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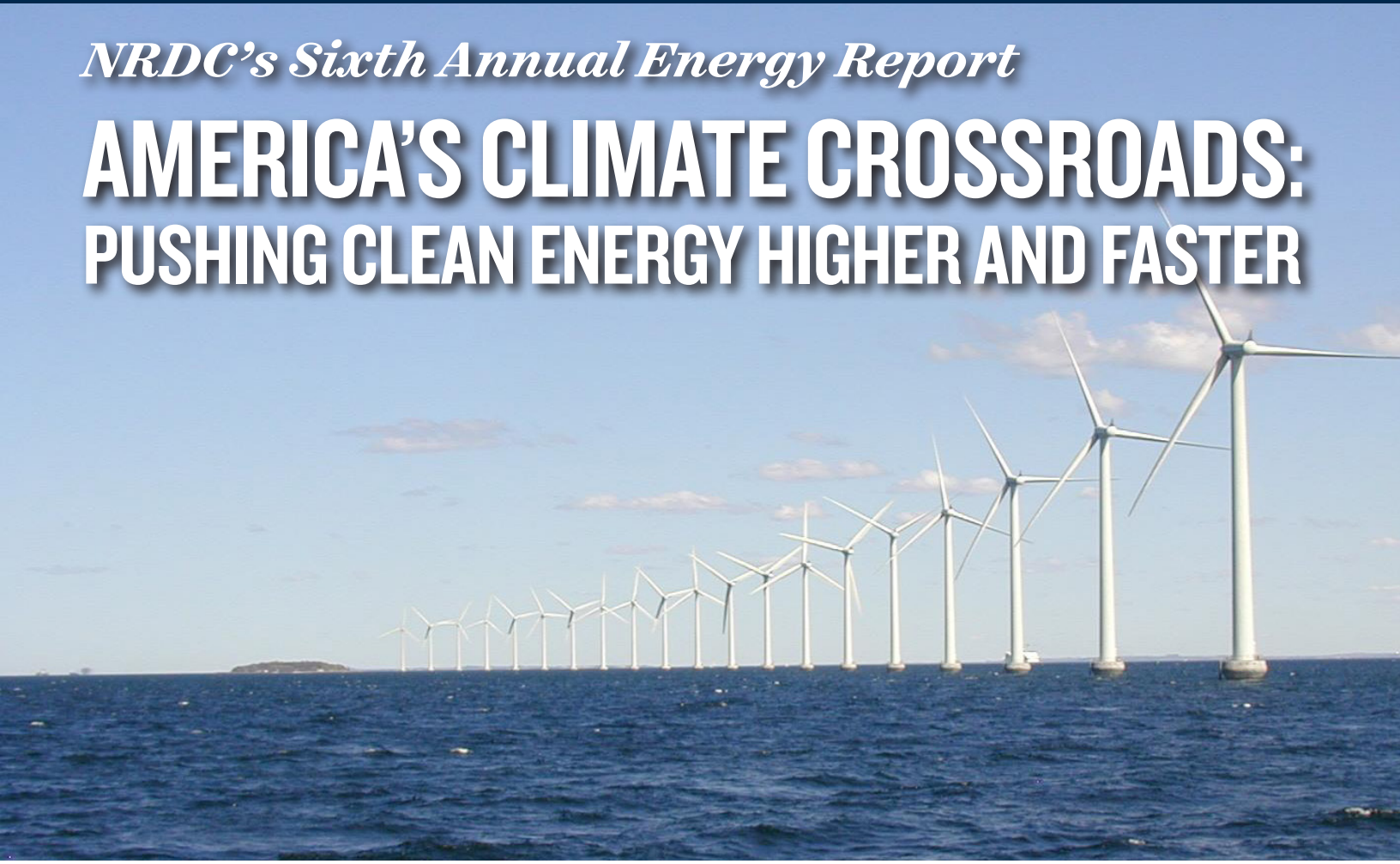
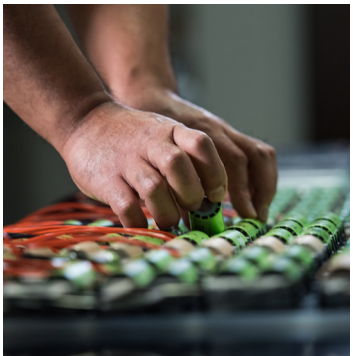
NRDC's Sixth Annual Energy Report

AMERICA'S CLIMATE CROSSROADS:
PUSHING CLEAN ENERGY HIGHER AND FASTER





ACKNOWLEDGMENTS

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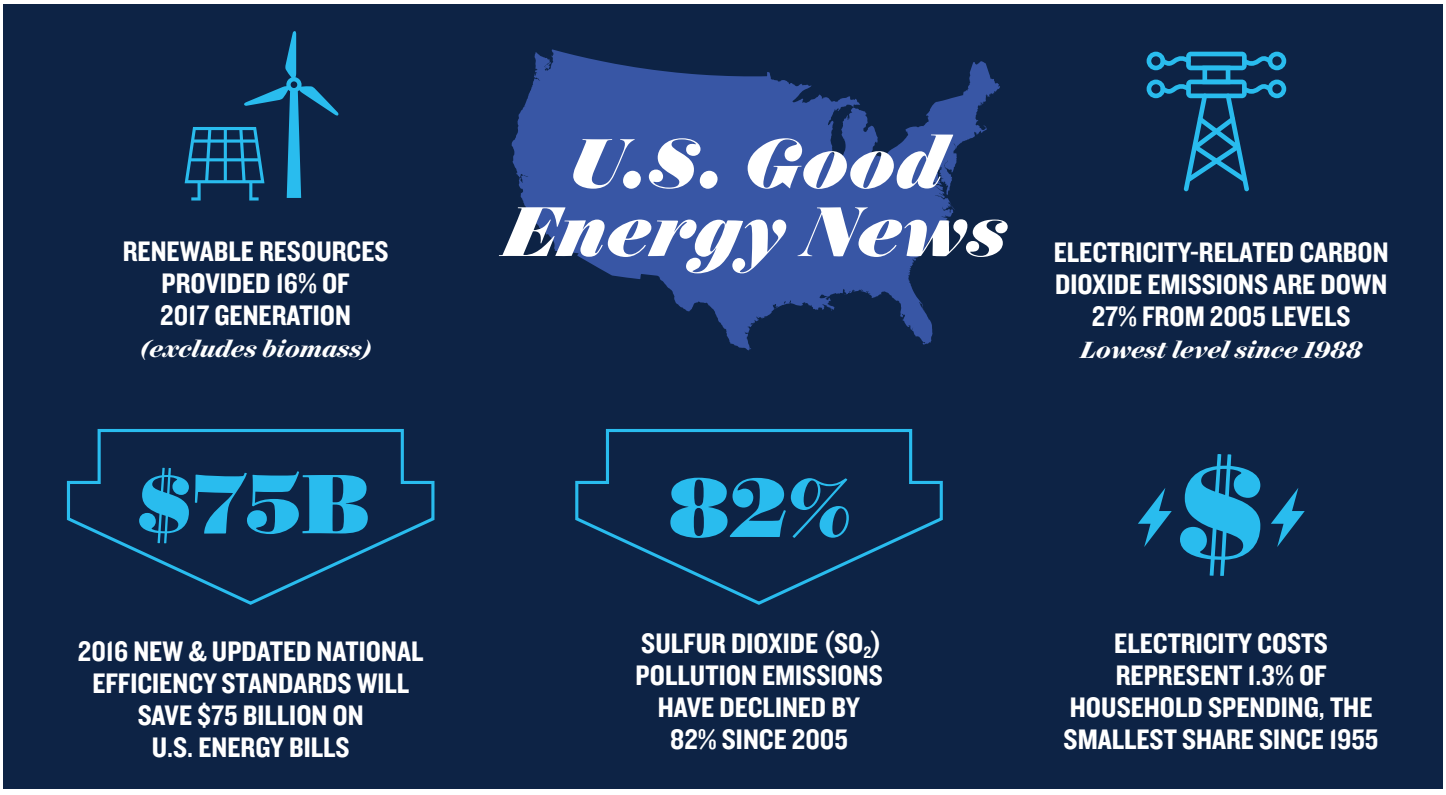
Sixth Annual Energy Report

The United States experienced another powerful year of significant clean energy advances in 2017, but the recent sobering report from the Intergovernmental Panel on Climate Change warns of dangerous worldwide impacts if we do not act quickly to limit global warming. This poses a critical question: Will we move full speed ahead toward an energy system that prioritizes clean resources, building upon extraordinary progress, or will we fight the clean energy tide and the innovation and economics that come with it to save the inflexible, riskier system of our past? Our Sixth Annual Energy Report not only highlights U.S. energy trends from the last year and a half, it also explores emerging opportunities—and roadblocks—on the path to a safer climate future.

Plunging costs prompted individuals, corporations, utilities, and states to invest heavily in renewable, electric, and efficient technologies in 2017. With renewable energy and energy efficiency as the cleanest and cheapest U.S. energy sources, coal's prominence fell to historic lows. As a result, the United States nearly achieved the emissions reduction targets in the Clean Power Plan 13 years earlier than anticipated, despite a hostile Trump administration. Progress and innovation have unlocked cleaner, cheaper alternatives, and they are becoming mainstream resources across the nation. Even with these positive trends, much more must be done to ensure the clean energy transition continues.



In the western United States, utilities reported record-low prices for wind and solar power—prices that few would have predicted just five years ago. New solar and wind projects *with battery storage* are coming in at costs below that of a new gas plant and even the price of operating many of the existing coal plants in certain areas of the West.[1]

As these dynamics shift, utilities in the West are quickly moving away from coal and gas. In fact, 12 gigawatts (GW) of coal is slated to retire in the West between 2018 and 2022, which is equal to the tailpipe pollution from 11 million cars in a year.

In the midwestern United States, about 75 percent of large utilities have established their own renewable energy goals that in many cases greatly exceed state renewable energy targets. For example, Iowa, which passed the first renewable energy standard in the United States in 1985, has not updated its targets since then. However, the state's largest utility, MidAmerican, already supplies 85 percent of its customers' electricity needs with wind and plans to achieve 100 percent renewable energy by the mid-2020s. The state already gets the most power from wind in the country—making up 37 percent of Iowa's power mix.

Energy efficiency and renewable energy have also begun to make footholds across the eastern United States.

