-federal leaders to convert existing commitments into action, while also expanding and accelerating action, including taking advantage of a series of opportunities laid out in this report. These include spurring the adoption of EVs through ZEV mandates and EV purchase consortiums, significantly enhancing the performance of our buildings, advancing renewable energy through mandates and incentives, and aggressively phasing out and addressing non-CO_2 pollutants, particularly methane.

Demonstrating that the clean energy economy builds more equitable prosperity and creates jobs will help increase confidence across the political spectrum that climate action is good for the economy, motivate non-federal players to embrace more ambitious interventions, and thereby lay the foundation for future re-engagement by the federal government on climate policy after 2020.

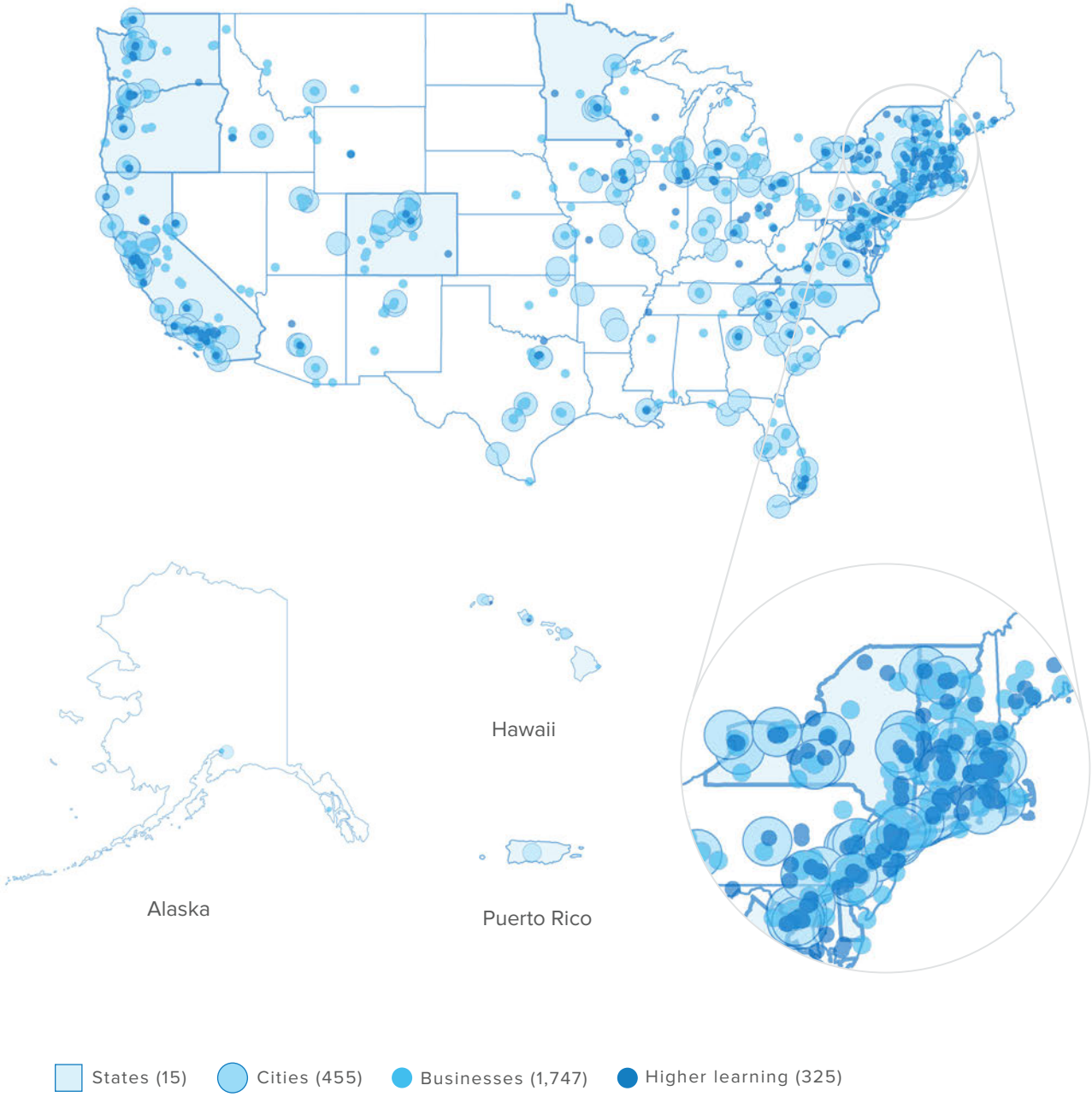
For those seeking a picture of climate action in the U.S. and what it adds up to, this **Phase 1 Report** presents an initial orientation. It is a snapshot of the scope and scale of non-federal action already underway. It also examines trends affecting the low-carbon transformation of the U.S. economy and discusses the potential for the market dynamics that have been key to reducing emissions over the last decade to continue.

Going forward, the America's Pledge project will aggregate and quantify non-federal commitments and project how these and other factors are likely to shape the future of U.S. GHG emissions outcomes. This research, which will be compiled in a **Phase 2 Report** to be published in 2018, will provide roadmaps and recommendations which non-federal leaders can use to craft policies, take actions, measure performance, and report on progress.

For now, our key takeaway is this: a powerful community of U.S. governors, mayors, business leaders, university presidents, and other influential non-federal leaders stand behind the Paris Agreement and in solidarity with other countries, not just in principle but in action and commitments. Non-federal climate action, together with existing market trends, can help the U.S. continue to make progress on our pledge under the Paris Agreement, thus transitioning the U.S. and global economy to a low-carbon future.

FIGURE ES-1A

Networks Supporting the Paris Agreement Across the United States



Note: Information represented on the map was based on available data as of October 1, 2017.
The coalitions represented are dynamic and the data will change over time.

FIGURE ES-1B

Gross Domestic Product of Largest Countries and of U.S. States and Cities Supporting the Paris Agreement

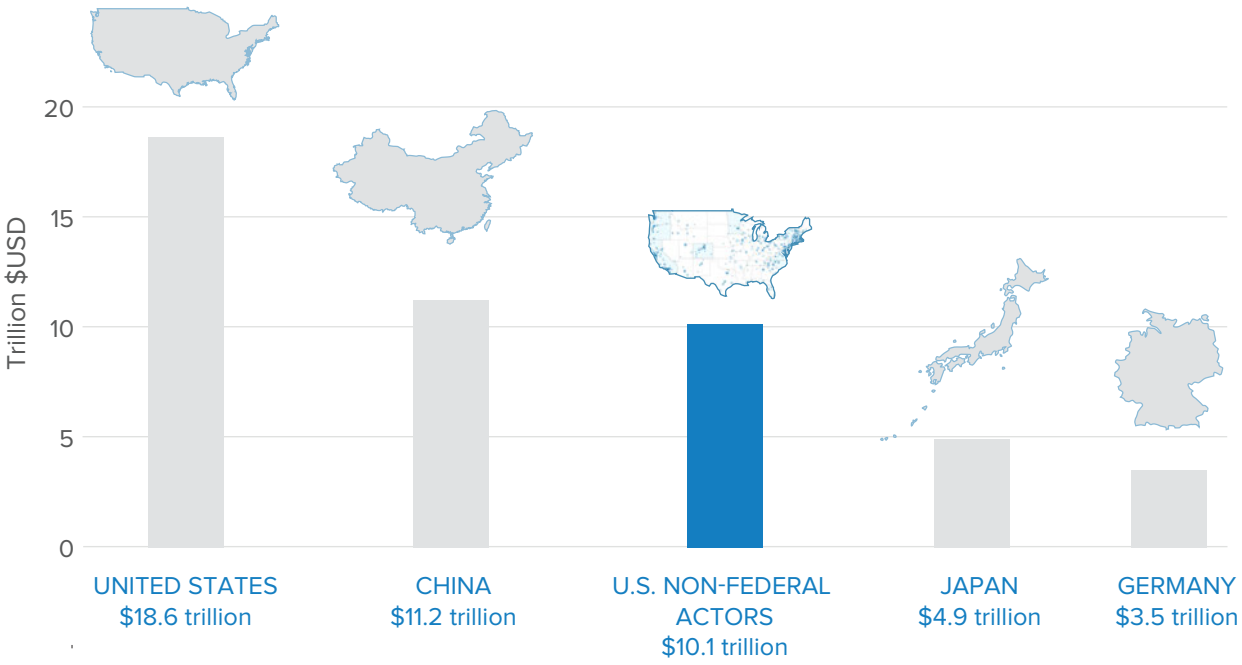


FIGURE ES-1C

Population, Gross Domestic Product, and Emissions of States and Cities Supporting the Paris Agreement Compared to U.S. Totals

FIGURE ES-2A

Number of States, Cities, and Businesses with GHG Reduction Targets

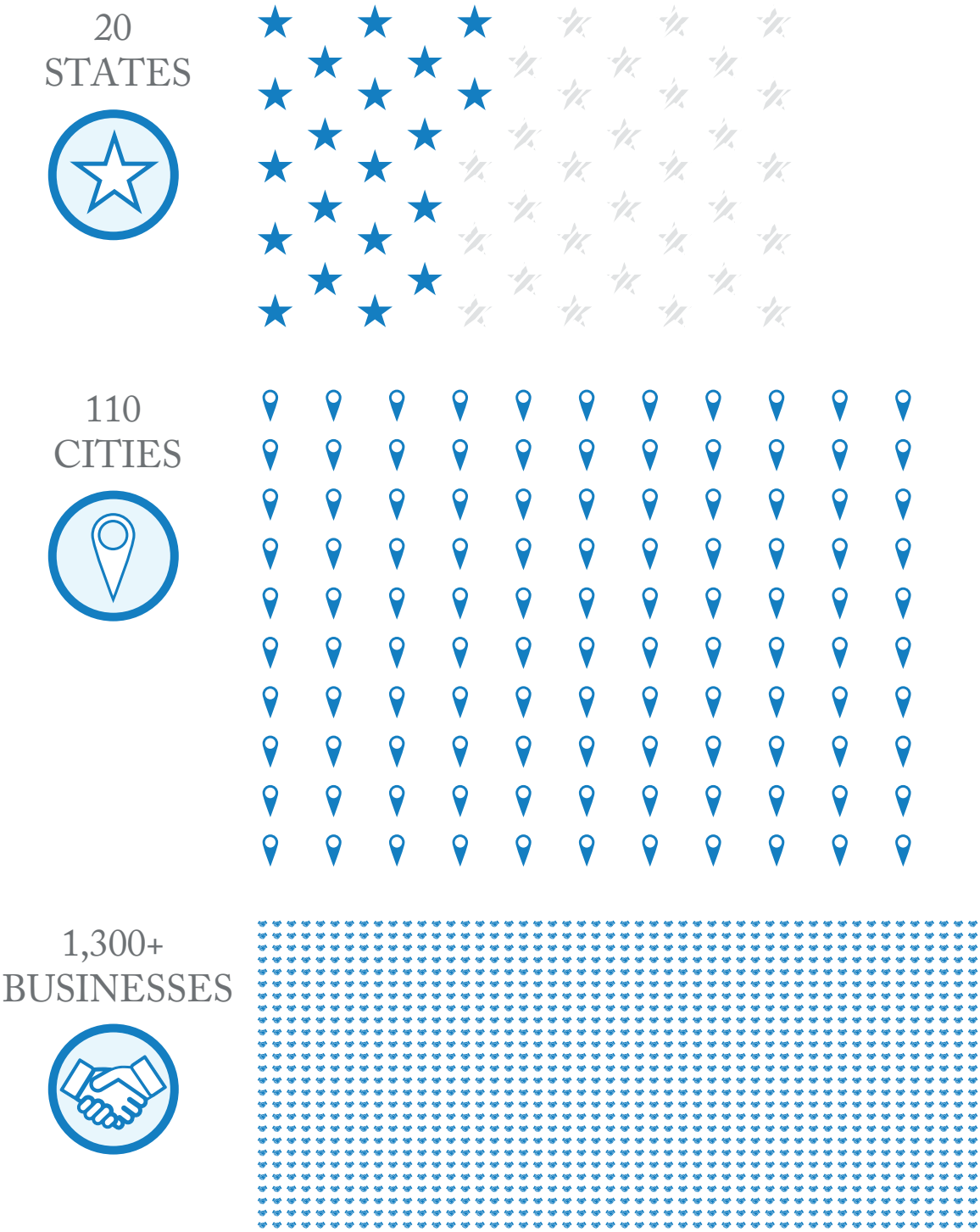


FIGURE ES-2B

Emissions of Largest Countries and of U.S. States and Cities with Existing Greenhouse Gas Targets

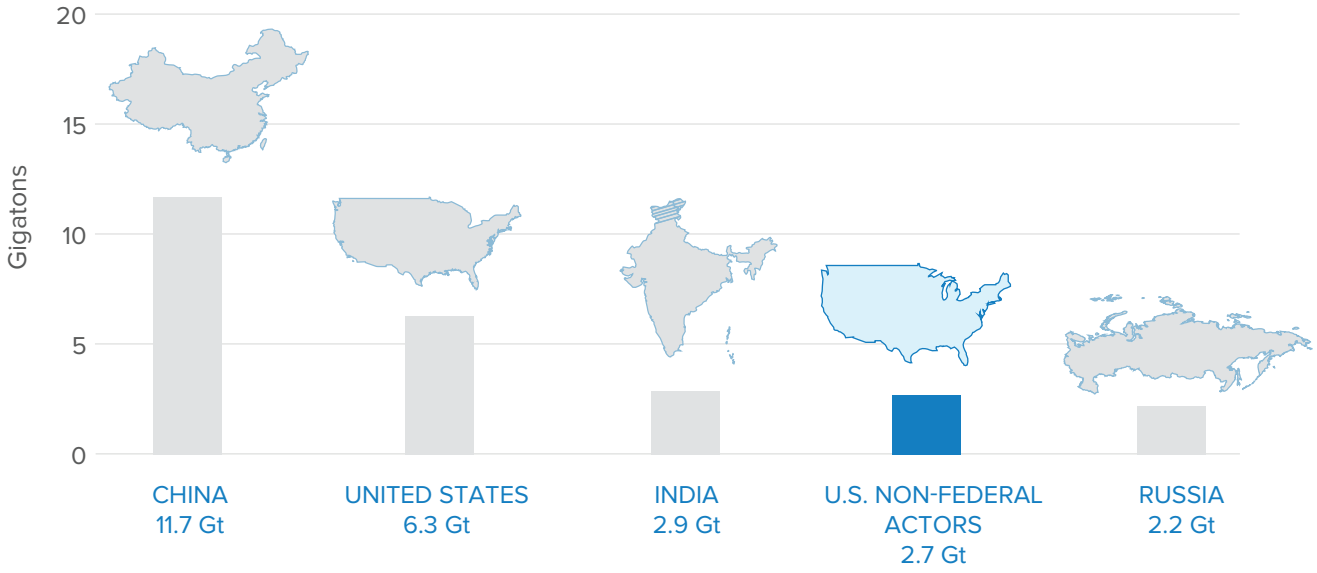


FIGURE ES-2C

Population, Gross Domestic Product, and Emissions of States and Cities with Existing Greenhouse Gas Targets Compared to U.S. Totals

POPULATION (2016)
182 Million
56% of all Americans

GROSS DOMESTIC PRODUCT (2016)
$11.2 Trillion
60% of total U.S. GDP

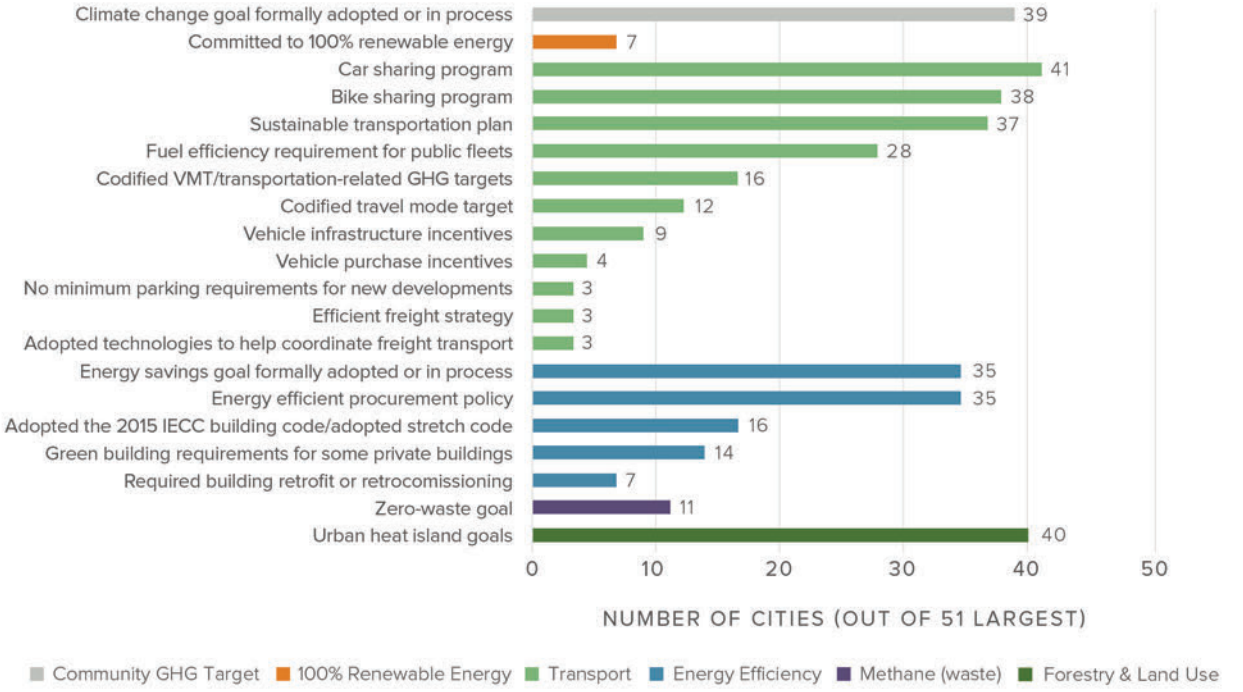
GHG EMISSIONS (2016)
2.7 GT
40% of U.S. GHG Emissions

FIGURE ES-3
Examples of Climate-Friendly Policies Adopted by U.S. States, Cities, and Businesses to Address Major Emissions Sources

States

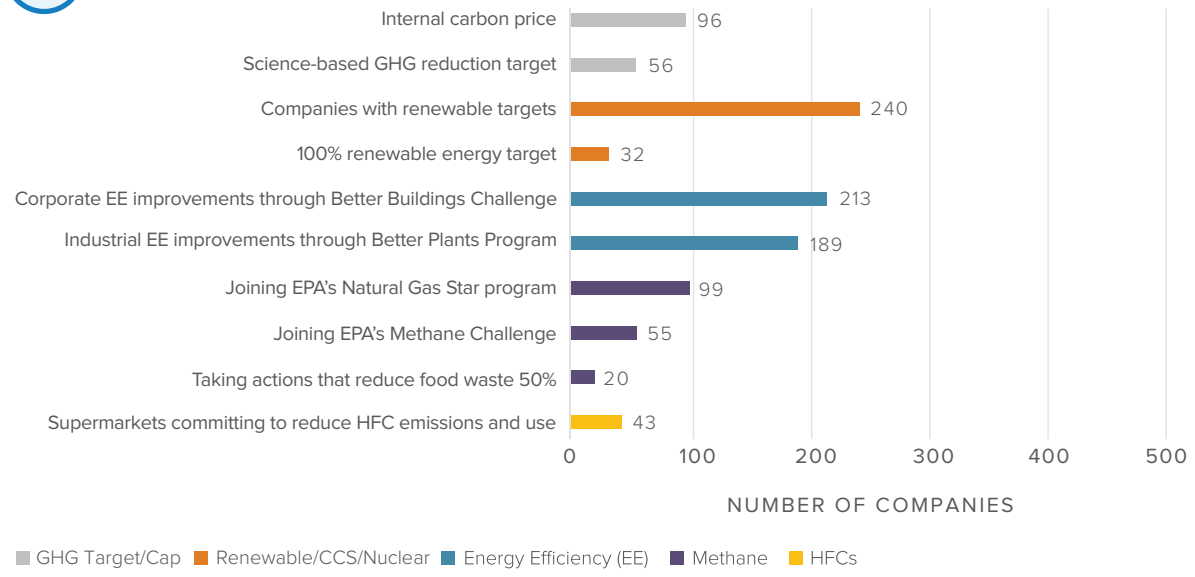
Source: Center for Climate and Energy Solutions, PACE Nation, National Conference of State Legislatures, ACEEE, U.S. Environmental Protection Agency, U.S. DOE, Appliance Standards Awareness Project, Open EI, ReFED, World Resources Institute, State of New York, California Air Resources Board, University of Minnesota, Land Trust Alliance, U.S. Forest Service.

Cities



Note: ACEEE assessed the central city of 51 metropolitan statistical areas (MSAs). They started with the nation's 50 most populous MSAs, but then excluded San Juan, Puerto Rico. They then also included Fort Worth and El Paso, which had been included in their original 2013 City Scorecard. The building and transport efficiency measures included are just a subset of all actions ACEEE examined in its annual scorecard to illustrate the different types to measures cities have adopted to address energy use and GHG emissions in these sectors.
Source: ACEEE, Sierra Club, U.S. Environmental Protection Agency, Waste360.

Businesses



Note: The number of companies with renewable targets only includes Fortune 500 companies due to data availability. The list of actions and number of actors is not meant to be comprehensive, only illustrative of the types of actions some companies are taking to address major GHG emission sources. In 2014, there were about 5.8 million small businesses with at least one employee and 19,000 firms with more than 500 employees.
Source: Science Based Targets, Carbon Disclosure Project, World Wildlife Fund, Calvert Investments, Ceres, U.S. Department of Energy, U.S. Environmental Protection Agency, U.S. Department of Agriculture.

Introduction

The multilateral process that created the Paris Agreement was, by its nature, a negotiation among nation-states. U.S. federal leadership was essential in that process, made possible by the strong domestic and international climate agenda of President Barack Obama's Administration—particularly during his second term. The Obama Administration laid a strong foundation of federal policy to put the United States on the path to reducing net GHG emissions by 26 to 28 percent from 2005 levels by 2025. Meanwhile, two other related forces continued to accelerate: climate leadership outside the federal realm, and a broad set of market and technological changes. **As federal policy goes backward, this America's Pledge Phase 1 Report examines the extent to which these other forces can help keep the U.S. on track towards its Paris Agreement emissions reductions commitment**.

Businesses, investors, cities, counties, states, tribal nations, colleges, universities, and nonprofits have rapidly expanded their actions to cut GHG emissions and prepare for the impacts of climate change. States have led in establishing the first renewable portfolio standards and cap-and-trade programs. In the clean technology sector, cities and businesses have been a proving ground for clean energy innovations such as electric vehicles (EVs). Non-federal actors have been early leaders in reshaping markets, as demonstrated by state and city municipal green building programs and the corporate procurement of large-scale renewables. Indeed, U.S. states, cities, and businesses were actively engaged alongside the national government on the global mobilization that led to the success of the Paris Agreement in 2015.

