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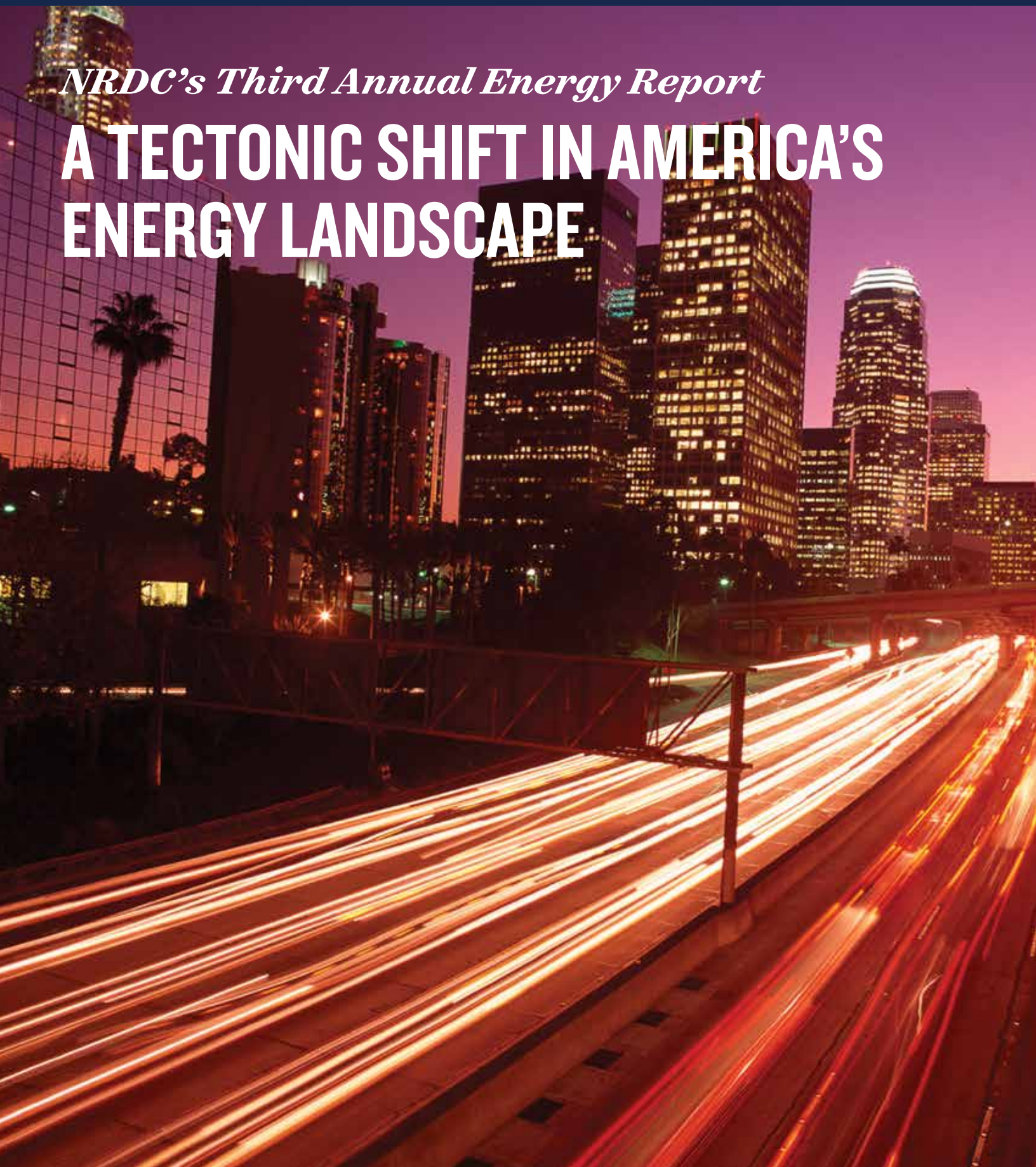
NRDC's Third Annual Energy Report

