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Overview

The 2017 Sustainable Energy in America Factbook marks the fifth year that BCSE and BNEF have collaborated to document the transformation of the US energy system and the growing contributions of sustainable energy technologies. In the past five years, these contributions have been significant, including:

- The addition of 76 gigawatts (GW) of renewable energy generating capacity, and 39GW of natural gas-fired capacity. Renewables (inclusive of large hydro) and natural gas now meet *half* of US power demand, up from only 38% in 2011.
- A 10% improvement in US energy productivity, meaning the US economy is using 10% less energy to power each unit of growth.
- A 3% drop in average retail electricity prices in real terms. In New York, Texas, and Florida, prices have fallen over 10% in that time.
- A 12% jump in total gas production, and a 79% surge in shale gas extraction since 2011.
- A 12% improvement in vehicle fuel economy, propelled by federal fuel efficiency standards.

The 2017 Factbook provides an update through the end of 2016, highlighting a number of key developments that occurred as the long-term transformation of US energy continues to unfold. The rapid pace of renewable energy deployment accelerated, consumption and export of domestic natural gas hit record levels, and the economy grew more energy efficient than ever. Utilities ramped up investments in electric and natural gas transmission, helping to create a more reliable energy system. In the face of all this change, Americans are enjoying lower energy bills and are directing less of their household income to energy spending than at any other time on record.

The Sustainable Energy in America Factbook provides a detailed look at the state of US energy and the role that a range of new technologies are playing in reshaping the industry. The Factbook is researched and produced by Bloomberg New Energy Finance and commissioned by the Business Council for Sustainable Energy. As always, the goal is to offer simple, accurate benchmarks on the status and contributions of new sustainable energy technologies.

About the Factbook (1 of 4):
What is it and what's new

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What is it?

- Aims to augment existing, reputable sources of information on US energy
- Focuses on **renewables, efficiency, natural gas**
- **Fills important data gaps** in certain areas (eg, investment flows by sector, contribution of distributed energy)
- Contains data through the end of 2016 wherever possible
- Employs **Bloomberg New Energy Finance data** in most cases, augmented by EIA, FERC, ACEEE, LBNL, and other sources where necessary
- Contains the very **latest information on new energy technology costs**
- Has been graciously underwritten by the **Business Council for Sustainable Energy**
- Is in its **fifth edition** (first published in January 2013)

What's new?

- **Format**: This year's edition of the Factbook (this document) consists of Powerpoint slides showing updated charts. For those looking for more context on any sector, the 2014 edition(1) can continue to serve as a reference. The emphasis of this 2017 edition is to *capture new developments that occurred in the past year*.
- **Updated analysis**: Most charts have been extended by one year to capture the latest data.
- **2016 developments**: The text in the slides highlights major changes that occurred over the past year.
- **New coverage**: This report contains data shown for the first time in the Factbook, including transmission investment, PURPA-driven solar build, battery pricing, natural gas exports, energy spending, biofuel blending and electric vehicle model availability.

(1) The 2014 Factbook can be found here: http://www.bcse.org/factbook/pdfs/2014%20Sustainable%20Energy%20in%20America%20Factbook.pdf

About the Factbook (2 of 4):
Understanding terminology for this report

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	FOSSIL-FIRED / NUCLEAR POWER	RENEWABLE ENERGY	DISTRIBUTED POWER, STORAGE, EFFICIENCY	TRANSPORT
SUSTAINABLE ENERGY (as defined in this report)	• Natural gas • CCS	• Solar • Wind • Geothermal • Hydro • Biomass • Biogas • Waste-to-energy	• Small-scale renewables • CHP and WHP • Fuel cells • Storage • Smart grid / demand response • Building efficiency • Industrial efficiency (aluminum) • Direct use applications for natural gas	• Electric vehicles (including hybrids) • Natural gas vehicles
OTHER CLEAN ENERGY (not covered in this report)	• Nuclear	• Wave / tidal	• Lighting • Industrial efficiency (other industries)	• Biofuels

US energy overview:
Retail and wholesale power prices (2016 $/MWh)

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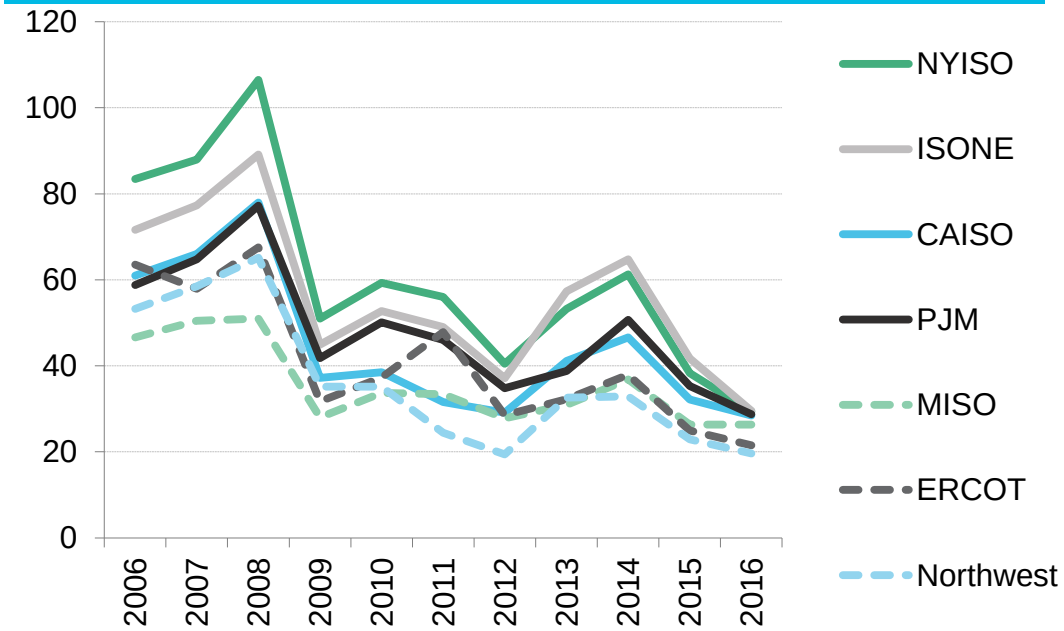
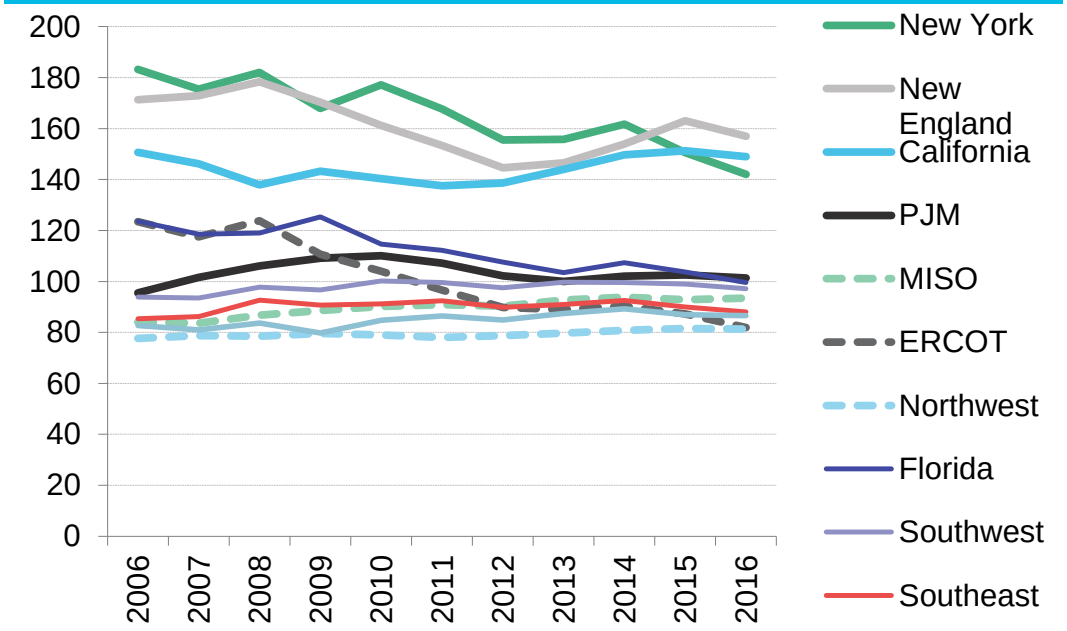
Wholesale power prices (2016 $/MWh)



Average retail power prices (2016 $/MWh)