On July 12, 2017, following President Trump's decision to withdraw the U.S. from the Paris Agreement, Governor Jerry Brown and former Mayor Michael Bloomberg launched the America's Pledge project. This initiative aims to compile and quantify the actions that U.S. cities, tribal nations, states, businesses, universities, and other institutions are taking to drive down their GHG emissions, consistent with the goals of the Paris Agreement. With this Phase 1 Report, we aim to:

1. Assess the scope and scale of non-federal action already underway, including both commitments recently made for continued climate action, and the range of policies and actions that have already been implemented by states, cities, businesses, universities, and other non-federal actors;

2. Examine the factors contributing to the low-carbon transition currently underway across the country's most GHG-intensive economic sectors; and

3. Identify ways in which non-federal action can help address barriers and create the conditions for strengthening and accelerating this transition.

This report also presents a series of case studies highlighting the actions that states, cities, businesses, and universities have taken to drive down their emissions. Many of these case studies feature We Are Still In signatories who have pledged their support for the objectives of the Paris Agreement.

This preliminary assessment of non-federal actions sets the stage for a subsequent quantified analysis of how such actions could affect future U.S. GHG emissions that will be presented in a Phase 2 Report.

Chapter 1: Scale of Non-Federal Action

Despite current efforts at the federal level to roll back climate policy, climate action is robust and accelerating across the U.S. economy. As of October 1, 2017, states and cities representing more than half the U.S. economy have declared their support for the Paris Agreement. If these actors were a country, its economy would be the third largest in the world and its emissions would rank fourth largest among Parties to the UNFCCC. In addition, more than 1,300 businesses operating in the U.S., valued at $25 trillion, and more than 500 universities, have voluntarily adopted GHG reduction targets.

This chapter explores the scope and scale of non-federal climate action, highlighting actors that have made two types of commitments: 1) joining a platform established explicitly to support the Paris Agreement, and 2) adopting quantifiable GHG emission reduction targets. Some of these targets (such as those of California and New York) are as ambitious as the most ambitious NDCs. Recognizing that this chapter focuses on just two types of commitments, Chapter 2 examines a broader set of climate-related actions that have been implemented by non-federal actors that have contributed to the decline in U.S. emissions. The methods used for the analyses presented in Chapter 1 are provided in Appendix A on page 95.

Support for the Paris Agreement

Non-federal actors encompassing a sizeable share of the U.S. population, economy, and emissions have formed various networks established explicitly to support the Paris Agreement. Both the U.S. Climate Alliance (a group of U.S. states) and We Are Still In (a declaration signed by states, tribal nations, cities, businesses, and universities) were established in June 2017 in the wake of President Trump's announced intention to withdraw from the Paris Agreement. The U.S. Climate Mayors (a network of cities) was established upon adoption of the Paris Agreement and expanded rapidly after President Trump's withdrawal announcement (see Figure ES-1 on page 18).

We Are Still In comprises leaders from America's state houses, city halls, boardrooms, and college campuses that have declared their support for the Paris Agreement. With an initial 1,219 signatories at its launch, We Are Still In has, as of October 1, 2017, more than doubled to 2,320 signatories in states, tribal nations, and cities accounting for a population totaling 131 million or 40 percent of Americans, and GDP totaling $8.5 trillion or 45 percent of the U.S. economy in 2016.

The U.S. Climate Alliance—comprising 14 states and Puerto Rico, representing 118 million people (36 percent of the U.S. population), and GDP of more than $7 trillion (40 percent of U.S. GDP)—commits states to meeting their share of the U.S. nationally determined contribution under the Paris Agreement (a 26 to 28 percent reduction in GHG emissions below 2005 levels by 2025).

U.S. Climate Mayors—comprising 383 cities with a total population of 74 million (23 percent of the U.S. population)—has committed to upholding the goals enshrined in the Paris Agreement and intensifying efforts to meet climate goals. Notably, almost half of these cities are in states that have not joined the U.S. Climate Alliance described above.

In addition to these three networks formed explicitly to support the Paris Agreement, many more coalitions have adopted similar objectives, including the Mayors Climate Protection Center—a coalition of 1,060 mayors vowing to reduce emissions below 1990 levels—and the Global Covenant of Mayors for Climate & Energy, an international alliance of cities and local governments with more than 140 U.S. members supporting voluntary action to combat climate change.

GHG Emission Reduction Targets

In addition to recent declarations of support for the Paris Agreement from new networks and members of existing organizations such as the U.S. Conference of Mayors, National League of Cities, and Global Covenant of Mayors, non-federal actors have for years set their own quantified GHG emission reduction targets. Some of these actors have set high ambition targets that, if achieved, would help meet their share of both near-term (2025) and longer-term deep decarbonization targets for mid-century. Like national NDCs, though, overall these targets represent a mix of ambition and it will be important to accelerate action and ensure follow through in order to meet the goals of the Paris Agreement.

As of October 1, 2017, a total of 20 U.S. states and 110 U.S. cities have enacted GHG targets (see Figure ES-2 on page 20). In addition, 1,361 businesses

with U.S. operations, representing $25 trillion in market capitalization and accounting for 14 percent of U.S. emissions (0.9 Gt CO_2e) in 2016, and 587 U.S. universities with total enrollment of 5.2 million students (25 percent of the U.S. college and university student population), have voluntarily adopted targets.

Networks and coalitions are also helping these non-federal leaders set long-range targets. For example, nine U.S. states, 12 U.S. cities, and one U.S. county have signed on to the Under2 MOU, which commits members to reduce GHG emissions 80 to 95 percent below 1990 levels by 2050, or to limit emissions to 2 metric tons of CO_2e per capita annually. The Science-Based Targets Initiative, a group of businesses that have adopted targets in line with the level of decarbonization required to keep global temperature increase below 2 degrees Celsius, now includes a total 56 U.S. businesses.

It is important to note that these targets, while numerous, vary in terms of level of ambition and therefore magnitude of expected emission reductions. Many are voluntary and could be dropped with little consequence, and others were adopted under previous political leadership, and may already be irrelevant. Whereas this initial analysis takes an inclusive approach, counting any actor that has joined a network or platform and/or registered a GHG target, future analyses in the Phase 2 America's Pledge report will look to existing methodologies (such as the Non-State and Non-federal Action Guidance developed through the Initiative for Climate Action Transparency and the Greenhouse Gas Protocol Mitigation Goal Standard and Policy and Action Standard) for assessing the impact of various actions on GHG emissions, including those that we highlight in Chapter 2.

WE ARE STILL IN

North Carolina

North Carolina is addressing climate change and taking steps to increase clean energy. These efforts build on past actions, such as the 2002 bipartisan Clean Smokestacks Act that slashed power plant emissions and the 2007 Renewable Energy and Energy Efficiency Portfolio Standard that set a national example for promoting clean energy, improving air quality, and creating jobs.

North Carolina now boasts the second-most installed solar capacity in the nation and has approximately 7,000 MW of cumulative renewable energy capacity. By 2016, clean energy jobs in the state exceeded 34,000.[a] Technology companies with clean-energy commitments such as Google, Apple, and Facebook have located energy-intensive data centers in the state and support policies that favor renewable energy. Amazon installed the state's first commercial-scale wind farm in 2016, injecting an annual $1.1 million into the local economy.[b]

The Tar Heel State continues to advance policies that promote renewable energy and address climate change. In July 2017, Governor Roy Cooper signed legislation that will grow the state's clean energy sector over the next five years and asserted his opposition to offshore oil and gas exploration and drilling. In June, Cooper declared North Carolina's participation in the We Are Still In campaign, citing the importance of state leadership in ensuring a healthy environment.[c]

Notes

[a] Clean Energy by the Numbers, NC Sustainable Energy Association, 2017.

[b] Amazon Wind Farm US East completed in North Carolina, Electric Light & Power, PowerGrid International, February 9, 2017.

[c] US Action on Climate Change is Irreversible, We Are Still In, 2017.

WE ARE STILL IN

Minneapolis

In Minneapolis, Minnesota, local leaders have set ambitious goals to curb the city's GHG emissions by 15 percent by 2015, 30 percent by 2025, and 80 percent or more by 2050 relative to 2006. So far the city is meeting—and exceeding—those goals. According to a June 2017 report, Minneapolis decreased its 2015 emissions by nearly 18 percent, beating its first target.[a]

To achieve its 2025 reduction goals, the city aims to reduce energy use by 17 percent, generate 10 percent of its electricity from renewable sources, double transit ridership, and reduce waste, among other efforts. In 2013, Minneapolis passed an ordinance requiring commercial buildings larger than 50,000 square feet to report their energy and water consumption. A year later, it became the first U.S. city to establish a public-private clean energy partnership with utility companies.

Today, Minneapolis is working to acquire 100 percent of electricity for city operations from renewable sources. The city is now ranked 11th most energy-efficient in the nation.[b] And Minneapolis' progress is contributing to a surging clean energy industry in Minnesota: The state has added 2,893 clean-energy jobs in the last year, growing 5.3 percent—3.8 times faster than overall job growth.[c]

Notes

[a] 2016 Clean Energy Partnership Report, Minneapolis Clean Energy Partnership, 2017.

[b] The City Energy Efficiency Scorecard, American Council for an Energy-Efficient Economy, 2016.

[c] New Report: Minnesota's Clean Energy Industry Growing Rapidly with More than 57,000 Total Jobs, Clean Energy Economy MN, September 7, 2017.

WE ARE STILL IN

Image Source: Mars Inc.

Mars

Mars, a global food company, is driving the conversation about how companies can respond to climate change. With the crops it needs at risk, the company announced an ambitious Sustainable in a Generation Plan, which includes the target of eliminating GHG emissions from direct operations by 2040, and reducing them across the entire value chain by 27 percent by 2025 and 67 percent by 2050.[a] The food, beverage and pet-food company has earmarked almost $1 billion for its plan and is calling on other major companies to join in.[b]

Mars has set up industry coalitions for sustainability, responsible sourcing programs, and funds to support smallholder farming. It is working to boost the income and wellbeing of 1,000,000 workers and to end deforestation in select supply chains; to encourage sustainable land use and water stewardship; and to reduce its landfill waste to zero (a goal achieved in 2015). The company is also investing in renewable energy sources. It supported one of the world's biggest wind farms in Texas, with 118 turbines, which created hundreds of local jobs. Mars has contracted for 100 percent renewable energy in 2018 for operations in 11 countries including the US, UK, France, Mexico, and Brazil.

Mars CEO Grant F. Reid says this environmentally sensitive approach will help Mars secure "a competitive advantage" for generations to come.[c]

Notes

[a] Sustainable In A Generation, Mars.

[b] Oscar Williams-Grut, "We're trying to go all in": Chocolate giant Mars pledges $1 billion to fight climate change, September 6, 2017.

[c] Anmar Frangoul, Mars to invest around $1 billion in sustainability plan, CNBC, September 6, 2017.

WE ARE STILL IN

Loyola Chicago University

Loyola Chicago University, a signatory of the Climate Leadership Network at Second Nature, is committed to addressing climate change in its educational curriculum, operations, and community engagement strategies. The school's climate action plan lays out a path for achieving carbon-neutrality by 2025, including reducing energy use, increasing clean energy, and implementing climate-ready infrastructure projects.[a]

Loyola Chicago is working to integrate sustainability in the campus life and across the curriculum.[b] The university has reduced its total carbon emissions by 38% per square foot of facility since 2008. The campuses also now house 11 LEED certified buildings,[c] two geothermal installations, and 55,000 square feet of green roofs.[d] Campus improvements also involve increasing central systems' efficiency; installing retrofits like upgraded insulation and lighting; implementing passive ventilation and stormwater management; and reducing energy demand. Targeted procurement policies aim to permanently reduce emissions. Beyond campus, Loyola Chicago is active in advocating for state-wide clean-energy policies and helps other universities participate in clean-energy and emissions-reduction programs.

Loyola Chicago's engagement has earned accolades, such as inclusion in Sierra Club's "America's Greenest Colleges: Top 10,"[e] a Second Nature Climate Leadership Award,[f] and a Gold rating from the Association for the Advancement of Sustainability in Higher Education.[g]

Notes

[a] A Just Future: A Climate Action Plan for Loyola University Chicago 2015–2025, Loyola University Chicago, September 2015.

[b] Sustainability Across Curriculum, Loyola University Chicago, 2017.

[c] LEED Certified Buildings, Loyola University Chicago, 2017.

[d] Sustainability on Campus, Loyola University Chicago, 2017.

[e] America's Greenest Colleges: The Top 10, Sierra Club, 2017.

[f] Loyola University Chicago: 2017 – Winner, Second Nature, 2017.

[g] Loyola Earns AASHE Gold Rating, Loyola University Chicago, 2017.

Chapter 2: Broader Role of Non-Federal Action in Driving Down U.S. GHG Emissions

The previous chapter limited its scope to states, cities, businesses, and others that have pledged to support the Paris Agreement or set GHG reduction targets. In this chapter, we broaden the lens to explore other climate-friendly actions—policies and efforts undertaken explicitly for the purposes of achieving GHG reductions as well as other actions that indirectly lower emissions through promoting a cleaner, more efficient economy—and illustrate the scope of their adoption.

This is important because many climate friendly actions have other benefits and may be taken for other reasons, for instance reduced health impacts from pollution abatement, reduced energy costs, and competitive local economies.

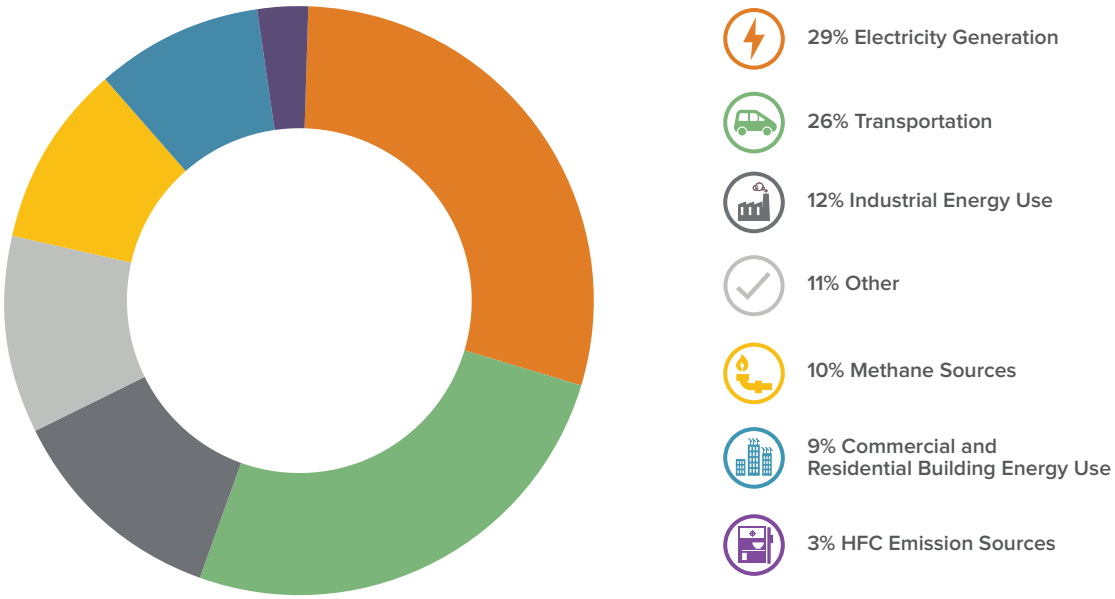
EPA Administrator Scott Pruitt and Energy Secretary Rick Perry previously held public office in two states experiencing substantial growth in renewable energy. In Oklahoma, Pruitt's home state, wind already provides a greater proportion of electricity generation than coal;[2] and by next year, wind will be the largest source of power in Texas,[3] where Perry served as Governor. In the last year, 8 of the 10 fastest growing solar markets voted for Trump, led by Mississippi and Alabama.[4] These shifts didn't happen because of an explicit climate protection agenda—it was simply that wind or solar became a profitable investment in those states.

This matters. In the U.S., cities, states, businesses, the federal government, and other actors share responsibility for the nation's economic development, energy production and use of natural resources that affect U.S. GHG emissions.[5] As a result, federal energy and environmental policies, non-federal policies and actions, and business decisions, as well as market trends (including the 2008 recession) and technological advances, are all factors contributing to recent GHG emission reductions. Perhaps more importantly, they are also all determinants of future emissions trajectories.

Looking forward, non-federal action can help address the largest existing GHG emissions sources (Figure 2-1). These include electricity generation (which still relies mostly on coal and natural gas), transportation (which consumes more petroleum than any other sector), residential, commercial, and industrial energy use (which rely heavily on natural gas), methane sources (methane is 36 times more potent than CO_2) and leakage of HFCs (which are up to 12,000 times more potent than CO_2). Action is also needed to manage U.S. lands so they once again are long-term carbon sinks, including by improving the health of the nation's forests, and improving the ability of other natural and working lands, such as farm and range lands, to sequester carbon.

FIGURE 2-1

U.S. Greenhouse Gas Emissions by Source (2015)



Source: U.S. Environmental Protection Agency, Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2015

Relationship Between Federal and Non-Federal Climate Action

While the U.S. federal government has primary policy responsibility in some areas, states and cities have explicit authority to act on their own in others. In the electric power sector, for instance, the federal government oversees the interstate transmission system and can provide incentives such as tax credits for wind and solar generation that have accelerated the clean energy

transition. Yet state governments are the primary regulators of U.S. energy markets, and hold authority over a raft of policies and measures that have further driven this transition—such as carbon-pricing systems, renewable portfolio standards (RPS), and energy efficiency targets. State-level public utility commissions (PUCs) directly regulate utilities and can levy funds for further renewable energy investment. In the transportation sector, the federal government has played a critical role in establishing national vehicle emissions standards. Yet such standards were informed by those initially adopted at the state level, and California has unique authority to promulgate standards more stringent than those at the federal level. Other states are also permitted to opt in to the California standards.

Importantly, non-federal policies cannot entirely supplant federal climate action. Federal investment by the DOE in research and development (R&D), for example, has resulted in revolutionary shifts in battery storage and grid technology. This form of R&D investment represents a long-term contribution to reducing emissions that state budgets may be unable to reproduce at similar scale, and which businesses are unable to invest in on their own. The federal government is also uniquely positioned to reform national farm subsidy policy to eliminate perverse incentives to climate-destructive agricultural practices.

These caveats aside, states, cities, businesses, and other non-federal actors have significant ability to reduce emissions through opportunities for incentives, regulation, conservation, efficiency, and investment at all jurisdictional levels and across a wide variety of sectors. The following sections illustrate the range of non-federal actions that have been taken, grouped by major emission sources and sectors. Note that the policies and actions highlighted below are not intended to be exhaustive, and in this Phase 1 Report we do not seek to measure their aggregate effect on GHG emissions. The methods used for the analyses presented in Chapter 2 are provided in Appendix B on page 103.

States: By the Numbers

States have a long history of serving as proving grounds for policies that support clean energy, energy efficiency, and pollution reduction. Supreme Court Justice Louis Brandeis noted in 1932 that “It is one of the happy incidents of the federal system, that a single courageous state may, if its citizens choose, serve as a laboratory and try novel social and economic experiments without risk to the rest of the country.”[6]

Iowa adopted the nation’s first renewable portfolio standard (RPS) in 1983 and Texas adopted the first energy efficiency resource standard (EERS) in 1999. Now, a majority of states have targets or goals for renewable energy

(38 states) and energy efficiency (28 states). This is partly due to the broad authority the Constitution grants states to regulate their energy sources and emissions.[7]

Given states' authority to enact energy and climate regulation, we examined what types of measures, if any, are being adopted that aim to help address the largest GHG emission sources. For each major sector or emission source, we consulted several different sources that track energy and climate policy adoption by state, including the National Conference of State Legislatures, federal agencies, and non-governmental organizations (NGOs) like the Center for Climate and Energy Solutions and American Council for an Energy-Efficient Economy. From this research, we selected 30 policies that showcase the range of actions that states are taking, aiming to identify at least one action that addresses each of the major emission sources that has been adopted by at least one state.

Figure 2-2 lists these 30 actions by sector and emissions source. This list represents just a subset of the actions states are taking to reduce their emissions either directly or indirectly. Some actions—like financial incentives—may not directly result in GHG emission reductions. Therefore, the count of policies does not equate to the potential of these actions to reduce GHG emissions.

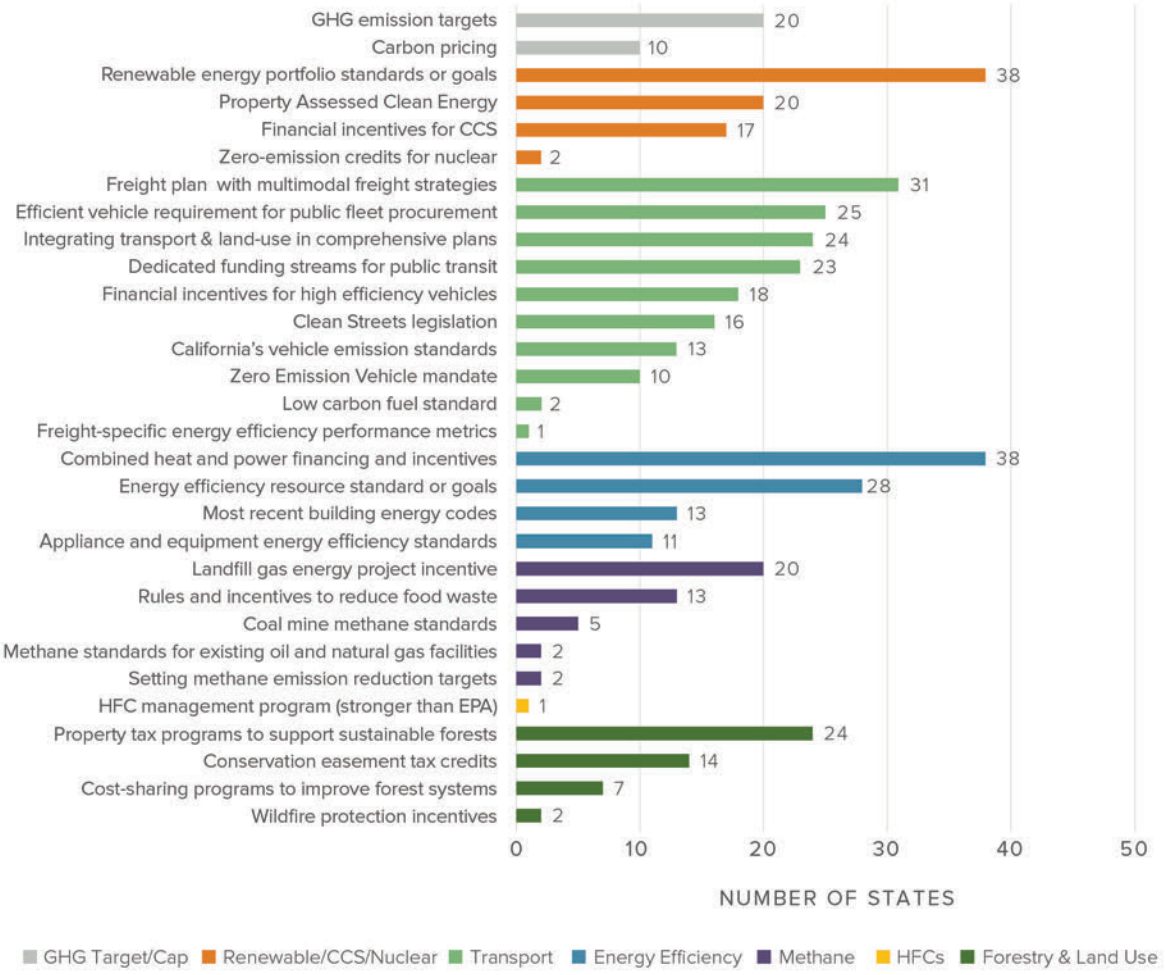
Carbon Pricing

Ten states have adopted legally binding carbon pricing regulations. **California was the first state in the country to adopt an economy-wide cap-and-trade program to reduce GHG emissions.** The program was implemented in 2012 to help achieve California's emissions reductions target as mandated under the California Global Warming Solutions Act of 2006, also known as AB 32.[8] Under AB 32, California is required to reduce its GHG emissions to 1990 levels by 2020, and the state is currently on track to hit this target. The cap-and-trade program is designed to work alongside a variety of complementary policies and action plans across the California economy.[9] Additionally, the state clarified the role of the cap-and-trade program through 2030 pursuant to AB 398, to help meet the requirement to reduce emissions 40 percent below 1990 levels per the mandate in SB 32.[10]

Working together, nine other Northeastern states have implemented a CO_2 cap-and-trade program called the Regional Greenhouse Gas Initiative (RGGI), to create a market-based system that sets a cap on emissions from the electric sector that declines by 2.5 percent per year through 2020.[11] Since 2005, RGGI, comprising of Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New York, Rhode Island, and Vermont, has reduced power sector CO_2 emissions more than 45 percent while the region's per-capita GDP continued to grow.[12] RGGI estimates that in 2015 alone, the reinvestments made with auction proceeds will return $2.31 billion in lifetime energy bill savings to the region's households and businesses.

