Wholesale power prices remain historically low in real terms. However, they rebounded slightly in 2017 across most regions relative to 2016 levels, as the yearly average Henry Hub natural gas price picked up 18% to $2.96/MMBtu.

Year-on-year, average wholesale prices rose as much as 27% in the Southwest and 17% in Northern California. ERCOT (Texas), PJM and MISO saw some of the smaller increases, at 6%, 0.9% and 0.6%, respectively.

Retail price responses were more muted, as wholesale power prices do not directly translate to retail rates (for example, retail rates take into account wires costs, and in most regions they are set through a slow regulatory process). Prices rose by about half a percent in New England and the Northwest; around 1% in New York, MISO and the Southeast; 1.2% in SPP; 1.5% in the Southwest; 3.5% in California; 4.8% in Florida; and 6.4% in Alaska. PJM and ERCOT saw average prices ease down by 0.5% and 0.6%, respectively.

California has also switched end-users to time-of-use rates, which means rates will now vary throughout the day based on peak hours.

Since their peak in 2008, average U.S. retail prices have come down 5.8% in real terms.

Source: Bloomberg New Energy Finance, EIA, Bloomberg Terminal
Notes: Wholesale prices are taken from proxy power hubs in each ISO and are updated through end-2017. All prices are in real 2017 dollars. The retail power prices shown here are not exact retail rates, but weighted averages across all rate classes by state, as published by EIA 826. Retail prices are updated through end-October 2017. All prices are in real 2017 dollars.
Policy (1 of 5) : COP 21 withdrawal, “We Are Still In” and other reactions

State members of the U.S. Climate Alliance and city members of Climate Mayors

- President Trump, on June 1, 2017, announced his intention to withdraw the U.S. from the COP 21 Paris Climate Accord, calling it “an agreement that disadvantages the United States to the exclusive benefit of other countries.”
- Many business and political leaders disagreed with the Administration’s decision, arguing that it abdicated American leadership on climate and threatened the country’s competitiveness in a low-carbon economy.
- Sixteen governors representing jurisdictions covering over 40% of the U.S. population joined the U.S. Climate Alliance (shown above, in purple). The existing U.S. Climate Mayors’ group expanded to 383 cities (in blue) covering 23% of the U.S. population—half of which are in states not associated with the Climate Alliance.
- Additionally, more than 2,642 mayors, governors, CEOs, college presidents, faith organizations, and tribal leaders responded by forming “We are Still In,” a movement that pledges ongoing commitment to the Paris Accord’s goals. A related group, America’s Pledge, is tracking these commitments and attempting to measure their impact. According to its initial accounting, these sub-national pledgees account for 2.7Gt in emissions. For comparison, U.S. emissions totaled an estimated 6.4Gt estimated in 2017.

Source: Bloomberg Terminal, We Are Still In, America’s Pledge, Climate Mayors, U.S. Climate Alliance, Simple Maps  Note: Hawai‘i and Puerto Rico have also pledged to the Climate Alliance but are not visible in the map above. Other state members not clearly visible include Massachusetts, Maryland, Rhode Island, Vermont and Delaware.
Policy (2 of 5): Department of Energy grid study on reliability and resilience

Average frequency of electric power service interruptions per customer (2016)

- In August 2017, the Department of Energy issued a grid study concluding that generators capable of providing “essential reliability services,” as well as resilience, to the grid should be compensated for these services. On the back of the report, Energy Secretary Rick Perry asked the Federal Energy Regulatory Commission (FERC) to launch an expedited rulemaking to provide cost recovery for “secure fuel” generators with 90-day fuel supplies on hand. Most coal and nuclear facilities meet that criterion; wind, solar and natural gas plants do not. The rule focused on plants in competitive wholesale power markets, as opposed to regulated power regions such as the Southeast.

- In January 2018, FERC refused to proceed with such a rulemaking, finding insufficient evidence that either on-hand fuel supplies or other criteria presented by Perry were satisfactory indicators of resilience. Instead, it asked regional grid operators to examine resilience within their systems.

- The Department of Energy grid study had noted that wholesale power markets have, to date, ensured reliability, despite pressures created by growing natural gas penetration, flat demand, and policy interventions (including renewables support); however, the study also questioned whether the grid would remain resilient in the face of future challenges.

- EIA power outage data suggest that two regulated power regions, Florida and the Southeast, topped 2016’s list in terms of the frequency of outage events (a measure of grid reliability). This is the case both when accounting for and when excluding the impact of major disruptive events (e.g., weather-related events such as hurricanes or heatwaves, and man-made disruptions such as cyber attacks). SPP and ERCOT ranked third and fourth, respectively, when accounting for major events.