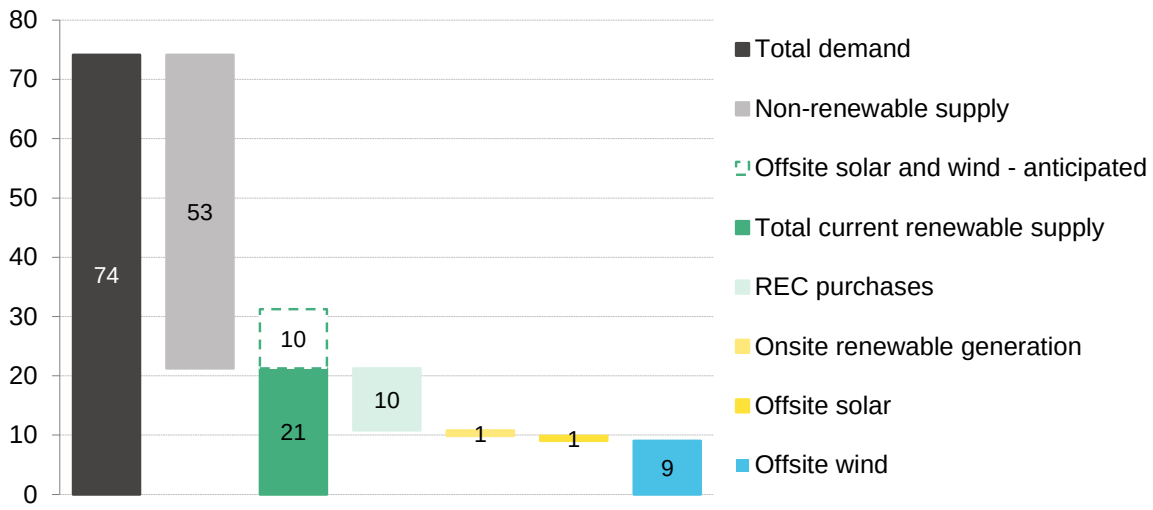


- Wholesale power prices continued their descent in 2016, as natural gas prices touched an 18-year low in March and more zero-marginal cost renewables bid into the market. Year-on-year, around-the-clock prices dropped by as much as 29% in New England (ISONE), 23% in New York (NYISO) and 18% in PJM in real terms. In the Midwest (MISO), prices held relatively flat, falling 0.2% year-on-year. The declines in 2016 followed after roughly 30% slides in 2015 for most regions.
- Retail prices also declined, at an average clip of 2.2% across the country. Regionally, the falloff in retail prices was most visible in New York and Texas (ERCOT), which saw decreases of 5.6% and 6.2%, respectively. Retail prices are typically less responsive to changes in the fuel mix or in fuel prices, because wholesale power costs make up only a portion of retail bills.
- Since 2005, US average retail prices have risen only 1.4% in real terms. Prices are down 7% from their 2008 peak.

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-2016. 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-November 2016. All prices are in real 2016 dollars.

Finance: Corporate procurement of clean energy

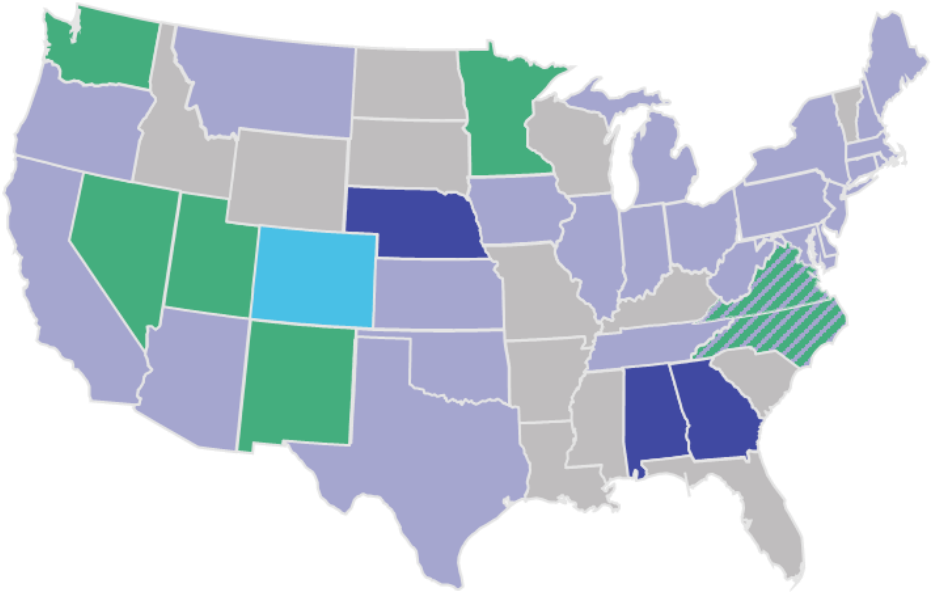
Global and US electricity supply and demand fundamentals of 50 'first-movers', 2016 (TWh)



- 50 corporates that account for almost 2% of US electricity demand contracted approximately 9TWh of offsite wind and 1TWh offsite solar in 2016. This volume will at least double by 2018, as offsite projects contracted in 2016 come online. Nonetheless, these corporates remain far from achieving 100% renewable electricity procurement – an increasingly common sustainability goal. Currently, these corporates still buy approximately 53TWh of brown wholesale power.
- Regulations pertaining to corporate procurement vary by state. Corporations can sign power purchase agreements in deregulated states and green tariffs in some regulated states.

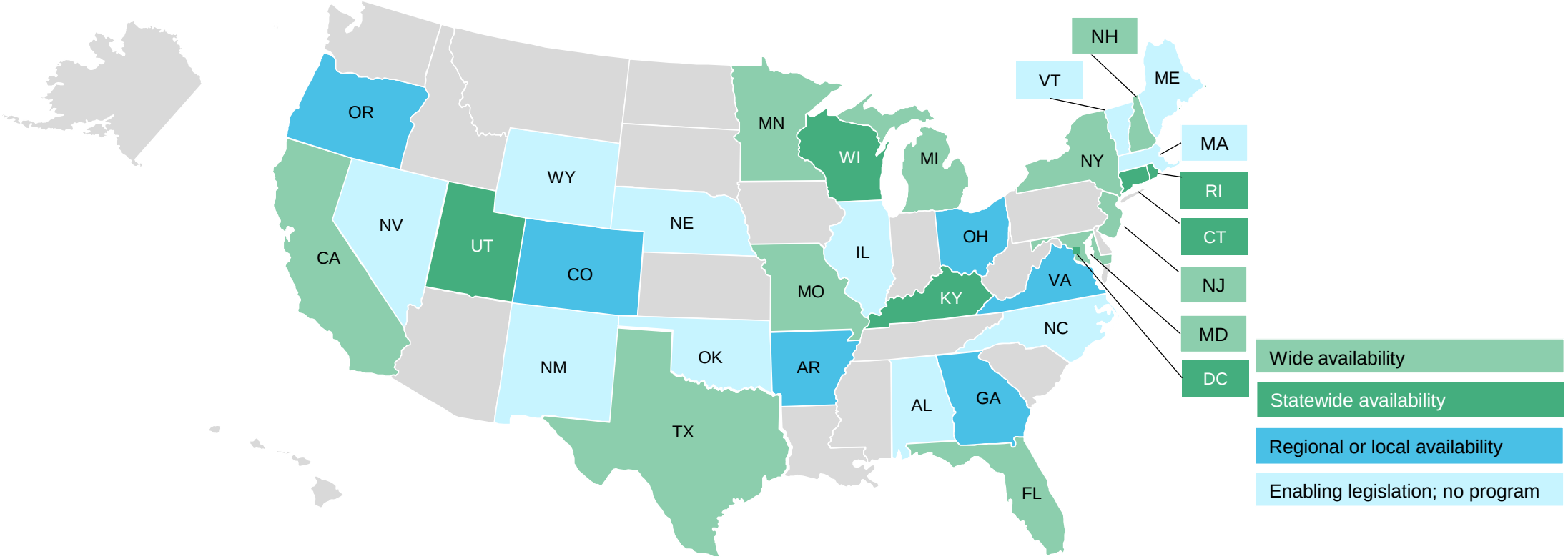
Source: Bloomberg New Energy Finance, company announcements

How corporates procure clean energy, by state



Notes: 'Onsite renewable generation' includes fuel cells and solar PV. 'First-movers' refers to a diverse, cross-sector sample of 50 companies with operations in the US that have joined the RE100, signed the Corporate Renewable Energy Buyers' Principles or set an ambitious renewable electricity target. 'Offsite solar and wind – anticipated' refers to power to be produced from projects contracted in 2016 but not expected to come online until 2017 or 2018.

Policy – key sustainable energy policy developments in 2015 (1 of 5): Availability of PACE financing, 2016



- Property Assessed Clean Energy (PACE) is a mechanism to help finance renewable energy and energy efficiency upgrades to buildings, by allowing the owner to pay off the cost over 20 years via an addition to property taxes.
- PACE is becoming more widely available across the country, as states and municipalities pass enabling legislation. In 2016, Nevada signed off on legislation to allow for PACE financing, and Atlanta and Loudon County, VA began developing new PACE programs. Financing via PACE providers is picking up rapidly: commercial PACE financing amounted to $45m in Q3 2016, up 380% from Q3 2015 levels.
- A number of other PACE developments occurred in 2016. In June, Renovate America closed the securitization of $305m in PACE bonds, the largest securitization to date. In July, the Internal Revenue Service found that, subject to restrictions, the interest portion of a PACE payment may be deducted from personal income taxes. And in August, the US's largest agricultural PACE project to date, a $4m financing of a farm-to-plate hog-raising facility, was completed in Missouri.

