

2019

# Sustainable Energy in America

FACTBOOK

Executive Summary



Energy Efficiency



Natural Gas



Renewable Energy

GROWTH SECTORS OF THE U.S. ENERGY ECONOMY

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## 2019 Factbook - Executive Summary

After a decade of mostly modest growth, the U.S. economy kicked into a higher gear in 2018. These new conditions rippled through nearly every aspect of the energy sector including overall demand, power generation, project build, energy prices, and CO2 emissions.

2018 affirmed many of the key trends documented in previous editions of the Sustainable Energy in America Factbook. But the year also raised questions about whether U.S. energy can continue on a lower-carbon pathway when economic growth is strong but federal policy support is weak.

Longstanding trends which continued in 2018:

- **Natural gas boomed.** The most new gas-fired power-generating capacity was added in 14 years propelling it to a record 35% of the country's power generation. At the same time, natural gas production hit record highs.
- **Renewables grew in volume and importance, while grid reliability was maintained.** Installations of new mostly wind and solar capacity in 2018 hit 19.5GW. Hydropower closely followed by wind are the largest sources of zero-carbon, renewable generation in the U.S.
- **Wind is the largest single source of zero-carbon power-generating capacity in the U.S.** Total wind installations are essentially level with nuclear in terms of capacity.
- **Coal's decline continued.** Its contribution to overall power generation fell to 27%, the lowest in the post-WWII era. Meanwhile, another 13GW of existing plants announced or completed retirement, the second most in U.S. history.
- **The power sector continued to de-carbonize.** Renewables + natural gas growth - coal = a less carbon-intensive U.S. power sector. Total electricity consumed in the U.S. rose 2.2% in 2018 while CO2 emissions from power plants rose just 0.6%.
- **Energy remained affordable.** Households continue to spend record lows of personal income on electricity and natural gas bills. In many major regions, weighted-average retail power prices fell 1-3% though they did rise in some regions.
- **U.S. energy jobs grew.** The U.S. energy sector employs approximately 6.5 million Americans, up 2 percent in 2017 from 2016 (the most recent data available), with energy efficiency, renewable energy and natural gas sectors employing 3.4 million Americans in 2017.
- **The U.S. retains a competitive advantage on industrial power prices.** The U.S. is second only to Canada with the lowest industrial electricity prices among the G7 nations.
- **The popularity of electric vehicles grew.** EVs accounted for only 1.3% of total vehicles sold in the U.S in the 4<sup>th</sup> quarter of 2017. By third quarter 2018, that had nearly doubled to 2.5%, then hit 3% by the fourth quarter.
- **Battery storage costs fell further.** Lithium-ion battery prices dropped another 18% year- on-year, boosting both EVs and stationary storage applications and encouraging electric utilities to sign power purchase agreements pairing storage with solar and wind.
- **Corporates continued to drive demand for sustainable energy.** Retailers, major technology firms, and even an oil major contracted record volumes of renewable power through direct contracts. Others pledged to double energy productivity or to green their vehicle fleets, with electric, fuel cell and renewable natural gas power vehicles.
- **States and localities again led the charge on sustainable energy policy-making.** California promised to achieve 100% renewables while Nevada, New Jersey and New York also upped the ante on their renewables, efficiency, and battery deployment pledges. Florida agreed to allow third-party PV installers to operate in the state.

Key questions that 2018 raised:

- **Can the U.S improve energy productivity when economic growth accelerates?** Energy productivity is a comparison of energy consumption and GDP. U.S. energy consumption, which had been relatively flat over the past ten years, grew by 3.3% in 2018, outpacing GDP growth of 2.9%, resulting in an energy productivity decline of 0.4% percent. The numbers suggest a potential departure from what had appeared to be a

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'decoupling' between energy use and economic growth in the U.S, although extreme weather also played a role. A ten-year look back shows that energy consumption grew by 7.5% while GDP expanded by 22%. Over that same period, energy productivity increased by 14%.

- **Can U.S. greenhouse gas emissions be kept in check without concerted federal government efforts?** As energy consumption expanded, so too did the U.S. CO<sub>2</sub> footprint. Greenhouse gas emissions rose an estimated 2.5% in 2018, driven by large year-on-year increases in the buildings and industrial sectors. The power sector continues to decarbonize thanks to the growth in natural gas and renewables generation at the expense of higher-emitting coal. The transportation sector for the second year accounted for the largest share of CO<sub>2</sub> emissions but has potential for CO<sub>2</sub> reduction, particularly if federal efficiency rules can take effect. Meanwhile, state and municipal governments continue to make important efforts to address climate change. Still, it remains to be seen if the U.S. can fully do its part to address global climate change if its federal government declines to make an effort.

Each of these trends is discussed at a high level below and then in far greater depth graphically in the Factbook slides.