FIGURE 2-2

Examples of Climate-Friendly Policies Adopted by U.S. States to Address Major Emissions Sources



U.S. DOE, Appliance Standards Awareness Project, Open EI, ReFED, World Resources Institute, State of New York, California Air Resources Board, University of Minnesota, Land Trust Alliance, U.S. Forest Service.

Electricity Generation

Renewable energy targets are among the most frequently adopted climate-friendly actions taken by U.S. states, with 29 states representing 56 percent of retail electricity sales in the country adopting mandatory renewable portfolio standards (RPS), and 9 others setting voluntary renewable energy goals. As of 2014, 23 states had achieved 100 percent of compliance with their RPS. Today, all but two states are on track to meet their targets. In fact, several states have increased or extended their current policies in 2016 or early 2017, **after the 2016 election**, including:[13]

- Massachusetts created requirements for off-shore wind (1,600 MW by 2027) and a new solar procurement program (1,600 MW);
- Maryland increased and accelerated its RPS to 25 percent by 2020;
- Michigan increased and extended its RPS to 15 percent by 2021;
- New York increased and extended its RPS to 50 percent by 2030, and expanded coverage statewide;
- Oregon increased and extended its RPS to 50 percent by 2040 for large investor-owned utilities; and
- Rhode Island increased and extended its RPS to 38.5 percent by 2035.

While state legislatures can pass laws requiring that a certain amount of electricity be generated by renewable or other zero carbon energy sources, it is often up to a state's public utilities commission (PUC) to approve how utilities plan to meet the state's target. For example, even though Hawaii increased and extended the state's RPS to 100 percent by 2045 in 2015, it wasn't until July 2017 that the state's PUC approved Hawaiian Electric Company's proposed implementation plan.

Eighteen states also offer financial incentives for other zero carbon energy technologies, like carbon capture and storage, and nuclear power.[14] For example, New York is providing zero-emission credits to compensate nuclear power plants for their ability to generate carbon-free electricity, something that wholesale power markets currently do not provide.[15]

Transport

California has led the way on GHG standards for motor vehicles. Because of California's historical challenges with air pollution, the Clean Air Act allows the state to set its own air emissions standards for motor vehicles, provided they are more stringent than federal standards and the state receives a waiver from the U.S. EPA.[16] Other states then have the option to adopt California's more stringent standards. In 2010, the California Air Resources Board (CARB) worked with the EPA and the National Highway Traffic Safety Administration to develop a national GHG and fuel economy standards program, which harmonized federal standards and California's emissions requirements for model years 2012 through 2025.[17] Both California and the EPA, through peer review processes, completed separate midterm evaluations of this program in January 2017, affirming that the existing standards should remain in place.[18] The Trump Administration is reconsidering that decision.[19] If the EPA decides to roll back federal regulations, California would defend its existing standards based on the waiver EPA granted in 2009.

Thirteen states have adopted California's advanced clean cars standards[20]—together, they represent almost 35 percent of the U.S. motor vehicle market[21]—and more could join. The auto industry has sought changes to relax

the 2022-2025 emission and fuel economy standards set by the Obama Administration. However, if the federal standards are relaxed it would create a fragmented motor vehicle compliance market in which it would have to produce one type of vehicle for California and its partners and another for the other states.

More than 30 states have adopted strategies to improve access to "multimodal" freight transport (moving goods using a sequence of at least two modes of transport, such as truck to rail), which can help reduce bottlenecks and emissions in the transport of goods. The federal Fixing America's Surface Transportation (FAST) Act requires all states to develop and finalize freight plans by December 2017. Among other factors, the plans must consider investments in multimodal projects. According to the American Council for an Energy-Efficient Economy (ACEEE), 31 states have already addressed multimodal freight strategies in their freight plans.[22] Only one state (California) has taken the next step in strengthening its freight plan by adopting energy efficiency performance metrics or freight-specific GHG reduction goals.

Half of U.S. state governments have policies requiring state vehicle fleets to become more efficient. This includes mandating fuel economy improvements greater than what is required through the existing federal standards, petroleum reduction targets, fleet-wide GHG emission reduction targets, and procurement requirements for hybrid-electric or all-electric vehicles.[23]

To get even more highly efficient vehicles on the road, **ten states (California, Connecticut, Maine, Maryland, Massachusetts, New Jersey, New York, Oregon, Rhode Island, and Vermont) have adopted Zero Emission Vehicle (ZEV) targets**,[24] which require an increasing percentage of an automaker's sales in the state to be ZEVs. Eight of these states have signed a memorandum of understanding, committing to having at least 3.3 million ZEVs operating on their roadways by 2025.[25] Zero-emission vehicles, including electric and hydrogen vehicles, reduce tailpipe GHG emissions compared to conventional gasoline and diesel cars and trucks, though the life-cycle GHG effects depend on the use of low-carbon sources of electricity and/or hydrogen.[26]

Residential, Commercial, & Industrial Energy Use

States have been taking additional actions to improve building efficiency. For example, **11 states have adopted at least one appliance or equipment energy efficiency standard for products not currently covered by standards set by the federal government**.[27] In fact, appliance energy efficiency standards have long been adopted first by states. After several states adopt a code, they typically work with manufacturers and other stakeholders to

develop a consensus recommendation to inform a national standard set by Congress or the U.S. Department of Energy (DOE). Additionally, 43 states have adopted energy codes for either residential or commercial buildings (or both). However, fewer states have adopted the most recent national model energy code, with only five states doing so for commercial buildings, and only 12 states doing so for residential buildings.[28]

Twenty states have Energy Efficiency Resource Standards (EERS) in place, which require utilities to reduce electricity or natural gas sales by implementing customer energy efficiency measures. An additional eight states have non-binding goals. Together, these states cover roughly 70 percent of electricity retail sales in the U.S. According to ACEEE, these states achieved 25.4 terawatt hours (TWh) of net incremental savings in 2016 (0.68 percent of 2016 retail sales, enough to power 2.4 million American homes for one year, on average).[29]

Thirty-eight states have incentives in place to help commercial and industrial facilities install combined heat and power systems. These systems are more than 80 percent efficient, compared to conventional technologies that are about 50 percent efficient.[30] Nearly all (45) states have interconnection standards for distributed generation sources like combined heat and power (CHP), while 33 states offer tax or production incentives and 19 offer grants or rebates.[31] Despite these incentives, CHP technologies remain underutilized, in part because they contradict the business model of most electric utilities (selling more electricity) and because existing policies and utility regulations are not designed to allow utilities to monetize CHP benefits (such as increased reliability and reduced emissions).[32]

Methane and HFC Leakage

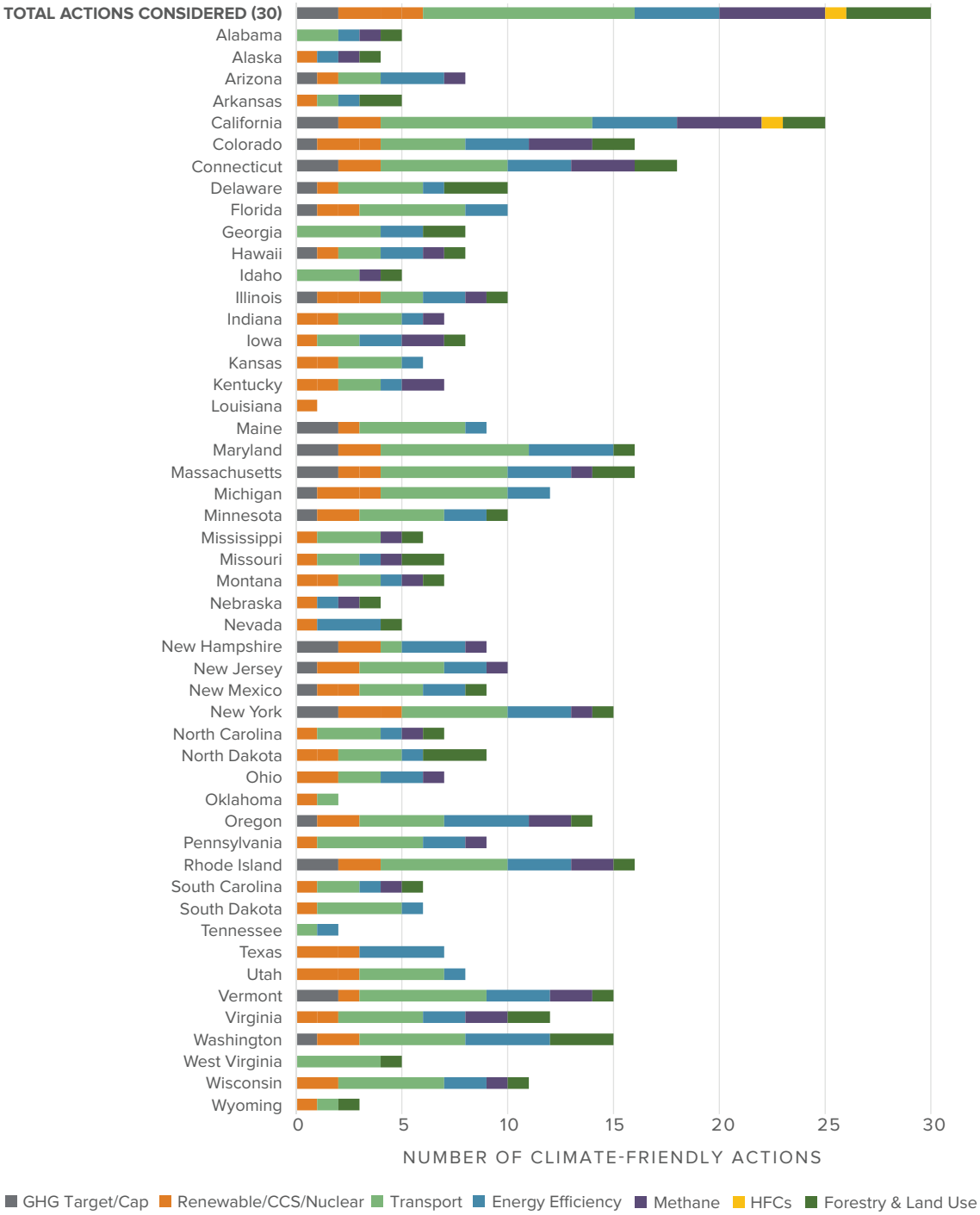
States are also helping to lead the nation in addressing emissions from non-CO_2 emission sources, such as oil and gas systems, landfills, agriculture, and leakage of HFCs. For examples of some of these policies, see the California Case Study on its Short-Lived Climate Pollutant Strategy on page 57.

Summary of States' Actions

While the 30 actions highlighted in Figure 2-2 are just a subset of all that states are doing, our initial analysis illustrates the wide range of climate-friendly actions available to states that can help reduce GHG emissions. However, comprehensive adoption of these regulations, incentives, and other measures is not widespread. Looking at which of these 30 climate-friendly actions has been adopted by each state, it is clear that some states are doing more than others (Figure 2-3). This suggests that even those states that are taking ambitious action in some areas can step up their ambition in others.

FIGURE 2-3

Climate Friendly Actions by U.S States: Types and Numbers



Source: Center for Climate and Energy Solutions, PACE Nation, National Conference of State Legislatures, ACEEE, U.S. Environmental Protection Agency, U.S. DOE, Appliance Standards Awareness Project, Open EI, ReFED, World Resources Institute, State of New York, California Air Resources Board, University of Minnesota, Land Trust Alliance, U.S. Forest Service.

Cities: By the Numbers

U.S. cities have also acted as leaders for new GHG reduction policies and technologies, although city authority and capacity to take on certain actions vary greatly across the country. Authority depends on state, county, and local division of responsibilities, revenue generation, founding charter scope and mandate, structure and composition of the office or governing body. For example, New York City's mayor has significant control over what actions the city takes up across a wide range of policies, in addition to a large budget. On the other hand, decision making power for many other cities resides in the city council. Depending on the city's charter and state laws, they may review and approve the annual budget, establish short- and long-term objectives and priorities, pass ordinances and resolutions, and regulate land use through zoning laws, among other responsibilities.[33] Similarly, cities in Florida have more freedom to demonstrate climate leadership because of Florida's "home rule" constitutional protection of city autonomy, while next door in Georgia, equally motivated mayors have far less flexibility under that state's constitution.

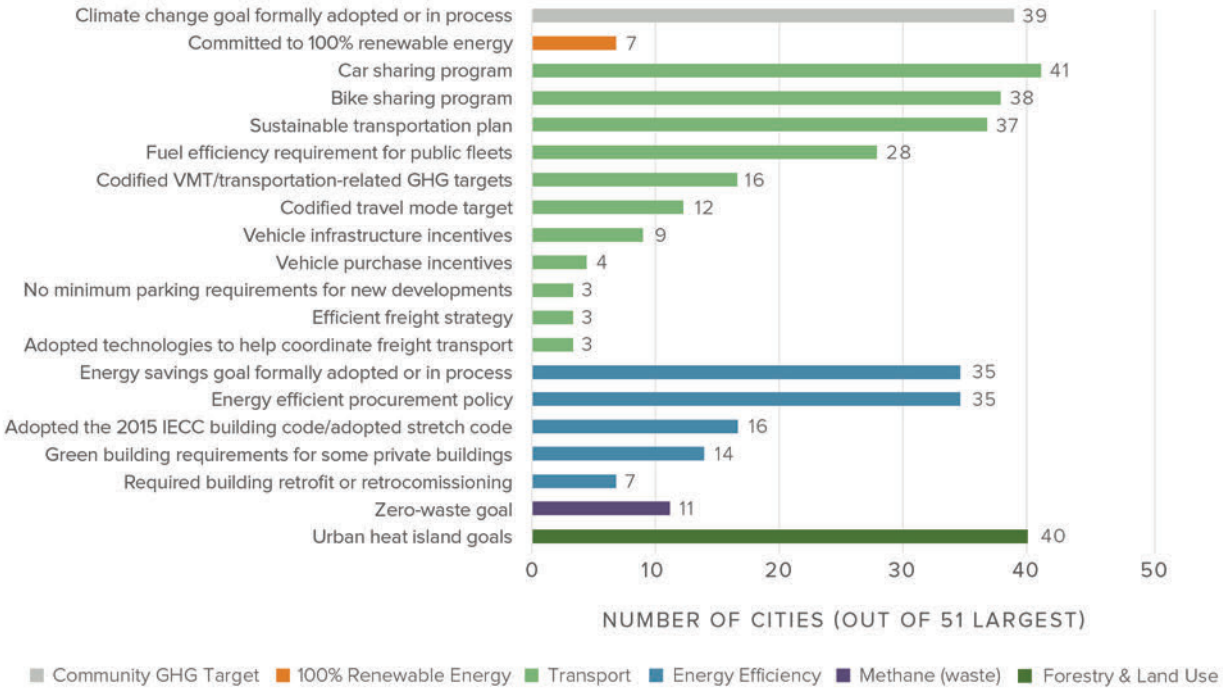
To examine what types of actions cities are adopting, we used ACEEE's most recent biennial city scorecard (reflecting existing policy data as of January 31, 2017) as a starting point. ACEEE's analysis tracks the adoption, stringency, and ambition of a wide range of energy efficiency measures that some of the largest 51 cities are taking (based on population of the metropolitan statistical area).[34] **These cities alone make up nearly 15 percent of the nation's population while the metropolitan areas in which they are located contain just over half of the U.S. population**.[35] We included 18 actions from ACEEE's analysis with the aim to illustrate the different types of actions that cities are taking to help reduce GHG emissions, increase building efficiency, and move people and goods around more effectively. Initial research found two additional ambitious actions that cities are taking to promote renewable energy and reduce methane emissions through waste reduction targets, but which ACEEE had not examined.

These 20 actions are listed in Figure 2-4 and illustrate just a handful of some of the climate-friendly actions that the largest cities in the United States are taking across different sectors. Just like the actions we examined for states, our tally of actions adopted does not equate directly to GHG emission reductions.

Setting a community-wide GHG emissions reduction target is one of the most popular actions. While not all cities have formally adopted such a target, the majority (39) of the largest U.S. cities are in the process of developing one. According to ACEEE, 29 of these cities have a codified GHG emission reduction target. Fifteen cities are on track to meet their nearest term goal,[36] illustrating the importance of follow-through and ensuring that sufficient policies are adopted to enable GHG reduction goals to be achieved.

FIGURE 2-4

Examples of Climate-Friendly Policies Adopted by 51 of the Largest U.S. Cities to Address Major Emission Sources



Note: ACEEE assessed the central city of 51 metropolitan statistical areas (MSAs). They started with the nation's 50 most populous MSAs, but then excluded San Juan, Puerto Rico. They then also included Fort Worth and El Paso, which had been included in their original 2013 City Scorecard. The building and transport efficiency measures included are just a subset of all actions ACEEE examined in its annual scorecard to illustrate the different types to measures cities have adopted to address energy use and GHG emissions in these sectors.
Source: ACEEE, Sierra Club, U.S. Environmental Protection Agency, Waste360.

Electricity Generation

Cities of all sizes are committing to 100 percent clean energy. Forty-three cities have committed to 100 percent clean energy goals already through the Sierra Club's Ready for 100 campaign. Five cities—Aspen, Colorado; Burlington, Vermont; Greensburg, Kansas; Kodiak Island, Alaska; and Rock Port, Missouri—have already achieved this target.[37] Salt Lake City, the largest city in and capitol of Utah, a traditionally Republican state, has not only set a 100 percent renewable energy goal, but has entered into an agreement with the state's largest private utility to provide that clean power by 2032.[38] In June, the U.S. Conference of Mayors, representing the 1,200 largest cities in the U.S. and covering 42 percent of electricity use, unanimously endorsed a goal of achieving 100 percent renewable energy by 2035.[39]

Residential and Commercial Buildings

Cities have long been leaders in addressing building energy use. In September 2017, **New York City announced it would become the first**

city with mandated fossil fuel limits for all buildings larger than 25,000 square feet. These standards will trigger the replacement of boilers and hot water heaters and building efficiency upgrades in the worst-performing 14,500 buildings, which together produce 24 percent of the city's total GHG emissions.[40]

Furthermore, thirty-five of the largest 51 cities are developing or have already adopted an energy reduction goal. The same number of cities has also committed to procuring only efficient products when purchasing new equipment.

Transport

Close to 40 of the largest 51 cities support car and bike sharing services, which can help reduce single-occupancy vehicle use and associated vehicle miles traveled.[41] A similar number of the largest **51 cities are developing a sustainable transportation plan or incorporating strategies within a broader climate action or sustainability plan**. Strategies often include improving local transit systems, improving location efficiency, or increasing the availability and safety of options such as biking and walking to reduce vehicle miles traveled.[42] Going a step further, 16 of the cities identified by ACEEE have **specific vehicle miles traveled reduction targets**.[43] These types of policies are being adopted by cities of all sizes; the National Complete Streets Coalition estimates that **more than 1,000 cities and counties have adopted policies that aim to improve the safety of their street networks and reduce congestion**.[44]

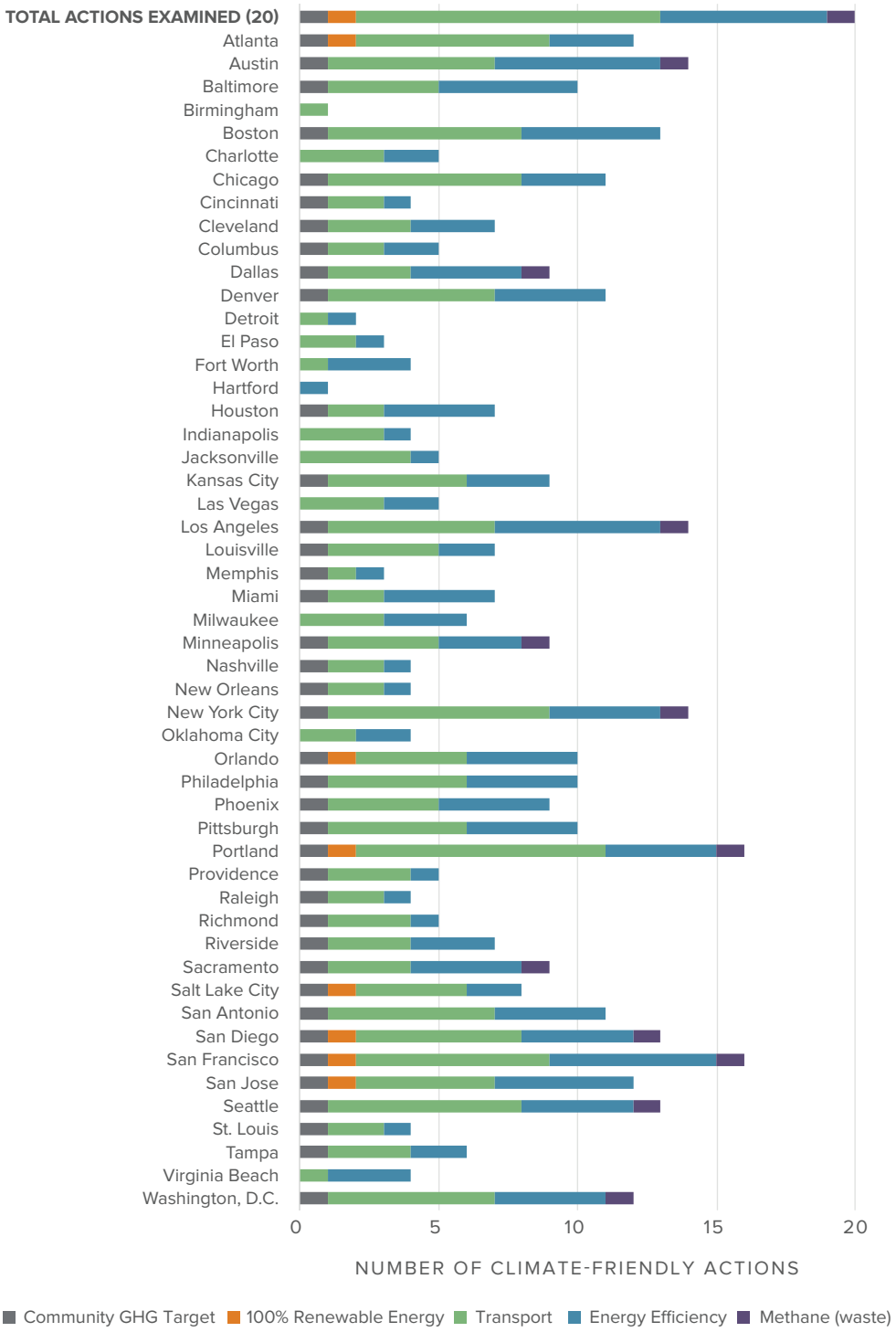
Taking a different tack, cities are also leveraging their market power by aggregating demand for low-carbon technologies through coordinated procurement efforts. Thirty U.S. cities, led by Los Angeles, have committed $10 billion to begin implementing a plan to purchase 114,000 EVs for their municipal fleets[45]—a number roughly equivalent to all the EVs sold in the first eight months of 2017.[46]

Methane

Some cities are adopting zero waste targets, which typically aim to reach 90 percent or more diversion from landfilling and combustion by a specific year through waste reduction, recycling, composting, waste-to-energy, and other measures.[47] **At least 11 large U.S. cities have zero-waste targets**, often with objectives that extend beyond reducing waste. For example, Minneapolis, Minnesota developed its zero-waste goal to not only divert waste from landfills and reduce garbage truck usage, but also to "reduce greenhouse gases, provide greater rate equity for customers, and other similar objectives."[48] Dallas, Texas sees its waste reduction plan as one of the first steps towards spurring economic growth, by recovering valuable raw materials and clean energy from discarded materials.[49]

FIGURE 2-5

Climate-Friendly Actions Adopted by the Largest 51 U.S. Cities: Types and Numbers



Note: ACEEE assessed the central city of 51 metropolitan statistical areas (MSAs), starting with the nation's 50 most populous MSAs, excluding San Juan, Puerto Rico. They then also included Fort Worth and El Paso, which had been included in their original 2013 City Scorecard. The building and transport efficiency measures included are just a subset of all actions ACEEE examined in its annual scorecard to illustrate the range of measures cities have adopted to address energy use and GHG emissions in these sectors.