Source: PACENation, Bloomberg New Energy Finance

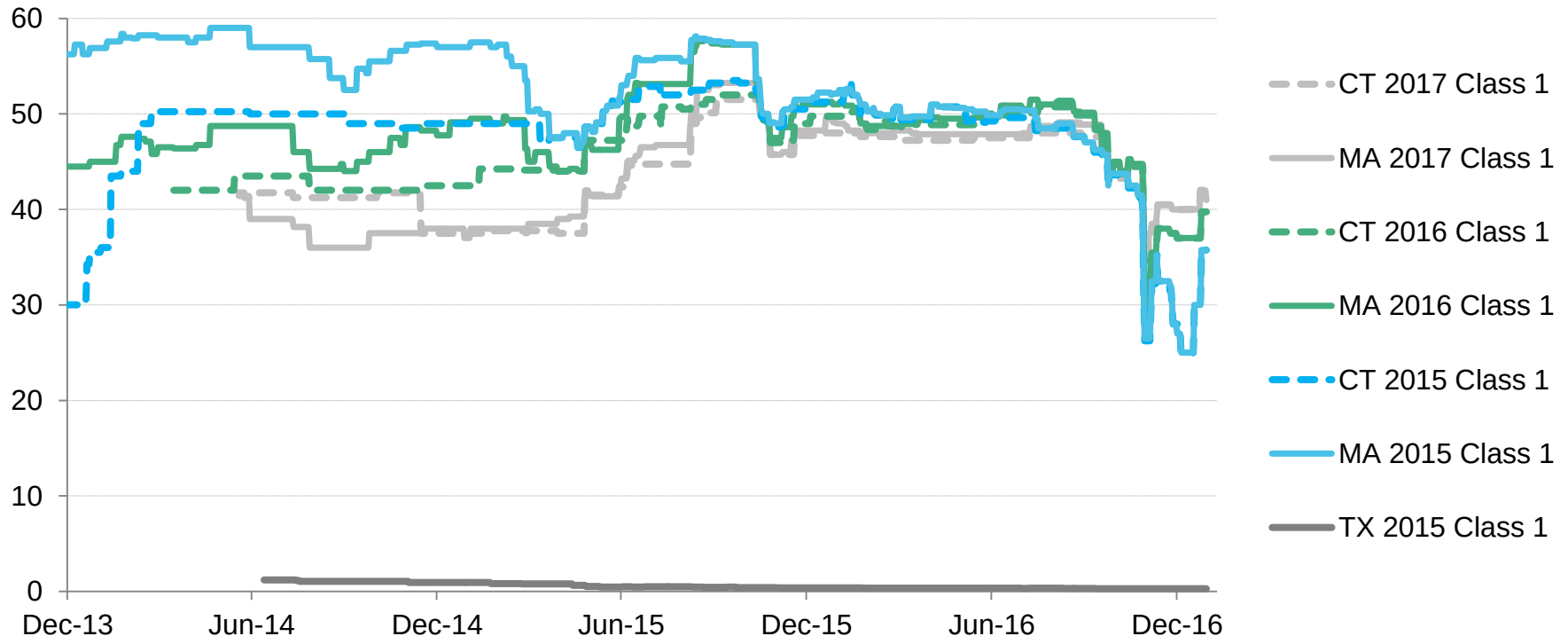
Policy: Recent regulatory amendments in the five largest PURPA states

State	Historical PURPA capacity	Planned PURPA capacity	Additional Information
Oregon	234	710	In March 2016, the Oregon Public Utility Commission rejected proposals to lower the state's standard contract to three years and decrease the maximum size to 100kW.
North Carolina	1,301	703	In January 2015, the North Carolina Utilities Commission rejected a utility proposal to reduce the maximum project capacity to 100kW and the standard PPA term to 10 years.
Utah	175	608	In January 2016, regulators approved a request to reduce PURPA contracts from 20 years to two.
Montana	188	513	In June 2016, the Montana Public Utilities Commission suspended all PURPA rates for qualified facilities, meaning IPPs will be forced to negotiate each PPA with the relevant utility. However, in December 2016, FERC overturned the suspension.
South Carolina	20	328	There is a ceiling of 2MW for standard contracts under PURPA. Any contract for projects larger than 2MW is negotiable, including contract length.

- The surge of solar projects flooding interconnection queues has propelled backlash from regulated utilities.
- In order to avoid being locked into outdated offtake prices in the long term, utilities are petitioning their state public utility commissions to reduce the project capacity thresholds for securing standard contracts under PURPA, as well as the lengths of these contracts.
- Changes to PURPA at the state level as a result of this backlash have forced developers to look to new states.

Source: Bloomberg New Energy Finance

Economics: 'Class I' REC prices in selected US state markets ($/MWh)



- Renewable Energy Credits (RECs) provide an additional revenue stream for qualified renewable projects, thereby improving project economics. However, oversupply drove down REC prices in major markets in 2016.
- New England Class 1 REC prices converged in 2016 due to oversupply. The region's prices plunged in the second half of the year in anticipation of additional supply from New England's Clean Energy Request for Proposals (RFP), before entering a partial correction around the end of the year.
- Texas has the greatest wind capacity in the country, resulting in a REC oversupply that has severely depressed prices.
- The PJM REC market remains oversupplied, and prices are guided by the value of use during potential future 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.

Economics: Solar REC prices in selected US state markets by vintage year ($/MWh)

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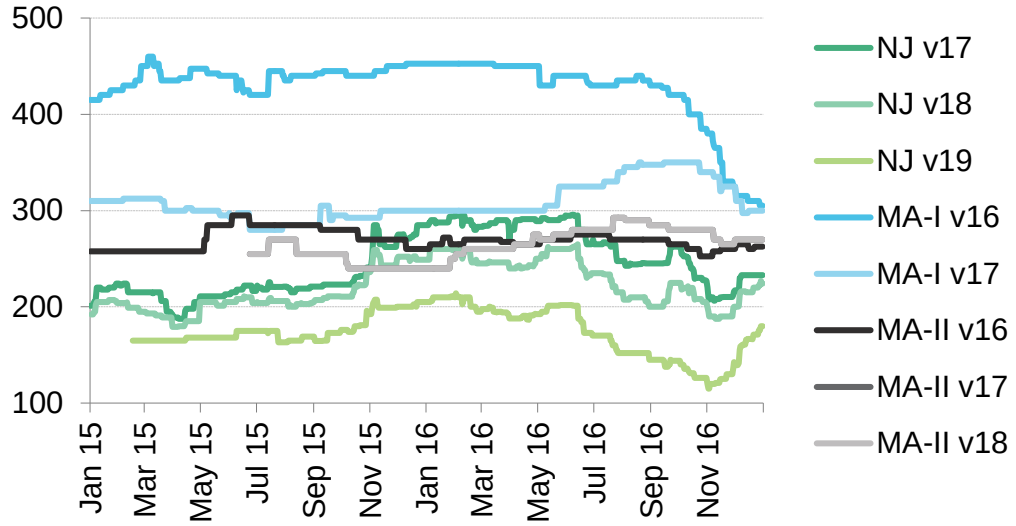
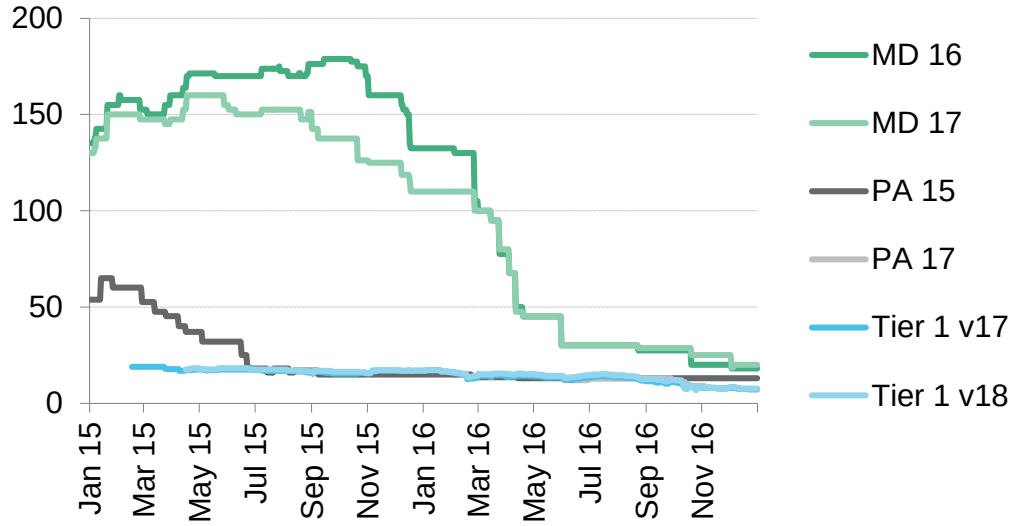
Massachusetts SREC-I/II and New Jersey SREC prices ($/MWh)



Maryland and Pennsylvania SREC and PJM Tier 1 REC prices ($/MWh)



Source: Bloomberg New Energy Finance, ICAP, SRECTrade, The Intercontinental Exchange (ICE) Notes: Some data in chart above is from ICAP; for that data, the disclaimer below applies; 'v' refers to credit vintage; 'MA-I' and 'MA-II' refer to Massachusetts' SREC-I and SREC-II programs; 'Tier 1' represents PJM Tier 1 prices.