***Economic growth, along with extreme weather, pushed energy demand to an all-time high in 2018.***

The U.S. economy in 2018 grew at its fastest pace in five years, posting an annualized GDP expansion rate of 2.9%. For the first time in several years, energy consumption grew at a faster clip than GDP, rising 3.3% over the same time period. Seasonal factors played an important role, as extreme weather boosted demand for both heating and cooling in the buildings sectors. The U.S. set a record for the most "cooling-degree days" (as defined by the Energy Information Administration) since at least 1990 causing Americans to use more air-conditioning to remain comfortable. The number of "heating degree days" bucked a long-term declining trend to hit their highest level since 2014.

Meanwhile, the increase in overall energy use belied slower growth in transportation consumption (up 0.7%), as Americans continued to buy larger, less fuel efficient cars, but vehicle miles traveled leveled off. Electricity demand as measured in terawatt hours grew at a slower pace of 2.2%. In other words, although overall energy productivity declined in 2018, the U.S. continued to grow more productive and efficient in its use of electricity. Even so, the increase was enough to push electricity sales to a projected all-time high of 3,950 terawatt-hours, a 1.2% increase over the previous record set in 2014.

***Rising electricity demand pushed generation levels to new highs while the fuel mix continued to transition away from coal and toward natural gas and renewables.***

Coal's role waned again, dropping to only 27% of the mix – the lowest share in the post-war era. In the past year, coal generation has shrunk by 6.3% as the grid retired nearly 13GW of coal-fired units, second only to 2015's record of 15GW retired. Coal units are struggling to compete with low-priced natural gas, increasing renewable penetration and state-level support for ailing nuclear units. Increasingly, large utilities are re-evaluating coal plants and electing to retire early in favor of low-cost renewables, gas, and energy storage.

A boom in natural gas build – the largest single-year addition in 15 years – helped push natural gas to 35% of the electricity mix, a record. Nuclear held steady at 19%, but renewables are closing the gap: in 2018, renewable generation rose 5.1% in absolute terms, as output from new wind and solar farms offset a modest contraction in hydroelectric output. Renewables including hydro now provide 17.7% of U.S. power, with hydro representing 7% and non-hydro renewables 10.7%.

Installations of new renewables assets rose slightly in 2018 to 19.5GW. Wind build stayed steady at approximately 7.5GW bringing its total cumulative capacity effectively level with nuclear. (Due to higher capacity factors, the nuclear fleet and hydropower generate more power overall.) At the same time, several Northeastern states held requests for proposals (RFPs) for offshore wind projects, a first for an industry that has seen significant levels of build and interest in international markets.

After a bumpy start to 2018, solar build rebounded with the installation of 11.7GW across large- and small-scale segments. Continued uncertainty over solar and metals tariffs weighed on purchasing decisions in the first half of the year; meanwhile, developers are replenishing pipelines following 2016's 14.1GW and before the step-down of the federal Investment Tax Credit. Residential solar installations remained roughly level year-on-year, as falling costs only partially mitigated the impact of the roll-off of net metering regimes in several states.

In terms of other renewable energy technologies, hydro added 142MW, biomass, biogas and waste to energy added 83MW, and geothermal added 53MW. None of these technologies benefitted in 2018 from federal tax credit support.

***As energy consumption expanded, so too did the U.S. carbon footprint.***

Greenhouse gas emissions rose an estimated 2.5% in 2018 above 2017 levels, driven by large year-on-year increases in the buildings (ie, residential and commercial segments) and industrial sectors. Total climate-warming emissions now sit approximately 10% below 2005 levels, or roughly two-fifths of the way to the Obama Administration's abandoned Paris Agreement target of 26% below 2005 levels by 2025.

A cleaner electricity mix dulled the impact of rising electric load, with power-sector greenhouse gas (GHG) emissions increasing only 0.6%. In the transportation sector, emissions rose an estimated 0.9%. Transportation remains the single largest source of greenhouse gases in the U.S. Total miles traveled by Americans in vehicles rose slightly while the average fuel efficiency of vehicles sold remained flat at 25 miles per gallon for 2017, the last year for which data is available.

The federal government continued to ease regulations on carbon emissions, proposing weaker fuel efficiency standards for light-duty vehicles as well as higher allowable thresholds for emissions from new coal-fired power plants.

***Prices remained low by historical standards, offsetting the impact of rising demand on consumers.***

Although total energy consumption rose, households continue to spend near-record lows of personal income on electricity and natural gas bills, tapping in at 1.3% and 0.4%, respectively, of outlays in 2018. A slight decline in average retail prices underlies this trend: in many regions of the U.S., weighted-average retail prices fell between 1-3%.

On the other hand, natural gas prices, while remaining low by historic averages, were volatile in 2018, at times pushing wholesale electricity prices up in tandem. Wholesale power prices escalated as much as 35% in Texas and 27% in New England as natural gas prices hit their highest levels in four years. Lack of natural gas delivery infrastructure has at times created regional delivery bottlenecks and boosted prices.