Source: ACEEE, Sierra Club, U.S. Environmental Protection Agency, Waste360.

Forestry and Carbon Sinks

Forests and soils are a critical factor contributing to the U.S. climate footprint. While in some developing economies like Brazil and Indonesia, deforestation can be a major source of net GHG emissions, in the United States afforestation in recent years has meant that the land use sector has served as a net sink, producing "negative emissions." This simply means that U.S. soils and forests are sequestering CO_2 into solid soil and biomass carbon. There is huge untapped potential for the U.S. to do even more to sequester carbon in its trees and soils—and some of it is in cities.[50]

Forty of the largest 51 cities have adopted an urban tree canopy cover goal or urban temperature-reduction target.[51] In addition to sequestering carbon, urban forests and tree cover can help reduce energy use to cool buildings and reduce water runoff.[52] In fact, more than **3,400 communities are committed to implementing basic urban forestry standards through Tree City USA**, including maintaining a tree board or department, and having a community tree ordinance.[53]

Summary of Cities' Actions

As illustrated in Figure 2-5, every one of the largest 51 cities has adopted at least one of the 20 climate-friendly actions we examined. Even though these cities have made progress in adopting new regulations, incentives, and other measures, comprehensive climate action is far from widespread. This suggests that cities of all sizes have an opportunity to take stronger action in the years ahead.

Regional cooperation is also going to be essential, as it is often under-appreciated when considering city authority and climate action. Large metropolitan areas can have millions of residents, with only a fraction living within the administrative boundary of the city. Transboundary issues like growth and sprawl, regional transport planning, and other shared infrastructure investments, require a strong coalition of local governments that can work together effectively.

Businesses: By the Numbers

U.S. businesses are at the forefront of developing next generation appliances, equipment, vehicles, and other products that will help all sectors of the economy become more efficient and less carbon intensive. Some companies are also reducing the GHG emissions associated with their own operations and value chains.

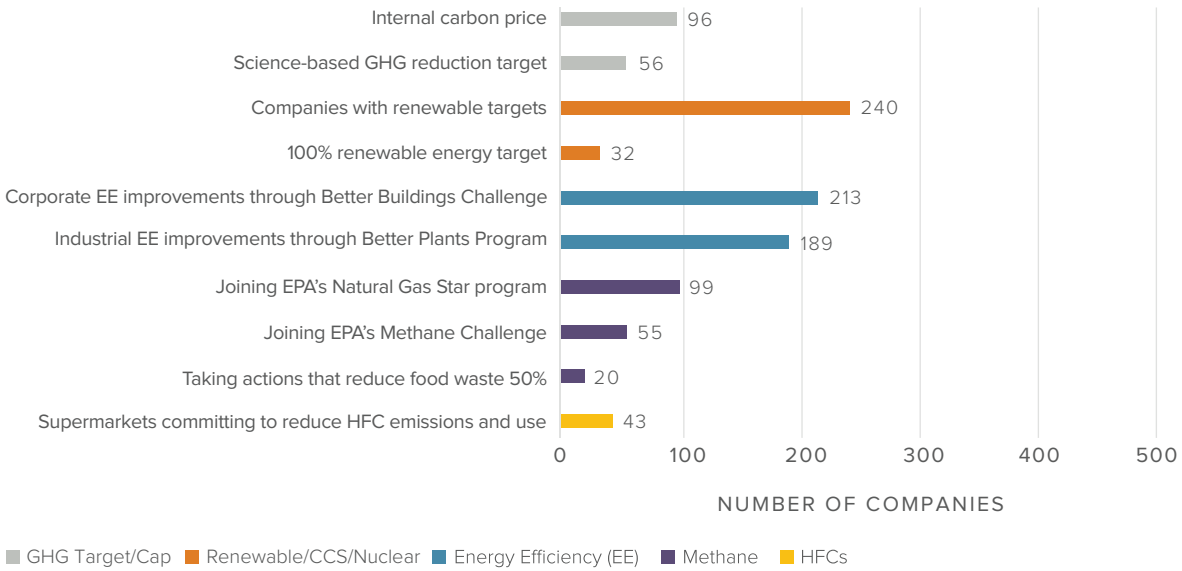
Below we highlight just a handful of climate friendly actions undertaken by businesses in the United States. Some of these examples also highlight the importance of federal and state programs, and incentives for encouraging climate friendly actions in businesses.

The U.S. DOE's Advanced Research Projects Agency-Energy (ARPA-E) program has provided energy researchers and businesses with $1.5 billion towards funding, technical assistance, and market readiness since 2009.[54] For example, through ARPA-E, Kohana Technologies is developing a wind turbine control system with advanced blades that can help grid operators better manage electricity generated during peak usage, potentially allowing for longer blades and an attendant increase in energy production.[55] ARPA-E has also funded transportation efficiency projects, including the creation of an EV battery by Cadenza Innovation with greater energy density at a lower cost compared to conventional batteries.[56]

As illustrated in Figure 2-6, a large number of businesses are taking a wide range of other climate friendly actions across different sectors, sometimes with help from DOE, EPA, and other federal programs. However, this represents just a small fraction of businesses in the United States. In 2014, there were about 5.8 million small businesses with at least one employee and 19,000 firms with more than 500 employees.[57] The climate-friendly actions we list below are not meant to be comprehensive. Instead, we collected information from the Carbon Disclosure Project (CDP), various NGOs, and federal agencies with the aim of providing examples of corporate action that address each of the major GHG emission sources.

FIGURE 2-6

Examples of Climate-Friendly Policies Adopted by Businesses Headquartered in the U.S. to Address Major Emission Sources



Note: The number of companies with renewable targets only includes Fortune 500 companies due to data availability. The list of actions and number of actors is not meant to be comprehensive, only illustrative of the types of actions some companies are taking to address major GHG emission sources. In 2014, there were about 5.8 million small businesses with at least one employee and 19,000 firms with more than 500 employees. Source: Science Based Targets, Carbon Disclosure Project, World Wildlife Fund, Calvert Investments, Ceres, U.S. Department of Energy, U.S. Environmental Protection Agency, U.S. Department of Agriculture.

GHG Emission Reduction Targets and Carbon Pricing

Companies can set a science-based target to commit to reducing GHG emissions in line with the goal of limiting global temperature increase to well below 2 degrees Celsius.[58] The Science-Based Targets initiative requires companies to include at least 95 percent of company-wide emissions associated with direct energy use (scope 1) and electricity consumption (scope 2).[59] Additionally, targets must be based on emission reductions achieved through direct action within their own boundaries or their value chains, as opposed to purchasing carbon offsets. As of October 2017, 21 U.S. businesses have set science-based targets and 35 additional U.S. companies have committed to taking science-based climate action. Among the companies in the U.S. that have set science-based targets are Mars, Adobe Systems, General Mills, Pfizer, and Walmart, reflecting a range of different sectors that are taking climate action.[60]

A growing group of businesses are implementing an internal price on carbon.[61] Internal carbon pricing can be done in different ways, but on the most basic level it is a financial tool that reflects the social, environmental, and economic costs of climate change in financial decisions.[62] In an October 2017 report, CDP found that 96 U.S. businesses use internal carbon prices, while 142 U.S. businesses plan to implement internal carbon pricing by 2019.[63] However, only two U.S. companies have signed on to align with the UN Global Compact's Business Leadership Criteria on Carbon Pricing through We Mean Business, a coalition working to catalyze climate action through business leadership.[64] To align with the Business Leadership Criteria on Carbon Pricing, businesses must set an internal carbon price high enough to materially affect investment decisions to drive down GHG emissions, publicly advocate for the importance of carbon pricing, and communicate progress over time in public corporate reports.[65]

Electricity Generation

One of the most significant actions that corporations have been taking is the purchase of renewable energy based on long-term procurement agreements with developers and utilities through power purchase agreements, green power purchases, green tariffs, and outright project ownership. Through these types of projects, large businesses can drive market development of new renewables.[66] Over the past 5 years, businesses have signed roughly 9 gigawatts (GWs) of renewable energy deals.[67] This amounts to roughly 20 percent of all utility-scale wind and solar capacity additions (as opposed to residential or commercial additions) between 2013 and July 2017.[68] These large-scale voluntary purchases of renewable electricity are explicitly surplus to regulatory requirements,[69] and are being driven by corporations including Amazon, Microsoft, 3M, General Motors, Mars, and Anheuser-Busch InBev (Figure 2-7).[70] Such purchases will likely continue as solar and wind become even more cost-effective.

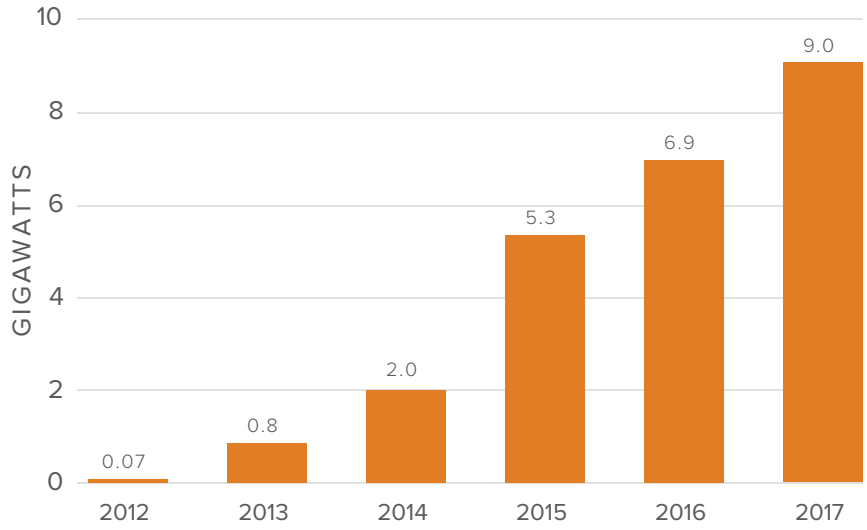
One of the biggest changes in renewable power markets is the rise of individual businesses as purchasers. In 2013 only 5 percent of renewable contracts were signed with big users, like companies, universities, and the military.[71] Last year nearly 40 percent of wind contracts were with such big users including businesses like Wal-Mart and GM.[72]

Corporate renewable energy commitments can have powerful ripple effects throughout the electrical supply chain. In coal-dependent West Virginia, the state's biggest public utility, Appalachian Power, recently told the state's governor, that it won't build any more coal power because its biggest customers, businesses like Steel Dynamics and Marathon Peroleu, have signaled that they don't want it. Instead, they are asking about how to get 100 percent renewable electricity.[73]

A number of public and private sector partners are working together to help facilitate large-scale renewable energy deals. One such initiative, the Renewable Energy Buyers Alliance (REBA) is a collaboration among the World Resources Institute, Rocky Mountain Institute, World Wildlife Fund, and Business for Social Responsibility. REBA aims to achieve an additional 60 GW in purchased renewable capacity in the U.S. by 2025 (from a 2015 baseline). Collectively, REBA works with more than 100 large energy buyers that represent large demand for renewable energy. REBA's network is expanding to include universities, hospitals, local agencies, and other large energy buyers.

FIGURE 2-7

Cumulative Publicly Announced Corporate Renewable Deals (2012-2017)



Note: 2017 data through September.
Source: Business Renewables Center.

Sixty-two Fortune 500 companies with U.S.-based operations have set renewable energy targets.[74] Autodesk, Starbucks, TD Bank Group, and Voya International have already achieved their 100 percent renewable energy targets, while Google expects to reach theirs in 2017. Those businesses achieved their targets by contracting with suppliers, purchasing unbundled renewable energy certificates (RECs), installing solar photovoltaic (PV), and self-generation.[75] Companies such as Apple, Walmart, Amazon, Google, and IKEA are installing solar panels and wind turbines to produce their own energy.[76]

Transport

One of the most popular climate friendly actions that U.S. businesses are taking is to improve supply chain transportation efficiency. Through EPA's Smart Way program, more than 3,500 U.S. companies (including UPS, Nike, CSX, and Target) have saved $27.8 billion in fuel costs and achieved 94 million metric tons of CO_2 reductions since 2004.[77] This public-private initiative includes a diverse group of partners, including truck, rail and barge carriers, and the retailers, manufacturers, and logistics managers who rely on them.[78] Participating companies voluntarily commit to improve their fuel efficiency and reduce their environmental impacts from freight transport. However, the future of federal public-private partnerships like Smart Way may be at risk under the Trump Administration.

The Climate Group, an international NGO that works with businesses and governments to reduce GHG emissions, launched a new business campaign focused on the uptake of EVs and infrastructure called EV100. Members of the initiative pledge to convert their large vehicle fleets to EVs by 2030.[79] While the international initiative was just announced at NY Climate Week in September 2017, two U.S. companies (HP, Inc., and PG&E) have already become members.[80]

Additionally, U.S. car manufacturers have recently committed to increased EV production. For example, General Motors is now working towards an all-electric, zero tail-pipe emissions future with 20 new EV models available globally by the early 2020's[81] and Ford announced its intention to accelerate global development of EVs, promising that it will add an all-electric SUV with a range of 300 miles by 2020.[82]

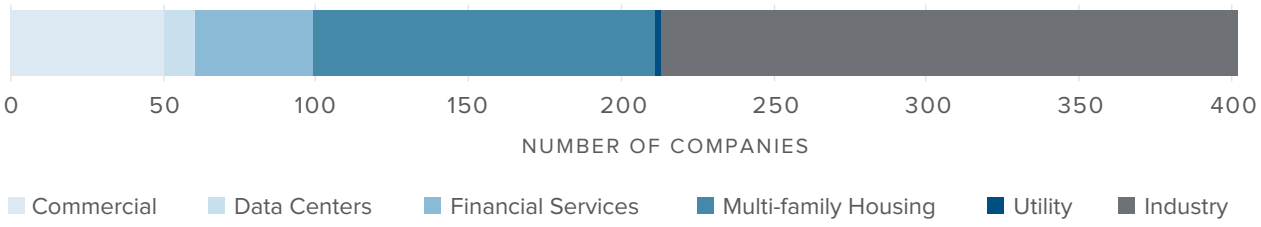
Commercial and Industrial Energy Use

Through the U.S. Department of Energy's (DOE) Better Buildings Challenge, **200 companies, representing more than 13 percent of total U.S. commercial building space, have voluntarily committed to reduce their building energy use by 20 percent over the next ten years (see Figure 2-8)**. This network of companies shares solutions, develops high-impact technical and market solutions for improving efficiency, and receives technical assistance from DOE experts.[83] The real estate community is also

working to reduce energy consumption in buildings—through, for example, reporting environmental, social, and governance data to the Global Real Estate Sustainability Benchmark (GRESB) organization to validate, score, and benchmark their progress. Since 2010, more than 200 real estate developers, realty advisors, and other companies in North America have participated, giving investors and participants insights on the performance of their building assets and portfolios.[84]

FIGURE 2-8

Number of Companies That Have Set Energy Efficiency Targets Through DOE



Note: Nearly 70 universities, cities, and states have also signed up for the Better Buildings Challenge. Industrial companies are part of the Better Plants program; all others are part of the Better Buildings program.
Source: U.S. Department of Energy. Better Buildings, Better Plants Solutions Center.

Additionally, nearly 200 companies representing almost 2,600 facilities in all 50 states, Washington D.C., and Puerto Rico are reducing the energy intensity of their industrial facilities through DOE's Better Plants program (see Figure 2-8). This represents about 12 percent of the total U.S. manufacturing energy footprint, with 14 partners in the Fortune 100. By adopting a variety of strategies and other innovative approaches, these companies have committed to decreasing their energy intensity by 25 percent over 10 years and have already reported 600 trillion Btu of cumulative energy savings and $3.1 billion in reduced energy costs.[85]

Methane

Nearly 100 U.S. based companies have joined EPA's Natural Gas Star program, agreeing to implement methane reducing technologies and practices throughout natural gas production, processing, transmission, and distribution, and to document their emission reductions.[86] The EPA's Methane Challenge Program allows U.S. oil and gas companies to go even further and to make specific and transparent commitments to reducing methane.[87] These include committing to using demonstrated emissions-reducing technologies, adopting best management practices, and/or joining the ONE Future Emissions Intensity Commitment to reduce their methane emission rate to one percent. There are currently 55 companies participating in the Methane Challenge Program, with National Grid, Kinder Morgan, Southwestern Energy Company, and Southern Company Gas reporting ONE Future goals to the EPA.[88]

Through the EPA and the U.S. Department of Agriculture's Food Loss and Waste 2030 Champions program, **20 companies—including General Mills, Walmart, Unilever, and Wegmans—have committed to reduce food loss and waste in their own operations in the U.S. by at least 50 percent by 2030**.[89] Furthermore, businesses like Tesla, Sierra Nevada Brewing Company, and Kellogg's have achieved their zero-waste goals at one or more of their facilities according to the Green Business Certification Inc.'s TRUE (Total Resource Use and Efficiency) waste certification system.[90]

Hydrofluorocarbons (HFCs)

Through EPA's GreenChill program, 43 supermarkets have committed to reducing their HFC emissions, with 533 individual stores becoming certified under this program since 2008. Because some alternatives offer performance benefits compared with the higher-GWP HFCs they replace, many consumers achieved energy and financial savings at the same time.[91] GreenChill partners, on average, reduce emissions by almost 10 percent within their first year of membership.[92] And the number of supermarkets getting certified as using at least 65 percent less refrigerant than the average supermarket has increased steadily over the last ten years. Coca-Cola, Pepsico, Red Bull, and Unilever have installed more than 5.5 million units using HFC-free refrigerants, with nearly 400,000 of those installed in the U.S.[93]

Summary of Businesses' Actions

Clearly, a number of non-federal actions are supported by programs run by federal agencies. However, while these programs are currently funded, it is important to note that continued funding decisions are controlled by the U.S. Congress and may shift according to the priorities of a particular party or administration.

WE ARE STILL IN

California

California has adopted the strongest targets of any U.S. state for reducing emissions from climate pollutants other than CO_2, often called "super pollutants" or "short-lived climate pollutants" (SLCP).[a] Through its SLCP Reduction Strategy, the state aims to cut emissions from HFCs and methane by at least 40 percent below 2013 levels by 2030, and non-forest black carbon emissions by at least 50 percent below 2013 levels by 2030.[b]

The SLCP Strategy includes various approaches for putting organic waste products to use, including through electrical generation, transportation fuel, pipeline-injected renewable natural gas, and composting. California seeks to reduce disposal of organic waste by 75 percent by 2025, and requires recovery of 20 percent of edible food in the organic waste stream to feed people in need.

California also aims to reduce fugitive methane emissions from existing oil and gas systems by 40 percent below 2013 levels in 2025 and 45 percent by 2030. The state will continue its research to improve emission monitoring and to identify "hotspots" responsible for the largest share of emissions.

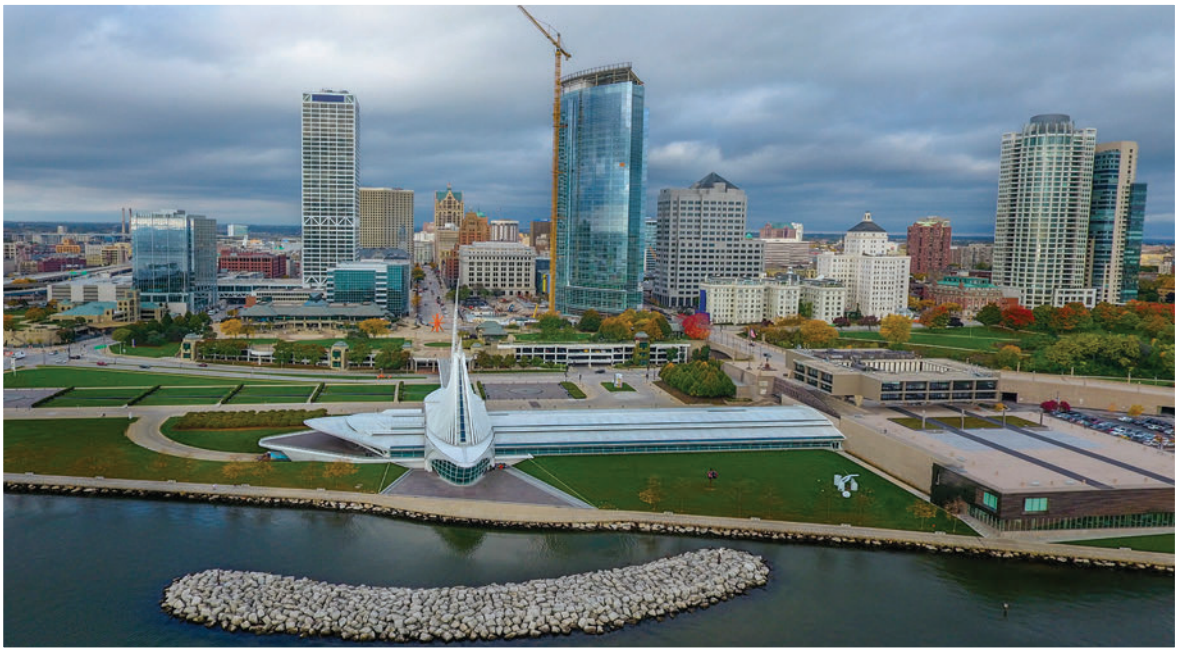
Finally, California is planning to outpace the HFC emissions reductions expected under the Kigali Amendment to the Montreal Protocol by adopting additional regulations and incentivizing available low-global warming potential (GWP) refrigerants where available. This builds on an existing refrigerant management program, which goes a step further than EPA's standards by requiring that all HFC leaks be repaired. This leadership is particularly important in the next five years, because HFCs, unlike methane, are not short-lived; some will remain in the atmosphere for more than one thousand years.