- Overall, SREC prices declined aross major markets in 2016, due to oversupply.
- **Massachusetts:** SREC-I and SREC-II credits remain above $300/MWh and $200/MWh, respectively, but eligibility for both programs has essentially closed.
- **New Jersey:** Vintage 2017-18 credits traded at the alternative compliance payment (ACP) level for most of 2016 before wavering in the second half of the year. NJ SRECs capped 2016 with a rally.
- **Maryland:** Prices saw modest declines on the threat of new utility-scale build in late-2015, before heading into freefall in the aftermath of the ITC extension. MD SRECs have continued to trade below $30/MWh since August 2016.
- **Pennsylvania:** Oversupply has led PA SRECs to gravitate towards PJM's Tier 1 price.

Source: Bloomberg New Energy Finance, Bloomberg Terminal, ICAP Notes: Data in the charts above ("SREC prices") are 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.

Economics: Biomass feedstock prices; biogas and waste-to-energy capex

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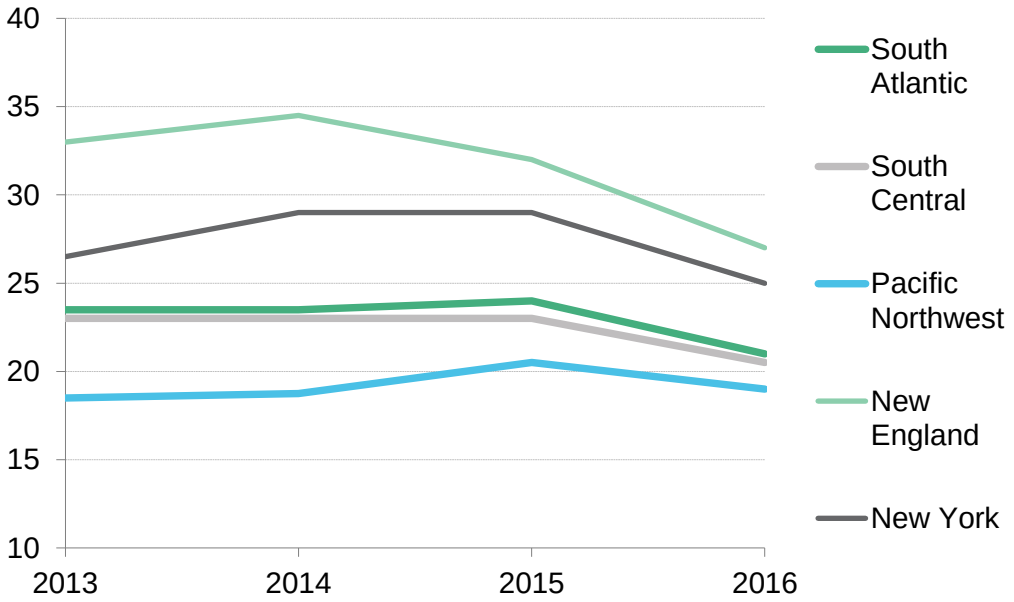
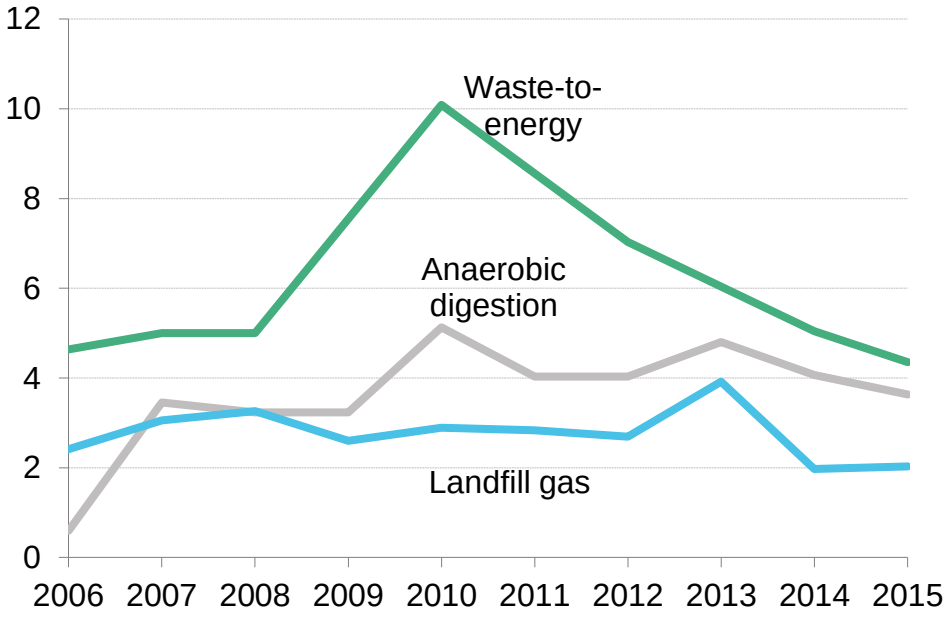
Biomass feedstock prices in selected US markets, 2013–16 ($/green ton)



Capex for biogas and waste-to-energy projects by type ($m/MW)



- Biomass feedstock prices in 2016 fell across the country, by as much as 16% in New England and 14% in New York. Price movements were more muted in the Pacific Northwest, which saw declines of 7%.
- Capex for waste-to-energy and anaerobic digestion decreased slightly in 2015. Annual changes in these figures can be strongly influenced by costs in individual projects since there are relatively few projects under development in biogas and waste-to-energy at any given time.

Source: Bloomberg New Energy Finance, US Department of Agriculture, EIA, RISI

Notes: Prices are nominal. Biogas category includes anaerobic digestion (projects 1MW and above except wastewater treatment facilities) and landfill gas power.

Policy – key sustainable energy policy developments in 2015 (4 of 5): US transmission infrastructure

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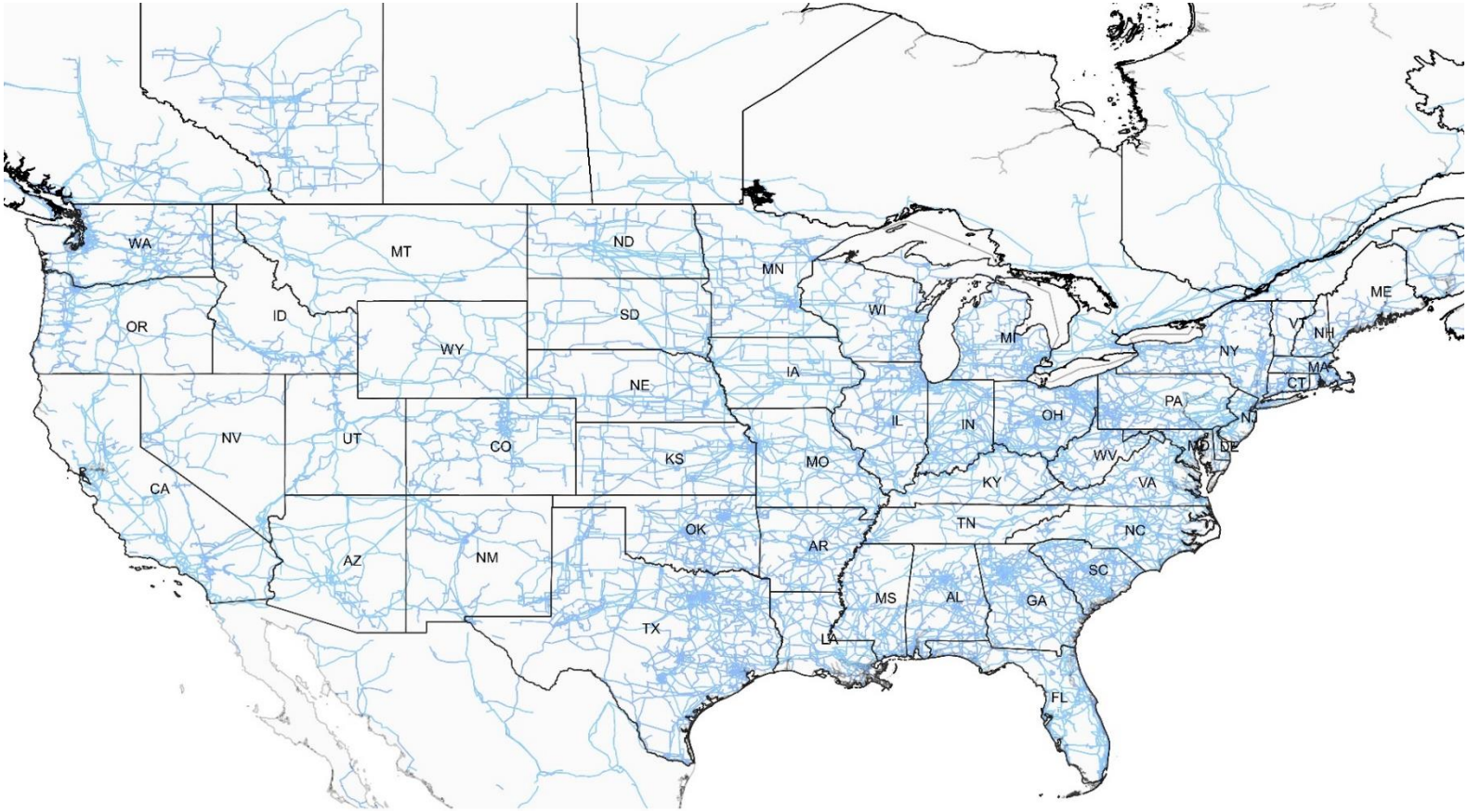
US transmission infrastructure asset map



- The aging US transmission system has seen increasing investment in recent years and may continue to be a major area of spending. For example, the transmission lines of AEP, the largest transmission owner in the US, have an average age of 52 years. AEP estimates that it would need to invest $2.5bn per year simply to maintain the current asset age profile of the over 40,000 miles of transmission lines under its ownership.
- President Trump has pledged to invest in modernizing and improving the reliability of the US electricity grid as part of his infrastructure plan.