- Florida and the Southeast also topped the list in terms of the average duration of outages during major disruptive events. This is likely driven by the greater impact of hurricanes on these two regions compared to the rest of the U.S. Removing major events, PJM and SPP endured the longest average outages (around 160 minutes).

- A number of factors, including customer density, the length of power lines, the makeup of the fleet, tree density, and how utilities define “major events” can all affect these measures of how frequently each region experiences outages, and how long they last.

Source: EIA, IEEE, BNEF
Policy (5 of 5): Trade policy

- President Trump in late 2017 began exploring in earnest how to make good on his campaign promise to renegotiate the North American Free Trade Agreement (NAFTA) with Canada and Mexico. The U.S. imports substantial hydroelectric power from Canada and is a major source of natural gas for Mexico.

- On January 23, 2018, Trump levied a 30% import duty on imported solar PV modules and cells, which will raise a module’s 2018 landed price by about 10¢/W and raise all-in project costs by an estimated 4-10% in the first year. The tariffs phase down by 5% annually through 2021 (expiring thereafter), and also come with a 2.5GW annual exemption for cell imports.

- The president also has questioned the benefits to the U.S. of free trade with the European Union. Taken together, his words and actions raise the risk of retaliatory action by longtime U.S. trading partners.

Source: BNEF Note: 2019-21 prices are illustrative.
Texas is home to one-quarter of America’s installed wind capacity, hosting over 22GW out of 90GW installed nation-wide as of December 2017.

The majority was enabled by a $7bn investment in the Competitive Renewable Energy Zone (CREZ) transmission lines, which connect West Zone and Panhandle wind to load centers in the East. The CREZ lines can accommodate roughly 12.7GW of West Zone and 5.8GW of Panhandle wind before significant curtailment (and congestion pricing) comes back into play. Most of this is already filled up, with only 2-3GW of space left on CREZ’s lines and a plethora of wind projects proposed in the region.

Source: Bloomberg New Energy Finance, ERCOT, EIA. Note: The Texas map displays all commissioned wind in Texas, including those outside of ERCOT.
The American Wind Energy Association (AWEA) estimates that transmission proposals across the U.S. could potentially enable 52GW of wind capacity between 2017 and 2024. This does not include transmission associated with AEP’s Wind Catcher Energy Connection.

AWEA’s estimate includes the 14GW-enabling1 Multi Value Project (MVP) transmission portfolio currently underway by the Midwest Independent System Operator (MISO). There are 17 projects within MVP: Five of these are already complete, 11 are expected to come online by 2019, and one by 2023. This expanded MISO transmission capacity is expected to fill up quickly—thirty gigawatts of wind and 15GW of solar are already in the MISO interconnection queue as of December 2017.

Finally, five high-voltage DC transmission projects by Clean Line Energy Partners represent 16GW of potential wind capacity.
- These projects have seen a myriad of challenges, including the Missouri Public Service Commission’s denial of the Grain Belt Express application.
- NextEra Energy Resources acquired Clean Line’s Plains & Eastern project assets in Oklahoma, after the project struggled to sign on the Tennessee Valley Authority as an offtaker.

Many of the proposed transmission projects have yet to begin construction and much of this will not be built. Generally, transmission build within a specific state or region receives full approval faster than those that cross multiple jurisdictions. Furthermore, utility-owned transmission projects have typically seen more success than private lines. The Transwest Express line, which expects to commission by 2021, has been under development since 2005 – meaning if the asset comes online, it will have taken 16 years to develop.
Economics: U.S. wind PPA prices compared to wholesale power prices in selected markets

$/MWh (nominal)

- Prices for wind power purchase agreements (PPAs) have fallen dramatically as levelized costs declined. According to interviews with project developers, projects secured offtake agreements in the mid-teens in the middle U.S. in 2017. For comparison, data reported to the Federal Energy Regulatory Commission indicate that offtake prices for contracts signed in 2011 averaged $47/MWh.

- The top regions for utility PPAs are high wind-speed regions with low development costs like SPP, MISO and ERCOT. Conversely, developing projects in New England can be costly and time consuming, and average project capacity factors are among the lowest in the country.

- A significant number of wind projects commissioned in 2015 – representing 2.4GW of capacity – secured corporate PPAs. The popularity of corporate PPAs continued in more recent years, with an additional 1.6GW contracted in 2016 and 2.3GW in 2017.