A TECTONIC SHIFT IN AMERICA'S ENERGY LANDSCAPE



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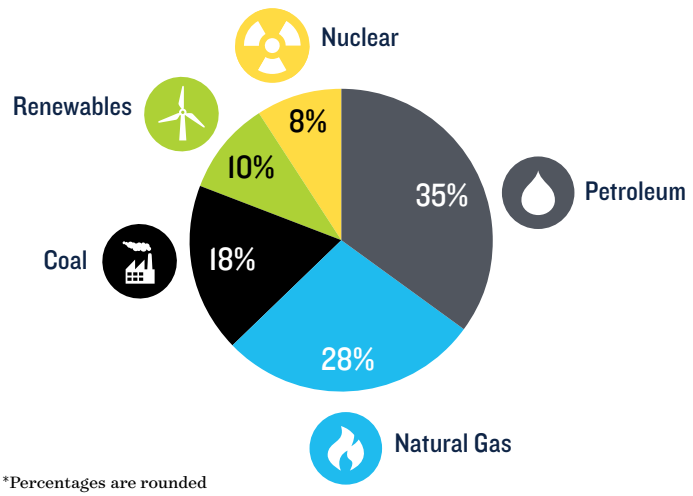
The United States is leading a global clean energy transition that reached new milestones over the past year, with coal and electricity consumption down nationwide, oil use flat, and renewable energy surging.[1] Sustained progress in energy efficiency, wind power, and solar generation paved the way for America's first nationwide limits on power plants' carbon pollution, issued in August, and offered hope for significant progress in the global climate negotiations scheduled for December in Paris. In the meantime, California has enacted the world's most ambitious combined clean energy targets.[2]

This positive activity all comes on top of a year in which the United States emitted less carbon dioxide pollution from its energy sector than in 1996, with a full 10 percent reduction from 2005 through 2014, although the total was still far too high.[3] Oil consumption dropped below levels recorded in 1973, when the U.S. economy was about one-third its current size. The United States is off to a good start toward meeting President Obama's commitment to cut carbon pollution by more than a quarter over the next decade through actions under existing law.[4] This includes 3 billion tons that will be eliminated via appliance, equipment, and building efficiency standards by 2030. We need to meet this commitment and then raise the bar much higher in order to do our share to stabilize the earth's climate.As California's lawmakers recognized in recent legislation, total emissions must drop at least 80 percent by 2050.[5]

NRDC's 2015 review of the most recent data confirms that the economic and environmental performance of America's energy systems has never been better. The single most important contributor to these positive trends is energy efficiency, the largest and least expensive way to meet the nation's energy needs. Smarter use has allowed America to get more work out of less energy while pushing our economy forward and cutting residential, business, and industrial customers' bills.

NRDC's *Third Annual Energy Report* follows an important advance in the global fight against catastrophic climate change: the Obama administration's Clean Power Plan (CPP), issued on August 3, 2015. With an ultimate goal of one-third less carbon dioxide (CO_2) emissions by 2030 relative to 2005 levels, the CPP ensures that the electric sector will continue to reduce its carbon pollution. Because the options to comply with the CPP limits will cost less than continuing to pollute, the average U.S. household will save an estimated $85 per year in electricity bills as power plant emissions decline. This policy innovation complements the Obama administration's earlier accord with major automakers to double the efficiency of our vehicle fleet.[6] Together with the changing economics of all energy resources, these milestones illustrate a tectonic shift in America's energy landscape.

U.S. Energy Sources in 2014



*Percentages are rounded

CLEAN ENERGY HIGHLIGHTS

This pie chart, while accurate as far as it goes, is missing its most important slice. Forty years of sustained improvements in optimizing energy use made energy efficiency America's largest single energy "resource" over that period—allowing utilities, for example, to avoid building more power plants and purchasing more fuel to generate electricity. Efficiency has become the equivalent of a supply source whose cumulative contributions to meeting growth in the nation's needs for energy services now exceed those of all competitors combined, from oil and coal to natural gas and nuclear power.[7] Energy efficiency also changes the marketplace in which all other energy sources compete: because we need less energy to power the country, the remaining resources must fight for a share in a smaller market. This stiffening of competition contributes to driving out more-expensive and polluting resources, led by coal and oil.

Energy efficiency demonstrates that progress toward a clean energy future goes hand in hand with economic health. America's success in embracing both objectives will help inspire global progress toward stabilizing atmospheric concentrations of greenhouse gases.

Over the past four decades, the United States has broken the link between economic growth and energy consumption. Thanks in part to continuing progress on energy efficiency, the nation's economy has tripled over this period, while energy use has increased by only one-third. Any hint that economic growth might still be tethered to energy consumption evaporated with the last recession: measured from the previous peak of 2007, the economy has now rebounded to a level 7 percent higher, whereas total energy consumption has dropped by almost 3 percent (Figure 1). The remainder of this report breaks down this general trend into some of its most important elements and explores the implications for our economy, security, and the environment.