Source: AEP company reports, campaign website of Donald Trump, Bloomberg New Energy Finance

Deployment: Planned additions to Appalachian Basin takeaway capacity (Bcfd)

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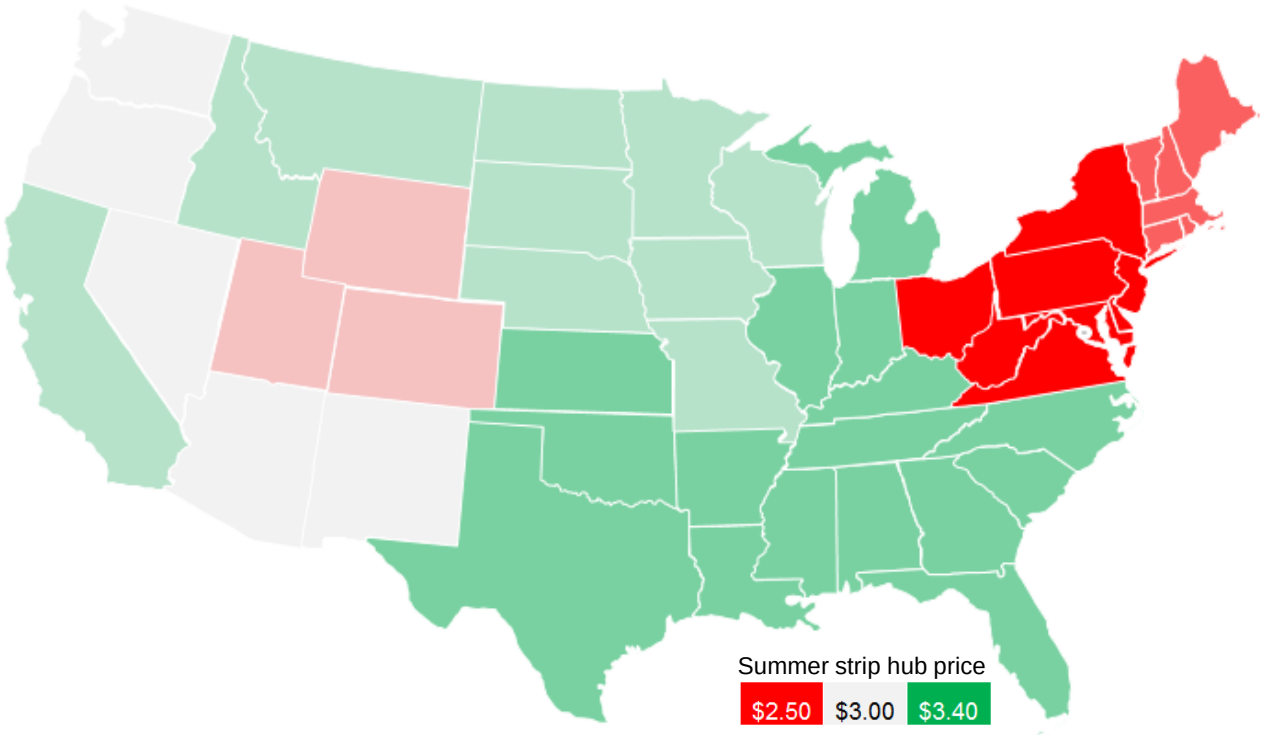
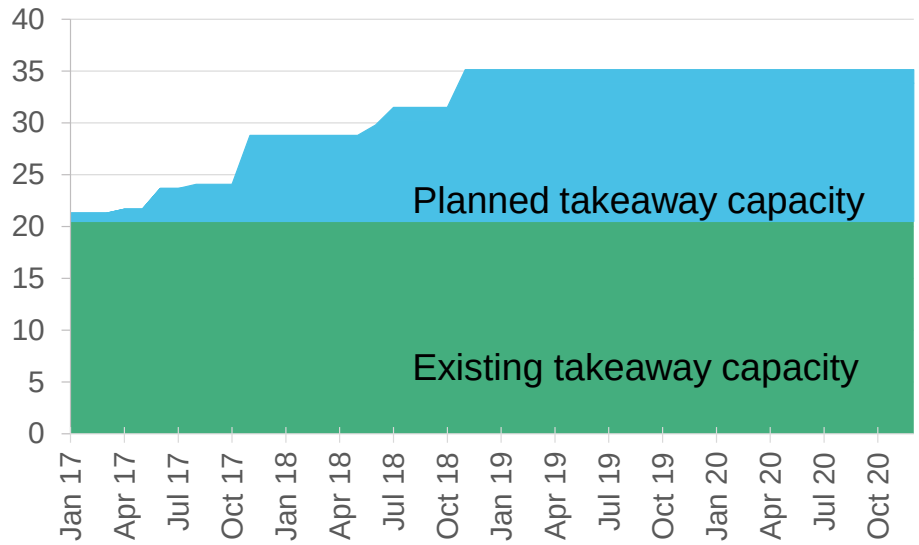
Summer 2017 hub price variation



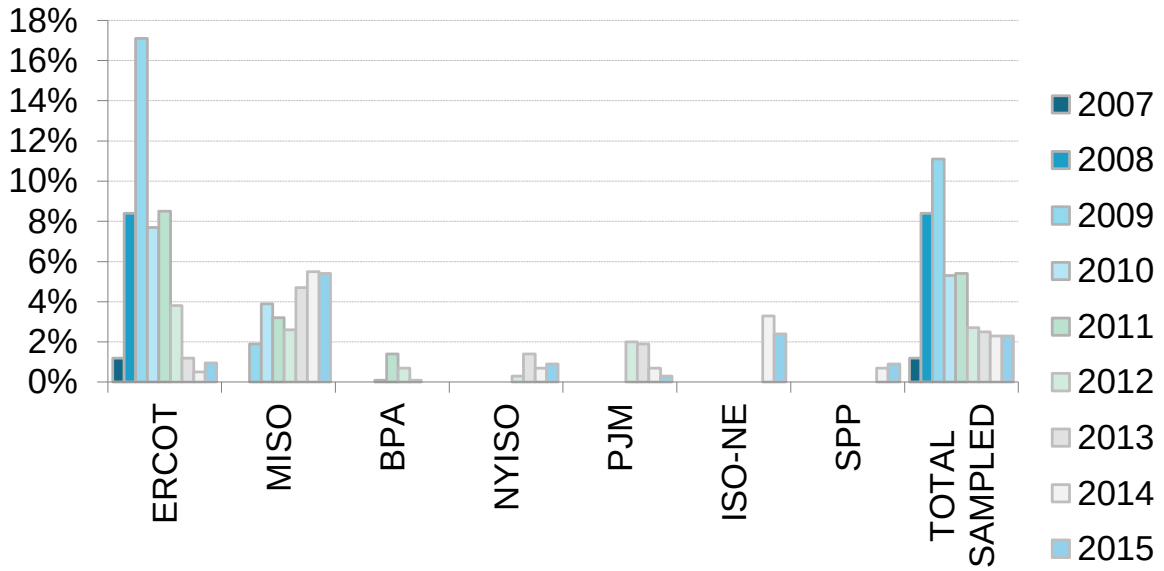
App basin takeaway capacity (Bcfd)



- Gas production in the Marcellus and Utica Appalachian basins has grown faster than the necessary takeaway infrastructure. As a result, summer 2017 futures prices for Dominion South (in southwest Pennsylvania) are the lowest in the country, trading at over a dollar discount to Henry Hub as of mid-January 2017.
- Producers in this region are eager to reach customers in other markets. Over a dozen pipeline projects have been planned for the next few years, to bring more Appalachian gas to markets in the South, West and Northeast. These projects aim to boost capacity 70% from current levels by 2020, which will help alleviate the negative hub basis in this region by allowing gas to flow more freely to the most attractively priced market.
- Takeaway capacity is only one part of the story – a build-out in next-mile delivery pipelines is also needed to bring the gas into constrained regions, such as New England, which experiences high prices due to constraints in winter.