The southern United States, which historically has seen less renewable development despite great resources, is enjoying a solar boom. Mississippi experienced the greatest percentage growth in solar in 2017 with a 25-fold increase in the state's solar power in just a single year. Florida Power & Light is undergoing one of the largest solar expansions ever seen in the United States, adding more than 3.5 million new solar panels in the last two years.[2]

In the northeastern United States, states made significant pledges to cut energy waste, curb climate-warming pollution from cars, and boost the development of more nascent clean technologies like battery storage and offshore wind since the start of 2017. To help meet these commitments, regulators across the northeast are implementing innovative approaches that incentivize utilities to be more effective partners on energy efficiency and renewable energy. With states and utilities working together toward a clean energy future, the region may be able to propel the same innovation and cost reductions in the offshore wind, energy storage, and electric transport sectors as we have already seen in the wind and solar industries in the last decade.

This clean energy progress arrives despite new roadblocks the Trump administration placed in the way of energy efficiency, renewable energy, and climate action. The administration has forged an anti-environment agenda, trying to force the nation back to dirty coal and oil at a high cost to the economy, public health, and the environment. The administration is also attempting to roll back environmental protections, such as the Clean Power Plan and vehicle fuel economy standards.

The last year also saw a significant debate in the United States around fuel security, grid resiliency, and the role and necessity of coal and nuclear resources. Past NRDC *Annual Energy Reports* have highlighted the rise of clean energy and its associated benefits for people and our climate. Occasionally the tension between the dirtier, riskier technologies of the past and the new renewable options of the 21st century bubbled up as isolated, individual incidents: a state considering a coal subsidy, a local government considering power plant closure impacts and transition programs, or a utility-specific "bailout" request.

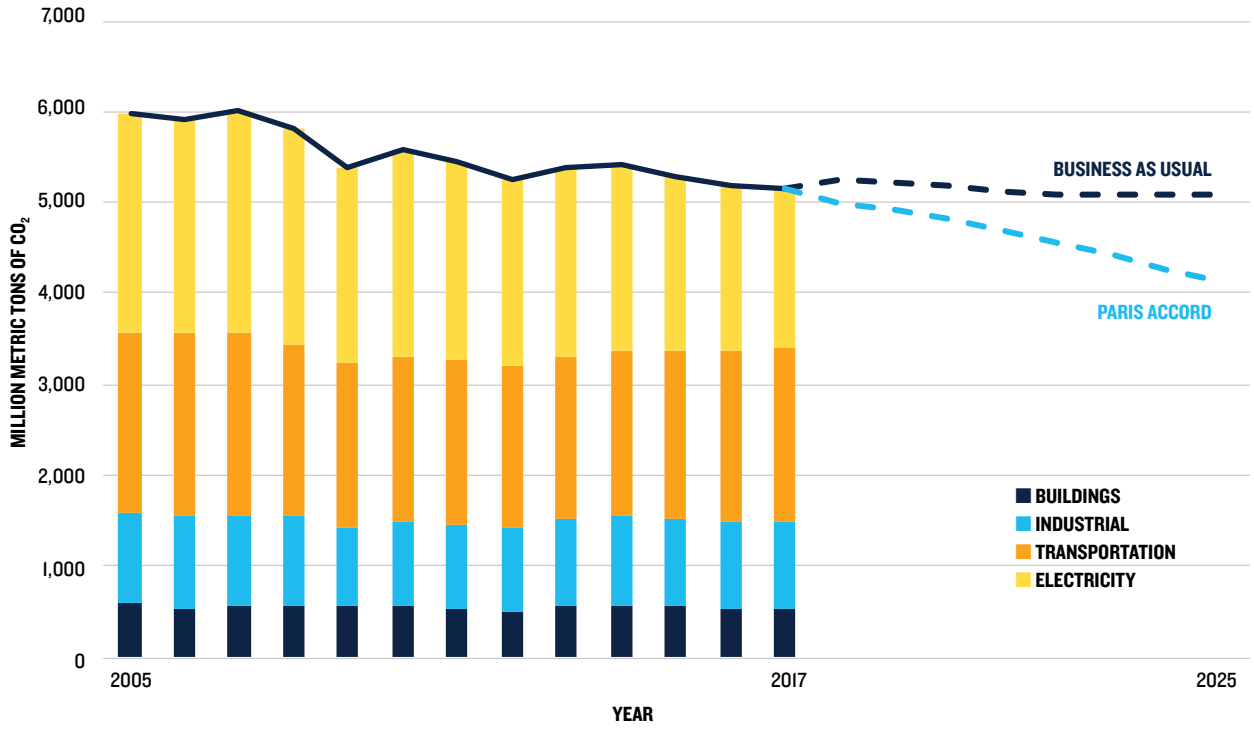
In the last year, the clean vs. dirty energy tensions reached a boiling point. Proposed interventions to prop up aging and uneconomic power plants proliferated at all levels, from the U.S. Department of Energy, to regional transmission operators, to state regulatory boards, and legislatures. These issues won't be resolved quickly and will likely dominate U.S. energy policy for the near future.

GREENHOUSE GAS EMISSIONS CONTINUE TO FALL

U.S. energy-related carbon dioxide (CO_2) emissions fell once again in 2017, marking the third consecutive year to see total reduction in climate-warming pollution. Emissions were 14 percent below 2005 levels (see Figure 1).[3,4] This is the lowest level since 1992 and a positive climate development. CO_2 accounts for the majority of U.S. greenhouse gas (GHG) emissions, with methane, nitrous oxide, and fluorinated gases the next-largest contributors. States and industry have driven this downward trend through innovation and policymaking, despite resistance at the federal level. However, the United States must do much more to meet our Paris Accord commitment to reduce GHGs by 26 percent to 28 percent below 2005 levels by 2025. The recent report from the IPCC has called for even greater and quicker reductions to further limit warming to just 1.5 degrees Celsius (instead of the Paris Accord target of below 2 degrees).[5] This would require the world to achieve net-zero carbon emissions by 2050, or about 20 years earlier than required to limit warming to two degrees.

Although the United States is currently off-track, with emissions expected to hover at just 17 percent below 2005 levels by 2025 (as shown in Figure 1), we can meet our climate commitments with the clean energy tools already available to us. At the end of 2017, NRDC released its own report, *America's Clean Energy Frontier: The Pathway to a Safer Climate Future*, detailing how the United States could reduce climate-warming pollution by more than 80 percent by 2050.[6] Under our clean energy pathway, the United States could meet both its 2025 and 2050 climate

FIGURE I: HISTORICAL AND PROJECTED U.S. EMISSION TRENDS



commitments, at minimal cost, mainly through investments in energy efficiency, renewable energy, and electrified appliances and vehicles. Additional measures, including a full roll-out of industrial efficiency programs, a quicker and broader electrification of our transportation system, and a faster transition toward clean electricity in the next 15 years could further cut U.S. emissions to better match a 1.5-degree trajectory.

Much of the decline in carbon pollution has been driven by the power sector, which has seen plunging emissions as new renewable energy resources, energy storage, energy efficiency, and lower-emitting natural gas have displaced aging, uneconomic coal plants. Power emissions declined by more than 4 percent in just the last year and by 28 percent since 2005 (reaching their lowest level since 1988). This is truly remarkable progress, putting the United States within spitting distance of the final 2030 targets set by the Obama administration's Clean Power Plan—13 years early. Even so, the U.S. power sector is still a significant climate driver. Continued investment in clean power through corporate and municipal power projects, state renewable portfolio standards, and stronger Clean Air Act regulations will be necessary to ensure that the power sector continues shifting toward a lower-carbon system.

As the nation's electricity grid has become cleaner, the transportation sector unfortunately has solidified its position as the largest source of carbon pollution in the United States, emitting more than any other sector for the second year in a row. Transportation emissions increased by 14 million tons in 2017, equivalent to the annual climate pollution from 2.7 million cars, making it the only sector to see an increase in carbon pollution in 2016 or 2017.[7] Moreover, transportation is expected to remain the dominant source of carbon pollution for the next few decades, with travel domestically and internationally increasing as flying becomes an affordable option for more people.[8] States and cities have begun to explore and develop solutions to address transportation emissions, even as the U.S. Environmental Protection Agency (EPA) attempts to roll back commonsense standards that reduce our climate footprint and dependence on oil. The innovation and associated rise of cleaner and cheaper options that have radically changed the U.S. power sector in the past decade are now starting to unlock new clean transportation solutions, such as more affordable electric cars, electric buses, and electrified freight transportation. These solutions will allow us to clean up our vehicles and transportation systems at a much lower cost and without impeding economic growth. With these emerging set of tools, consumers, manufacturers, and policymakers can address this growing source of pollution much more effectively.

CONNECTING THE DOTS: CLEANER AND GREENER TRANSIT BREATHES NEW LIFE INTO THE CITY

TRAILBLAZING THE NEW ENERGY FRONTIER

Electrified Transportation Gets a Jolt

The federal government is trying to roll back the vehicle fuel economy standards that help consumers save money at the pump, avoid local and climate-warming-pollution, and reduce the nation's dependence on oil. The long-expected proposal released in August 2018 abandons future annual fuel-efficiency increases central to the Obama-era rule, which would have nearly doubled the fuel economy of a new car to an average of about 54 miles per gallon in 2025.[9] Instead, the new standards would freeze clean car and fuel economy targets at model-year 2020 levels through 2026.[10] Equally controversial is that the revised rule aims to prevent California from setting its own pollution standards for vehicles—a significant reversal that will affect the 12 states now following California's lead, which together make up 40 percent of the auto market.[11]

The economic and environmental impact from this proposal will be substantial. Analysts have estimated that the increase in CO_2 emissions by 2035 would be larger than the combined annual carbon pollution from the 70 smallest countries in the world. At the same time, U.S. gasoline use is projected to rise by more than 500,000 barrels a day due to the fuel efficiency standards freeze, equal to the average daily gasoline imported from Venezuela.[12] However, the Trump administration rollback will not move forward without a fight; 19 states have already sued the EPA over the proposal. At the same time, American states and utilities are forging ahead to address the smog-producing and climate-warming pollution spewing from vehicle tailpipes themselves.