ELECTRICITY: Americans spend almost $400 billion annually just on electricity to power their homes, offices, and factories.[8] Electricity use more than doubled from 1973 to 2000 while the population increased by only about a third. However, thanks to America's increased energy productivity, since then—for the first time in modern history—electricity consumption has risen more slowly than the population for an extended period, as shown in Figure 2. From 2000 to 2014, electricity consumption rose by 7.5 percent, with an average annual growth rate of about 0.5 percent, even as the population grew at almost twice that rate (13 percent). As a result of this continuing slowdown, there is growing interest in a "utility business model of the future" that will end utilities' long-standing financial addiction to robust growth in electricity sales, and instead link their financial health to success in delivering affordable and reliable clean energy services.

OIL: The amount of oil used in U.S. vehicles, homes, and businesses rose negligibly in 2014 (about 0.5 percent), and the total is down by more than 13 percent from its 2005 peak. Surprisingly, oil use today is slightly lower than it was in 1973, when the nation's economy was about one-third its current size (Figure 3). Thanks to recent fuel economy and clean car standards, the U.S. Environmental Protection Agency (EPA) projects that U.S. oil consumption in 2025 will have decreased by 2.1 million barrels per day, which is more than the United States purchases now from any OPEC nation.[10] The efficiency of the U.S. auto fleet has gone up by 25 percent in the past 10 years, and electric vehicle sales more than quintupled between 2011 and 2014.[11,12] Adding new transportation policies to provide more alternatives to driving, like public transit, and further accelerating electric vehicle sales could save the United States nearly 4 billion barrels of oil each year by 2035.[13] That's almost the same amount of oil, in a single year, as the Interior Department estimates can ever be recovered from drilling all our offshore waters from Florida to Maine.[14] Reductions in U.S. demand have also contributed to sustained downward pressure on oil prices in 2014 and 2015.[15] Cutting oil consumption and expanding the transition to clean alternatives like electric vehicles move our country into a more secure geopolitical position as we shift to clean, domestically produced sources. Combined, these advances also provide a much-needed breath of fresh air for communities around the nation who suffer disproportionate health damage from the drilling, transporting, and burning of oil.

Figure 1: U.S. Growth in Energy Consumption and Gross Domestic Product Since 1949[9]