Notes

a Reducing Short-Lived Climate Pollutants in California, California Air Resources Board, 2017.

b Short-lived Climate Pollutant Reduction Strategy, California Air Resources Board, March 2017.

WE ARE STILL IN



Milwaukee

In Milwaukee, Wisconsin, intensive focus on urban forestry and land use is helping the city lead on pollution reduction, stormwater management, native plant health, and green infrastructure development. In 2013, the conservation organization Urban Forests named Milwaukee one of the top 10 U.S. cities for urban forests.[a] Its 200,000 street trees function as a natural carbon sink and provide other environmental services. The urban forest helps remove 569 metric tons of pollution each year, particularly ozone, a service with an associated value of at least $5.6 million. It stores 380,000 metric tons of carbon (estimated value: more than $29.8 million), and sequesters another 14,100 metric tons (more than $1.1 million).[b]

Milwaukee's Forestry Section conducts an intensive, six-month employee training program on topics like tree climbing, dendrology, and tree pruning. With this well-trained team in place, 98 percent of all felled street trees are replaced. The city has focused on creating bioswales in roadway medians and replacing ornamental trees with 4,500 larger shade trees, which are placed closely together on medians to create denser canopy. The canopy is valued by the community and its shade is estimated to save more than $1.3 million annually in energy-related costs for residential buildings.

Notes

[a] American Forests Names the 10 Best U.S. Cities for Urban Forests, CISION PRWeb, February 5, 2013.

[b] i-Tree Ecosystem Analysis – Milwaukee, Urban Forest Effects and Values, September 2008.

WE ARE STILL IN

Ingersoll Rand

In 2014, Ingersoll Rand (NYSE: IR), a world leader in creating comfortable, sustainable and efficient environments, committed to reducing the greenhouse gas refrigerant footprint of its products by 50% by 2020 and of its own business operations by 35% by 2020.[a] This commitment also included a $500 million investment in product-related research and development.

A year later, the company announced the EcoWise™ portfolio of products designed to lower environmental impact with next generation, low global warming potential refrigerants and high efficiency operation.[b] And since 2013, Ingersoll Rand's ecological focus has allowed it to prevent the release of about 6.7 million metric tons of carbon emissions. By 2030, the company's carbon footprint is expected to shrink by 50 million metric tons.[a, c]

Ingersoll Rand's sustainability efforts also include the "Green Team" certification program, which was active in all manufacturing locations by 2013. These teams engaged more than 4,000 employees and saved the company more than $200,000 in operational costs. In 2016, the Green Teams helped the company divert 2.4 million pounds of waste from landfills, reduce carbon emissions by 2,064 metric tons, and save 2.2 million gallons of water.[d] Ingersoll Rand's Center for Energy Efficiency and Sustainability continues to find ways to innovate.[e]

Notes

[a] Ingersoll Rand to Cut Greenhouse Gas Emissions in Half by 2020; Invests $500 Million in Energy Efficiency to Address Climate Change, Ingersoll Rand, September 22, 2014.

[b] Ingersoll Rand Marks Climate Commitment Achievement At White House HFC Reduction Roundtable, TheStreet, October 15, 2015.

[c] Our Climate Commitment, Ingersoll Rand.

[d] Community Relations, Ingersoll Rand.

[e] Center for Energy & Sustainability: Shaping the Future, Ingersoll Rand.

WE ARE STILL IN

Target

Target is racing toward a low carbon future by setting a goal of a 25% reduction in GHG emissions by 2025.[a] The company has earned ENERGY STAR certification for 1,409 of its more than 1,800 stores and aims for 80% by 2020. With solar arrays installed at 350 locations, the retailer was named SEIA's 2016 top corporate solar installer in the U.S. In 2016,[b] Target entered into a partnership to purchase enough wind power to offset 100% of the energy used at 60 of its Texas stores.[c] By 2020, the company aims to install solar rooftop panels on 500 buildings and expand its investment in off-site renewable energy.

Target is creating efficient buildings, using resources responsibly, eliminating waste, and minimizing its carbon footprint. The company pledged to introduce hydrofluorocarbon-free refrigerants in its food distribution centers (FDCs) and stand-alone refrigerated display cases by 2020.[d] Today, all five of its FDCs are using HFC-free refrigerants for cold storage areas and more than 1,000 stores are using HFC-free refrigerants in stand-alone cases.[e] These units are as much as 50% more efficient than the ones they replaced, and they also eliminate greenhouse gases vastly more powerful than carbon dioxide. Additionally, Target is eliminating the use of HFC's in their market area by using CO_2 and lower GWP HFO refrigerants in its stores.

Notes

[a] Sustainable Operations, Target.

[b] Solar Means Business: Tracking Solar Adoption by America's

[c] Top Companies, Solar Energy Industries Association, 2016.

[d] Power Up: Check Out Target's New Wind Energy Partnership in Texas, Target, July 21, 2016.

[e] Target Unveils Eight New Climate Pledge Commitments, Target, October 29, 2015.

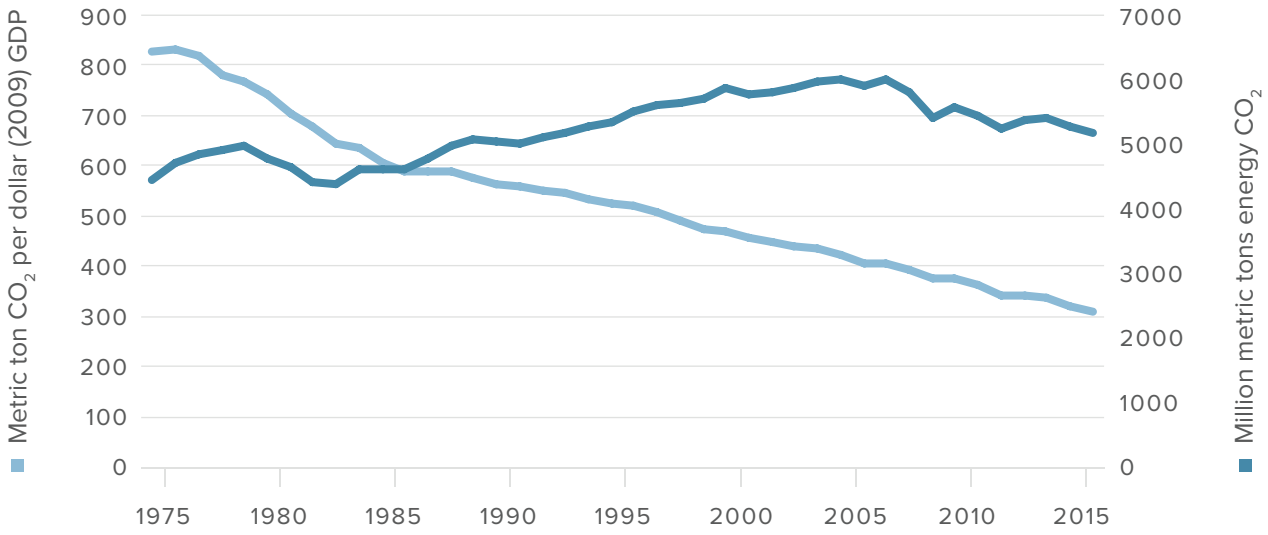
[f] 2016 Target Corporate Social Responsibility Report, Target, 2016.

Chapter 3: The Changing U.S. Economy: Market Trends, Barriers, and Opportunities for Non-federal Actors to Step Up

The actions described in Chapter 2 are taking place in the context of a changing U.S. economy. The United States has seen a steady decline in the carbon intensity of its economy since the 1970s (Figure 3-1). More recently, U.S. net GHG emissions have decreased by just over 11 percent since 2005.[94] The driving forces of this decline include advances in technology, changing markets, federal policies, and non-federal actions such as those outlined in Chapter 2 of this report.

FIGURE 3-1

Changes in Carbon Intensity and CO_2 Emissions in the U.S.



Source: U.S. Energy Information Administration, Monthly Energy Review; U.S. Bureau of Economic Analysis, National Economic Accounts: Current Dollar and "Real" GDP.

Much of this change to date is embedded in the U.S. economy in ways that reversals in federal policy are unlikely to impact. What hangs in the balance is the degree to which decarbonization of the economy continues, how rapidly it will accelerate, and what role non-federal action will play in its continuance and acceleration in the years ahead.

Improved building codes mean that new buildings are more efficient, providing incremental but durable changes to the overall building stock. New renewable power projects will remain operating for decades, with near-zero marginal costs, while coal power plants that have been retired are unlikely to be brought back on line. Even coal plants that have merely been scheduled for retirement within a few years are almost certain to be shut down, because of lack of maintenance and the cost-competitiveness of natural gas and renewables. Increased fuel efficiency standards for cars and trucks over the last decade have increased the average efficiency of vehicles on the road, which is unlikely to be reversed. The decarbonization already built into the economy is thus likely to endure. While changes in federal policy may slow or stop progress in these areas, they are not likely to turn back the clock.

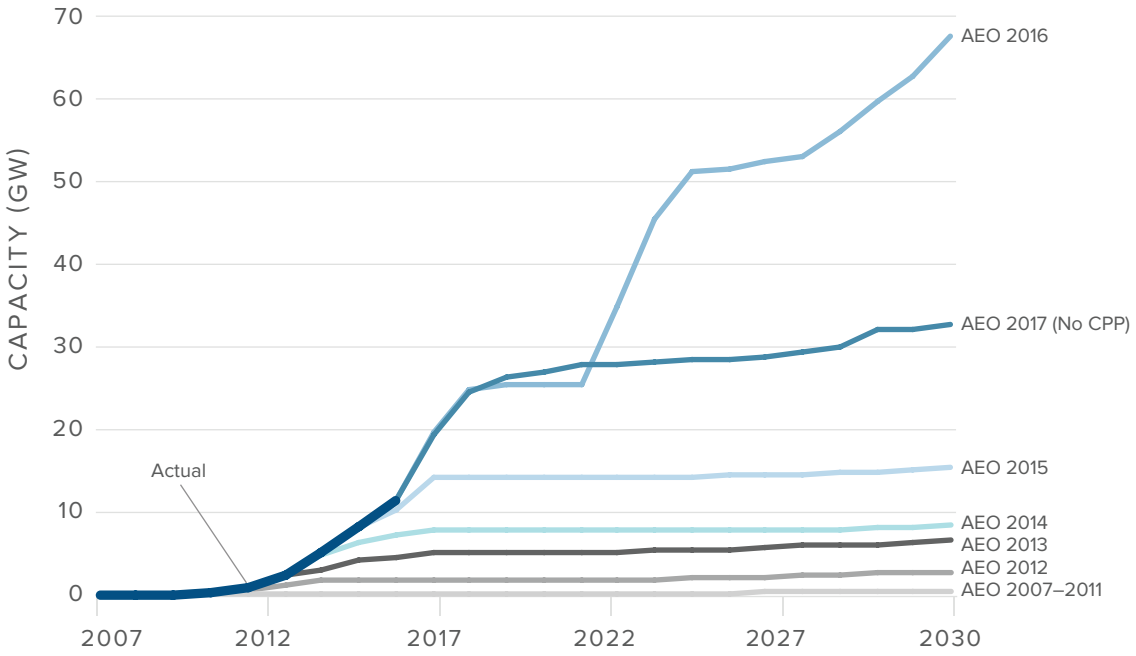
These trends tell only part of the story as we look at the potential for the U.S. to achieve deep emission reductions in the decades ahead. A full understanding of the extent of these changes requires a better accounting not just of the changes to date, but also the rate of growth and potential changes in that rate of growth. This accounting must consider both the potential acceleration of these trends, as has been seen in the solar and wind industries, and the potential headwinds from market barriers and a federal administration acting to reverse U.S. climate policies.

The mainstream view of energy system transformation, as reflected in industry publications and analyses, is that current shifts will follow paths similar to those of the more resource-intensive energy systems of the past. However, recent experience shows that clean energy markets and technologies can have quicker implementation paths if they reach critical thresholds, and then can continue to grow at accelerating rates. This type of pattern has been seen in technologies both inside and outside the energy context, for example with the rapid evolution of cell phones and the recent spread of smart phones. An energy example can be seen in solar photovoltaics (PV), as indicated in Figure 3-2, when comparing the actual growth in U.S. PV against annual Energy Information Administration (EIA) projections.[95]

The prospects for decarbonization can vary widely depending on whether we look at current economics or track trends over time. Measuring today's average costs often yields startlingly different results than the best technical projections of tomorrow's costs. For example, Lazard's current levelized cost analysis for lithium-ion battery storage is $399/ kilowatt hour (kWh).[96] But the Royal Society of Chemistry concluded that once one terawatt hour (TWh) of such capacity was installed, prices would fall to the $175/kWh range.[97]

FIGURE 3-2

Projected and Actual Annual U.S. Utility-Scale Solar PV Additions 2007-2030



Note: This figure illustrates U.S. Energy Information Administration's (EIA) Reference Case projection for each publication year noted, except for AEO 2017. According to EIA, the Reference Case reflects "trend improvement in known technologies, along with a view of economic and demographic trends" and reflects "current laws and regulations affecting the energy sector." Because of the U.S. Supreme Court's decision to stay the Clean Power Plan in 2016, and the Trump Administration's recent proposal to repeal these power plant standards, we included EIA's AEO 2017 side case that assumed the Clean Power Plan was no longer in place to better reflect the status of existing energy policies.
Source: U.S. Energy Information Administration, "Annual Energy Outlook," 2007-2017, https://www.eia.gov/outlooks/aeo/

Solar provides another illustration. Not just in the U.S., as shown in Figure 3-2 above, but globally, analysts have consistently underestimated the future deployment of solar panels, even when forecasting only a year or two in advance. A report from the Mercator Institute in Germany found that typical "integrated assessment models" repeatedly under-predicted the growth of the solar market. Those used by the International Energy Agency (IEA), for example, have been off by 16-30 percent.[98] The researchers concluded that models routinely failed to take into account the impact of public policy, including policy by states and cities; the speed of technological advance; and the impact of public attitudes on corporate decisions.

While progress has been made and the outlook is promising, several challenges may inhibit deeper GHG emissions reductions across the U.S. economy and slow the transition in specific sectors. This is particularly apparent at the federal level with the potential for significant shifts in program funding and technical support from federal agencies and national labs.[99]

In the discussion below, we examine how economic trends have played out across major sectors and for key non-CO_2 gases, reflecting both progress to date and some remaining barriers. Throughout this discussion, we pay attention to ways that non-federal action can play a meaningful role in reducing emissions, helping address barriers, and enabling acceleration of the transition to a low-carbon economy. We have also highlighted "opportunities to step up"—examples of areas where concerted non-federal action may be well positioned to overcome barriers and support acceleration of the trend toward a low-carbon future.

Power Sector

Power sector emissions have fallen rapidly for the last decade, outpacing progress in all other major economic sectors.

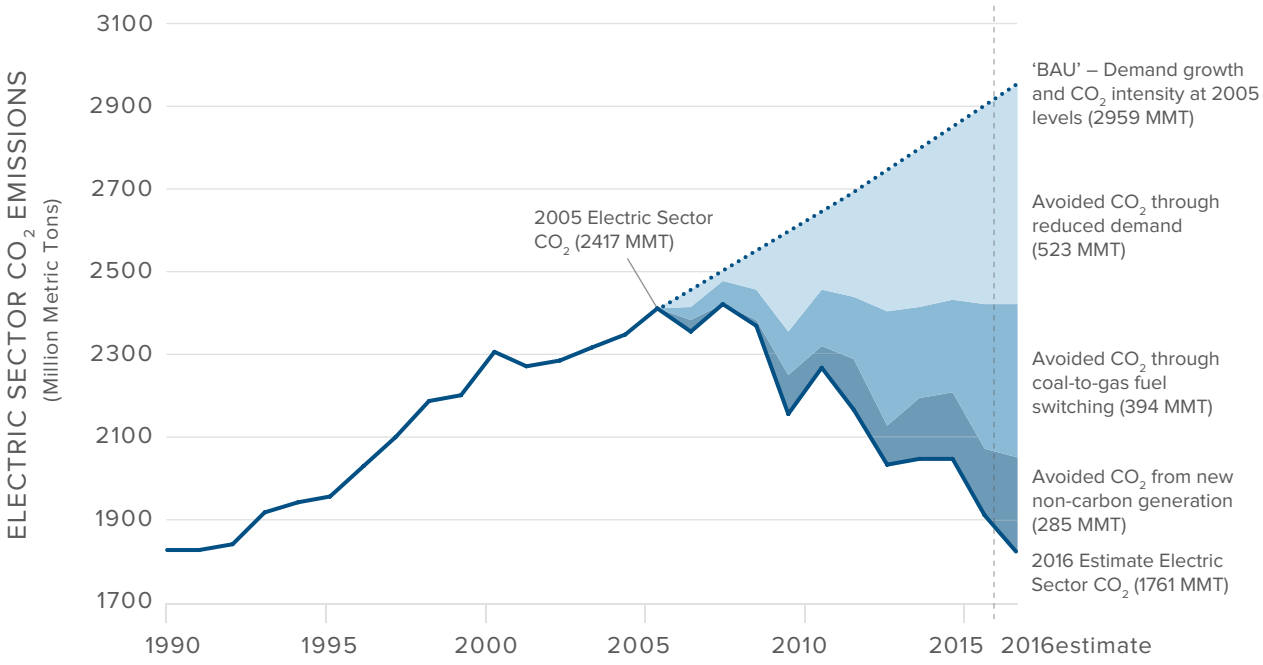
For decades, electricity generation was America's leading source of GHG emissions, but the U.S. power sector is undergoing a significant transformation. Several factors are contributing to this trend: electricity used per unit of GDP has declined because of efficiency improvements and changes in the structure of the economy. Falling natural gas prices, aging power plants, and stringent pollution control requirements have also contributed to a significant decline in coal's share of generation. Community efforts such as the Sierra Club's Beyond Coal campaign have also played a role in that decline. Meanwhile, renewable generation has been growing due in part to state policy mandates, corporate procurement, federal tax credits and falling technology costs for solar and wind.

As a result, power sector emissions are at their lowest level in decades. In the last decade alone (2005 to 2016), CO_2 emissions from the utility sector fell by 24 percent.[100] This rate of sectoral decarbonization has almost no large economy precedent. How did it happen?

Analysts have differed widely in how they interpret the causes of the rapid decline in GHG emissions from the U.S. utility sector. In 2015, emissions were roughly 40 percent lower than the EIA had projected just a decade earlier.[101] A Carnegie Mellon University study attributes over 50 percent of the reductions in emissions intensity over that period to the switch between coal and natural gas.[102] Other studies focusing on total emissions reductions, such as the Sierra Club's Beyond Coal campaign, ascribe more impact to lower than expected electricity demand and renewables. This discrepancy is understandable given how multiple factors have combined over many years to contribute to U.S. power sector decarbonization. At one level, the shift in the composition of generation by source is straightforward. According to a 2014 EIA analysis

FIGURE 3-3

Power Sector Avoided CO_2 Emissions



Source: Sierra Club Beyond Coal Campaign

updated in 2017 by the Sierra Club, if 2005 trends had continued, by 2016 the U.S. power sector would have emitted 3,000 MMT of CO_2e; in fact, it emitted only 1,800 MMT (Figure 3-3).[103] Of these avoided emissions, roughly 500 MMT were primarily the result of lower-than-expected demand.[104] Since 2005, electricity demand has essentially remained flat while the carbon intensity of electricity generation has decreased.[105] Of the avoided emissions remaining, the Sierra Club found that just 400 MMT of avoided emissions, or 33 percent, came from fuel switching between coal and natural gas, while 300 MMT were attributable to the deployment of renewables.[106]

These numbers tell us how the U.S. power sector has begun the process of decarbonization. Understanding **why** this transformation is occurring is harder to tease out. Below, in chronological order, are eleven key factors. Notably, **non-federal actors** have a prominent role in almost all of these:

1. Starting in the late 1970's, **utilities** postponed and delayed cleaning up power plant pollution—sulfur, particulate matter, ozone and mercury in particular. In the 2000s, EPA began revising national air quality standards for particulate matter (2006, 2012), ground-level ozone

(2008, 2015), sulfur dioxide (2010), nitrogen dioxide (2010), and lead (2008).[107] In December 2011, EPA finalized the first standards for toxic air pollutants like mercury.[108] Power plant owners had a choice: either install or upgrade their pollution control equipment, or retire.

2. Major **utility companies** planned to replace the oldest and most out-of-compliance plants with newer units starting in the early 2000s. Older, less efficient natural gas plants accounted for 64 percent of the power plant retirements between 2000-2010.[109] By the end of 2012, almost 10 percent of the existing coal-fired capacity was slated for retirement, with 20 percent still deciding whether to retrofit to comply with the EPA Mercury and Air Toxics Standards.[110] Around the same time, shale gas arrived. Shale gas accounted for 1.6 percent of total natural gas production in 2000,[111] but with productivity skyrocketing between 2007 and 2011,[112] it suddenly offered utilities, customers and investors an alternative to replace older, coal- or less efficient natural gas-fired units.

3. Meanwhile, demand didn't grow as some in the power generation business had expected. The U.S. economy shifted towards lower energy intensity sectors; technology slashed power demand within many sectors across the U.S. economy.[113]

4. The Sierra Club's Beyond Coal campaign and allies shifted their focus to retiring existing plants.[114] This put the question of whether to pursue coal or clean power on the front burner for **governors, utility regulators, cities, investors and industrial customers**. Many concluded that coal-fired electricity generation was no longer necessary or desirable.

5. Most **states** adopted renewable electricity portfolio standards, energy efficiency rules, or both.[115] **Investors**, incentivized in part by tax credits, rushed in, scaling up U.S. wind and solar capacity.[116]

6. Significant new Chinese investment in solar manufacturing, together with European commitments to renewables including solar and wind, rapidly drove down the global cost of renewable power. Since 2008, land-based wind, utility scale solar, and electric vehicle battery costs fell by 41 percent, 64 percent and 73 percent, respectively.[117] Despite political rhetoric to the contrary, U.S. **states** like Iowa, Kansas, and Oklahoma became renewable energy powerhouses.[118]

7. Competitive markets in **states** like Texas allowed gas and renewables to undercut coal on price.[119] Because renewable power bids into the wholesale market with zero marginal costs, coal was forced to the end of the bid stack. As coal plants operated fewer and fewer hours, their economics collapsed.

8. Regulatory challenges to the least viable old coal plants resulted in diminishing economic competitiveness for coal-fired generation as **states, regulators, utility and customers** looked for more affordable options.