A bipartisan coalition of 12 northeast and mid-Atlantic states and the mayor of Washington, D.C., formed a Transportation and Climate Initiative to revamp the region's interconnected transportation system, reduce congestion, and cut tailpipe pollution that contributes to local smog and climate change. These states are exploring ways to create a cleaner, more equitable, and more accessible transportation system for the region by investing in electric vehicle (EV) infrastructure, increased and cleaner public transit options, and more bike lanes and sidewalks.[13]

State governments have tremendous power not only to revitalize and improve their public transit systems and transportation infrastructure, but also to incentivize, support, and engender the adoption of EVs. Utilities from the southeast to west coast have begun offering programs and incentives to boost EV interest in their service areas. Both Georgia Power and Indianapolis Power & Light have partnered with Nissan to give a $10,000 discount on Nissan Leaf purchases.[14] Green Mountain Power in Vermont offers free home EV chargers when its customers purchase a new EV.[15] Other utilities are developing programs and rate designs that will help customers charge their EVs cleanly and even allow utilities to use EV batteries to reliably integrate higher levels of renewable energy into the grid and strengthen it. For example, Hawaiian Electric is exploring the demand-response potential of EVs by offering "super off-peak" rates to incentivize midday charging when

the island's grid is overflowing with solar energy. And in California, the governor announced an initiative to increase EV charging infrastructure by nearly twenty-fold to reach 250,000 vehicle chargers by 2025, including 10,000 new public fast chargers.[16]

Investments in EV infrastructure is driving new interest from both U.S. consumers and the auto industry. More electric cars were sold in 2017 than ever before: almost 200,000 electric vehicles, a 25 percent increase over the record-breaking sales of 2016.[17] In total, almost 750,000 EVs were zooming across the nation's roads at the end of 2017. Experts anticipate EVs will account for 55 percent of all auto sales by 2040.[18] Auto companies are warming up to the electrified future. Volvo pledged to exclusively produce fully electric or hybrid models by 2019.[19] Not to be left behind, General Motors announced it will produce at least 20 EV models by 2023.[20]

Other world powers are making even greater strides toward a promising electric vehicle future. China, the world's largest vehicle market, has announced that it intends to ban the sale of internal combustion engines (ICE), although set no date.[21] Following this announcement, China rolled out a program to increase electric vehicle adoption in the country in the next few years. Experts expect that it could prompt the production of more than 1 million EVs annually in China by 2020, or about 4 percent of sales, which would exceed the entire annual production of the world today. Much of Europe has also announced plans to phase out new gasoline vehicle sales in favor of cleaner electric options, with Norway and the Netherlands banning ICE purchases by 2025, and the UK and France banning them by 2040.[22] A global trend toward cleaner vehicles is spurring automakers to ride the wave or be left behind. Entrepreneurs' and governments' responses have funneled capital into battery research and development that is having positive spillover effects in other parts of the economy.

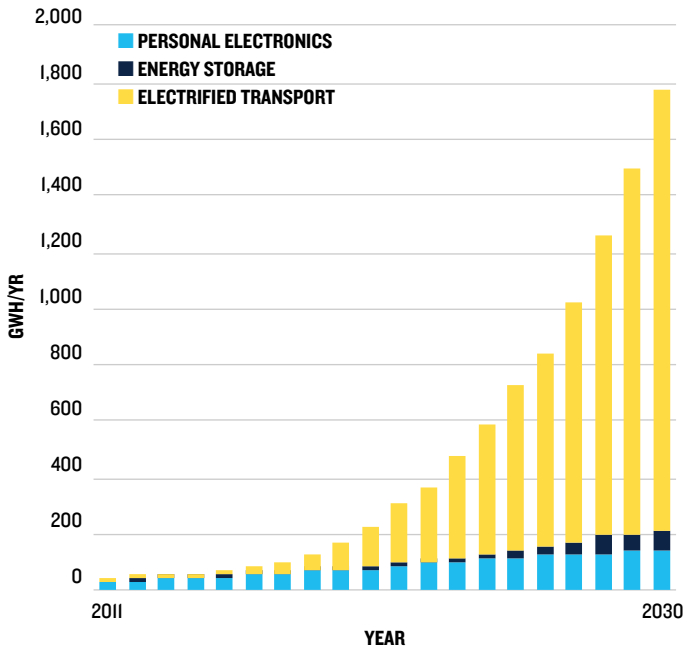
Batteries & Storage: Making a Clean System Work

As we charge into America's clean energy future, batteries ranging from those in our EVs to much larger utility-scale battery systems are promising to provide both huge value for electrified transport and great relief to our increasingly clean electric grid.[23] Batteries that can store and then release electricity make the grid safer and more reliable by quickly responding to changes in electricity demand. They can provide grid operators with the services and capacity to integrate more solar and wind on the system, while maintaining its reliability and resiliency. This allows more of our electricity to be cleaner and reduces the amount of clean electricity that may be curtailed or wasted.[24] Batteries can also help fossil fuel plants run more efficiently and even help systems restart quickly and efficiently after power outages, saving our energy system significant costs and reducing emissions associated with restarting fossil facilities.[25] The benefits of batteries have long been understood but until recently have been too expensive to justify.

Driven by electric vehicle research and development, the price of lithium ion battery packs has decreased almost 80 percent from 2010 to 2017.[26] Costs of grid-scale battery storage will continue to come down, with financial firms expecting the price of batteries to decrease by another 45 percent from 2018 to 2025.[27] With these falling costs, Microsoft, Apple, GM, and Walmart, some of the world's most influential companies, are developing interest in batteries. And they're not alone. PG&E recently released plans to install the world's largest battery storage system *as a replacement for three natural gas plants*—finding storage a cheaper option.[28] Other utilities, including Con Edison and Bonneville Power, are avoiding expensive upgrades to their local distribution systems by installing battery storage to address system constraints instead.[29] Energy analysts expect the annual value of the U.S. energy storage market to exceed $1.2 billion by next year.[30]

As shown in Figure 2, lithium-ion batteries are finding application everywhere, but the lack of diversity in energy storage types can become a growing issue if left unaddressed. Exclusive use of lithium-ion batteries increases exposure and risk related to the supply of rare minerals and raw material required for these batteries, most notably cobalt. Two-thirds of our global cobalt supply is concentrated in the Congo.[31] China is poised to become the global leader in cobalt refining.[32] Major American industries, including consumer electronics, EV producers, and jet engine manufacturers, have a serious

FIGURE 2: FORECASTED GROWTH OF BATTERY APPLICATIONS



cobalt appetite. As the demand and interest in lithium ion batteries grows—whether for our electric vehicles, phones, or power systems—these supply chains could be significantly affected by geopolitical affairs in the Congo and China. At its worst, this could lead to spiking prices, humanitarian issues, product shortages, and worker layoffs.

Diversifying energy storage options and innovating new solutions to reduce the dependence on these raw materials is a burgeoning interest in the United States and around the world.[33] Researchers are developing lithium-ion batteries that do not use cobalt, and others are discovering a more diverse set of technologies. Beyond battery technologies, companies and governments are exploring other storage contenders, such as pumped hydropower, compressed air energy storage, and electrolysis that use excess energy to do work (e.g. pump water up a hill) and then release this potential energy (e.g. release the stored water) to generate power when needed.[34] Such technologies will become cost-competitive—if the U.S. government supports their nascent growth through research, development, and demonstration programs, like the Department of Energy's Advanced Research Projects Agency-Energy (ARPA-E) program.[35] To achieve our climate goals, energy policies must ensure that storage systems are deployed and operated to maximize reductions in greenhouse gas emissions and support renewables integration, rather than keeping fossil plants online. Doing so will decrease customer costs by providing the cheap, stored electricity during times when electricity is needed most—like a hot summer day—and will boost opportunities for American manufacturing to develop and lead on the next wave of energy storage systems.

Even with some challenges on the horizon, batteries have made undeniable progress, aided by smart state policies. Five states already have set utility-scale battery storage targets, including major announcements from New Jersey and New York since the start of 2018.[36] The targets established by these states alone would represent more than an eight-fold increase in large-scale battery storage capacity in the United States.[37] Meanwhile, Arizona utilities have included almost 600 MW of energy storage in their latest resource plan, including the nation's first "peaking" solar + storage facility that will be able to provide power in the evening when Arizonans need it the most. And Arizona regulators want the state's utilities to go even further, recently calling for 3,000 MW of energy storage by 2030.[38]

EFFICIENCY GETS A BOOST FROM CUTTING-EDGE STATE POLICIES

States made strides on energy efficiency in the last year and a half, reflecting in part an increased appreciation of its role in promoting the resiliency and reliability of our energy systems. Most recently, the Northeast saw significant efficiency developments across the region. New Jersey passed the "Clean Energy Act of 2018," upping the state's utility energy efficiency savings target to the equivalent of 2 percent of sales per year.[39] This would more than triple the state's current annual efficiency savings. Days later, New York Governor Andrew Cuomo announced he was increasing the state's energy efficiency targets to 3 percent of annual electricity sales, putting it on par with Massachusetts and Rhode Island as a national leader.[40] A month later, Vermont passed new energy efficiency appliance standards for a suite of products—from computers and electronics to showerheads. This suite reflects the leading edge for state appliance standards and is expected to save Vermont consumers $17 million a year on utility bills by 2025.[41,42] Connecticut passed new building energy codes, bringing the state in line with the more recent 2015 building code standards.