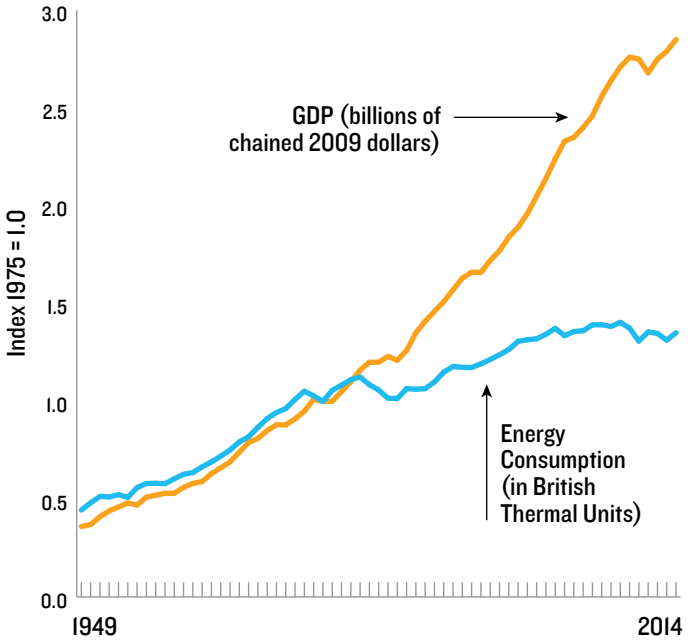


Figure 2: Growth in National Electricity Consumption and Population

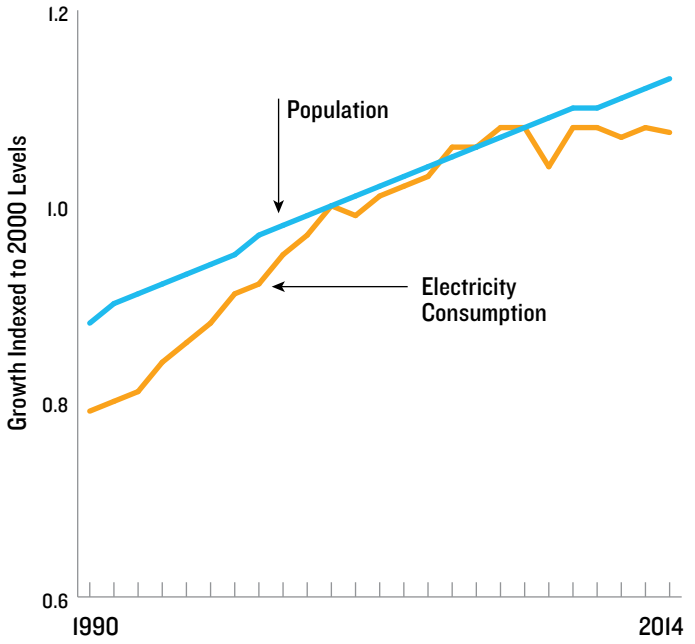


Figure 3: U.S. Changes in Annual Petroleum Consumption

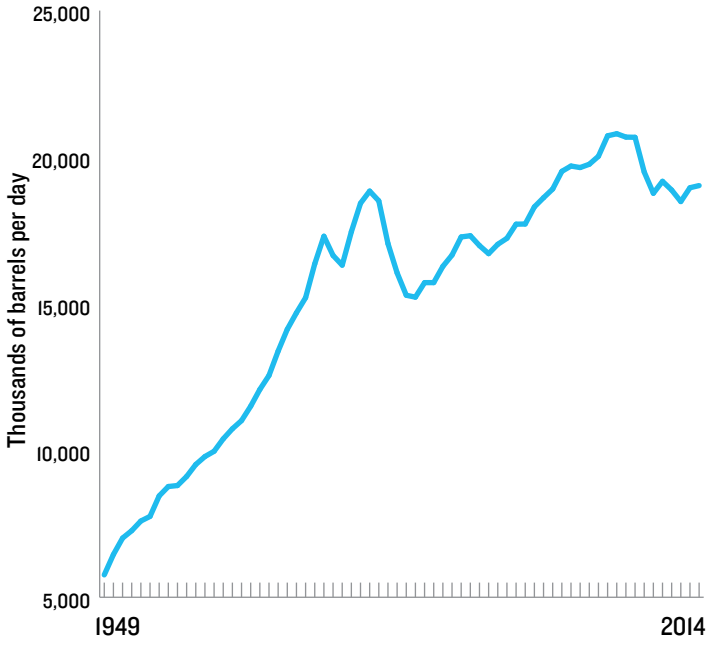


Figure 4: Percentage of U.S. Electricity Generation from Coal and Natural Gas

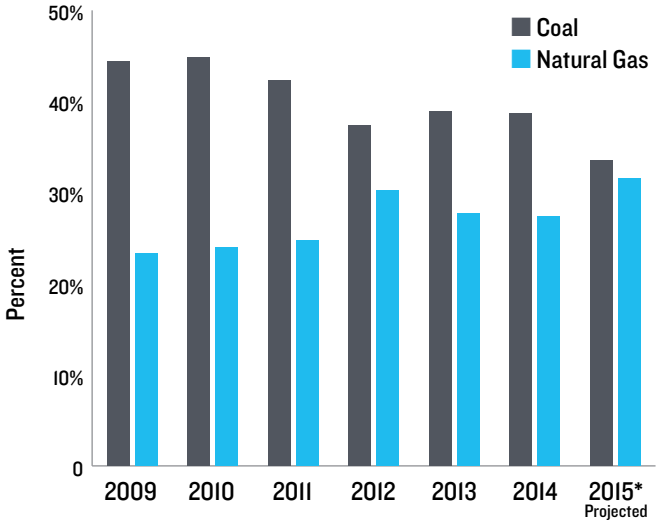
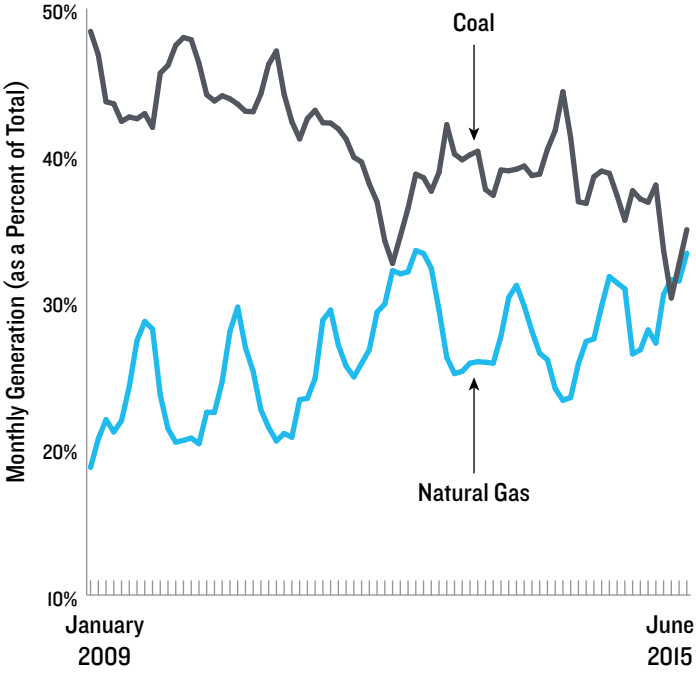