Source: Bloomberg New Energy Finance, EIA

Deployment: US wind curtailment (% of wind generation)

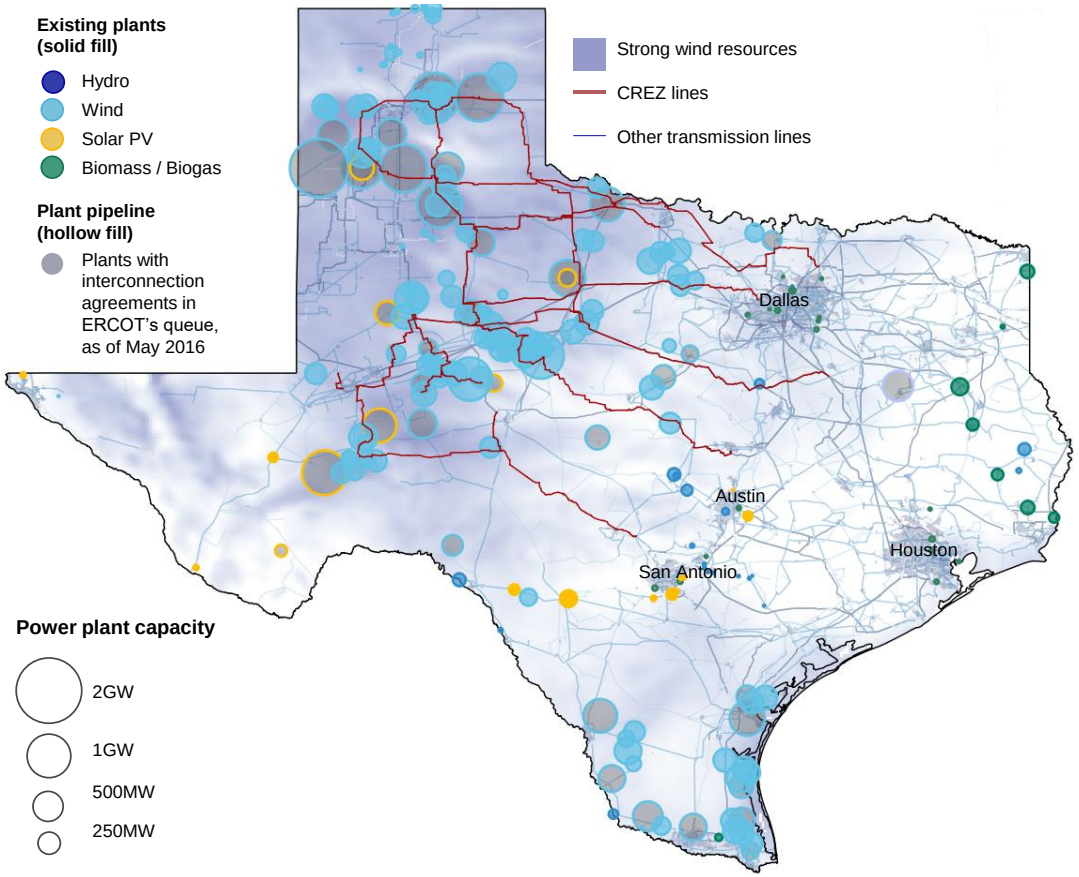


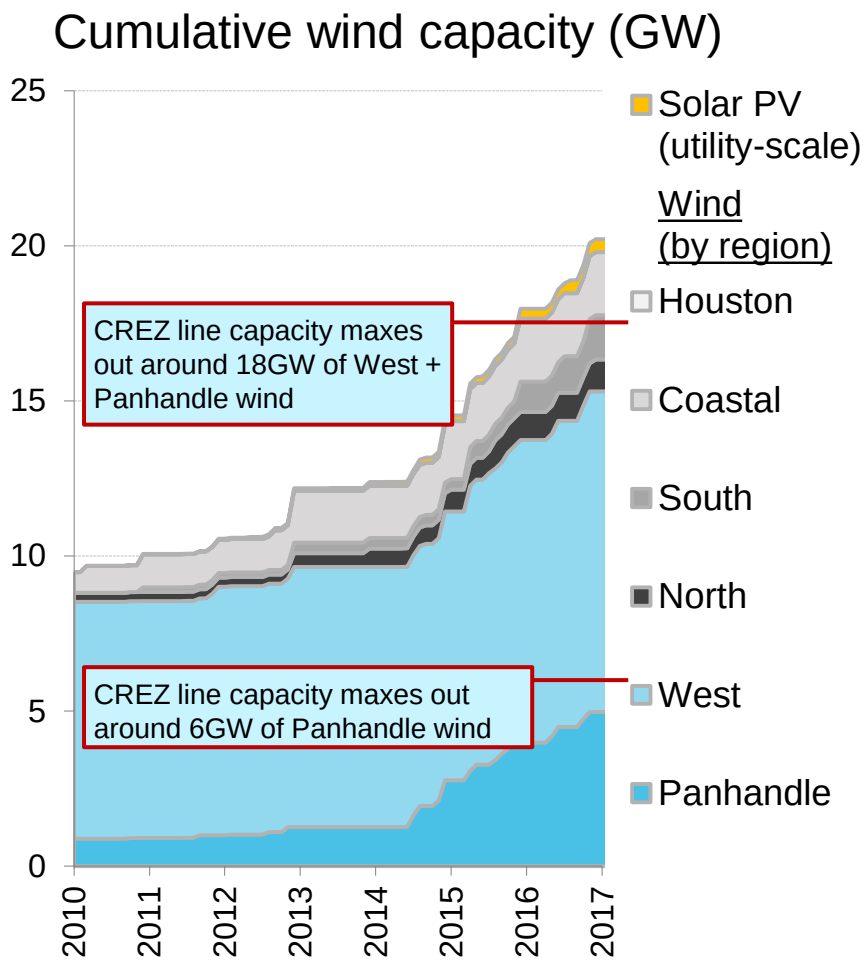
- Curtailment can occur due to transmission constraints, inflexibilities in the grid and environmental or generation restrictions.
- This was a significant problem in ERCOT (Texas) from 2008-2013, but the build-out and upgrade of the Competitive Renewable Energy Zone (CREZ) transmission lines and increased efficiency in ERCOT's wholesale electricity market addressed the problem. Curtailment fell from a peak of 17% in 2009 to 0.5% in 2014, and stayed just under 1% for 2015.
- PJM saw the lowest curtailment of any region in 2015, at 0.3%.* MISO and New England, on the other hand, have experienced higher curtailment than other regions. Like ERCOT before CREZ, MISO's transmission investment has not kept pace with the rapid build-out of wind projects, and annual curtailment numbers continue to rise. MISO is currently building transmission in order to alleviate congestion. New England's curtailment levels in 2015 dropped to 2.4% from 3.3% in 2014. Even so, this is still over double that of SPP and NYISO.
- In aggregate, total curtailment has shrunk since 2009. However, time-varying influences also played a role: in 2015, for example, the western and interior US experienced below-normal wind speeds, reducing generation and therefore the need to curtail in constrained regions.

Source: Bloomberg New Energy Finance, Lawrence Berkeley National Laboratory

Notes: *Except for BPA, data represents forced and economic curtailment. BPA's 2014-15 estimates were unavailable, and data for 2010-2013 are partly estimated. PJM's 2012 figure is June-December only. SPP's 2014 figure is March-December only. ISO-NE and SPP are included only for 2014 onward, as the ISOs did not previously report curtailment data.

Deployment: ERCOT's Competitive Renewable Energy Zone (CREZ)