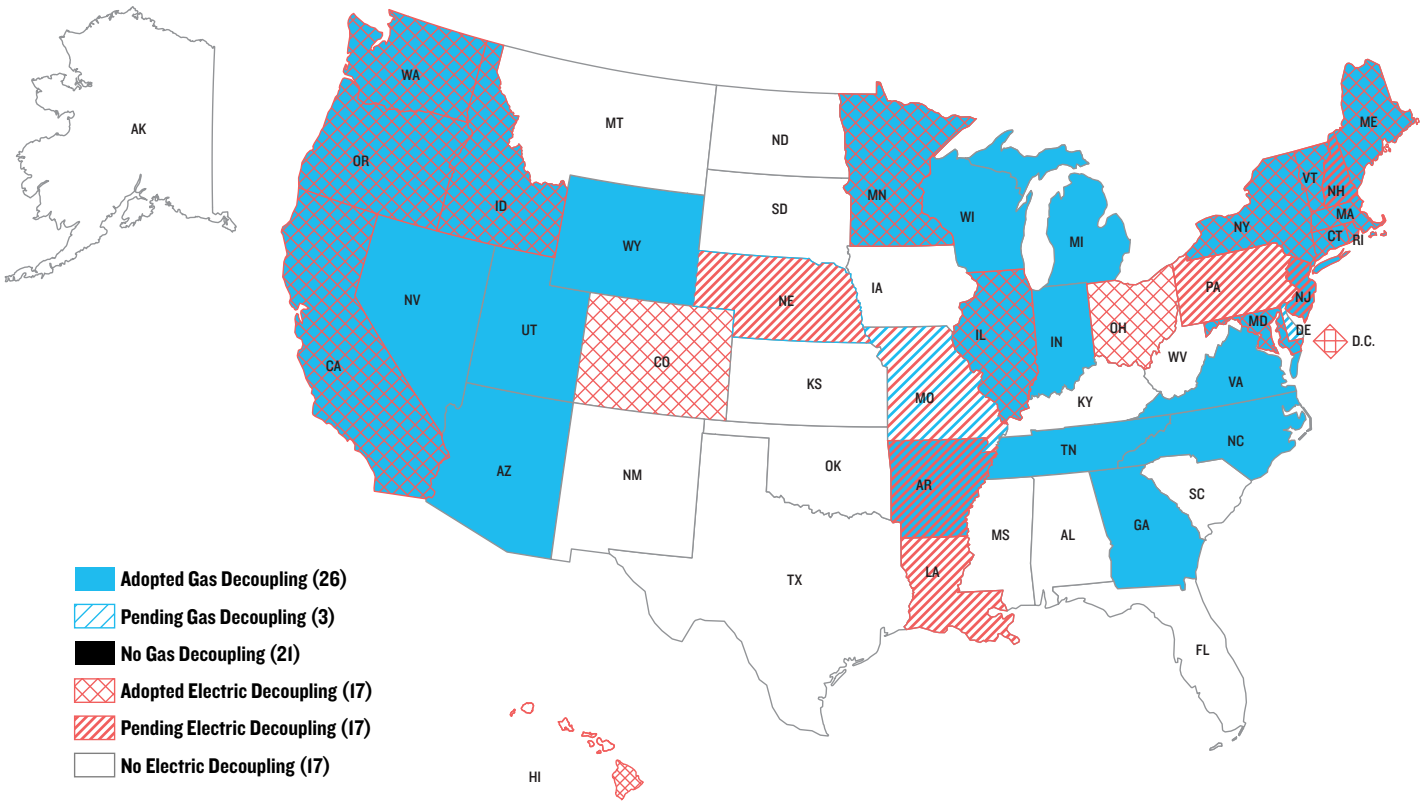
A few western states also passed leading-edge building code standards in the last year. This includes California's new "net-zero electricity" codes, which will require new homes and low-rise apartment buildings (where feasible) to use solar and efficiency to fully offset expected annual electricity usage.[43] Oregon's governor issued an executive order laying out an ambitious plan to cut energy use and carbon emissions from state-owned buildings, improve the efficiency of new residential and commercial construction, and require both electric-vehicle-ready new construction and zero-energy ready homes.[44]

Pennsylvania and Virginia adopted updated building code standards in 2018, as well. Virginia also passed new efficiency legislation that will require the state's utilities to spend $1.3 billion on energy efficiency programs over the next 10 years, more than tripling their energy efficiency spending.[45] In addition, Colorado, Illinois, Michigan, Nevada, and Ohio all renewed, or strengthened, their utility energy efficiency programs in the last year. Many of these states are also rethinking the way they regulate their utilities, exploring alternative approaches to incentivize utilities to become even more productive clean energy partners.

In May of 2017, Xcel Colorado became the latest electric utility to receive approval for a decoupling rate mechanism—where the link between a utility's sales and revenue is broken, eliminating the utility's disincentive to invest in and promote energy efficiency.[46] Decoupling uses modest, regular rate reconciliations every year to compensate for under- or over-collection of fixed costs during the previous year. 105 gas and electric utilities are now decoupled (see Figure 3), spanning 32 states across the country.[47] New Hampshire became the latest state to approve decoupling, accepting a new gas decoupling mechanism for Liberty Utilities in May 2018; the state's electric utilities will transition to decoupling in 2020.

Across the entire United States, utilities spent almost $8 billion last year helping consumers reduce energy waste in their homes and businesses, an increase of about $300 million from 2016 spending levels.[48] These new investments

FIGURE 3: ELECTRIC AND GAS DECOUPLING IN THE U.S., OCTOBER 2018

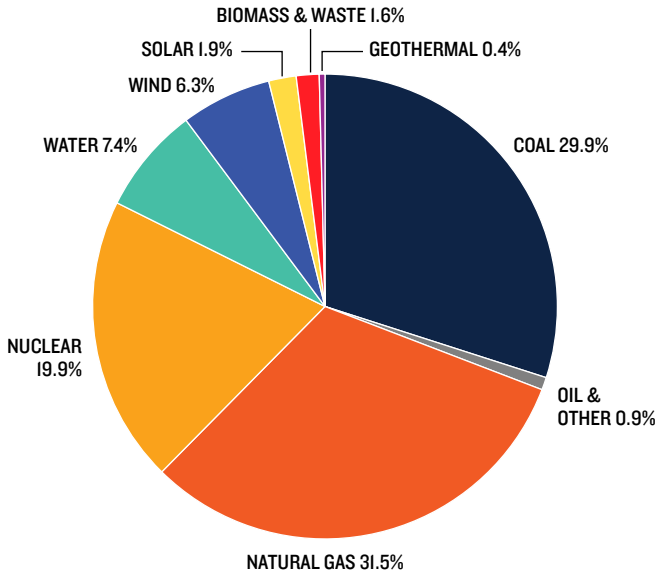


saved more than 27.3 million megawatt-hours (MWh) of electricity in 2017, about enough to power every home in Nevada, Utah, and Montana.[49] This is a seven percent bump up from the incremental energy savings achieved in 2016. When including the continued energy savings from efficiency upgrades and investments made in prior years as well, the U.S. saved enough electricity in 2017 to reduce total U.S. electricity demand by 6.5 percent—almost the entire electricity footprint of California.[50]

RENEWABLE ENERGY BEGINS TO OVERTAKE CONVENTIONAL POWER SOURCES

The U.S. power industry has seen a remarkable shift as nuclear and coal struggles to compete with energy efficiency, renewable energy resources, cheap fracked gas, and the rising need for a more flexible energy system. Renewables now account for 16 percent of U.S. power generation, a substantial increase even from 2016 levels, when renewable energy provided 14 percent of U.S. power.[51] More than half of that—8.1 percent—came from wind and solar, with most of the rest from hydropower (See Figure 4). Wind and solar energy are now consistently providing more than 10 percent of all electricity during the cooler spring months.[52] In fact, during the first three months

FIGURE 4: THE U.S. ELECTRICITY MIX IN 2017



of 2017, renewables provided more power than nuclear plants. This year, renewables provided more generation than nuclear power during the first five months of 2018, representing 20 percent of the nation's electricity mix.[53]

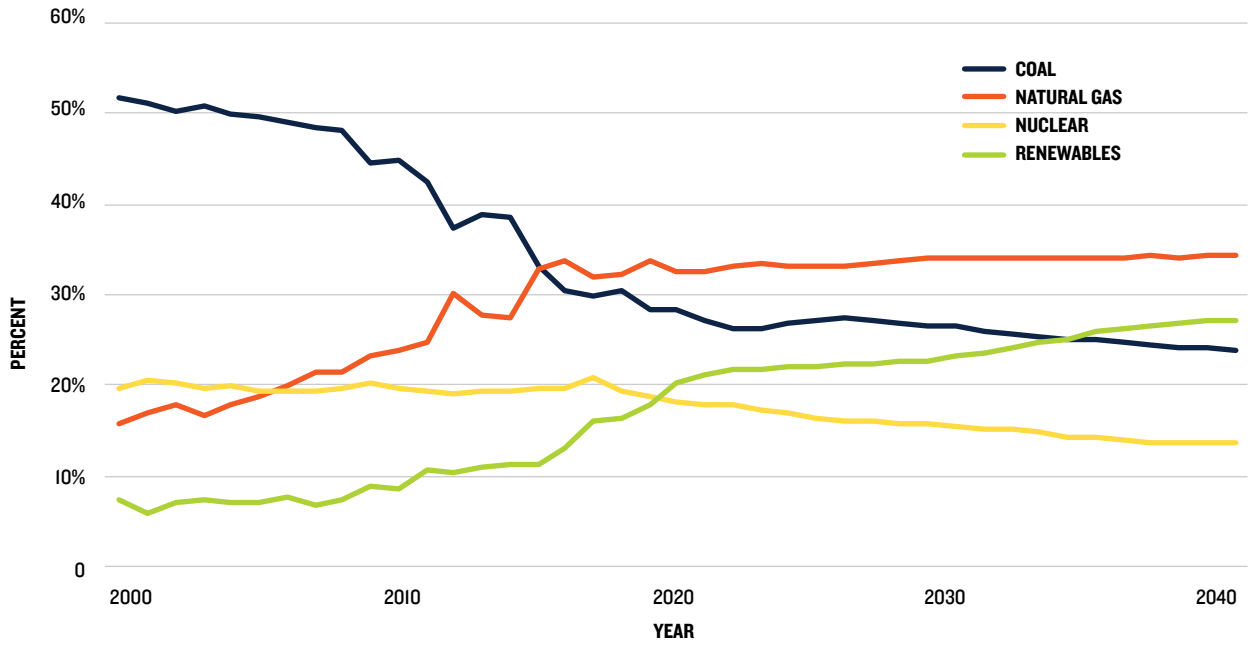
This growth in renewables has mainly displaced fossil fuels, such as coal, natural gas, and oil, in our power system (see Figure 5). In 2017, we used fewer fossil fuels than in 1994.[54] Coal use was at its lowest levels since 1982 and oil consumption in the power sector (which is not a prevalent fuel for power) hit the lowest levels on record. The reduction in coal power has resulted in dramatic drops in air pollutants that are harmful to human health, such as nitrogen oxides (NO_X) and sulfur dioxide (SO_2). NO_X is a key component of smog and acid rain and can cause respiratory issues, especially in the young and elderly, as well as worsen asthma and allergies. Like NO_X, SO_2 is a precursor to fine particulate matter, which can result in respiratory issues, asthma attacks, and even premature mortality.[55] Economy wide, SO_2 emissions have fallen by 82 percent and NO_X emissions by 47 percent since 2005.