***Falling battery prices helped drive record electric vehicle sales, as well as non-hydro energy storage build.***

Sales of electric vehicles leapt higher in 2018, spurred by the full launch of the Tesla Model 3. Customers received 138,000 units of Tesla's new lower-cost, long-range battery electric vehicle in a rush to capture the federal electric vehicle tax credit before it begins to phase down for Tesla in 2019. Battery electric and plug-in hybrids accounted for just over 106,000 units in the third quarter of 2018, double the number of vehicles sold in the same quarter in 2017. This represented or 2.5% of total sales for the quarter, overtaking hybrid sales for the first time. In the fourth quarter, sales of such vehicles jumped again, to 132,000 units.

As electric vehicle sales drive down lithium-ion battery prices, the economics of batteries for stationary storage continues to improve. An estimated 292MW of non-hydropower energy storage was commissioned in 2018, compared to an average of 200MW annually over the prior three years. California remains the market leader, with 345MW of cumulative installations. Meanwhile, batteries are being deployed for a more diverse suite of applications, including for meeting resource adequacy requirements in California, pairing with solar and wind to help increase dispatchability in the Southwest and Hawaii, and offsetting demand charges on commercial and industrial power bills. The use of batteries for these applications has pushed the average duration of deployed project up to nearly two hours, from only one hour in 2012.

Overall deployment of non-hydro energy storage remains small in comparison to pumped hydro projects, which tally to nearly 23GW. There have been no new pumped hydro projects built since 2012, but as of October 2018, the Federal Energy Regulatory Commission was considering licenses for 2.3GW of new projects, mostly in New England and the Pacific West.

***States continued to act as a counterweight to federal policy, raising clean energy goals at the same time that the federal government sought to roll back environmental regulations.***

Federal policy set up roadblocks to the ongoing transformation of the energy sector, as the White House sought ways to provide financial support to uneconomic coal and nuclear units and announced plans to rollback efficiency and emissions standards across various sectors. In the transport sector, the Environmental Protection Agency released a rulemaking proposing to freeze vehicle fuel efficiency standards at 2020 levels, as well as revoke California's waiver to set more stringent targets. The move likely sets up a protracted legal battle between the Trump Administration and California's government. If implemented as proposed, it could impact future sales of battery, plug-in hybrid and fuel-cell electric vehicles. The ongoing trade dispute with China led to tariffs on steel and aluminum imports, metals which are critical inputs into all types of energy assets.

On a positive note for clean energy development, the Administration through the Bureau of Ocean Energy Management successfully auctioned offshore wind development leases off the east coast, paving the way for what are anticipated to be the first U.S. large-scale offshore projects. Congress and the Trump Administration also passed a number of energy related tax measures at the beginning of 2018 including extension of the ITC for fuel cells, combined heat and power, small wind, and geothermal and reform to 45Q to incentivize carbon capture and storage.

On a state level, California set a number of new, ambitious targets and regulations. A spring 2018 ruling by the state's energy commission will require solar on almost all new homes built beginning in 2020. Legislation passed in September now mandates that the state source 100% of its power from zero-carbon energy by 2045, and an executive order will aim for the state's entire economy to be carbon neutral by the same year. New Jersey's updated renewable portfolio standard – which now targets 50% renewables by 2030 – also raised the target for

distributed solar to 5.1% by 2021, at the same time that it made plans to eventually phase out net metering. New York transitioned commercial customers to an innovative 'value of distributed energy' tariff.

Not all the news out of the states was positive, however, as some made plans to scale back net energy metering or renewable energy credit programs that promote rooftop solar build. Maine, Connecticut, Michigan, Indiana and Utah all enacted or announced net metering program suspensions.

***Large energy consumers are growing even further engaged, taking steps to reduce and green their footprints.***

Globally, 158 corporations have now pledged to source 100% of their electricity needs from renewable energy under the RE100 Initiative. In the U.S., corporate interest in clean energy blew through previous records: large energy buyers signed contracts for 8.6GW of wind and solar, over twice the previous record of 3.4GW contracted in 2015. Procurement reached into new markets, as companies such as Facebook, Google and Walmart worked together with vertically integrated utilities in New Mexico, Georgia and Tennessee (among others) to build new wind and solar projects. New aggregation models also arose, allowing smaller energy buyers like Etsy and Adobe to combine their demand to sign onto an individual project, thereby leveraging economies of scale previously only open to large consumers.

Corporate activity stretched beyond electricity consumption, with pledges to the EP100 campaign – under which they seek to double energy productivity by 2030 – nearly tripling in 2018. 37 companies including H&M, Hilton and Swiss Re are members of the initiative, up from only 13 in 2017. Additionally, a new campaign called the EV100 garnered 31 corporate pledges. Companies like IKEA, HP and Unilever promised to ramp up integration of electric vehicles into their corporate fleets and to assist employees in transitioning to cleaner transportation.

Finally, back on the electricity delivery side, 2018 saw some key announcements from U.S. utilities regarding sustainable energy. Minneapolis-based Xcel Energy, which operates utilities in eight states, said it would deliver only carbon-free power to all its customers by 2050. Ohio-based AEP, which serves customers in 11 states, said it will cut its CO2 emissions 80% by 2050 (vs. a 2000 baseline).

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