Figure 5: U.S. Monthly Electricity Generation from Coal and Natural Gas



COAL: The tectonic shift in the energy sector shows up clearly in America's decreased reliance on coal. We burned less of it in 2014 than we did in 1990, and the annual total is down more than 21 percent from the peak year of 2005. This trend primarily reflects electricity markets' move away from aging coal-burning power plants, which have become increasingly uneconomical and are responsible for air pollution that produces more premature deaths than any other form of energy use.[16] Decreased demand for coal at home relieves some of the pressure to excavate fragile landscapes: for the first time in two decades, domestic coal production dropped below 1 billion short tons in 2014.

These trends reflect the power sector's move from coal to natural gas, renewable energy like wind and solar, and smarter use of energy through efficiency. As recently as 2009, coal was outproducing natural gas, wind, and solar by a factor of two, but in the past five years our power mix has shifted substantially. Both natural gas and renewable energy are seizing more market share, even as energy efficiency has cut deeply into growth in electricity demand.

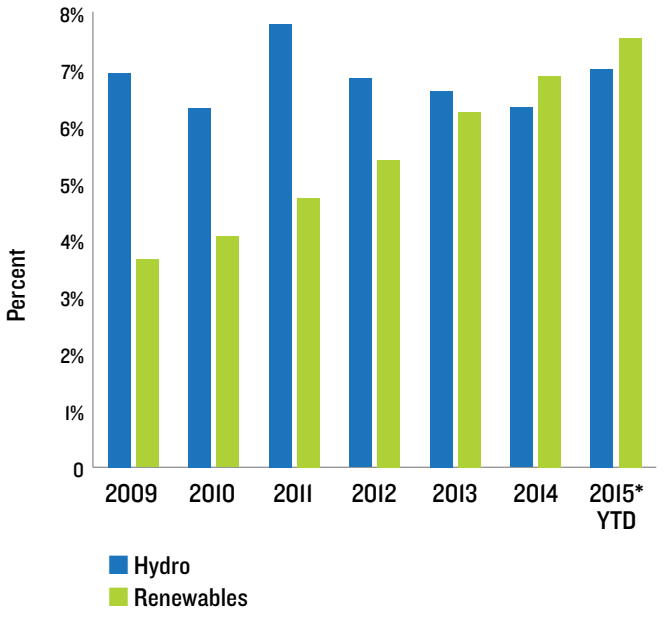
NATURAL GAS: Natural gas hit a 40-year high in market share in 2012 when it was used to generate more than 30 percent of the nation's electricity. It dropped back below 28 percent the following two years, but it is likely to surpass 30 percent again in 2015 (Figure 4).

In April 2015, U.S. power plants for the first time generated more electricity from natural gas than coal. However, this unprecedented ascendancy did not last long; coal generation took the lead again the following month. Coal plant owners had taken many units off-line in April for routine maintenance in advance of the summertime surge in electricity use. Much the same thing occurred in April 2012, when natural gas generation nearly tied coal generation, only to drop back in the following months. Nonetheless, there is a substantial shift under way. Figure 5 shows that natural gas is catching up with coal for electricity production, despite some ebbs and flows. Natural gas development has been linked to health-harming air pollution, water contamination, and emissions of methane, a potent climate change pollutant.

RENEWABLE ENERGY: Wind power continues to dominate the nation's renewable energy growth, contributing roughly two-thirds of generation from renewable resources other than hydropower. Wind power production scored a 33-fold increase from 2000–2014. In 2014, for the first time, wind provided more than 4 percent of U.S. electricity generation. Meanwhile, the absolute increase in wind generation from 2000 to 2014 was more than four times greater than the corresponding increase in nuclear generation. Solar power grew even faster in 2014, doubling its output over the previous year (for the fourth year running) and, for the first time ever, eclipsing the annual generation of the nation's geothermal resources, which generate electricity from naturally occurring underground heat sources. By July 2015, installed solar capacity had exceeded 20,000 megawatts (MW), with almost one-third (6,304 MW) having come online in the previous 12 months.[17] These gains, however, are relative: solar still represented less than one-half of 1 percent of total U.S. electricity production in 2014.