In the last decade, SO_2 emissions from the electric power sector declined by 85 percent, while NO_X emissions decreased 66 percent.[56] These reductions have been achieved through a combination of air pollution control equipment driven by the EPA and state clean air rules, and coal plant retirements. For example, Pennsylvania passed a 2016 law requiring all power plants equipped with NO_x pollution controls to operate those controls year-round (which the plants were not doing). In just one year, NOx emissions from the state's power sector fell by 55 percent.[57]

With new technology and falling costs, clean energy will undoubtedly continue to grow. The U.S. government now expects renewables to become the third-largest source of power—behind natural gas and coal—by the early 2020s. By the early 2030s, even without new policies, the government expects renewable energy to overtake coal to become the country's second-largest source of power.[58]

Globally, wind and solar are now projected to reach at least 50 percent of the world's electricity mix by 2050, with Europe hitting this milestone by 2030.[59] Many U.S. states are also on track to achieve this by 2030, or even earlier, as clean energy becomes more affordable, grid integration improves, and flexible storage options are added to the grid, making it cheaper and easier to support reliable, regional grids with high amounts of renewable power.[60] In April 2018, New Jersey became the sixth state to pass a renewable portfolio standard (RPS) requiring the state's utilities to get half or more of their power from renewable energy by 2030.[61] The state's Clean Energy Act of 2018 includes notable sub-targets: 2 GW of battery storage (or more than twice as much storage now installed in the U.S.) and 3.5 GW of offshore wind (or almost 120 times as much offshore wind as currently installed). There are new signs that such state policies are set to jumpstart U.S. offshore wind and energy storage markets. Most recently, in August 2018, Massachusetts utilities shocked U.S. energy experts, announcing an offshore wind contract for one-fourth the cost of the first (and only) operating offshore wind farm in the United States and half the price of the offshore wind contracts approved in Maryland just three months earlier.[62]

FIGURE 5: THE U.S. BUSINESS-AS-USUAL ELECTRICITY MIX FROM 2000 TO 2040



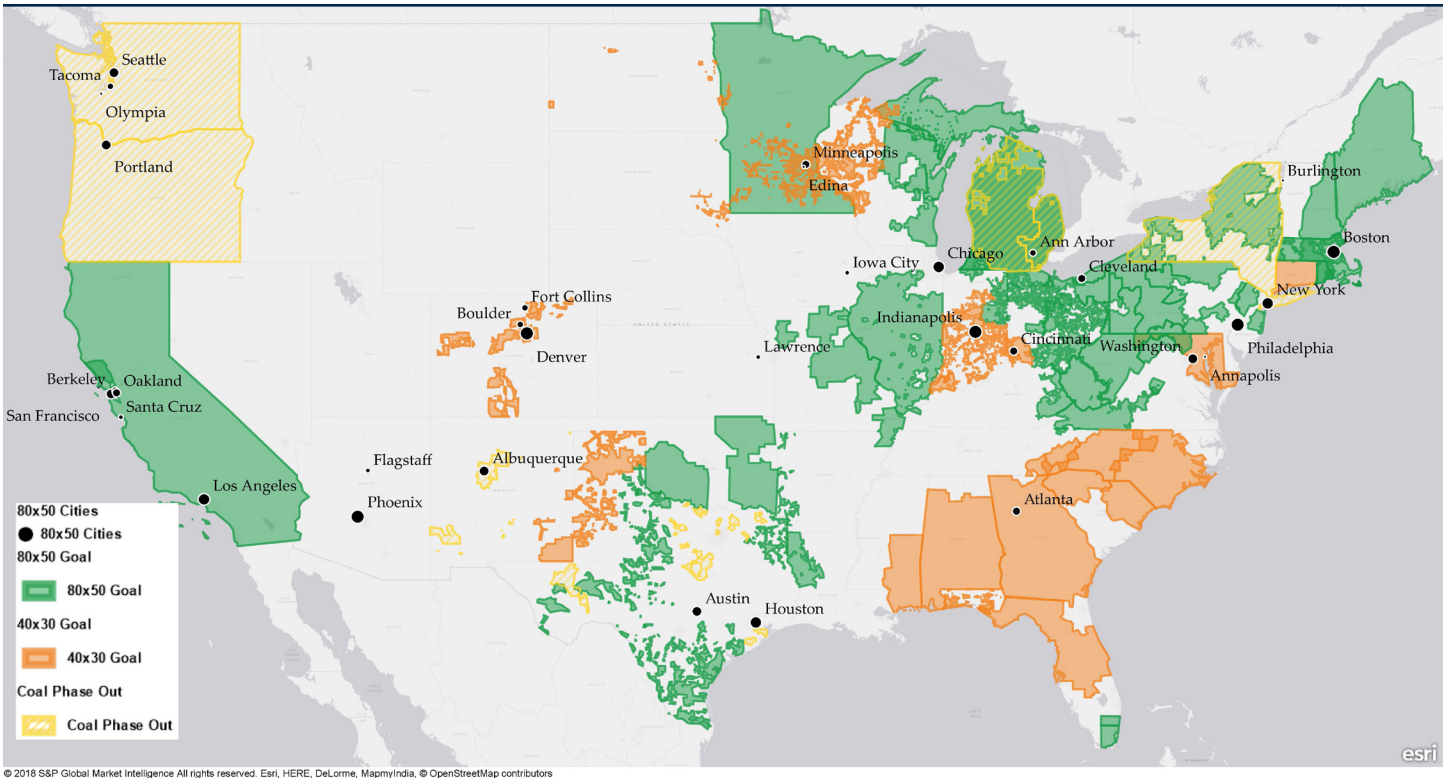
Meanwhile, Arizona and Nevada are voting on 2018 ballot initiatives to increase their respective RPS requiring 50 percent of their electricity to be generated from renewable resources by 2030. While state policies play a critical role in transitioning the country to a clean energy system, businesses and economics also have begun to drive significant renewable energy development in America. The first half of 2018 saw record corporate renewable energy purchases in the United States and globally. U.S. businesses had already inked more renewable energy deals in the first half of 2018 than ever achieved over an entire year.[63] Corporations have contracted for more than 3.8 GW of renewables in the United States in the first half of 2018 (an amount that could power around 1.2 million U.S. homes a year); the previous annual record was 3.1 GW in 2015. Globally, corporate renewable energy purchases in the first half of 2018 easily surpassed the 2017 yearlong record.[64] In 2018, corporate purchases are expected to reach over 10 GW, which would almost double the 2017 corporate green energy purchases globally. More than 140 corporations have pledged to go 100 percent renewable energy, unlocking almost 200 terrawatt hours (TWh) of new demand for clean power by 2030 (equal to Pennsylvania's annual power generation).[65] These pledges are expected to drive another 100 GW of renewables (an amount greater than the entire U.S. wind fleet) by 2030.[66]

At the utility level, renewable and carbon emission pledges have also become mainstream (See Figure 6). A recent study found that three-fourths of all investor-owned utilities in the Midwest have made voluntary renewable or emissions-reduction pledges that go above and beyond what's required under their state laws, such as an 80 percent reduction by 2050 (80x50) or a 40 percent cut by 2030 (40x30). As of August 2018, 54 percent of the 50 largest U.S. utilities had established their own climate and clean energy targets, outside of state or federal requirements.[67] This includes a rash of recent announcements from utilities pledging to be coal-free within the next few decades, including Public Service of New Mexico and the two largest utilities in Michigan: DTE and Consumers' Energy.

Natural Gas is Still Expanding and Still Not a Clean Fuel

The natural gas industry continued its growth and expansion, which has resulted in a substantial buildout of natural gas infrastructure nationwide in the last five years. Natural gas remained the top source of electricity in 2017 and is expected to remain a substantial source of power for the next few decades. The nation's natural gas combined-cycle power capacity is now larger than coal-fired power capacity. At the same time, domestic gas production is growing at a record rate. The federal government reported that the United States pumped out more than 90 billion cubic feet of gas per day (bcf/d) in 2017.[68] Domestic demand, which remained relatively stable in 2017 cannot consume all this new gas. The natural gas industry is now investing in and developing massive gas infrastructure projects, from new liquified natural gas (LNG) export terminals to pipelines, to find new markets for the fast-growing supply of fracked gas and to increase producers' profits.

FIGURE 6: SAMPLING OF STATE, LOCAL, & UTILITY CLIMATE COMMITMENTS



For the first time in nearly 60 years, the United States was a net exporter of natural gas in 2017, exporting 36 percent more natural gas than in 2016.[69] Year-over-year, LNG exports quadrupled. Domestic production and exports are expected to climb even higher in the next few years. The federal government estimates that natural gas production will hit new record highs, growing to over 81 bcf/d.[70] This would represent a 7.5 bcf/d increase from 2017, which would also mark a record increase in production over a single year. Natural gas exports are expected to increase five-fold between 2017 and 2018 and then double in 2019, with much in the gas leaving the country as LNG to serve countries in Asia and Europe.[71]

Although natural gas has helped the country transition away from coal and petroleum, it is not a clean fuel. The extraction and combustion of natural gas poses a myriad of problems for clean air, clean water, wildlife, landscapes and ecosystems, human health, local communities, and our climate. Leaking natural gas infrastructure is a source of unaccounted climate and toxic air emissions and can create emissions hotspots, human health impacts, and environmental justice issues. Improved technologies and techniques have unlocked new domestic gas reserves and led to an overproduction of natural gas and overbuilding of our pipeline system when the domestic demand does not exist. While natural gas supporters contend that new pipelines are essential to grid security, we should prioritize a reliable and renewable energy system to ensure we do not over-rely on natural gas and jeopardize the nation's progress toward clean, renewable energy and away from dirty energy.

Many states are actively fighting against overreliance on natural gas. Regulators are rejecting and questioning utilities' continued rush to gas that has already resulted in a massive, dirty, and overly costly buildout of natural gas in the last five years. In Arizona, Republican utility regulators took the unprecedented step of rejecting the long-term plans of two electric utilities due to their significant new gas builds, and placed a nine-month moratorium on new plants.[72] Minnesota regulators also rejected new gas plants, calling on the utilities to explore clean alternatives like renewables, energy efficiency, demand response, and storage instead.[73] And in California, that state's utilities and regulators are building a significant amount of energy storage to replace the need for reliability-required contracts with costly gas plants and to help move the state off of natural gas storage systems, which have experienced catastrophic and high-profile leaks in the last few years.[74]

THE OLD GUARD OF DIRTY FUELS STILL LURKS

U.S. is Now a Top Oil Producer

Like natural gas, the United States has seen a domestic oil expansion in recent years ,primarily due to the diminishment of key regulatory safeguards in concert with the adoption of new technologies. In November 2017, monthly crude oil production exceeded 10 million barrels per day for the first time since November 1970.[75] Almost all of the growth in domestic oil in the last five years has come from onshore production, with shale oil production growing from just 7 percent of domestic oil production 10 years ago to 51 percent in 2017.[76] Like natural gas, oil and other petroleum products are becoming a larger source of exports for the nation. In fact, petroleum, such as gasoline, propane, and diesel, made up a majority of all U.S. energy exports last year. The United States is expected to increase oil production from 9.4 million barrels a day in 2017 to 10.7 million and 11.7 million barrels a day in 2018 and 2019, respectively.[77] This would make the United States the world's largest oil producer, overtaking Russia, within the next year.