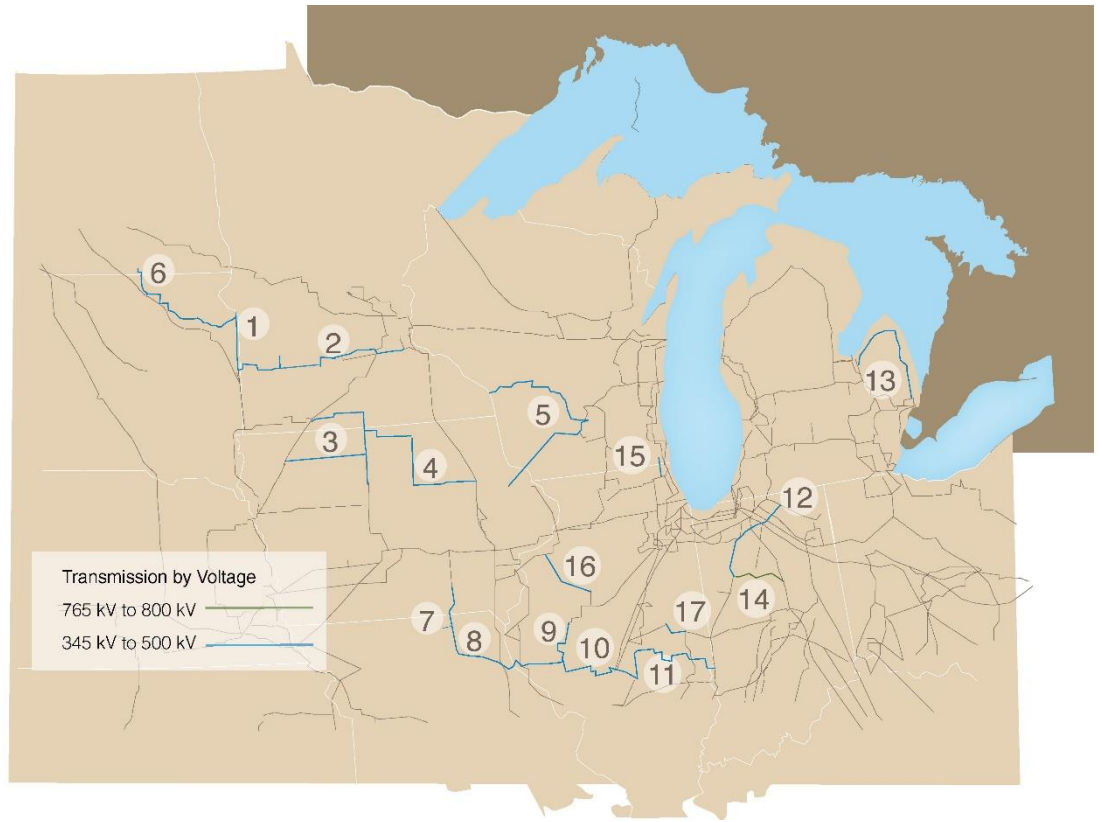




- Texas is home to one-quarter of America's installed wind capacity (over 18GW of 76GW installed as of November 2016).
- The majority was enabled by a $7bn investment in the Competitive Renewable Energy Zone (CREZ) transmission lines, which connect West Zone and Panhandle wind to load centers in the East.
- The CREZ lines can accommodate roughly 18GW of West + Panhandle wind before significant curtailment (and congestion pricing) comes back into play—and West + Panhandle wind is within 3 GW of reaching CREZ's maximum capacity.

Source: Bloomberg New Energy Finance, ERCOT

Deployment: Transmission build-out in MISO

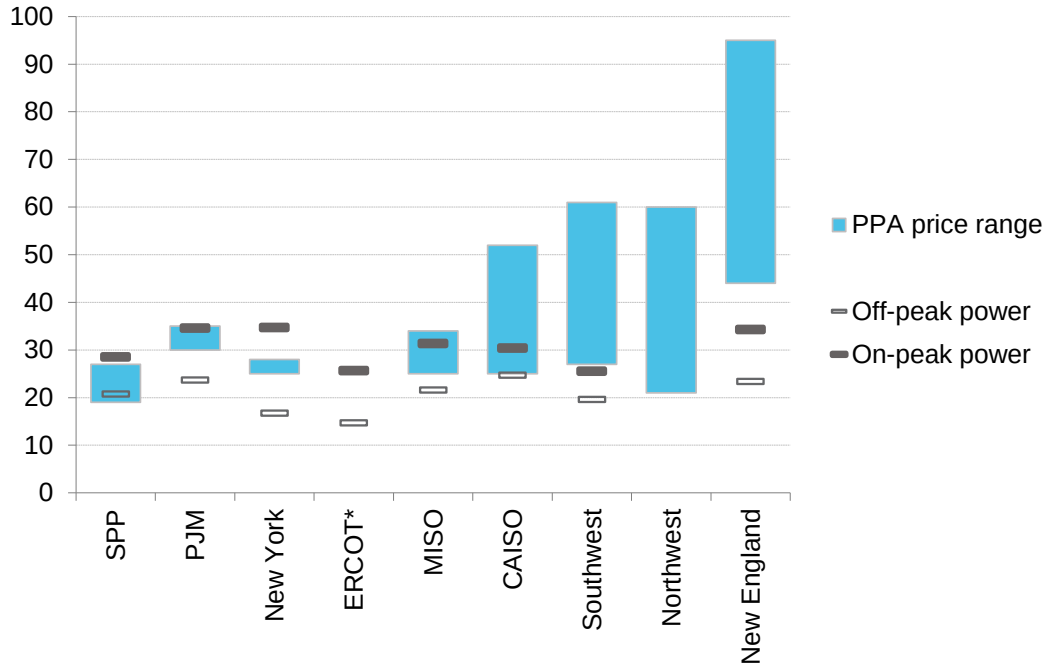


- MISO currently has the most transmission build underway for wind, which will alleviate congestion and create new opportunities for wind development. MISO's Multi Value Project (MVP) Portfolio, the result of an extended transmission analysis, includes 17 projects, some of which are interstate (shown above).
- Additionally, across the US (and sometimes connecting into Canada), there has been a number of proposals for high-voltage direct current (HVDC) transmission lines. However, none of these have yet begun construction. Generally, transmission build *within* a specific state or region receives full approval faster than those that cross multiple jurisdictions. Nearly 21GW-worth of HVDC transmission projects with at least a portion in the US are currently under development or under construction. Much of this will not be built.

Source: Midwest ISO; MISO MTER14 MVP Triennial Review, September 2014

Notes: Projects are as follows: (1) Big Stone–Brookings, (2) Brookings, SD–SE Twin Cities, (3) Lakefield Jct.–Winnebago–Winco–Burt Area & Sheldon–Burt Area–Webster, (4) Winco–Lime Creek–Emery–Black Hawk– Hazleton, (5) LaCrosse–N. Madison–Cardinal & Dubuque Co– Spring Green–Cardinal, (6) Ellendale–Big Stone, (7) Adair–Ottumwa, (8) Adair–Palmyra Tap, (9) Palmyra Tap–Quincy–Merdosia–Ipava & Meredosia–Pawnee, (10) Pawnee–Pana, (11) Pana–Mt. Zion–Kansas–Sugar Creek, (12) Reynolds–Burr Oak–Hiple, (13) Michigan Thumb Loop Expansion, (14) Reynolds–Greentown, (15) Pleasant Prairie–Zion Energy Center, (16) Fargo-Galesburg–Oak Grove, (17) Sidney–Rising.

Economics: US wind PPA prices compared to wholesale power prices in selected markets ($/MWh)



- Prices for wind power purchase agreements (PPAs) have fallen dramatically as levelized costs declined. According to interviews with project developers, projects secured PPAs as low as $19/MWh in SPP in 2016. For comparison, data reported to the Federal Energy Regulatory Commission indicate that the average offtake price for contracts signed in 2011 was $47/MWh.
- The top regions for utility PPAs are high wind-speed regions with low development costs like SPP, MISO and ERCOT. An ERCOT price range is not included in the chart above due to insufficient data; however, the region offers some of the lowest levelized costs for wind in the US, with projects in West and North Texas boasting costs as low as those in SPP.
- 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 into 2016, with an additional 1.5GW contracted.

Source: Bloomberg New Energy Finance, SEC filings, interviews, analyst estimates Notes: *ERCOT PPA information is missing due to insufficient data. MISO is the Midwest region; PJM is the Mid-Atlantic region; SPP is the Southwest Power Pool, covering the central southern US; NEPOOL is the New England region; ERCOT is most of Texas. Wholesale power price is average of quarterly future power prices (based on Bloomberg Commodity Fair Value curve) maturing in calendar year 2016 for selected nodes within the region.

Deployment: US announced and commissioned energy storage projects, as of December 2016 (MW)