Only a decade ago, hydropower accounted for three times as much generation in the United States as all non-hydro renewable energy sources combined. In 2014, however, wind, solar, geothermal, and other renewable sources together produced more electricity (7.5 percent of the U.S. total) than all the nation's hydroelectric turbines. Given rates of growth in solar and wind energy, the gap should continue to widen, with hydropower dropping further behind.

Figure 6: Percent of U.S. Electricity Generated by Hydro Resources and Non-Hydro Renewables



NUCLEAR: Nuclear power in 2014 remained below 20 percent of total electric generation for the fifth consecutive year, after decades of rising sales driven mostly by increased productivity at existing plants. Although total nuclear power production in 2014 was up slightly from the year before, it is still below the average for 2006–2011. The retirement of aging and uneconomical plants, such as Southern California Edison's two San Onofre units, Entergy's Vermont Yankee, and Duke's Crystal River reactor in Florida, are significant factors in the trend. Of the five plants now under construction, only one looks likely to begin generation in the near future (Watts Bar 2 in Tennessee); four plants in South Carolina and Georgia have seen repeated slippages in their dates for coming online and are not expected to begin service before 2019.[18]

ENERGY EFFICIENCY: For more than four decades, providing equal or better service with less energy has been by far America's largest and most productive energy option. The amount of energy required to produce an inflation-adjusted dollar of economic output dropped by almost 60 percent between 1970 and 2014, but opportunities still abound to optimize energy use in our homes and businesses. Stretching energy dollars is far less costly than adding other energy resources like fossil fuels, and it already is saving the nation hundreds of billions of dollars annually, preventing millions of tons of carbon emissions, helping U.S. workers and companies compete worldwide, and making America more energy secure.[19] By 2014, in just one four-state region (Idaho, Montana, Oregon, and Washington), utilities' energy efficiency investments and government standards had cut annual electricity bills by nearly $3.5 billion.[20]

President Obama's administration is now more than two-thirds of the way toward achieving his goal of securing 3 billion metric tons of carbon dioxide emissions reductions by 2030 through efficiency standards for appliances and federal buildings. The U.S. Department of Energy (DOE) finalized minimum efficiency standards for seven product categories between March 2014 and March 2015. These include furnace fans, electric motors, commercial clothes washers, and ice makers. These new standards will prevent the emission of 335 million metric tons of carbon dioxide pollution by 2030 and yield net savings of $54 billion for utility customers.[21] DOE has proposed rules for several additional product categories this year, including residential furnaces and commercial pumps, and is in the process of developing new and updated standards for other products, such as commercial air conditioners and fans, all of which will add to the savings figures once finalized. Efficiency standards are now a familiar part of the American residential and business landscapes; in the decades since President Reagan first signed them into law in 1987, standards have yielded enduring improvements in devices that account for at least half of our total electricity consumption.

ON THE HORIZON: AMERICA'S UTILITIES PREPARE FOR NEW ROLES

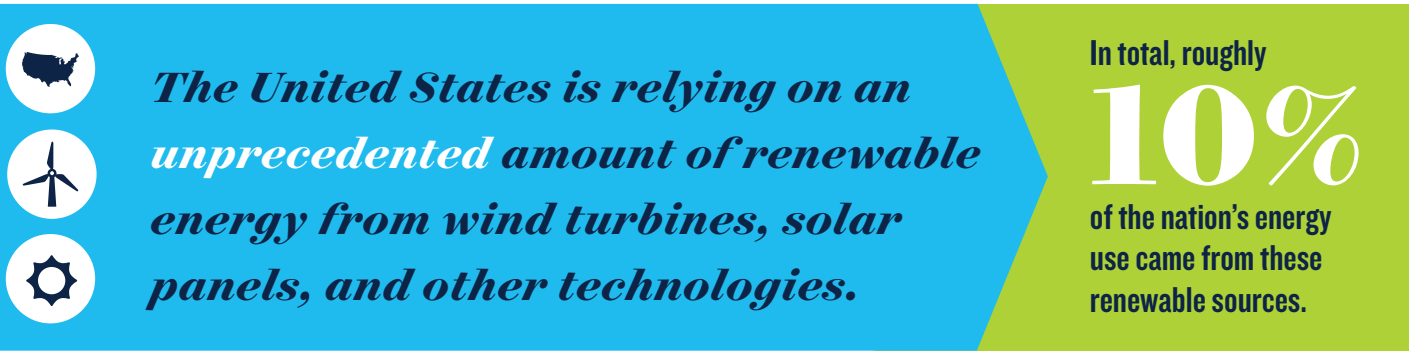
The energy landscape is changing, dramatically and for the better. Small-scale distributed (onsite) energy resources are proliferating, utilities and customers are trading power back and forth through solar net metering, cars are beginning a transition from gasoline to electricity, and the cost of clean energy has reached historic lows.[22] To maintain the reliability of a decarbonized electric grid, load increasingly will need to shift to meet supply, not vice versa. Changes in electricity pricing are key tools for creating a utility business model that works for the future, but this needs to be done thoughtfully and strategically. Hasty solutions for short-term problems—like loading up utility bills with fixed charges that don't vary with consumption—will create deeper problems in the long term.