9. First to go were, predictably, older, smaller and less efficient coal units. But in their wake were some of the most modern coal plants with the best pollution controls and highest heat rates.[120] As electricity prices declined thanks to cheap natural gas and renewable energy, the prohibitive cost of operating scrubbers and selective catalytic reduction units at these plants made coal power too expensive in much of the wholesale U.S. power system.[121]

10. By late 2017, half the U.S. coal plants that had been operating in 2010 were retired or had publicly committed to retire by a specified future date. Just the retirements as of mid-2017 amounted to 50 gigawatts of coal capacity (16 percent of the 2010 total).[122] Over the same period, coal's share of total U.S. power generation fell from approximately 50 percent to just 30 percent.

11. Renewables gained momentum as their prices fell and more coal plant retirements created space in the market. In fact, more than 60 percent of new utility-scale generation capacity came from wind and solar in 2016.[123]

So the reasons are complex, but the outcome is clear; the U.S. power sector is decarbonizing.

The Trump Administration has suspended, and may well succeed in undoing, the Obama Administration's Clean Power Plan (CPP), which was designed to cut GHG emissions from existing power sector sources by 32 percent by 2030. But just as the EPA announced its proposal to repeal the rule, a study by the Rhodium Group revealed that the U.S. was likely to meet the CPP emissions reduction target anyway.[124]

The shift away from coal is likely to continue, with recent projections showing continued retirements of coal plants (Figure 3-4). The pace of coal retirements has not slowed under the Trump Administration. From January 2010 until January 2017, one coal plant announced its retirement every 16 days. But since Trump took office, the pace of coal retirements has accelerated, to one announcement every 10 days.[125] This shift is driven largely by market forces and will likely continue regardless of federal efforts to dismantle existing clean energy policies.[126] The U.S. coal fleet is aging and many plants can no longer compete with relatively cheap natural gas.[127] At the same time, wind and solar costs are rapidly falling and are cost-competitive with new coal generation in many markets across the country (Figure 3-5).[128] The Department of Energy's

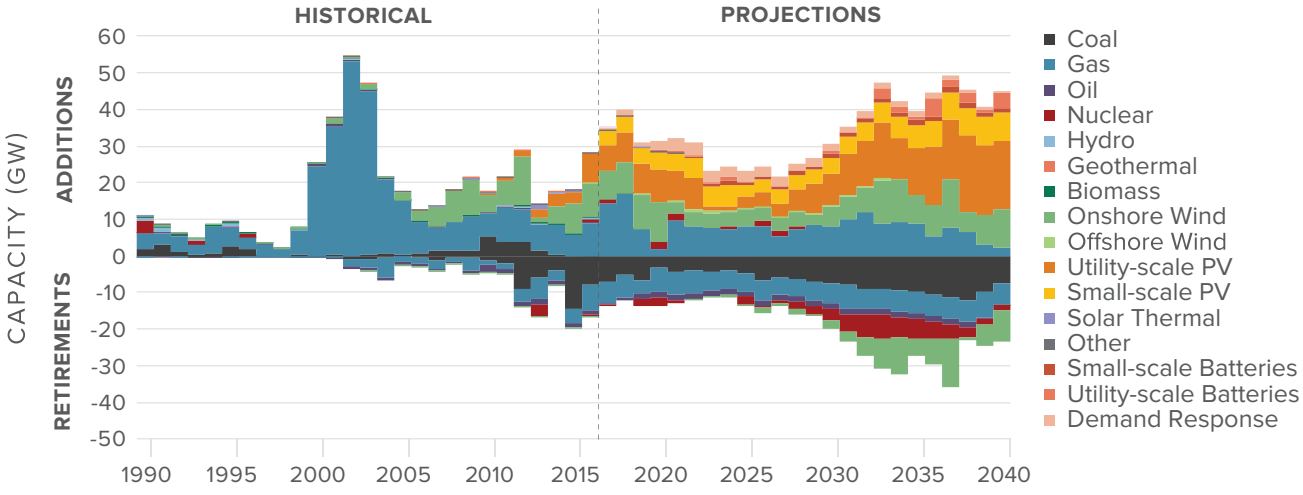
SunShot Initiative, which aimed by 2020 to make grid-connected solar cost-competitive with other forms of energy, announced in August that it achieved this target for utility-scale solar PV three years earlier than expected.[129]

Despite the Trump Administration's stated intent to "bring back coal," [130] the market is moving on. For example, CSX, a freight railroad company with roots in Appalachian coal, recently told investors that it will not be purchasing any new coal train locomotives. [131] Hunter Harrison, CEO of CSX, was quoted in the Financial Times as saying, "Fossil fuels are dead. That's a long-term view. It's not going to happen overnight. It's not going to be in two or three years. But it's going away, in my view."[132] Underscoring this point, after the Department of the Interior (DOI) lifted the moratorium on federal coal leasing in March 2017, which reinstated 44 federal coal leases, eight leases were suspended by their owners and five were cancelled outright. DOI has received only one new lease application.[133]

Looking forward, achieving significantly higher penetrations of renewable energy generation in the coming years will require addressing their variability and intermittency through storage, demand response, improved forecasting accuracy and other measures. Non-federal players, including state utility commissions, utilities, and others can work to improve the flexibility of the electric distribution system, and can work on regional approaches to improve

FIGURE: 3-4

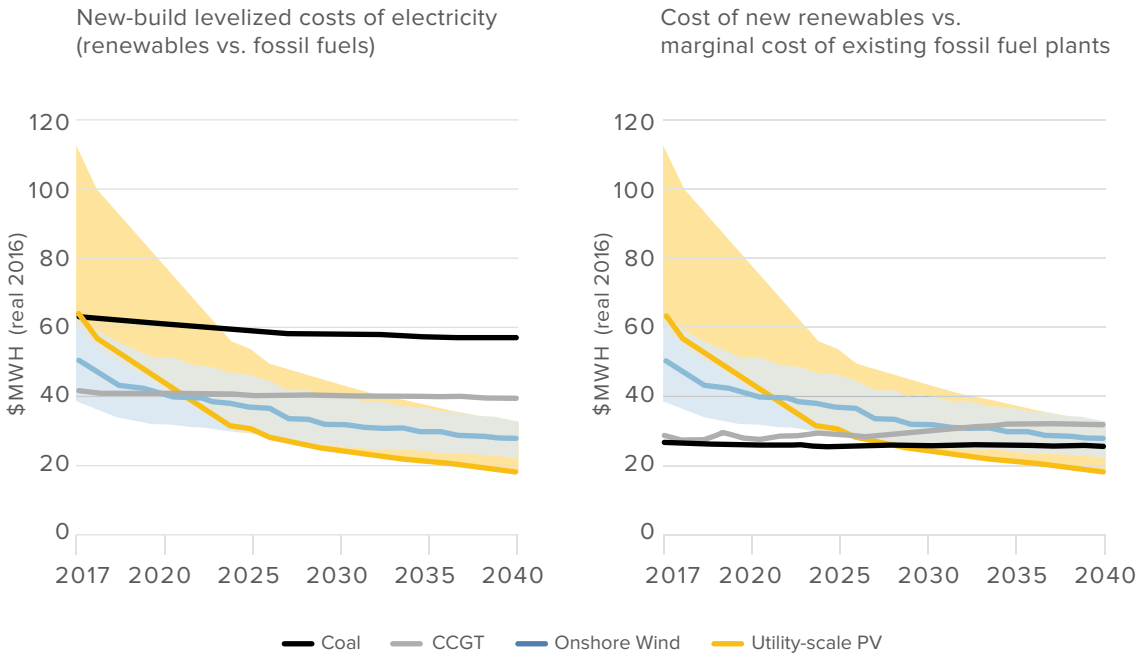
U.S. Power Sector Historical and Projected Capacity Additions and Retirements



Source: U.S. Energy Information Administration (historical); Bloomberg New Energy Finance (projections)

FIGURE: 3-5

Relative Cost in U.S. of Renewables and Fossil Fuel Capacity



Source: Bloomberg New Energy Finance, New Energy Outlook 2017

the transmissions system. Additionally, the location of untapped wind and solar resources does not always match up with the businesses or cities that would like to take advantage of these clean sources, requiring new transmission lines. Texas has been a leader in developing transmission to connect wind resources to urban areas where the electricity is needed.[134] Furthermore, falling power prices (due in part to cheap natural gas and renewable energy) and flat electricity demand are making nuclear plants in some markets less economic to operate, calling into question the role of a significant source of zero-carbon generation over the long-term.[135]

Flexible resources like demand response and batteries are also projected to play a role in the future, and can help integrate intermittent renewable resources into the system. Battery technology is expected to follow a similar trajectory as solar and wind, with energy density continuously improving[136] and average costs coming down from approximately $1,000 per kWh in 2010 to under $300 per kWh by 2016, and projected to fall to $73 per kWh by 2030.[137]

Opportunity to Step Up

States, cities, and businesses accelerate renewable energy growth. While a lot of non-federal actions have already occurred to support renewable energy, there is potential for more ambitious actions to further drive market growth. A major challenge in many locations is that monopoly utilities, many still reliant upon legacy fossil fuel generation, have significant influence over state legislatures and regulators, and those that might seek cheaper, cleaner renewable power are hampered in doing so. But even where cities or counties have choice about the carbon intensity of their power, they need to collaborate to exercise this choice. Cities with municipal utilities like Georgetown, Texas have the most authority and are going 100 percent renewable.[i] Seven states, including California, Illinois, Ohio and Massachusetts, allow cities to seek their own electricity provider through "community choice aggregation." But it is a large organizational task for a city or county to become a choice aggregator—and incumbent utilities often create significant roadblocks. A major opportunity exists to help bring cities wanting cheaper and cleaner renewable power together with generators seeking customers to accelerate the utility sector's decarbonization, and grid developers hoping to connect the two.

Where community aggregation is not permitted, cities and businesses, if they collaborate, can still change the electrical sector. Salt Lake City, for example, has no formal control over its electricity sources—but is working with its private utility in its move to 100 percent renewable energy.[138]

More states, cities, and businesses can commit to generating, or procuring, 100 percent renewable energy. At the same time, states, cities, and businesses will need to work with utilities and state agencies to avoid issues of added grid volatility and curtailment. Grid operators and states that invest in transmission infrastructure and grid expansion as well as battery storage can thus enable renewable energy commitments to be realized effectively, driving a more comprehensive transformation in U.S. energy markets and allowing for the establishment of even more ambitious targets.

Through this transition, the U.S. power grid system has the potential to become cleaner, nimbler, more localized, more resilient, more equitable, and more efficient—saving consumers and businesses money on their energy bills each month, and billions of dollars in avoided infrastructure and generation investment costs.

i For example, Georgetown Utility Services, which provides power to over 24,000 customers, is planning to switch to 100 percent renewable energy by 2018 through a contract with NRG Energy and EDF Renewable Energy for power from solar and wind plants located in Texas. Source: "Renewable Energy FAQs," Georgetown Utility Services, https://gus.georgetown.org/renewable-energy-faqs/.

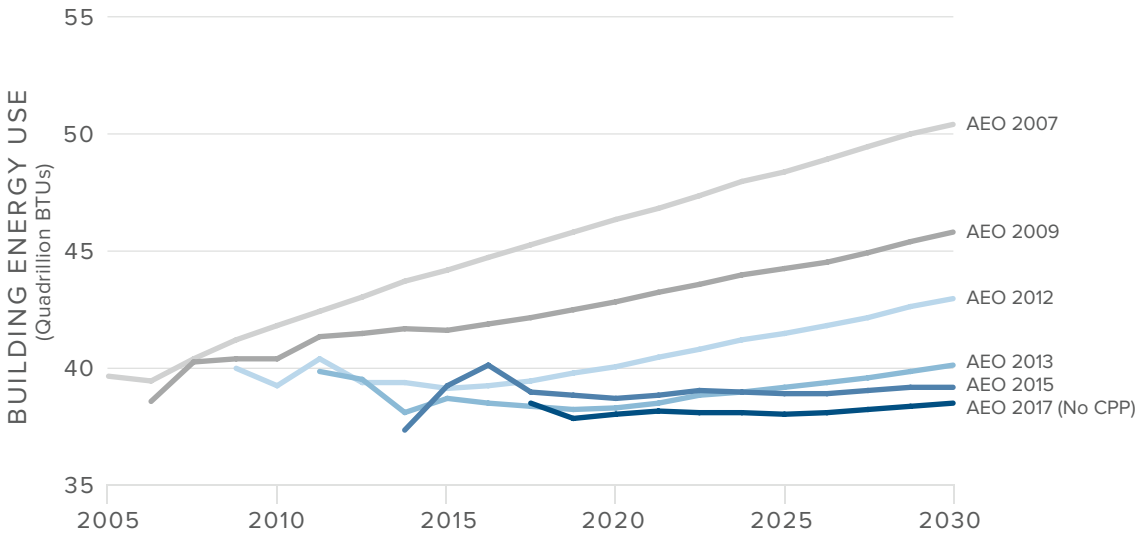
Building Efficiency

About 40 percent of the nation's total energy and more than 70 percent of its electricity was used in residential and commercial buildings as of 2016.[139] Over the past 40 years, there has been a significant shift towards high-performance buildings as the standard for new construction and innovative energy efficiency programs have been developed to address existing building energy use.

Building energy codes in the U.S. are set in a patchwork fashion, with independent, private bodies setting model codes, and states or cities then deciding which of these to adopt (or exceed). Non-federal actors can also participate in the code-setting process through participating in stakeholder engagement, submitting proposals, providing comments, and attending hearings.[140] Cities in particular have enormous influence over these codes, since in most states they must enforce them, and the code setting bodies have very strong city representation.[141] In recent years, significant improvements have been made in the model codes by organizing urban delegations to the code congresses; however, as noted, most cities have yet to adopt the full range of these improvements. Residential code reforms were

FIGURE 3-6

U.S. Building Energy Use Projections from 2006-2017



Note: This figure illustrates U.S. Energy Information Administration's (EIA) Reference Case projection for each publication year noted, except for AEO 2017. According to EIA, the Reference Case reflects "trend improvement in known technologies, along with a view of economic and demographic trends" and reflects "current laws and regulations affecting the energy sector." Because of the U.S. Supreme Court's decision to stay the Clean Power Plan in 2016, and the Trump Administration's recent proposal to repeal these power plant standards, we included EIA's AEO 2017 side case that assumed the Clean Power Plan was no longer in place to better reflect the status of existing energy policies.
Source: U.S. Energy Information Administration, "Annual Energy Outlook," 2007-2017, https://www.eia.gov/outlooks/aeo/

specified in the U.S. NDC, but never proposed by the Obama Administration, since there is currently no federal authority here. California's climate program requires a doubling of building energy efficiency,[142] and New York City recently mandated ambitious building efficiency improvements. [143]

Since 1980, best-in-class energy efficiency building codes have resulted in a 40 percent reduction in energy usage for those residential buildings they cover and 50 percent reduction in energy usage for covered commercial buildings.[144] Green building programs and certifications, including LEED, ENERGY STAR, and Better Buildings, are creating demand for improvements to buildings beyond code compliance. Appliance and equipment efficiency have also improved significantly over the past 40 years.[145] We can see the effects of these changes in building efficiency in EIA projections of building energy consumption in 2025, which declined by more than 12 quadrillion Btu between analyses from 2007 and 2017 (Figure 3-6). This is yet another example of the difference that a dynamic understanding of trends and projections makes on estimates of future climate pollution. Lawrence Berkeley National Laboratory estimated that by 2025 improved building codes could save 80 TWh of electricity, and 200 trillion Btu of natural gas, representing 3 percent of current residential and commercial electricity and natural gas consumption.[146]

Looking ahead, advances in technology are projected to drastically cut costs for more energy efficient products—sometimes drastically, as in the case of LED lighting—allowing for more widespread adoption of efficient appliances and equipment. For example, a 2015 study by the Department of Energy suggests that implementation of all cost-effective efficiency measures by 2030 would result in 23 percent savings in building energy consumption relative to business-as-usual.[147] At the same time, there is an opportunity to electrify many end-uses that currently run on natural gas. Doing so will help reduce emissions over the long-term, especially as we see a corresponding improvement in the carbon intensity of U.S. electricity generation.[148]

Despite progress, barriers persist. The market is not fully capturing cost-effective energy efficiency opportunities as a result of capital constraints, split incentives (such as the differing motivations of owners versus renters), access to information, and aversion to modifying traditional construction practices.[149] In addition, local jurisdictions often lack the resources to fully enforce the applicable building codes. While much has been done to address these challenges, particularly for new buildings, they remain a consistent impediment to sufficiently addressing emissions from the existing building stock. Only an estimated three percent of the U.S. building stock is new or renovated annually,[150] which drastically reduces the impact of solutions to addressing building energy efficiency that focus solely on new and renovated buildings. Looking ahead, investment in the existing building stock must accelerate; at the same time, increasing electrification in the building sector may be needed to achieve long-term emissions goals.

Opportunity to Step Up

States, cities, and private sector real estate and development partners work together to adopt and enforce ambitious building energy codes. These code reforms should be designed to optimize both new and existing building efficiency and environmental performance. This includes encouraging maximum electrification in order to phase out use of natural gas and fuel oil in buildings and appliances, water use reductions, or the use of low-GWP foams and refrigerants. Until these new building codes are in place, states and cities can adopt building energy codes that go beyond the most recent energy codes and create finance mechanisms and funding models to incentivize deep retrofits or retro commissioning of existing buildings. Additionally, the real estate sector can work with government partners to promote the value of energy efficiency to home and businesses buyers and sellers.

Transport

Transport, at 26 percent of total U.S. GHG emissions in 2015, is a significant and growing carbon pollution source.[151] In fact, according to the most recent EIA data, CO_2 emissions from the transport sector exceeded CO_2 emissions from the U.S. power sector in 2016.[152] Beyond continued progress on vehicle efficiency, for both light-duty and heavy-duty vehicles, the global movement towards electrification of the sector along with private sector innovation may unlock new opportunities to shift away from the dominance of fossil fuels in transportation energy. This in turn could establish the foundation for the rapid decarbonization of the transport system—a transition which is being initiated by non-federal actors, but will also require federal re-engagement to tackle sectors like shipping and aviation that fall primarily under federal jurisdiction.

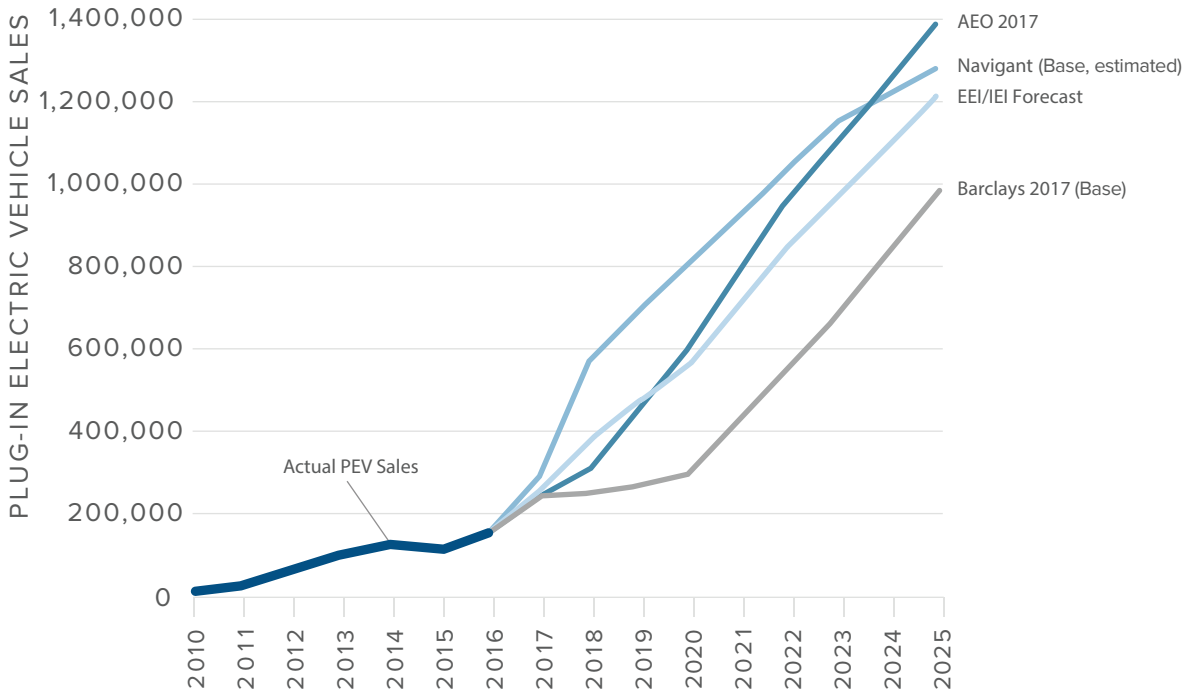
The rapid growth of zero emission and hybrid EV sales has the potential to dramatically alter the emissions intensity of light-duty vehicles in the U.S. and globally. Plug-in vehicles (including both electric and plug-in hybrid) currently represent only one percent of the total market, albeit as high as five percent in California.[153] EV sales are projected to accelerate in the coming years (Figure 3-7), in large part as a result of the continued rapid decline in lithium-ion battery costs, projected to reach $73/kWh by 2030, a 93 percent decrease from 2010 costs.[154] ZEVs are expected to become cost-competitive with conventional vehicles by 2026.[155] General Motors, in announcing that it would add 20 new electric models by 2020, also noted that “General Motors believes in an all-electric future.” Ford promptly announced that would bring 13 new electric models to market.[156]

Some businesses are also developing passenger vehicles powered by hydrogen, although this early commercialization is focused primarily in California. Toyota released its fuel cell Mirai during the summer of 2015 in California. It has a range of more than 300 miles and can be refueled in five minutes (compared to EVs, which take anywhere from 30 minutes to hours). It is also close to half the price of Tesla's Model S. To help accelerate investment in hydrogen vehicles, Toyota is offering its 5,680 fuel-cell patents to competitors for free until 2020.[157] Toyota also recently announced plans to release a smaller version of the Mirai in 2019 that is 20 percent cheaper.[158] And, in September 2017, Mercedes-Benz announced it will be releasing a plug-in SUV (GLC F-CELL) that utilizes both an electric battery along with a hydrogen fuel cell in the U.S. by the end of 2019.[159]

Most current projections nevertheless put ZEVs at around 10 percent or less of annual vehicle sales by 2025,[160] suggesting that battery and other technology and fuel cost declines alone will not be enough to transform the light-duty vehicle market as quickly as needed.

FIGURE 3-7

U.S. Plug-in Electric Vehicle Sales Forecast



Source: The Edison Foundation Institute for Electric Innovation and Edison Electric Institute.

Among the other critical ingredients is the creation of early adopter markets, such as in California, which can rapidly lower ZEV manufacturing costs associated with scale. As previously noted, cities are starting to play a major role, as illustrated by the 30 U.S. cities which recently committed $10 billion to purchase over 110,00 electric vehicles for their municipal fleets.[161]

Another barrier that non-federal actors can help scale is charging and hydrogen fueling infrastructure. The most ambitious investment in getting America's highways ZEV-ready is coming not from the coasts, but from seven Rocky Mountain and largely republican governors, who have launched a 5,000 mile Canada-to-Mexico EV superhighway, arguing that the 20,000 EVs registered in their states already warrant getting ready for the ZEV future.[162]

While ZEVs are significantly more efficient than fossil-fueled alternatives, to realize their full GHG emissions reduction potential, the electricity generation capacity and/or hydrogen fuel production process must be transitioned to low-carbon sources in parallel.