The combined growth in oil and gas production, coupled with increasing energy efficiency across the U.S. economy, has resulted in declining net imports of oil and gas. In 2017, net energy imports fell by 35 percent compared to 2016, reaching the lowest level since 1982.[78] However, much of the decline has been driven by increasing exports of fossil fuels, rather than decreasing imports of foreign fuels. The increasing production of oil and gas across the country, despite lackluster demand domestically, has also resulted in an increasingly constrained market for fossil fuel products and a producer-led interest in expanding our nation's pipeline system and exporting capabilities to sell our climate-warming fossil fuels to other countries. This leaves U.S. consumers with the environmental burden and risks, like oil spills, water contamination, and harmful local air pollution, from oil and gas drilling sites. At the same time, it makes it harder for the world and the United States to move away from fossil fuels toward a cleaner and more efficient system. Increasing investments in efficiency and local renewable energy, while also addressing regulatory mechanisms that favor fossil fuel development, can better address the nation's continued reliance on foreign fuels by cutting costly waste out of our system and promoting the development of energy resources that don't rely on fossil fuels, but rather on the infinite energy of the sun and wind.

Coal and Nuclear Bailouts Keep Bad Fuel Options in the Mix

As the costs of alternatives, such as solar, wind, and gas, have fallen in the last few years, legacy fuel sources like coal and nuclear have faced escalating financial pressures. Recent reports estimate that over half of the coal and nuclear power fleets in the United States are in the red, and indeed, power plant operators continue to shutter these older power plants across the country. In response, some regulators at the state, regional, and federal levels have proposed to intervene in the markets to prop up uneconomic plants.

U.S. power producers are expected to retire more than 18 GW of coal-fired power plants in 2018.[79] Another 17 GW of coal-fired power plant capacity is scheduled

to go offline by the end of 2022.[80] This retiring capacity will be more than adequately replaced by new gas and renewable projects, as shown in Figure 7. (The new projects reflect those announced, though not all will be built.) Wind and solar make up a significant portion of the new projects, especially those slated to begin operation in the next three years. They are hoping to capitalize on the renewable tax credits before they phase out or down at the start of the next decade. Natural gas power plants are also popular among power producers, especially in areas with access to fracked gas. However, this can be a risky bet for both consumers and our climate. If gas prices rise or we get serious about climate action, many of these natural gas plants may become costly stranded assets.

FirstEnergy made headlines in March 2018 when it asked the U.S. Department of Energy (DOE) to declare a grid emergency, claiming the closure of its uneconomic coal and nuclear plants would destabilize the mid-Atlantic grid. In June, the White House called on Energy Secretary Rick Perry to take immediate steps to keep both coal and nuclear power plants running, backing Perry's claim that plant closures threaten national security.

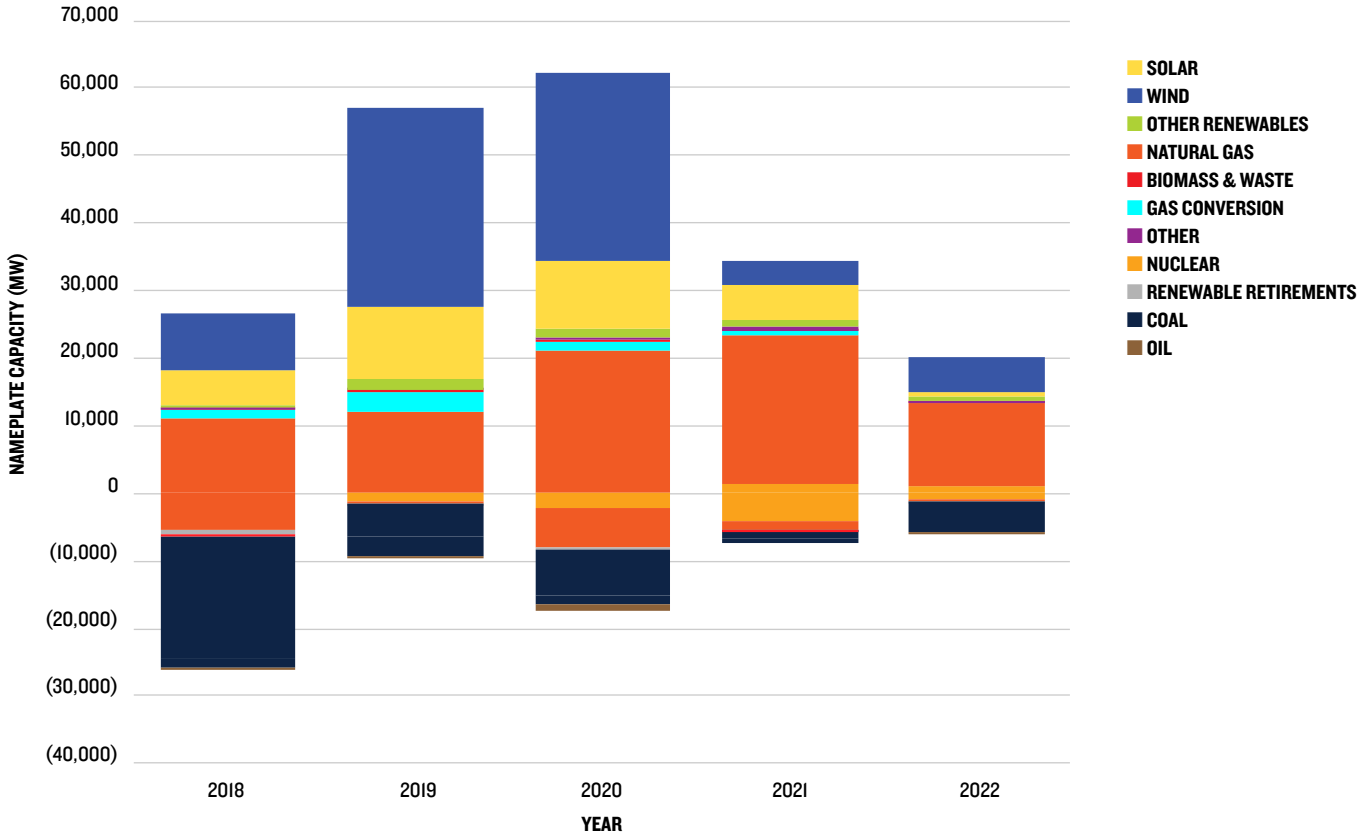
This request came after almost a year of (unsuccessful) attempts by the administration to save uneconomic coal and nuclear plants. Secretary of Energy Rick Perry started it off in April 2017 by ordering his staff to conduct a study of grid resilience and reliability. Although Perry explained that the study would help the federal government formulate sound policies to protect the nation's electric grid, the final study, published in August 2017, concluded that the grid has become more reliable in the last 15 years—notwithstanding coal and nuclear retirements.

With little support for a bailout, Perry moved on to a second attempt in the fall of 2017, with a Notice of Proposed Rulemaking (NOPR) designed to provide financial compensation for "fuel-secure resources."[81] It was unanimously rejected by the Republican-controlled Federal Energy Regulatory Commission (FERC) at the start of 2018.[82] Despite these setbacks, the DOE and some nuclear and coal interests are still attempting to pass on the costs of these uneconomic resources onto everyday Americans.

What does saving these old nuclear and coal plants mean for our health, our environment, and our wallets?

What a bailout will look like is still unknown, resulting in a range of outcomes from bad to much worse. Experts have projected they could cost American consumers between $130 million to $35 billion every year, depending on which plants are covered and how much of their costs consumers bear. On the higher end, the Brattle Group found that the annual cost of supporting all coal and nuclear plants could

FIGURE 7: POWER CHANGES OVER THE NEXT FIVE YEARS (PLANNED RETIREMENTS AND ADDITIONS BY FUEL)



total as much as $35 billion if owners are granted a return on investment.[83] On the low end, the National Mining Association, which represents the coal sector and other mining interests, preposterously assumed only three coal plants in the entire United States would receive subsidies but that cost was still $130 million per year.[84] Meanwhile, the regional grid operator for the mid-Atlantic (PJM) estimated it would cost consumers in its region between $3.8 billion to $35 billion a year, if efforts to save "aging, less competitive plants" go forward.

Keeping these uneconomic coal plants afloat would also have deadly consequences. Resources for the Future estimated that a bailout would keep about 25 GW of coal plants online and polluting, creating about $217 billion in costs to public health and the environment.[85] The coal bailouts could result in 27,000 more Americans dying prematurely over the next 20 years. Emergency room visits, hospital admissions, heart attacks and cases of chronic bronchitis would also increase.

CHEAPER, LEANER, GREENER IS THE BEST CHOICE FOR AMERICA'S ENERGY FUTURE

The United States has made significant strides on clean energy in the last few years, as the costs and performance of these technologies have improved. This is made clear when one looks at what the Department of Energy (DOE) predicted 2017 would look like 10 years ago. As shown below, the U.S. is much less reliant on dirty and imported fuels than the DOE anticipated. Economy-wide, coal use was 40 percent less in 2017 than projected, representing the lowest level since 1978, and oil imports were more than a quarter below forecasts. Both are a direct result of investments in energy efficiency and renewable energy.

Across the entire economy, the United States used 15 percent less energy in 2017 than the DOE estimated we would a decade earlier. Total U.S. energy consumption last year was even below the amount used when the decade-old projections were made: we used 3 percent less energy in 2017 to support an economy 16 percent larger (in real terms) than it was in 2007.

The energy resources we depended on in 2017 also looked vastly different. Wind and solar capacity was 600 percent higher than anticipated and natural gas prices were 60 percent lower, contributing to much less dependence on coal and oil. This has resulted in measurable benefits for our health and environment: total U.S. carbon pollution was 23 percent lower than initially projected and 15 percent lower than it was in 2007.