Real solutions begin with revenue decoupling, which removes the inherent financial penalty to utilities that reduce retail energy sales volumes through energy efficiency. Decoupling does this without abandoning the tradition of volumetric pricing and its incentives for customers to use energy efficiently. More than half the states have now adopted this approach for at least one electric or natural gas utility, and a comprehensive March 2015 order[23] by the Minnesota Public Service Commission is the latest primer on how to do it effectively, using modest annual adjustments in rates that few if any customers even notice. A February 2014 agreement[24] between NRDC and the Edison Electric Institute addresses additional proposals for utility business model reform and rate design that are critical to a clean energy transition, including ways to increase solar power and ensure equitable allocation of grid enhancement costs.[25] Elements of that proposal have begun to emerge from regulatory proceedings now under way in leadership states like California, Hawaii, and New York.

CONCLUSION

This edition of NRDC's *Annual Energy Report* marks a historic shift in America's energy choices. By the close of 2014, the United States was relying on an unprecedented amount of renewable energy from wind turbines, solar panels, and other technologies. In total, roughly 10 percent of the nation's energy use came from these renewable sources. That's like powering the world's largest economy for more than a month without using any pollution-spewing coal, oil, or natural gas; without breathing all their harmful pollutants, like the soot that contributes to respiratory illnesses and heart disease; and without the harm to our lands, waters, and wildlife that is associated with extracting fossil fuels. Energy efficiency is larger than ever and plays a complementary role in decarbonizing energy markets. Total carbon pollution from the energy sector has dropped below 1996 levels.

The great advances of the 20th century were built largely on the energy provided by fossil fuels. But toward the latter half of the century, the consequences of undue reliance began to surface, including degraded national security, dirty air, and billion-dollar weather events that wreaked havoc on our communities. In the 21st century, those weather events fueled by climate change are continuing, but we are bearing witness to fundamental change in the energy sector, reflecting the needs and aspirations of all who depend on it.



ENDNOTES

1 Unless otherwise indicated, all data on U.S. energy production and use in this report are taken from U.S. Department of Energy, Energy Information Administration, *Monthly Energy Review*, September 2015.

2 The bill in question, SB 350, is summarized by Peter Miller, Natural Resources Defense Council (NRDC), *California Legislature Passes Bill Setting Target of 50 Percent Renewables by 2030*, September 11, 2015, switchboard.nrdc.org/blogs/pmiller/california_legislature_passes_.html. SB 350 ensures that California will get at least 50 percent of its electricity from renewable energy sources by 2030. It also doubles the state's energy efficiency savings from utility programs and government standards and accelerates what was already the world's most aggressive vehicle electrification program.

3 Carbon dioxide emissions from the U.S. energy sector in 2014 and 2005 were 5,400 million metric tons and 6,000 million metric tons, respectively. www.eia.gov/todayinenergy/images/2015.04.20/main.png.

4 The U.S. has formally pledged to cut GHG emissions by 26–28% below 2005 levels by 2025. See USA, *U.S. Cover Note, INDC and Accompanying Information*, United Nations Framework Convention on Climate Change, March 31, 2015. www4.unfccc.int/submissions/INDC/Published%20Documents/United%20States%20of%20America/1/U.S.%20Cover%20Note%20INDC%20and%20Accompanying%20Information.pdf.

5 SB 350 (DeLeon), Public Utilities Code section 740.12(a)(1)(D) and 740.12(b), enacted September 11, 2015.

6 For a description of the federal Clean Car Standards, see Roland Hwang, NRDC, *Clean Car Standards Shows Way Forward on Solving Climate Change, November 4, 2012*, switchboard.nrdc.org/blogs/rhwang/clean_car_standards_shows_way.html.