Source: Bloomberg New Energy Finance, SEC filings, interviews, analyst estimates   Notes: MISO is the Midwest region; PJM is the Mid-Atlantic region; SPP is the Southwest Power Pool which covers the central southern U.S.; NEPOOL is the New England region; ERCOT covers most of Texas. Wholesale power prices are based on market-traded futures for calendar year 2018 for select nodes within the region.
Economics: ‘Class I’ REC prices in selected U.S. state markets

- In areas with Renewable Portfolio Standards, Renewable Energy Credits (RECs) are given to eligible renewable generators for each MWh of electricity they supply to the grid. Eligible plants can sell their RECs for additional revenue. When REC prices are high, renewable energy investment sees a higher rate of return and new renewable build is encouraged. REC prices are driven by supply-demand considerations, among others.

- Renewable build in most major REC markets has surpassed RPS demand, thereby depressing REC prices.

- Massachusetts and Connecticut Class I RECs lost over a third of their value in 2017. New England’s Clean Energy Request for Proposals, which seeks to procure additional Class I eligible renewables through long-term contracts, threatens to prolong the glut in regional REC markets.

- PJM Tier I Tri-Qualified REC prices fell over 70% in 2017. The drop reflects worsening market sentiment with respect to the extent of the oversupply. Cheap wind build in western PJM has proliferated rapidly and has exerted downward pressure on REC prices.

- Texas’ massive wind fleet has greatly exceeded state renewable energy goals. Texas RECs trade at their transactional value ($0.50/MWh), reflecting the low likelihood of future REC shortages.

Source: Bloomberg New Energy Finance, ICAP, Evolution, Spectron Group. Notes: “Class I” generally refers to the portion of REC markets that can be served by a variety of new renewables, including wind. In contrast, solar REC (SREC) markets are not Class I, as these can only be met through solar. The “Class I” component is usually the bulk of most states’ renewable portfolio standards. Data in the charts above is the sole property of ICAP United, Inc. Unauthorized disclosure, copying or distribution of the Information is strictly prohibited and the recipient of the information shall not redistribute the Information in a form to a third party. The Information is not, and should not be construed as, an offer, bid or solicitation in relation to any financial instrument. ICAP cannot guarantee, and expressly disclaims any liability for, and makes no representations or warranties, whether express or implied, as to the Information’s currency, accuracy, timeliness, completeness or fitness for any particular purpose.
Policy: Net metering regulation as of August 2017 by state

- As of August 2017, net metering at the full retail rate was available to most customers within 40 states and D.C. Net metering has been discontinued in three states over the past year and reform proposals are being considered in a number of other states.

- Arizona, Indiana and Maine formalized plans to transition away from retail-rate net energy metering in the past year, joining Hawaii, Louisiana and Nevada. The replacement schemes vary: Arizona will compensate small-scale PV systems at the five-year-average utility-scale PPA price, and only for 10 years; Indiana will only offer net metering to systems connected before 2022; and Maine will phase down the value of a net metering credit by 10% each year starting in 2018.

Source: Bloomberg New Energy Finance, DSIRE
Deployment: U.S. stationary fuel cell build

- Stationary fuel cell build hit its highest point on record, reaching an estimated 85MW of new installations in 2017. Build has rebounded since reaching a low in 2014, surpassing 70MW every subsequent year. Key developments in 2017 included:
  - Bloom Energy’s strategic alliance with PowerSecure generated 37MW of installations using its solid oxide fuel cell (SOFC) technology at twelve Equinix data centers in California and New York state. These began installation in 2017 and will be completed in 2018.
  - FuelCell Energy reduced its annual output from 50MW to 25MW to support cost control measures. Despite this, its carbonate fuel cell technology has been sought for a sizeable 39.8MW project with Long Island Power Authority’s FIT IV Program at three sites. It also secured a 7.4MW PPA with Connecticut Municipal Electric Energy Cooperative which will provide resiliency to the local U.S. Navy submarine base.
  - Doosan Fuel Cell America signed a strategic alliance with Wells Fargo to finance new PPAs that Doosan Energy Solutions secure may with new commercial, industrial and municipal customers.
- U.S. fuel cell activity is concentrated in six states: California, Connecticut, Delaware, New York, New Jersey and North Carolina. In 2017, subsidies were cut in California and New Jersey. Fuel cell companies have moved towards PPA models that shield end-customers from the high upfront cost of these systems, finding some success in 2017.