One of the most remarkable aspects of this ongoing transition: it has come at little or no cost to everyday Americans. Household spending on electricity (as a percent of income) has reached record lows in the last year and a half.[86] In 2017, U.S. households spent just 1.3 percent of their income on electricity, down from the record-low of 1.4 percent in 2016. In the 1980s, households spent about 2.2 percent of their income on electricity.[87] This trend is only gaining traction as the costs of renewable energy falls further, becoming not only the cheapest source of new power but even less expensive than running existing fossil power plants.

Since the federal government started tracking household spending in 1959, U.S. households have only spent less that 1.3 percent of their monthly income on electricity in just four months. All four occurred in the last year and a half: January, February, and August of 2017, and February 2018.[88] And when considering all expenses we face to heat and light our homes, including both electricity and natural gas expenses, the results are even more striking. In 2017, U.S. households spent half the amount of income on these energy expenses than they did in the early 1980s (1.7 percent versus a high of 3.5 percent in 1982 and 1983).[89]

However, this mutually beneficial transition is under threat from federal interventions designed to prop up uneconomic and dirty power plants and roll back federal standards that encourage companies to develop more efficient appliance and vehicles that save Americans money at the pump and on their utility bills. These obstacles threaten not only our climate and health, but the checkbooks of U.S. households and businesses.

	WHAT WE THOUGHT THE U.S. WOULD LOOK LIKE IN 2017 (10 YEARS AGO)	WHAT THE U.S. ACTUALLY LOOKED LIKE IN 2017	% DIFFERENCE
Total Coal Use	26.23 Quads	15.62 Quads	-40%
Total Wind & Solar Capacity	18.5 GW	130.4 GW	605%
Barrels of Oil Imported per Day	10.8 Million	7.9 Million	-27%
Price of Natural Gas (2005$/mcf)	$5.74	$2.30	-60%
Total Energy Demand	114.5 Quads	97.7 Quads	-15%
Total Carbon Emissions	6,716 MMT	5,142 MMT	-23%

The United States is currently off-track from meeting our climate commitments, and the delta between where we are headed and where we need to be to avert the worst impacts of climate change will only grow. Under the current proposed federal rollbacks, the United States is expected to emit another 857 million tons of CO_2 a year above our nation's Paris Accord target in 2025 and an estimated 1.8 billion tons of CO_2 above a 1.5-degree scenario.

However, the falling costs of renewables and electric vehicles have made clean options the best future for both our climate and our economy, and the recent investments in these renewable and EV options are consistent with scenarios to keep the increase in global warming to 2 degrees. The economics of climate action have shifted significantly in the last decade thanks to innovation and human ingenuity. The U.S. has already achieved much greater change than imagined just a decade ago - and now we must push further, faster to avoid the worst impacts of climate change. We have the tools necessary—we just need the political will to do so. Cities, states, businesses, and the federal government need to do much more to cut climate pollution, and ramp up investments in energy efficiency and the electrification of our homes, businesses, and industry. Accelerating the adoption of more efficient and electric appliances and vehicles will be crucial to support a clean and climate-safe future.

The United States is at a crossroads. Many states have pledged to move forward toward a clean, efficient future, even as the federal administration turns away from national climate and clean energy action. We must move full speed ahead toward a system that prioritizes the clean, distributed, flexible system of tomorrow—a system that will be best for our health, wallets, economy, and climate.

ENDNOTES

1 Kevin Steinberger and Noah Long, "*Western Renewable Energy Just Keeps Getting Cheaper*," NRDC Expert Blog, January 2018, https://www.nrdc.org/experts/kevin-steinberger/western-renewable-energy-just-keeps-getting-cheaper; Gavin Bade, "NV Energy 2.3-cent solar contract could set new price record," *Utility Dive*, June 13, 2018, https://www.utilitydive.com/news/nv-energy-23-cent-solar-contract-could-set-new-price-record/525610/.

2 John Weaver, "Florida's distributed solar market doubled in 2017," *PV Magazine,* July 5, 2018, https://pv-magazine-usa.com/2018/07/05/customer-owned-solar-doubles-in-florida-in-2017/.

3 U.S. Energy Information Agency (hereinafter EIA), "U.S. Carbon Dioxide Emissions from Energy Consumption (from 1973)," *Monthly Energy Review*, Section 12, March 2018, https://www.eia.gov/environment/data.php#summary.

4 U.S. Environmental Protection Agency (hereinafter EPA), "Overview of Greenhouse Gases," last updated April 14, 2018, https://www.epa.gov/ghgemissions/overview-greenhouse-gases.

5 Intergovernmental Panel on Climate Change, Global Warming of 1.5 °C: an IPCC special report on the impacts of global warming of 1.5 °C above pre-industrial levels, October 2018, http://www.ipcc.ch/report/sr15/

6 Gowrishankar, Vignesh and Levin, Amanda, "America's Clean Energy Frontier: The Pathway to a Safer Climate Future," *Natural Resources Defense Council* (hereinafter NRDC), September 2017, https://www.nrdc.org/resources/americas-clean-energy-frontier-pathway-safer-climate-future.

7 U.S. EIA, *Monthly Energy Review: U.S. Carbon Dioxide Emissions from Energy Consumption (from 1973)*, Section 12, March 2018, https://www.eia.gov/environment/data.php#summary.

8 U.S. EIA, *Annual Energy Outlook 2018,* January 2018, https://www.eia.gov/outlooks/aeo/.

9 Carol Davenport, "Trump Administration Unveils Its Plan to Relax Car Pollution Rules," *New York Times*, August 2, 2018, https://www.nytimes.com/2018/08/02/climate/trump-auto-emissions-california.html.

10 U.S. EPA, "*U.S. EPA and DOT Propose Fuel Economy Standards for MY 2021-2026 Vehicles*," Press Release, August 2, 2018, https://www.epa.gov/newsreleases/us-epa-and-dot-propose-fuel-economy-standards-my-2021-2026-vehicles.

11 This includes: NJ, CT, WA, VT, NY, ME, RI, MA, OR, PA, MD, DE, and Washington D.C. NRDC, "*Trump Administration Reverses Clean Car Standards, Gutting Another Key Climate Policy*," NRDC Expert Blog, August 2, 2018, https://www.nrdc.org/experts/nrdc/trump-administration-reverses-clean-car-standards-gutting-another-key-climate-policy.

12 U.S. EIA, *Monthly Energy Review: Petroleum Trade: Imports from OPEC Countries,* Table 3.3c, March 2018, https://www.eia.gov/totalenergy/data/monthly/pdf/sec3_10.pdf.

13 Bruce Ho, "*Reimagining Transportation in the Northeast and Mid-Atlantic*," NRDC, July 19, 2018, https://www.nrdc.org/experts/bruce-ho/reimagining-transportation-northeast-and-mid-atlantic.

14 Siddiq Khan, "As electric vehicles gain favor, utilities can accelerate EV adoption," *American Council for an Energy-Efficient Economy,* 13 February 2018, https://aceee.org/blog/2018/02/electric-vehicles-gain-favor.

15 "Utilities, Governor, Mayor Announce New Electric Vehicle Incentives for Low- and Moderate-Income Vermonters," *Green Mountain Power*, October 3, 2017, https://greenmountainpower.com/news/utilities-governor-mayor-announce-new-electric-vehicle-incentives-low-moderate-income-vermonters/.

16 Simon Mui, "*California Goes Big on EVs,*" NRDC Expert Blog, January 26, 2018, https://www.nrdc.org/experts/simon-mui/california-goes-big-evs.

17 Mark Kane, "2017 US Plug-In EV Sales Charted: Market Grows 26%, Record 1.6% Share in December," *InsideEVs,* January 11, 2018, https://insideevs.com/2017-us-plug-in-ev-sales-charted-market-grows-26-record-1-6-share-in-december/.

18 Bloomberg New Energy Finance (hereinafter BNEF) *New Energy Outlook 2018,* June 2018, https://about.bnef.com/new-energy-outlook/ (subscription required).

19 "The Future is Electric," *Volvocars*, September 4, 2018, https://group.volvocars.com/company/innovation/electrification.

20 "GM's Path to an All-Electric, Zero Emissions Future," *General Motors*, March 7, 2018, https://www.gm.com/mol/m-2018-mar-0307-barra-speech.html.

21 David Roberts, "The world's largest car market just announced an imminent end to gas and diesel cars," *Vox,* September 13, 2017, https://www.vox.com/energy-and-environment/2017/9/13/16293258/ev-revolution.

22 Sean Szymkowski, "UK to ban diesel, gasoline car sales by 2040; follows France, Norway, Holland bans," *Green Car Reports*, July 27, 2017, https://www.greencarreports.com/news/1111770_uk-to-ban-diesel-gasoline-car-sales-by-2040-follows-france-norway-holland-bans.

23 McKinsey & Company, "Battery Storage: The next disruptive technology in the power sector," June 2017, https://www.mckinsey.com/business-functions/sustainability-and-resource-productivity/our-insights/battery-storage-the-next-disruptive-technology-in-the-power-sector.

24 Paul Denholm and Mai Trieu, "*Timescales of Energy Storage Needed to Reduce Renewable Energy Curtailment: Report Summary*," National Renewable Energy Laboratory, October 2017, https://www.nrel.gov/docs/fy18osti/70238.pdf.

25 U.S. EIA, "Today in Energy: Batteries perform many different functions on the power grid," January 8, 2018, https://www.eia.gov/todayinenergy/detail.php?id=34432.

26 Bloomberg New Energy Finance (hereinafter BNEF), *Sustainable Energy Factbook 2018*, https://about.bnef.com/blog/sustainable-energy-america-factbook-2018/.

27 Lazard, *Lazard's Levelized Cost of Storage Analysis Version 3.0*, November 2017, https://www.lazard.com/media/450338/lazard-levelized-cost-of-storage-version-30.pdf.

28 Peter Maloney. "PG&E to replace 3 gas plants with world's biggest battery projects." *Utility Dive,* July 3, 2018. https://www.utilitydive.com/news/pge-to-replace-3-gas-plants-with-worlds-biggest-battery-projects/526991/.

29 Gavin Bade, "ConEd Brooklyn-Queens non-wire alternative project installs first microgrid," *Utility Dive,* December 14, 2016, https://www.utilitydive.com/news/coned-brooklyn-queens-non-wire-alternative-project-installs-first-microgrid/432380/.