7 See, e.g., Bipartisan Policy Center, *America's Energy Resurgence*, February 2013, p. viii: "Over the last four decades, energy savings achieved through improvements in energy productivity have exceeded the contribution from all new supply resources in meeting America's growing energy needs." http://bipartisanpolicy.org/wp-content/uploads/sites/default/files/files/BPC%2520SEPI%2520Energy%2520Report%25202013%5B1%5D-1.pdf.

8 U.S. Energy Information Administration, *Electric Power Monthly*, Table 5.2. Revenue from Sales of Electricity to Ultimate Customers, August 2015.

9 Economic data from U.S. Bureau of Economic Analysis, *National Economic Accounts*, August 2015.

10 See U.S. Environmental Protection Agency (EPA), "Regulatory Impact Analysis: Final Rulemaking for 2017–2025 Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards," EpA-420-R-12-016, August 2012, table 7.4-7, www.epa.gov/otaq/climate/regs-light-duty.htm). Also see Energy Information Administration, U.S. Imports By Country Of Origin, August 31, 2015. www.eia.gov/dnav/pet/pet_move_impcus_a2_nus_ep00_im0_mbblpd_a.htm.

11 EPA, *Light-Duty Automotive Technology, Carbon Dioxide Emissions, and Fuel Economy Trends: 1975 – 2014*, EPA-420-R -14-023, October 2014.

12 Electric Drive Transportation Association, "Electric Drive Sales Dashboard," available at http://electricdrive.org/ht/d/sp/i/20952/pid/20952.

13 This estimate reflects calculations by NRDC's Luke Tonachel as part of work in progress, September 13, 2015.

14 U.S. Department of the Interior, Bureau of Ocean Energy Management, "Proposed Outer Continental Shelf Oil &Gas Leasing Program 2017–2012," January 2015, www.boem.gov/2017-2022-DPP.

15 Amory Lovins reflects at length on the relationship between improved oil use efficiencies and oil prices in Lovins, Rocky Mountain Institute, "The Oil Price Roller Coaster," June 18, 2015 https://medium.com/solutions-journal-summer-2015/the-oil-price-roller-coaster-abafecb1ffb9.

16 See, e.g., Clean Air Task Force, "The Toll From Coal: An Updated Assessment of Death and Disease from America's Dirtiest Energy Source," September 2010.

17 See Munsell, GTM, *Installing 1,393MW of PV in Q2 2015, US Solar Market Surpasses 20GW*, September 11, 2015. www.greentechmedia.com/articles/read/installing-1393-mw-of-pv-in-q2-2015-us-solar-market-surpasses-20-gw.

18 For Georgia's two new Vogtle units: "The new delays mean Unit 3 is expected to start up around the second quarter of 2019, and Unit 4 one year later." www.eenews.net/stories/1060012611. For the two Summer units in South Carolina: "Current estimates suggest that substantial completion for Unit 2 will occur on June 19, 2019, with Unit 3 following roughly a year later." www.powermag.com/challenges-continue-for-summer-nuclear-plant-project/. Tennessee's Watts Bar 2 looks on track to produce electricity later this year. www.neimagazine.com/features/featuretva-readies-watts-bar-2-4616852/.

19 Bipartisan Policy Center, *America's Energy Resurgence*, Executive Summary, pages vii and viii, Chapter 3, pages 67-70.

20 Northwest Power and Conservation Council, *Progress Toward Regional Conservation Goals*, October 2014, p. 22. The reductions in regional electricity use were large enough to "serve the entire state of Oregon and Western Montana." Ibid. note 19.

21 See Appliance Standards Awareness Project, "Progress Toward 3 Billion MT CO_2 Reduction," December 2014, www.appliance-standards.org/sites/default/files/Progress_toward_3_billion_CO2_reduction_1.pdf.

22 See, e.g., Ramez Naami, "How Cheap Can Solar Get? Very Cheap Indeed," *Energy Transition*, September 14, 2015, energytransition.de/2015/09/how-cheap-can-solar-get/. Mark Jacobson et al., "100% Clean and Renewable Wind, Water and Sunlight All-Sector Energy Roadmaps for the 50 United States," *Energy and Environmental Science*, Volume 8, Issue 2093, June 2015.

23 http://switchboard.nrdc.org/blogs/scarter/washington_minnesota_and_new_y.html.

24 http://switchboard.nrdc.org/blogs/rcavanagh/path-breaking_agreement_to_get.html.

25 See Edison Electric Institute and NRDC, "Joint Statement to State Utility Regulators," February 2014, http://docs.nrdc.org/energy/files/ene_14021101a.pdf.