Deployment: U.S. announced and commissioned energy storage projects

- **CA**: 1.325GW storage target by 2020, with an additional 500MW led by utilities
- **CO**: Xcel receives $21-36/MWh solar + storage and wind + storage bids
- **OR**: 39MW proposed by PGE
- **NV**: Energy storage target consideration signed into law
- **NY**: 1.5GW storage target announced*
- **PJM**: 280MW+ operational for frequency regulation
- **MA**: 200MWh aspirational energy storage target established
- **MD**: Approved 30% tax credit for residential and commercial storage projects
- **HI**: KIUC signs $110/MWh solar + storage PPA with AES
- **TX**: NextEra, NRG, and E.On brought online 51.8MW of projects in ERCOT
- **AZ**: AZ Commissioner Andy Tobin proposes 3GW target*
- **FL**: Duke Energy Florida and FPL each propose 50MW pilots

Source: Bloomberg New Energy Finance  Note: Includes projects that are larger than 500kW/500kWh, have announced a specific location, and has been confirmed by the relevant company through public data. *These targets were proposed in January 2018
Deployment: U.S. non-hydropower commissioned energy storage capacity

- Annual energy storage installations have increased since 2014, and is expected to do so again in 2017. Build ramped up in 2015 from projects seeking to participate in the PJM frequency regulation market – those represent most of the capacity in Illinois, West Virginia, Ohio and Pennsylvania.
- While PJM states are still, in aggregate, the biggest energy storage market in terms of commissioned capacity in the U.S., California is the largest single state market. The majority of the commissioned capacity there was built between late 2016 and early 2017 as an emergency response to the gas supply shortages expected from the Aliso Canyon gas storage facility leak-mitigation efforts.
- Beyond California and PJM, many smaller projects have commissioned in other states such as Hawaii, Texas, Indiana and New York.
- Falling lithium-ion battery pack prices have helped to lower costs for new stationary storage applications (see here).

Source: Bloomberg New Energy Finance  Notes: *2017 includes expected but unconfirmed capacity as of January 31, 2018. Unconfirmed capacity is marked in white. Does not include pumped hydropower, underground compressed air energy storage, or flooded lead-acid batteries. Minimum project size for inclusion in this analysis is 500kW or 500kWh. Cumulative capacity subtracts capacity that was decommissioned. Installations by state includes only confirmed capacity.
Policy: Share of total electricity consumption by U.S. state and region, and electrical efficiency savings by state, 2016

- The presence of EERS legislation (red highlights) and electricity savings (blue shading) are correlated and follow regional trends.
- The Southeast is notable for having both low EERS uptake and limited utility electricity savings.
- In the Rocky Mountain and Plains regions, uptake of EERS is mixed. In the rest of the U.S., uptake is near universal and electricity savings are accordingly higher.

Source: ACEEE, EIA, Bloomberg New Energy Finance  Notes: The shading for individual states indicates savings from utility electrical efficiency programs as a fraction of retail sales. State codes highlighted in red indicate EERS requirements for electric utilities. Hawaii and Alaska are not depicted.
Policy: Share of total natural gas consumption by U.S. state and region, and natural gas efficiency savings by state, 2016

- As with electricity, states which have implemented natural gas EERS see higher utility natural gas savings, and both these factors follow regional trends. However, EERS policies appear more correlated with savings for natural gas than for electricity—states with natural gas EERS in a region with low savings (e.g. AZ, AR, KY) stand out more from their neighbors, as do states with no EERS in high-savings regions (e.g. PA, OH).

- Fewer states overall have adopted EERS for natural gas than for electricity.

- The Southeast and Southwest, which account for 45% of U.S. gas (end-use) consumption, have the lowest levels of overall savings.

Source: ACEEE, EIA, Bloomberg New Energy Finance  Notes: The shading for individual states indicates savings from utility natural gas efficiency programs as a fraction of retail sales. State codes highlighted in red indicate EERS requirements for natural gas utilities. Hawaii and Alaska are not depicted.
Massachusetts was the highest-ranked state in 2017. Through utility programs, it achieved record-high electricity savings equal to 3% of sales.

Second-placed California scored maximum points across a number of categories, including building energy codes, state government initiatives and appliance standards, reflecting a number of major policy initiatives.

Idaho was a notable climber in the middle-rankings, moving from 33rd to 26th year-on-year due to increased utility spending on efficiency, updates to building codes and an uptick in electric vehicle registrations.

Iowa fell the furthest, due to a temporary suspension of its loan and grant programs while the Iowa Energy Center moves from Iowa State University to the Iowa Economic Development Authority.

Source: ACEEE, EIA, Bloomberg New Energy Finance  
Note: Numbers in parentheses at the bottom of the chart indicate 2016 ranking. Numbers in parenthesis at the top denote the change in score from 2016 levels.
The majority of states have adopted some version of the International Energy Conservation Code (IECC) for both residential and commercial buildings.

Over time, standards are amended and become more stringent. Thus states that have adopted the most recent (2015) standard have stronger incentives in place for building efficiency.