This report focuses on U.S. non-federal actors and market forces. But the U.S. is not an island. If solar panels—or EV batteries—get cheaper because of global policy, technology or investment decisions—they will get cheaper in the US as well. It was not American investment that drove the precipitous drop in the price of solar panels—it was German, Spanish, and Chinese policy and markets that created affordable roof-top solar in Arizona.[163]

Likewise, GM and Ford are not releasing dozens of new electric models only because of U.S. demand—whether driven by Washington D.C., states or cities. They are responding to global forces. With the largest (China), fourth largest (Germany) and sixth largest (India) vehicle manufacturing nations[164] announcing they are going to phase out the internal combustion engine, and with other countries like Britain and France joining in,[165] the auto industry can see their future is in EVs manufactured at scale.

Medium- and heavy-duty vehicles are also a large source of transport emissions; according to the EPA, they were responsible for more than 23 percent of total transportation emissions in 2015.[166] What's more, freight emissions are likely to increase going forward; the U.S. Department of Transportation estimates that shipping (measured by freight-tons moved) will grow by 40 percent by 2045.[167] This is largely due to increased activity in the freight sector and attendant increases in energy consumption since 1970 (with a dip in 2008 due to the recession) without a corresponding improvement in energy efficiency.[168]

However, the private sector has recently made advances in technology that improve trucking efficiency. This is particularly true in long-haul trucking, which accounted for 23 percent of total transportation energy usage in 2014.[169] For example, North American Council for Freight Efficiency (NACFE) member

companies improved their fleets' performance to 7.11 miles per gallon (mpg) on average in 2016, compared to the national average of 5.89 mpg. In the 'Run on Less' roadshow organized by NACFE and the Carbon War Room, trucks operating in real-world conditions averaged more than 10 mpg.[170] These improvements are the result of a combination of federal and state programs and advances in available technologies, and are an indication of the potential for further efficiency improvements.

Opportunity to Step Up

More states, cities, and businesses adopt the full range of light-medium- and heavy-duty vehicle emission reduction policies. Transitioning to zero-emission vehicles represents an important GHG emission reduction strategy in the transportation sector, due to the lower GHG intensity of electricity (on average) compared to petroleum powered vehicles.[171] Stronger ZEV mandates, incentives, and R&D support for both passenger vehicles and medium- and heavy-duty busses and trucks will likely be needed at the state level. At the same time, state programs that support the rapid development of EV recharging and hydrogen refueling stations will be critical to the transformation of these sectors.

The Clean Air Act allows states to opt in to California's independently managed vehicle emission programs, creating an opportunity for climate ambitious state governments to go further in embracing a wide range of policies California has adopted—particularly its Low Carbon Fuel Standard and Zero Emission Vehicle Mandate. Lawrence Berkeley National Laboratory has estimated that if the ZEV mandate currently adopted by ten states was adopted by all 50 states, it would translate to 16 million EVs on the road in 2025, 6 percent of the projected fleet—and would save 50 MMT of CO_2e in 2025.[172]

Even if a much smaller number of states adopted more ambitious policies, they could help shift the national vehicle market. States with current ZEV policies in place, for instance, represent nearly one-third of the motor vehicle market. Securing even more robust policies for ZEVs in that much of the market would lay the groundwork for deeper transportation electrification and decarbonization after 2020.

While cities lack the authority to require such mandates, they can encourage growth in the ZEV market share through joint purchase programs for their fleets, offering incentives for ZEV adoption by taxi and ride-sharing industries, and financing or requiring the deployment of charging infrastructure. Businesses and universities, particularly large fleet operators, can purchase ZEVs and/or adopt

highly efficient trucking technologies, while public utilities can offer significant incentive programs and assist in deploying charging infrastructure. Multiple cities, universities, and businesses partnering together to procure ZEV fleets could send a strong demand signal to vehicle manufacturers and encourage the development of even more ZEV options and technologies at greater scale and lower cost.

Industry

The diversity of the industrial sector presents both opportunities and challenges in finding a path toward a lower carbon future. With projected growth in the industrial sector, the challenge will be to offset that growth with accelerated efficiency improvements, fuel switching, low carbon process substitutes, electrification, and carbon capture. While the United States saw a significant decrease in industrial activity during the 2008 economic crisis, EIA projects that industrial sector demand (as measured in value of shipments in 2009 dollars) will grow 25 percent by 2025 compared to 2015 levels. Because of this, industrial sector GHG emissions are expected to increase 1.2 percent annually over the same time period.[173]

Of course, the total amount of energy consumed, and CO_2 emitted from industry as a result of the expected increase in demand could be higher or lower than these projections. This will depend on whether the sector transitions to lower carbon fuels and adopts more efficient processes. However, there are numerous barriers to the decarbonization of the U.S. industrial sector. Some are technical—much of the climate pollution in this sector is process emissions from the production of cement or steel—so substituting lower carbon fuels in these instances does not solve the problem of carbon in the raw material.

Other barriers are political and economic. Cities and states compete fiercely for manufacturing plants, and are reluctant to set higher emission standards than their neighbors. And much of U.S. manufacturing is exposed to fierce competition from other countries, many with lower environmental standards.

While industrial emissions have received less attention from policymakers than electricity or transportation, California broke new ground this year when it passed “Buy Clean” legislation—the first anywhere requiring public sector procurement for projects like highways and bridges to source building materials like structural steel, rebar, and insulation that meet low carbon intensity standards.[174] Moreover, increasing proliferation of advanced manufacturing practices, like automation, information and communication technologies, and materials re-use/recycling, presents an opportunity for non-federal engagement with the goal of not only continuing to lower emissions intensity, but of reversing projected industrial CO_2 emissions growth.

Investment in the transformation of the industrial sector is lacking. Many utilities focus on residential and commercial opportunities rather than industrial ones. While industrial electricity demand accounted for 32 percent of total demand in 2016, utility spending on industrial efficiency programs was only 5 percent of total spending.[175] What's more, efficiency gains and fuel switching can only take the industrial sector so far towards decarbonizing. The International Energy Agency notes the important role that carbon capture and storage (CCS) can play in reducing those GHG emissions that other approaches cannot tackle, although such technologies are not yet proven at commercial scale.[176]

Opportunity to Step Up

Manufacturing industries work with state agencies and utilities to boost efficiency and distributed generation. The U.S. industrial sector is one of the most complex and difficult sectors to decarbonize. Energy efficiency offers one approach for the sector that can enhance the competitiveness of industries that lower emissions. In 2010, McKinsey and Company Analytics estimated potential U.S. industry sector energy efficiency savings of 18 percent by 2020. The analysts projected that harvesting these gains would require an estimated $113 billion investment, but that the benefit/cost ratio would be 4:1.[177] Collaboration to harvest these efficiency gains is a major opportunity for states, cities, and businesses to work together to develop next generation approaches to increasing energy efficiency and reducing emissions. Working together, key stakeholders can identify the right combination of financing, regulation, and other support mechanisms that will enable U.S. industries to electrify, upgrade facilities with more efficient equipment, source renewable energy, and use lower carbon fuel sources and/or feedstocks. A potential early cooperation opportunity might be for other states to adopt California's pioneering "Buy Clean" approach to ensure that their public-sector infrastructure is built with low carbon intensity steel and insulation.

Hydrofluorocarbons

Hydrofluorocarbons (HFCs) are a small but rapidly growing component of U.S. (and global) GHG emissions. These gases, commonly used as refrigerants, foam-blowing agents, and aerosol propellants, are potent GHGs. The HFCs that have the highest global warming potential (GWP) trap thousands of times the amount of heat as CO_2 per ton emitted. Their use is on the rise due to the phase-out by 2030 of their ozone-depleting predecessors, hydrochlorofluorocarbons (HCFCs), under the Montreal Protocol. In 2016, a decade-long effort to amend the Protocol to phase down HFCs came to fruition when the Kigali Amendment was adopted.[178] Successful transition

away from the HFCs specified by the Kigali Amendment will result in the avoidance of 80 billion metric tons of CO_2 equivalent by 2050 and some 0.5°C of warming by the end of the century.[179]

The Kigali Amendment was possible largely because manufacturers like Honeywell, DuPont, and Arkema were already producing alternatives to HFCs with low or zero GWP. They include "natural refrigerants" like CO_2 and hydrocarbons, as well as synthetic alternatives with far lower GWP than the HFCs typically used today. The shift away from HFCs is already underway with many businesses transitioning to less HFC-reliant systems.[180]

Opportunity to Step Up

States, cities, and businesses create public private partnerships and/or incentive programs to accelerate the phase down of HFC use and emissions. States can adopt new legislation to ban sales on high-GWP refrigerants in new equipment where lower-GWP alternatives are available. States can also work with businesses to develop refrigerant recycling and management programs that go beyond current federal requirements and require leaks detected at any level to be repaired. Such state initiatives do not have to be universally adopted to dramatically speed up the phase down of HFCs. Once a sufficient share of the cooling or refrigeration market is met with climate friendly refrigerants, the rest of the market will shift to avoid manufacturing and supply chain fragmentation. And the number of auto, air conditioning or refrigeration manufacturers who must collaborate is relatively small. Ultimately, states, cities, and businesses have the opportunity to work together to ensure that new, affordable technologies are available to meet increasing demand. Such collaboration can include R&D support to businesses developing these technologies, internal commitments to low-GWP equipment procurement, and grant or rebate programs for low-GWP products for homes, businesses, or plants. Lawrence Berkeley National Laboratory estimated the benefits of such a faster shift to low-GWP refrigerants could save 80 MMT of CO_2e by 2025.[181]

Methane

Methane is a potent short-lived climate pollutant, with major sources including the oil and gas industry, landfills, wastewater treatment, manure management, and cattle. Methane is the primary component of natural gas, so controlling methane emissions often brings net economic benefit if the methane is captured and used for fuel. States, cities, and businesses have been leading the way in developing policies with the potential for creating a win-win situation for climate and corporate bottom lines.

Oil and natural gas systems

In the oil and gas industry, cost-effective technological solutions are available to address major sources of methane emissions from natural gas production, processing, and distribution. While these solutions would help businesses prevent lost product, not all businesses proactively control these leaks. This suggests that, even though states, cities, and companies are already collaborating to address oil and natural gas leaks from existing infrastructure, additional opportunities are available. One example is the reluctance of many state regulatory agencies to allow natural gas distribution companies to spend the necessary funds to identify and repair methane leaks. These methane leaks are charged to customers, and if sufficiently large, pose serious safety hazards, but avoiding rate increases typically takes priority, making it difficult for utilities to invest in upgrades.[182]

Approaches for addressing this problem include piloting advanced sensing technologies and practices (e.g., leak detection and repair methods developed by the Environmental Defense Fund and Google Earth Outreach in partnership with gas distribution utilities).[183] Special focus should be in urban areas, where less progress has been made to address methane leaks in natural gas distribution equipment systems, especially in Northeastern and Midwestern cities with older, leakier pipes.

Landfills, wastewater treatment plants, and manure management

Methane emissions can be captured from landfills, wastewater treatment plants, and agricultural sources. Renewable natural gas (RNG) can be produced from raw biogas generated by these sources. Relatively few projects currently produce RNG for fuel, but the RNG market has significant potential for growth with the resource base already available from food waste, landfills, farms, and wastewater treatment plants. Plentiful waste resources are currently available where biogas is already being produced or could potentially be produced and collected.[184]

While biogas generated from anaerobic decomposition of organic waste materials is still a small market, cities and towns are leading in ensuring that as it comes to market, it finds buyers. Los Angeles for example, has signed contracts with Clean Energy Fuels to power its natural gas buses with CEF's biofuels feedstocks originating from the city's garbage.[185]

Keeping food waste out of landfills can also help reduce methane emissions. An estimated 52 million tons of food is sent to landfills annually, accounting for 21 percent of landfill volume.[186] The multi-stakeholder nonprofit ReFED recently estimated that if fully implemented, food waste solutions could generate $10 billion of economic value, save 1.8 billion meals, save 1.6 trillion gallons of water, generate $1.9 billion business profit potential, and reduce 18 MMT CO_2e annually.[187]

Opportunity to Step Up

States and cities work with businesses to capture more methane at landfills and dairy farms. While methane is already being captured at nearly 250 livestock farms and 650 landfills, EPA estimates that there are about 400 landfills that are suitable for waste from landfill to gas projects[188] and 8,000 additional dairy and hog farms that are technically able to implement biogas recovery systems.[189] At the same time, California's state policy calls for a diversion of 75 percent of waste from landfills by 2020, a goal other states or cities could emulate.

Collaborative public private partnerships could be a key to motivating more cities and states to follow California's lead, so businesses can play a major role here as well. Specifically, major distributors and retailers of food and dairy products could green their supply chains by assisting dairies and other producers to reduce their methane footprints, or by supporting cities and states to reduce food waste and divert remaining organic waste streams from landfills to climate friendly disposal technologies like anaerobic digestion and composting.

Relatively few projects currently produce RNG for fuel, giving non-federal actors the opportunity to take advantage of this market potential. To do this, more states can provide grants or rebates for landfill gas to energy projects and work with municipal and private landfill owners to reduce other barriers to implementation. At the same time, scaling the adoption of zero waste goals at the state, city, and corporate level can help reduce the amount of waste sent to landfills to begin with. States can also support the uptake of anaerobic digesters in the dairy industry through financial assistance for digester installation as well as incentivizing research and development of other methods to reduce methane emissions from livestock.

Carbon Pricing

In addition to the sector and source specific discussions above, a key element of climate policy is putting a price on carbon to send a clear economic signal to reduce emissions. While a national, economy-wide cap-and-trade system or carbon tax would provide a consistent, national price signal, states have already blazed the trail in establishing cap-and-trade systems. As discussed above, California has created an economy-wide cap-and-trade program and is linked with the Canadian provinces of Quebec and Ontario, while nine northeastern states have joined the Regional Greenhouse Gas Initiative (RGGI) cap-and-trade program to cut emissions from the generation of electricity. If more states were to step up on carbon pricing, more of the country would be

covered by a carbon price that would internalize the costs of carbon pollution, and these programs could potentially link or converge over time.

Opportunity to Step Up

States join together and adopt robust carbon pricing policies. While states can adopt their own policies, they can also join existing markets, such California's market with Quebec and Ontario, or RGGI. Existing carbon markets can also expand beyond currently covered sectors to include emissions from transportation, currently in place or not, more businesses can adopt their own internal carbon pricing plans to help manage climate risk in their operations and push for further consistency across non-federal carbon pricing programs.

WE ARE STILL IN

Austin and San Diego

Austin, Texas, and San Diego, California, boast some of the most ambitious renewable and clean energy goals in the nation. In August 2017, the Austin City Council voted to get the city running on 65 percent renewable energy by 2027, an increase from the previous goal, set in 2014, to implement 55 percent renewables by 2025.[a] In 2015, San Diego, the country's eighth-largest city, became the biggest to aim for 100 percent renewable electricity.[b] The target is included in the city's Climate Action Plan, which vows to reduce GHG emissions by half by 2035 and by 80 percent by 2050.[c]

The cities anticipate economic and community benefits from their assertive action on environmental goals. A study by nonprofit and university researchers shows that Austin's "clean technology" industry contributes $2.5 billion to Austin's regional GDP, is responsible for 20,000 area jobs, and is projected to grow by 11 percent by 2020, fueling continued economic growth and creating even more jobs.[d] In San Diego, the city council identified several co-benefits of increasing energy sustainability, including cementing the city's leadership role in clean technology industries, promoting active transportation and rapid transit systems, and increasing demand for workers in high-growth "green" industries.[c]

Notes

[a] Robert Walton, "Austin Energy targets 65% renewables by 2027," Utility Dive, August 21, 2017.

[b] Matt Richtel, "San Diego Vows to Move Entirely to Renewable Energy in 20 Years," The New York Times, December 15, 2015.

[c] "Climate Action Plan," City of San Diego, 2015.

[e] Kathleen Baireuther, Ryan Field, Brian Kelsey, Mitch Jacobson, John King, and Helen Brauner, "Economic Impact of the Cleantech Sector In The Austin-Round Rock-San Marcos MSA," CleanTX, Civic Analytics, Austin Technology Incubator, 2015.

WE ARE STILL IN

Photo by: Julienne Schaer

New York City

New York City will be the first city to set greenhouse gas emissions standards for existing buildings, a path-breaking move that positions the Big Apple as a national climate leader.[a] All buildings larger than 25,000 square feet will now be held to fossil fuel caps, with violators facing financial penalties and denial of permits for major renovations. Almost a quarter of the city's GHG emissions come from approximately 14,500 buildings, which can burn up to four times more fossil fuel than more energy-efficient ones. Retrofitting these buildings with upgraded insulation, windows, heating and cooling systems, and other equipment could create as many as 17,000 new "green" jobs.[b]

In June, New York City reaffirmed its commitment to the Paris Agreement, with Mayor Bill de Blasio joining the 383-member group of Climate Mayors.[c] Building on New York City's "80x50" plan to reduce emissions by 80 percent over 2005 levels by 2050, the city in September finalized and released the world's first city plan to limit emissions in line with the Paris Agreement's 1.5 degree Celsius target. City officials anticipate that upgrading the city's most inefficient buildings will alone contribute to that goal by reducing total greenhouse emissions by 7 percent over 2005 levels by 2035.

Notes

[a] Brady Dennis and Kayla Epstein, "New York's buildings emit most of its greenhouse gases. The mayor has a plan to change that." The Washington Post, September 13, 2017.

[b] "Mayor de Blasio: NYC Will Be First City to Mandate that Existing Buildings Dramatically Cut Greenhouse Gas Emissions," Office of the Mayor, City of New York, September 14, 2017.

[c] "Cities adopt the Paris Climate Agreement Goals," Climate Mayors, 2017.

WE ARE STILL IN

Tesla

Tesla's mission is to accelerate the world's transition to sustainable energy. The company produces the safest vehicles on the road, solar panels and roof tiles, and the most advanced storage technology in the world. Tesla's Gigafactory 1 in Nevada will rival the battery-production power of the entire globe and contributes to the over 30,000 US jobs Tesla has already created.[a] Tesla has outspent the rest of the auto industry combined on charging infrastructure, with over 1,000 Supercharger Stations and more than 6,500 individual chargers. By making significant advances in battery technology and manufacturing, Tesla has realized reductions in battery costs of over 77% in less than 10 years. Tesla is also the largest rooftop installer in the US and when fully operational, Gigafactory 2 in Buffalo will be the largest solar manufacturing facility in the western hemisphere.

Notes

[a] Tesla Gigafactory, Tesla.

Citi

Citi has been outspoken in its support for the U.S. to remain in the Paris Agreement, having established a long track record of financing low-carbon projects while also reducing the climate impact of its own operations.[a] Citi continues to make progress on its ten-year $100 Billion Environmental Finance Goal, with $53.3 billion in financing committed in the first three and a half years. Key milestones have included its support of Deepwater Wind's 30MW Block Island Wind Farm, the first offshore wind farm in the U.S., and underwriting the first-ever asset-backed green bond for the auto industry for Toyota Motor Credit Corporation.

Citi continues to leverage products and expertise to support sustainable infrastructure and cities, including underwriting municipal bonds to support an array of improvements in sustainable transportation and water programs. Through a partnership with the World Resources Institute Ross Center and C40 Cities, the Citi Foundation supports the Financing Sustainable Cities Initiative, focused on identifying new finance strategies that accelerate sustainable urban solutions and climate resilience.

For its own operations, Citi has 2020 targets to reduce energy and water use by 30%, and waste to landfill by 60% against a 2005 baseline. This September, Citi committed to powering its global operations with 100% renewable energy by 2020, a goal which Citi intends to fulfill by leveraging the expertise of its businesses and clients.

Notes

[a] A Commitment to Sustainability, Citigroup Inc., 2017.

Conclusion: Next Steps for Fulfilling America's Pledge

In November 2016 the Obama Administration released the *United States Mid-Century Strategy for Deep Decarbonization* report. Reflecting on the major progress of the preceding years, the report noted that the United States had laid "the foundation to reach its 2025 target (26-28 percent reductions by 2025)."[190] However, U.S. domestic and foreign policy developments in 2017 have threatened to crack that foundation, and it is natural for the rest of the world to wonder whether America's pledge on climate action can be fulfilled.

As this Phase 1 Report has sought to demonstrate, commitment to climate action is growing across an increasing swath of America. States, cities, and businesses constituting more than half of the U.S. economy have mobilized behind the U.S. pledge under the Paris Agreement. An even larger subset of American cities, states and companies are taking concrete actions that reduce GHG emissions. They are embracing ZEVs, building efficiency upgrades, renewable energy use, and a host of other low-carbon technologies.

At the same time, the low-carbon transition is taking off in several key market sectors. Falling clean technology prices, emerging innovations, and actions by states, cities, and businesses have helped reduce U.S. net GHG emissions by 11.5 percent between 2005 and 2015 while the economy grew by 15 percent over that period. However, currently committed non-federal efforts are not sufficient on their own to meet the U.S. commitment under the Paris Agreement to reduce emissions 26-28 percent below 2005 levels. While there is still a long way to go, non-federal actors can utilize the authority they have to take on additional climate-friendly measures. Doing so will help maintain momentum toward meeting America's pledge under the Paris Agreement.

Future Analysis: America's Pledge Phase 2

Building on the actions and market trends identified in this report, the America's Pledge initiative will develop a more comprehensive analysis focusing on bottom-up non-federal contributions to 2025 U.S. emissions outcomes, to be published in a Phase 2 Report in 2018. This analysis will assess the role that non-federal action can play in helping to achieve America's pledge under the Paris Agreement, including the environmental and economic implications of current actions, pledges of future action by non-federal actors, and the implications of more ambition from multiple sectors and jurisdictions across the U.S. economy. We will aim to present this work in ways that help non-federal actors understand the impacts of their actions to date and their options and best opportunities for further climate action, in hopes of catalyzing further ambition and accelerated, near-term GHG emissions abatement.

In approaching this work, America's Pledge will explicitly address a number of challenges. First is the uncertainty regarding major macroeconomic trends (such as GDP growth) and energy market trends (such as the price of natural gas, which fluctuates almost entirely independently of climate policy decisions). Carbon sequestration by forests and other land uses introduces another large element of uncertainty. The Rhodium Group considered these uncertainties in their *Taking Stock* report. It concluded that, before considering policy changes, U.S. 2025 net GHG emissions could be anywhere from 13 to 23 percent below 2005 levels, with the wide variability largely reflecting the uncertainty around emissions trajectories in the natural and working lands sector.[191]

Interest in understanding how non-federal actors can meaningfully contribute to climate action is neither unique to the U.S. nor new to this initiative. In approaching our work in 2018, America's Pledge will work in partnership with both U.S. and international institutions to develop a consistent methodology for aggregating, quantifying and reporting non-national climate actions. For this work, we intend to look to existing standards (such as the Greenhouse Gas Protocol's Policy and Action Standard),[192] new guidance that is being developed (for example, through the global Initiative for Climate Action Transparency),[193] and similar efforts to track non-federal efforts globally (such as the Non-State Actors Zone for Climate Action, or NAZCA).[194]

Future Action: Accelerating Progress Towards Deep Decarbonization

President Trump's decision to withdraw from the Paris Agreement has galvanized a wide range of international and domestic non-national leaders who are eager to achieve emissions reductions targets, develop more ambitious climate plans to accelerate action, and keep the world on track to avoiding dangerous and irreversible climate change.