30 GreenTech Media (hereinafter GTM), "U.S. Energy Storage Monitor: 2017 Year in Review," March 2018, https://www.greentechmedia.com/research/subscription/u-s-energy-storage-monitor

31 Reuters, "*Cobalt to be declared a strategic mineral in Congo*," March 14, 2018, https://www.reuters.com/article/us-congo-mining-cobalt/cobalt-to-be-declared-a-strategic-mineral-in-congo-idUSKCN1GQ2RX.

32 The Economist, "*Electric vehicles are poised to unleash a cobalt boom*," March 22, 2018, https://www.economist.com/graphic-detail/2018/03/22/electric-vehicles-are-poised-to-unleash-a-cobalt-boom.

33 "*Rush Opening Remarks at Energy Storage Hearing*," Press Release, July 18, 2018, https://rush.house.gov/media-center/press-releases/rush-opening-remarks-at-energy-storage-hearing.

34 Energy Storage Association, "*Energy Storage Technologies*," Accessed September 5, 2018, http://energystorage.org/energy-storage/energy-storage-technologies.

35 ARPA-E, "*About Us*," Accessed September 5, 2018, https://arpa-e.energy.gov/.

36 The five states are MA, OR, NY, NJ, and CA; Peter Maloney, "*As second wave of state storage targets builds, utilities propose new projects*," August 7, 2018, https://www.utilitydive.com/news/as-second-wave-of-state-storage-targets-builds-utilities-propose-new-proje/529495/.

37 U.S. EIA, "*U.S. Battery Storage Market Tre*nds," May 2018, https://www.eia.gov/analysis/studies/electricity/batterystorage/pdf/battery_storage.pdf.

38 Peter Maloney, "*As second wave of state storage targets builds, utilities propose new projects*," August 7, 2018, https://www.utilitydive.com/news/as-second-wave-of-state-storage-targets-builds-utilities-propose-new-proje/529495/.

39 "*Governor Murphy Signs Measures to Advance New Jersey's Clean Energy Economy*," Press Release, May 23, 2018, https://www.nj.gov/governor/news/news/562018/approved/20180523a_cleanEnergy.shtml.

40 RTO Insider, "*NY Sets 40% Hike in EE Goal*," April 26, 2018, https://www.rtoinsider.com/nyserda-energy-efficiency-ee-91399/.

41 Appliance Standards Awareness Project, "*Vermont Doubles Down on Efficiency Standards, Enacts New Law*," May 24, 2018, https://appliance-standards.org/blog/vermont-doubles-down-efficiency-standards-enacts-new-law.

42 Robert Walton, "Connecticut lawmakers pass sweeping energy bill," *Utility Dive*, May 10, 2018, https://www.utilitydive.com/news/connecticut-lawmakers-pass-sweeping-energy-bill/523264/.

43 Pierre Delfore, "*CA Building Code Takes Big Step Toward Net-Zero Energy*," NRDC Expert Blog, May 9, 2018, https://www.nrdc.org/experts/pierre-delforge/ca-building-code-takes-big-step-toward-net-zero-energy.

44 Office of the Governor, State of Oregon, Executive Order No. 17-20, https://www.oregon.gov/gov/Documents/executive_orders/eo_17-20.pdf.

45 NRDC, "Virginia Lawmakers Approve Bill Doubling Clean Energy," Press Release, March 2, 2018, https://www.nrdc.org/media/2018/180302-0.

46 Susan Nedell, "The public utilities commission did the right thing to advance Colorado's clean energy economy," *Environmental Entrepreneurs*, June 26, 2017, https://www.e2.org/general/public-utilities-commission-right-thing-advance-colorados-clean-energy-economy/.

47 Dylan Sullivan and Donn DeCostanzo, "*Gas and Electric Decoupling: Fact Sheet*," NRDC, August 30, 2014, https://www.nrdc.org/resources/gas-and-electric-decoupling.

48 American Council for an Energy-Efficient Economy (hereinafter ACEEE), *2018 State Energy Efficiency Scorecard*, October 2018, http://aceee.org/state-policy/scorecard.

49 Id; U.S. EIA, "Sales of Electricity to Ultimate Customers by State, Year-to-Date," *Electric Power Monthly*, Section 5.4, February 2018, https://www.eia.gov/electricity/monthly/.

50 Id.

51 Figure excludes biomass. U.S. EIA, "U.S. Carbon Dioxide Emissions from Energy Consumption (from 1973)," *Monthly Energy Review,* Section 7, March 2018, https://www.eia.gov/totalenergy/data/monthly/.

52 Reuters, "Wind, solar surpassed 10 percent of U.S. electricity in March: EIA," June 14, 2017, https://www.reuters.com/article/us-usa-energy-renewables-idUSKBN195291.

53 GTM, "US Renewables Are Closing In on Nuclear Generation," *Greentech Media*, August 9, 2018, https://www.greentechmedia.com/articles/read/us-renewables-are-closing-in-on-nuclear-generation.

54 U.S. EIA, "Today in Energy: Electric power sector consumption of fossil fuels at lowest level since 1994, May 26, 2018, https://www.eia.gov/todayinenergy/detail.php?id=33543.

55 U.S. EPA, "Sulfur Dioxide Basics," Accessed September 10, 2018, https://www.epa.gov/so2-pollution/sulfur-dioxide-basics#what%20is%20so2.

56 U.S. EPA, "State Average Annual Emissions Trend," July 2018, https://www.epa.gov/air-emissions-inventories/air-pollutant-emissions-trends-data.

57 Id.

58 U.S. EIA, *Annual Energy Outlook 2018*, January 2018, https://www.eia.gov/outlooks/aeo/.

59 BNEF, *New Energy Outlook 2018,* June 2018 https://about.bnef.com/new-energy-outlook/ (subscription required).

60 U.S. EIA, "Electric Power Monthly with Data for March 2017," May 2017.

61 "Governor Murphy Signs Measures to Advance New Jersey's Clean Energy Economy," Press Release, https://www.nj.gov/governor/news/news/562018/approved/20180523a_cleanEnergy.shtml.

62 Bloomberg, "First Big U.S. Offshore Wind Farm Offers $1.4 Billion to Customers," August 1, 2018, https://www.bloomberg.com/news/articles/2018-08-01/first-big-u-s-offshore-wind-offers-1-4-billion-to-customers.

63 Rocky Mountain Institute, "*Corporate Renewable Energy Procurement Sets New Record in 2018*," August 8, 2018, https://www.rmi.org/press-release/corporate-renewable-energy-procurement-sets-new-record-in-2018/.

64 Brian Eckhouse, "Corporate Giants are Buying so Much Clean Power This Year They Already Broke 2017's Record," *Bloomberg,* August 3, 2018, https://www.bloomberg.com/news/articles/2018-08-03/corporate-giants-clean-energy-buying-shattering-2017-record.

65 RE100, "Companies," Accessed September 4, 2018, http://there100.org/companies.

66 Rocky Mountain Institute, "Corporate Renewable Energy Procurement Sets New Record in 2018," August 8, 2018, https://www.rmi.org/press-release/corporate-renewable-energy-procurement-sets-new-record-in-2018/.

67 Based on a NRDC analysis of utility commitments.

68 U.S. EIA, "Today in Energy: By Some Measures, U.S. natural gas production set a record in 2017," April 10, 2018, https://www.eia.gov/todayinenergy/detail.php?id=35712.

69 U.S. EIA, "Today in Energy: U.S. net energy imports in 2017 fall to their lowest levels since 1982," March 28, 2018, https://www.eia.gov/todayinenergy/detail.php?id=35532.

70 U.S. EIA, *Short Term Energy Outlook*, August 2018, https://www.eia.gov/outlooks/steo/.

71 U.S. EIA, *Short Term Energy Outlook*, August 2018.

72 Dave Roberts, "Clean energy is catching up to natural gas," *Vox*, August 8, 2018.

73 Id.

74 Id.

75 U.S. EIA, "Today in Energy: U.S. monthly crude oil production exceeds 10 million barrels per day, highest since 1970," February 1, 2018, https://www.eia.gov/todayinenergy/detail.php?id=34772.

76 Id.

77 U.S. EIA, Short Term Energy Outlook, August 2018, https://www.eia.gov/outlooks/steo/.

78 US EIA, "Today in Energy: U.S. net energy imports in 2017 fall to their lowest levels since 1982," March 28, 2018, https://www.eia.gov/todayinenergy/detail.php?id=35532.

79 Based on NRDC Analysis and tracker of utility announcements. Tracker updated regularly with information from S&P Global Market Intelligence, U.S. EIA, and state regulatory docket systems.

80 Id.

81 Miles Farmer, "*DOE Proposes Outrageous, Massive Coal and Nuclear Bailout*," NRDC Expert Blog, September 29, 2017, https://www.nrdc.org/experts/miles-farmer/doe-proposes-outrageous-massive-coal-and-nuclear-bailout.

82 Miles Farmer and John Moore, "*FERC Rejects Perry's Coal/Nuke Bailout, Finding It Illegal*," NRDC Expert Blog, January 9, 2018, https://www.nrdc.org/experts/miles-farmer/ferc-finds-perrys-coalnuke-bailout-illegal.

83 Metin Celebi, et. al. *The Cost of Preventing Baseload Retirements: A Preliminary Examination of the DOE Memorandum*, Prepared for the Advance Energy Economy by The Brattle Group, July 2018, https://info.aee.net/hubfs/Brattle_AEE_Final_Embargoed_7.19.18.pdf.

84 Paul Gough, "Advocates battle over cost of potential DOE bailout of coal, nuclear plants," *Pittsburgh Business Times*, July 20, 2018, https://www.bizjournals.com/pittsburgh/news/2018/07/20/advocates-battle-over-cost-of-potential-doe.html

85 Resources for the Future, "*Projecting Impacts of DOE's Grid Resiliency Pricing Proposal*," January 18, 2018, http://www.rff.org/blog/2018/projecting-impacts-doe-s-grid-resiliency-pricing-proposal.

86 U.S. Bureau of Economic Analysis, "Table 2.4.5U: Personal Consumption Expenditures by Type of Product," Section 2, Accessed September 4, 2018, https://apps.bea.gov/iTable/iTable.cfm?ReqID=19&step=2#reqid=19&step=2&isuri=1&1921=underlying.

87 Id.

88 Id.

89 Id.