As with other legislation, there are strong regional trends. States on the West Coast tend to have either 2015 or 2012 standards in place, whereas on the East Coast 2012 and 2009 are more common.

The four most populous states (California, Texas, Florida and New York) all have 2015 standards in place for both residential and commercial buildings.

Even for states that are labeled as having “no state energy code,” many of the larger jurisdictions within these states have adopted a recent version of the IECC.

Source: U.S. Department of Energy, U.S. Census Bureau, BNEF
Policy: U.S. building floor space covered under state or local energy use benchmarking/disclosure policies

In order to increase the transparency of building energy usage, states and cities have created building energy use policies such as energy efficiency benchmarks and mandates.

The square footage of commercial building space covered by such policies jumped in 2017 from 9% to 13%.

California’s existing law required utilities to begin disclosing whole-building aggregated energy use data to owners of commercial buildings and multifamily homes at the start of 2017.

On the county level, Los Angeles passed new benchmarking laws that came into effect for public and non-residential buildings in July 2017.

Similar laws for Evanston, Illinois and Orlando, Florida also came into effect mid-2017.

Kansas City, Missouri passed a disclosure law that came into effect in May 2016.


Notes: Accounts for overlap between cities and states (e.g., no double-counting between Seattle and Washington State numbers). Assumes that the Buildings Energy Data Book’s definition of floor space covered at least roughly corresponds to IMT’s definition. Shaded areas show amount of floor space covered, diamonds represent percentage of U.S. commercial sector floor space covered. Diamonds are spaced out in irregular intervals since data for the denominator (total commercial sector floor space in the U.S.) is available at irregular periods (2008, 2010, 2015e). The diamond for December 2014 assumes linear growth in the denominator over 2010-15. Previous editions of the Factbook omitted Cambridge, MA as the floor space was still being tallied. Portland, ME is not shown this year for the same reason.
Deployment: U.S. wholesale demand-response capacity

By region

- U.S. wholesale demand-response (DR) capacity remained flat through the first half of 2017, growing a measly 61MW. Despite growth in some markets – notably ERCOT which jumped to 3.2GW from 2.4GW in 2016 – it only just offsets the continued erosion of DR capacity in the Northeast. PJM volumes declined for the second year in a row, while ISO-NE capacity dropped for the sixth straight year. A variety of changes to the capacity markets in both ISOs have challenged demand response and will put downward pressure on volumes and revenue in the years ahead.

- The vast majority of wholesale demand response is concentrated in capacity markets and reliability mechanisms. Even in ERCOT which has no formal capacity market, almost 1.9GW of DR has been contracted through its capacity-style Emergency Response Service. Ancillary service participation, which grew 9% annually on average over 2010-2015, has remained flat since, in the 1.8-1.9GW range. Despite the furor surrounding FERC 745, demand response activity within the energy markets remains negligible.

- Our methodology for tracking demand-response capacity has changed since last year. Previously we used data reported to FERC and the results of capacity auctions. This year’s analysis is built bottom-up by assessing the amount of demand response active within each market in each ISO/RTO. The most notable change is in PJM, where for some years the GW value is as much as a third lower than previously.

Source: Bloomberg New Energy Finance. Note: Demand-response was only formally integrated with the CAISO market in 2015.
Deployment: U.S. smart electricity meter deployments

U.S. smart meter deployments

- Smart meter installations hit a peak in 2010 and 2011, supported by stimulus funding awarded in 2009. Many of the largest U.S. utilities took advantage of the Smart Grid Investment Grant to roll out smart meters across their territories. As grant funding dried up, deployments slowed, hitting a trough in 2014. Smart metering activity has since increased to a fairly constant six million meters per year.

- Today almost 51% of U.S. electricity customers have a smart meter, but there is enormous regional variation. The top 10 states all have penetration of greater than 79%. In contrast only one in five or fewer customers have smart meters in the bottom 10 states. Over 2016-17, Illinois and Michigan were the most active smart metering markets, deploying 2.4 and 1.1 million meters, respectively.

- The greatest cost saving for utilities from smart metering is replacing the need for manual meter reads. But a renewed focus on grid modernization and growing interest in dynamic retail tariffs is leading state regulators and utilities that have shied away from the technology to reassess the benefits of deployment. Hold-out states, such as New York and Rhode Island (where smart meters currently number in the hundreds), have both committed to extensive smart meter rollouts over the next five to ten years.

Source: Bloomberg New Energy Finance, EIA. Note: there is a 10-month lag in official smart meter statistics, as a result 2017 figures include BNEF estimates.