While non-federal policies cannot entirely replace federal climate action, states, cities, businesses, and others can use their explicit authority to act on their own in many areas. Existing non-federal policies and actions have already helped to shape market trends, accelerate technological developments, and contribute to the decarbonization of the U.S. economy. And now states, cities, businesses, and other non-federal actors are demonstrating a willingness to do more. In the U.S., non-federal actors are continually stepping up to the task, making significant commitments to reduce GHG emissions, and implementing actions tailored to their unique capabilities and circumstances.

In the course of our work over 2018, the America's Pledge initiative will work with a variety of partners not only to quantify the potential of U.S. non-federal action toward further climate progress, but also to provide a menu of options (a "roadmap") for how strategic, coordinated and sustained non-federal action can help keep the U.S. on track to achieve deep decarbonization in line with our country's current pledge under the Paris Agreement.

The number of states, cities, businesses and other non-federal actors that have committed to delivering on the Paris Agreement signals the continued momentum of the low-carbon transition in the U.S., building on what has already happened over the last decade. Strengthening and accelerating that momentum will be an essential basis for the re-engagement of the federal government on climate and clean energy policy in the future.

Appendix A

Data And Methodology: Networks Supporting the Paris Agreement and Non-Federal Entitites with GHG Targets

This appendix describes the methodology and provides the numeric results underlying Figures ES-1 and ES-2, which depict the population, GDP, and emissions of 1) networks of non-federal entities supporting the Paris Agreement, and 2) non-federal entities with GHG targets. Unless otherwise noted, these figures contain no missing values. This data was collected by CDP (formerly Carbon Disclosure Project), and the methodology was developed jointly by CDP, RMI, and WRI for America's Pledge.

Support for the Paris Agreement

This portion of the analysis documents the scope of coalitions formed explicitly to support the objectives of the Paris Agreement. While several coalitions undertake activities in line with the targets and objectives of the Paris Agreement, three coalitions have formed explicitly to demonstrate non-federal commitment to the Agreement. Two of these coalitions—We Are Still In and The Climate Alliance—were formed immediately following the announcement of President Trump's intent to withdraw from the Agreement. The third—U.S. Climate Mayors—was formed upon the adoption of the Agreement in December 2015 (see Tables A-1 and A-2 on page 96).

TABLE A-1

U.S. Non-Federal Networks Supporting the Paris Agreement

	Number of Entities	Population & Percent of U.S. Total (2016)		GDP & Percent of U.S. Total (2016)		Current GHG Emissions & Percent of U.S. Total (2016)	
We Are Still In	2,320[1]	131 million	40%	$8.5 trillion	45%	1.8 Gt CO_2e	27%
U.S. Climate Alliance	14 states plus Puerto Rico	118 million	36%	$7.6 trillion	40%	1.5 Gt CO_2e	23%
U.S. Climate Mayors	383 cities	74 million	23%	$5.0 trillion	27%	1.0 Gt CO_2e	15%
Total States & Cities[2]	470 cities and states (including Puerto Rico)	159 million	49%	$10.1 trillion	54%	2.3 Gt CO_2e	35%

[1] 9 states, 239 cities and counties, 1747 businesses, and 325 universities

[2] This row shows the number, population, GDP, and emissions of states and cities that are part of at least one coalition. Each entity is counted only once, and coalition cities within coalition states or coalition counties are subtracted to account for double counting. This row does not equal the sum of the first three rows.

TABLE A-2

Types of Entities Included in Each Cell of Table A-1

	Number of Entities	Population, GDP and GHG Emissions	U.S. Totals for Calculating Percentages
We Are Still In	States, cities, businesses and universities	States and cities (corrected for double counting as described below)	**For population and GDP**: Total for all 50 states, District of Columbia and Puerto Rico **For GHG emissions:** Total for all 50 states, District of Columbia and territories
U.S. Climate Alliance	States plus Puerto Rico	States plus Puerto Rico	
U.S. Climate Mayors	Cities	Cities	
Total States & Cities	States plus Puerto Rico and cities	States plus Puerto Rico and cities (corrected for double counting as described below)	

Number of Entities: Sum of the number of entities in each coalition as of October 1, 2017. In the remainder of the discussion of the methodology for networks supporting the Paris Agreement, "states" includes Puerto Rico. "Total States & Cities" aggregates the number of states and cities that are part of least one coalition. This number is not corrected for double counting – for example, both Duluth (a WASI city) and Minnesota (a U.S. Climate Alliance state) are included in the total.

Sources: We Are Still In, U.S. Climate Alliance, U.S. Climate Mayors.

Population: Sum of 2016 U.S. Census data for entities in each coalition. Percent of U.S. total calculated based on total U.S. population (including the District of Columbia and all territories) in 2016. The following adjustments were made to avoid double counting:

WASI population includes states and cities only, and does not include population of WASI cities within WASI states, or WASI cities within a county that has also joined WASI.

"Total States & Cities" aggregates the population of states and cities that are part of least one coalition, adjusting for double counting by excluding totals for cities located in states in either WASI or the U.S. Climate Alliance. For example, because Minnesota is in the U.S. Climate Alliance, Duluth's population is not added to the total.

Source: U.S. Census 2016, U.S. Census Cities 2016.

GDP: For states, sum of 2016 Bureau of Economic Analysis (BEA) data, and for cities, sum of estimates based on BEA 2016 data. Cities GDP estimated for all cities with population above 10,000 by multiplying the GDP of the corresponding metropolitan statistical area (MSA) by the ratio of city population to MSA population. This provides a reasonable approximation of city-level GDP, and is more appropriate to use than GDP for the full MSA. Percent of U.S. total calculated based on total U.S. GDP (including the District of Columbia and all territories) in 2016. The following adjustments were made to avoid double counting:

WASI GDP includes states and cities only, and does not include the GDP of WASI cities within WASI states, or WASI cities within a county that has also joined WASI.

"Total States & Cities" aggregates the GDP of states and cities that are part of least one coalition, adjusting for double counting by excluding totals for cities located in counties or states in either WASI or the U.S.

Climate Alliance. For example, because Minnesota is in the U.S. Climate Alliance, Duluth's estimated GDP is not added to the total.

Source: U.S. Department of Commerce, Bureau of Economic Analysis "Gross Domestic Product by Metropolitan Area, 2016".

Emissions: Sum of 2016 gross emissions where available and estimated 2016 gross emissions for entities in each coalition. Percent of U.S. total calculated based on EPA U.S. gross emissions (including the District of Columbia and all territories) in 2015 (most recent available year).

State emissions were estimated based on the World Resources Institute's CAIT Climate Data Explorer 2014 data, which were adjusted to 2016 figures by measuring year-on-year sectoral changes at the national level (based on EPA Inventory of U.S. GHG Emissions and Sinks data for non-electricity sectors and EIA Monthly Energy Review data for the electricity sector) and extrapolating to the state level.

City emissions data are for 2016 and were sourced first from CDP 2016 and 2017 cities questionnaires, and second from the carbon*n* registry for emissions reported from 2010–2017 where CDP data were unavailable. Where reported data were unavailable, estimates for city emissions were calculated by multiplying the adjusted WRI CAIT state emissions data by the ratio of city to state population.

The following adjustments were made to avoid double counting:

WASI emissions includes states and cities only, and subtracts WASI cities within WASI states or counties to correct for double counting.

"Total States & Cities" aggregates the total emissions of states and cities that are part of least one coalition, adjusting for double counting by excluding totals for cities located in counties or states in either WASI or the U.S. Climate Alliance. For example, because Minnesota is in the U.S. Climate Alliance, Duluth's estimated emissions are not added to the total.

Sources: CDP Cities Questionnaire 2016 and 2017; carbon*n* "Reporting Entities", 2010-2017; World Resources Institute CAIT Climate Data Explorer; U.S. EPA "Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2015," April 2017; U.S. EIA, "Monthly Energy Review," September 2017.

GHG Emission Reduction Targets

This portion of the analysis documents the number of non-federal entities that have enacted GHG targets. These targets, while numerous, vary in terms of level of ambition and therefore magnitude of expected emission reductions. Many are voluntary and could be dropped with little consequence, and others adopted under previous political administrations may already be inactive.

In this initial analysis, we have taken an inclusive approach by including all entities that have registered a GHG target. Future analyses from America's Pledge will rely on best practice for quantifying the potential impact of these targets. Specifically, future analyses will look to existing methodologies (such as the *Non-State and Non-federal Action Guidance* developed through the Initiative for Climate Action Transparency, and the Greenhouse Gas Protocol *Mitigation Goal Standard* and *Policy and Action Standard*) for assessing the impact of various actions on GHG emissions.

TABLE A-3

U.S. Non-Federal Entities with GHG Targets

	Number of Entities	Population and Percent of U.S. Population (2016)		GDP and Percent of U.S. GDP (2016)		Global Market Capitalization	Emissions and Percent of U.S. emissions (2016)	
States	20	165 million	51%	$10 trillion	54%	-	2.3 Gt CO_2e	35%
Cities	110	51 million	16%	$3.6 trillion	19%	-	0.59 Gt CO_2e	9%
Businesses	1361	-	-	-	-	$25 trillion	1.0 Gt CO_2e	14%
Universities	587	5.1 million	-	-	-	-	27 million tCO_2e	-
Total States & Cities	130	182 million	56%	$11.2 trillion	60%	-	2.6 Gt	39%

Number of Entities: For states, count of entities that have publicly announced or recorded a GHG emissions target through CDP, C2ES, or Under2MOU. For cities, count of entities that have recorded or announced a GHG emissions target through CDP, Under2MOU, carbon*n*, or ACEEE. For businesses, count of entities that have reported both emissions in the U.S. and a climate action through CDP, Science-Based Targets Initiative, or CDP's Power Forward 3.0 report. For universities, count of universities that have announced or recorded a GHG emissions target through Second Nature. "Total States & Cities" aggregates the number of states and cities that have adopted a GHG target.

Sources: CDP Cities Questionnaire 2016 and 2017; Center for Climate and Energy Solutions, "Greenhouse Gas Emissions Targets," September 2016; "Under 2 Coalition" 2017; carbon*n* "Reporting Entities" 2010-2017; American Council for an Energy-Efficient Economy "State and Local Policy Database" 2017; Science Based Targets "Companies Taking Action" 2017; CDP Power Forward 3.0; Second Nature Climate Leadership Commitments 2016.

Population: For cities and states, same method and sources as used to calculate population for networks supporting the Paris Agreement. For universities, population data were based on enrollment data from Second Nature's Climate Leadership Commitments reporting for 2016.

> "Total States & Cities" aggregates the population of states and cities that have adopted a GHG target, adjusting for double counting by excluding cities with targets located in a state that also has a target.

Sources: U.S. Census 2016, U.S. Census Cities 2016, Second Nature Climate Leadership Commitments 2016.

GDP: For states, same method and sources as used to calculate GDP for networks supporting the Paris Agreement. For cities, sum of estimated GDP for cities with a population greater than 10,000 (107 of 110 cities) based on the same method and sources as used to calculate GDP for networks supporting the Paris Agreement.

> "Total States & Cities" aggregates the GDP of states and cities that have adopted a GHG target, adjusting for double counting by excluding cities with targets located in a state that also has a target.

Sources: U.S. Department of Commerce, Bureau of Economic Analysis "Gross Domestic Product by Metropolitan Area, 2016".

Market Capitalization: Sum of the most recent market capitalization figures available through Bloomberg Terminal for all businesses reporting emissions in the U.S. This figure captures 907 of 1361 actors, with most of the missing

values from private or subsidiary companies. These figures are not localized and represent the total market capitalization of companies' global operations.

Source: Bloomberg, Q1 2016 – Q3 2017.

Emissions: For states and cities, same method and sources as used to calculate emissions for networks supporting the Paris Agreement. Note that in the report, combined state and city emissions are shown as 2.7 Gt or 40 percent of U.S. emissions; the 2.6 Gt and 39 percent figures in this appendix reflect corrections after the report went to print and are the most up-to-date data. For businesses, emissions include scope 1 emissions for the U.S. only, based on 2016 and 2017 CDP response data. Business emissions figures are included for 1141 of 1361 companies. Note that the report references business emissions of 0.9 Gt, which reflects emissions for U.S. based companies only. For universities, emissions data are based on Second Nature reporting.

> "Total States & Cities" aggregates the population of states and cities that have adopted a GHG target, adjusting for double counting by excluding cities with targets located in a state that also has a target.

Sources: CDP Cities Questionnaire 2016 and 2017; carbon*n* "Reporting Entities", 2010-2017; World Resources Institute CAIT Climate Data Explorer; U.S. EPA "Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2015," April 2017; U.S. EIA, "Monthly Energy Review," September 2017; Second Nature Climate Leadership Commitments 2016.

Appendix B

Broader Role of Non-Federal Action In Driving Down U.S. GHG Emissions: Methodology and Limitations

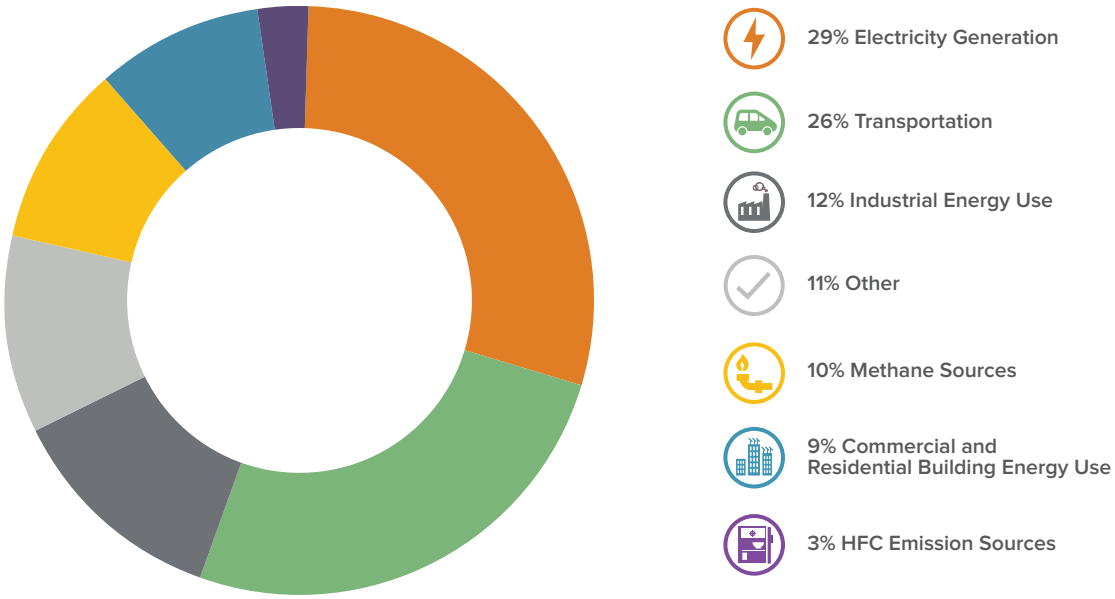
As noted in Chapter 2, a number of states, cities, and businesses have already adopted a wide range of actions to help achieve their GHG targets. Many others are taking actions that can also help reduce GHG emissions, even if they are not always enacted with climate change in mind. This chapter aimed to highlight climate-friendly actions—policies and actions taken explicitly for the purposes of achieving GHG reductions as well as actions that indirectly lower emissions through promoting a cleaner, more efficient economy—and illustrate the scope of their adoption.

To do this, we examined what types of measures, if any, are being adopted by states, cities, and businesses that help address the largest GHG emission sources: electricity generation; transportation; industrial, commercial, and residential energy use; methane sources; and hydrofluorocarbon (HFC) leakage (see Figure B-1 on page 104). We also examined actions being taken that can help increase the carbon sink, such as improving forest health.

For this initial America's Pledge report, our aim was to provide an initial sense of the range of climate-friendly actions that states, cities, and businesses have already started to take. Because these lists of actions are intended to illustrate the range of non-federal activities under way, and we have not conducted analysis of the effectiveness of the actions, inclusion of actions in our list should not be deemed as an endorsement.

FIGURE B-1

U.S. Greenhouse Gas Emissions by Source (2015)



Source: U.S. Environmental Protection Agency, Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2015

For each major sector or emission source, we consulted several different sources that track energy and climate policy adoption for non-federal entities. These sources include federal agencies, non-governmental organizations (NGOs), and state, city, and business-specific agencies or organizations. **It is important to note the limitations of this analysis. Specifically, we did not aim to:**

Identify *all* actions that are being taken. The policies and actions highlighted are not intended to be exhaustive. The list for each non-federal entity represents just a subset of all climate-friendly actions that are underway.

Identify the actions that have the largest GHG emission reduction potential. The number of non-federal entities adopting of each policy we examined does not necessarily equate to GHG emission reductions. For example, a city may adopt a GHG emission reduction target, but that does not necessarily mean it will be achieved over the stated time period.

Also, a state may offer financial incentives for the purchase of zero-emission vehicles, but that does not necessarily mean that they will be purchased by households and businesses that are in the market for new vehicles.

Differentiate between commitments and actions. The examples of climate-friendly actions that we include in this analysis does not necessarily distinguish between legally binding targets (i.e. approved by a state legislature or city council) and non-binding "goals," unless explicitly stated.

Identify actions that could be inhibiting climate action. This analysis does not assess "unfriendly climate actions" that states, cities, and businesses have adopted that may result in increasing GHG emissions.

In the next phase of America's Pledge through 2018, we plan to build on this list, aggregate the GHG impact of these actions (where possible), and model the potential for increased ambition. Note, it is possible that this future analysis finds that many of these policies overlap and/or interact in a way that do not lead to unique GHG emission reductions.

Below, we outline some more specific limitations and assumptions and limitations around our current analysis for states, cities, and companies, along with the data sources we used to collect the adoption status for each non-federal entity.

States

For states, we aimed to identify at least one action for each of the major emission sources that has been adopted by at least one state. Our initial research resulted in a selection of 30 policies that showcase the range of actions that states are taking, as summarized below. We acknowledge this list is limited, and intend to conduct a more thorough literature review and expert consultation to identify additional actions that states are taking, or could take to scale their ambition.

Sources for Climate-Friendly State Actions

GHG Target / Cap

GHG Emission Targets: Center for Climate and Energy Solutions, "Climate Programs and Policy Maps," https://www.c2es.org/us-states-regions#states

Carbon pricing: Center for Climate and Energy Solutions, "Climate Programs and Policy Maps," https://www.c2es.org/us-states-regions#states

Renewable / CCS / Nuclear

Renewable energy portfolio standards or goals: Center for Climate and Energy Solutions, "Climate Programs and Policy Maps," https://www.c2es.org/us-states-regions#states

Property Assessed Clean Energy: PACE Nation, "PACE Programs," http://pacenation.us/pace-programs/

Financial incentives for CCS: Center for Climate and Energy Solutions, "CCS financial incentives," https://www.c2es.org/us-states-regions/policy-maps/ccs-financial-incentives

Zero-emission credits for nuclear: National Conference of State Legislatures, "State Action In Support Of Nuclear Generation," http://www.ncsl.org/research/energy/state-action-in-support-of-nuclear-generation.aspx

Transport

Efficient vehicle requirement for public fleet procurement: American Council for an Energy Efficient Economy, "State Efficiency Scorecard 2017," http://aceee.org/state-policy/scorecard

Integrating transportation & land-use in comprehensive plans: American Council for an Energy Efficient Economy, "State Efficiency Scorecard 2017," http://aceee.org/state-policy/scorecard

Dedicated funding streams for public transit: American Council for an Energy Efficient Economy, "State Efficiency Scorecard 2017," http://aceee.org/state-policy/scorecard

Adopting legislation in line with Complete Streets objectives: American Council for an Energy Efficient Economy, "State Efficiency Scorecard 2017," http://aceee.org/state-policy/scorecard

Financial incentives for high efficiency vehicles: American Council for an Energy Efficient Economy, "State Efficiency Scorecard 2017," http://aceee.org/state-policy/scorecard

California's vehicle emission standards: Center for Climate and Energy Solutions, "ZEV Program," https://www.c2es.org/us-states-regions/policy-maps/zev-program

Freight plan with multimodal freight strategies: American Council for an Energy Efficient Economy, "State Efficiency Scorecard 2017," http://aceee.org/state-policy/scorecard

Zero Emission Vehicle mandate: Center for Climate and Energy Solutions, "ZEV Program," https://www.c2es.org/us-states-regions/policy-maps/zev-program

Low carbon fuel standard: Center for Climate and Energy Solutions, "Low Carbon Fuel Standard," https://www.c2es.org/us-states-regions/policy-maps/low-carbon-fuel-standard

Freight-specific energy efficiency performance metrics: American Council for an Energy Efficient Economy, "State Efficiency Scorecard 2017," http://aceee.org/state-policy/scorecard

Energy Efficiency

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Cities

To examine what types of actions cities are adopting to help address GHG emissions, we used ACEEE's most recent biennial city scorecard, which reflects existing policy data as of January 31, 2017, as a starting point. ACEEE's analysis tracks the adoption, stringency, and ambition of a wide range of energy efficiency measures that some of the largest 51 cities (based on metropolitan statistical area) are taking. ACEEE assessed the central city of

each of the nation's 50 most populous metropolitan statistical areas (MSAs), excluding San Juan, Puerto Rico and including Fort Worth and El Paso, which were including in their original 2013 City Scorecard.

We included 18 actions from ACEEE's analysis with the aim to illustrate the different types of actions that cities are taking to help reduce GHG emissions, increase building efficiency, and move people and goods around more effectively.

Because we wanted to include examples of what cities are doing to address other major sources of U.S. GHG emissions (like electricity generation, methane, and HFCs), we conducted an initial literature review and found two additional ambitious actions that we included in this report: committing to 100 percent renewable energy and reducing methane emissions through waste reduction targets.

We acknowledge that the actions that these 51 largest cities are taking may not be completely representative of all the states and geographies in the United States. As such, we intend to conduct a more thorough literature review and expert consultation in the next phase of the America's Pledge initiative to identify additional actions that cities of all sizes are taking, or could take, to address GHG emission.

Sources for Climate-Friendly City Actions

GHG Target / Cap

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Renewable / CCS/ nuclear

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Energy Efficiency

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Forestry & Land Use

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Companies

The climate-friendly actions we list below, along with the number of U.S.-based businesses taking each action, is not meant to be comprehensive. Instead, we collected information from the Carbon Disclosure Project (CDP), various NGOs, and federal agencies with the aim of providing examples of corporate action that address each of the major GHG emission sources.

However, the line between corporate GHG emissions in and out of the United States by U.S.-based companies is not always clear and we do not take into

account companies based outside the U.S. that may have a large presence here. As such, just like for states and cities, we are aiming to expand and refine this list as we move to the next phase of America's Pledge.

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AMERICA'S PLEDGE

U.S. states, cities, and businesses, have emerged as **the new face of American leadership on climate change**, and are stepping up with commitments to **reduce greenhouse gas emissions** to help meet **America's climate pledge to the world.**