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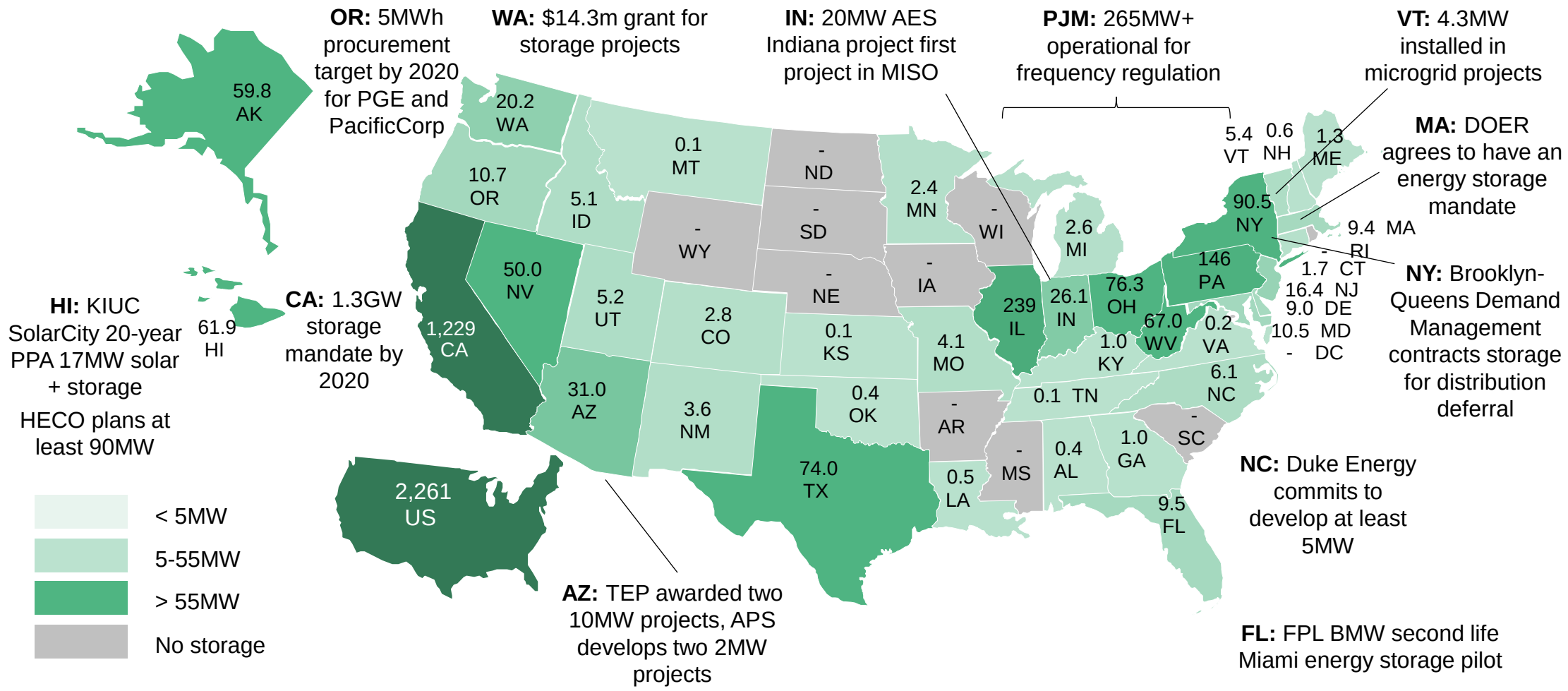

OR: 5MWh procurement target by 2020 for PGE and PacificCorp

WA: $14.3m grant for storage projects

IN: 20MW AES Indiana project first project in MISO

PJM: 265MW+ operational for frequency regulation

VT: 4.3MW installed in microgrid projects

MA: DOER agrees to have an energy storage mandate

NY: Brooklyn-Queens Demand Management contracts storage for distribution deferral

HI: KIUC SolarCity 20-year PPA 17MW solar + storage

HECO plans at least 90MW

CA: 1.3GW storage mandate by 2020

AZ: TEP awarded two 10MW projects, APS develops two 2MW projects

NC: Duke Energy commits to develop at least 5MW

FL: FPL BMW second life Miami energy storage pilot

Source: Bloomberg New Energy Finance Note: Does not include underground compressed air energy storage, pumped hydro, or lead-acid batteries for non-grid applications; minimum threshold for projects is either 100kW or 100kWh, includes projects announced up through December 2016. Note that the whole Alevo's 200MW project with Customized Energy Solutions is not included because its exact locations are not yet announced.

Policy: Share of total electricity consumption by US state and region, and electrical efficiency savings by state, 2015 (%)

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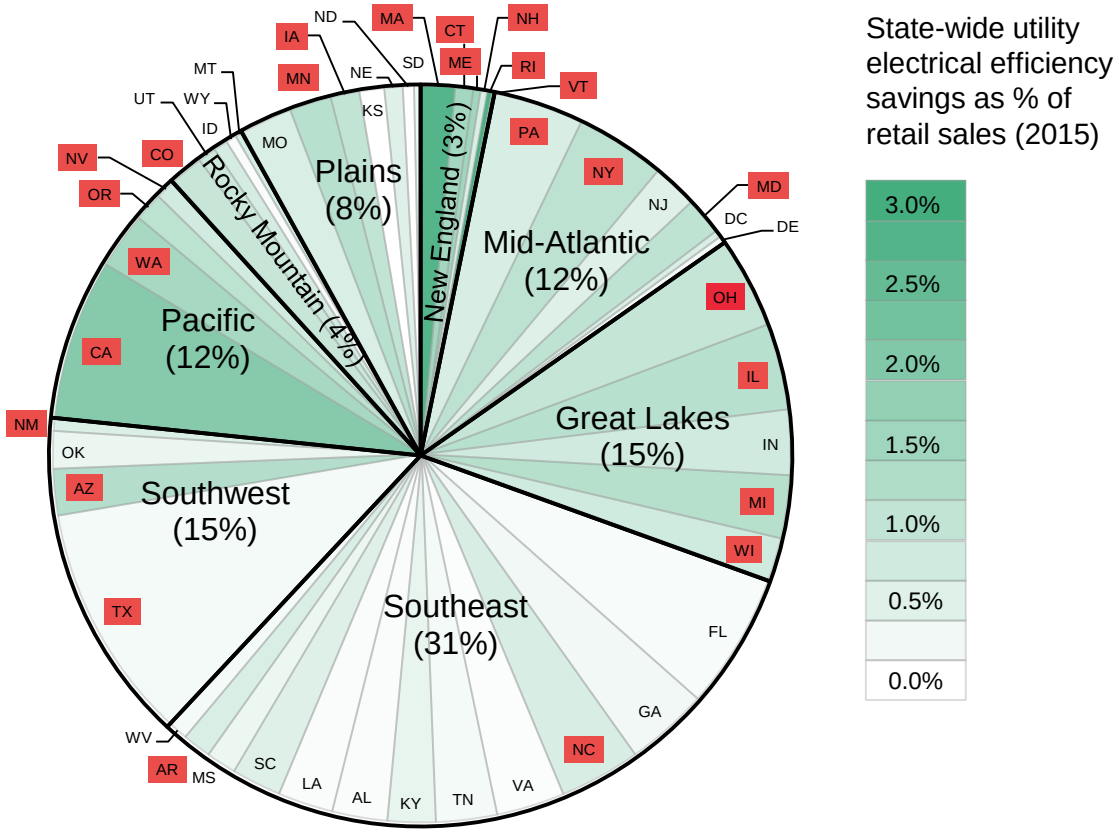
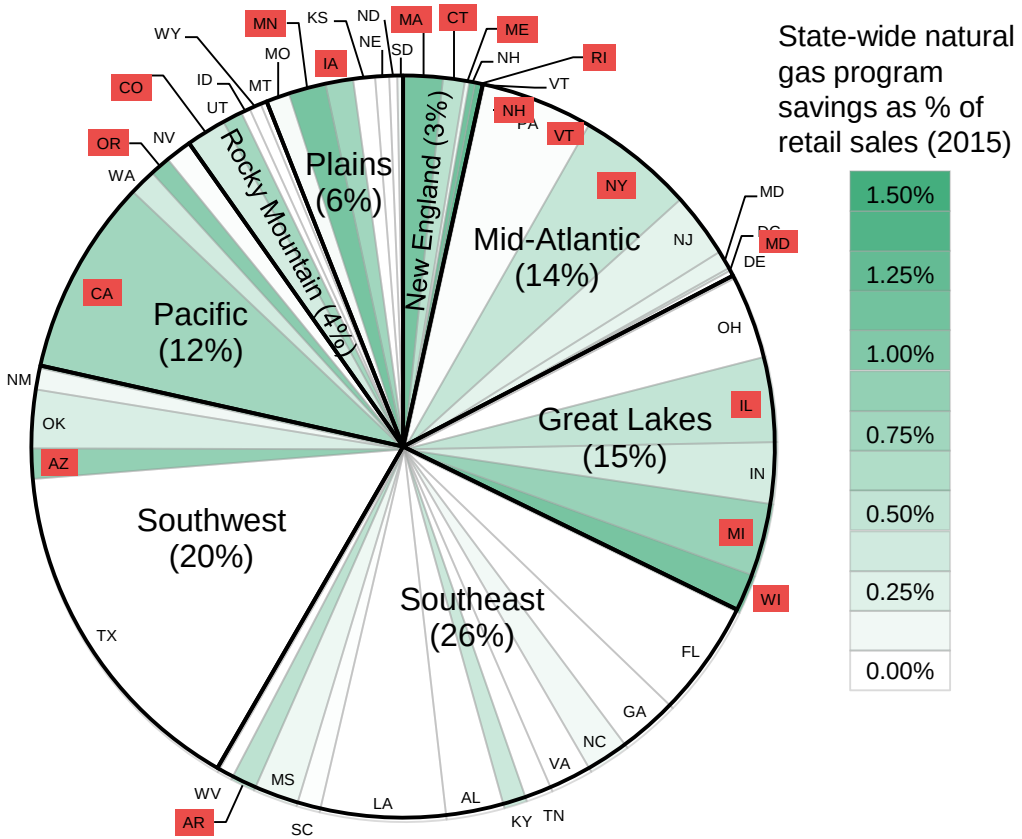


- There is some correlation between EERS policies (states highlighted in red) and energy efficiency savings. States with EERS have a higher rate of savings than their neighbors. However, regional trends dominate: a state with EERS in a region with low savings (e.g. NC, AR) tends to have a lower saving rate than states that without EERS in regions with higher savings rates.
- While EERS are a driver of energy efficiency, the levels of savings achieved depend on a multitude of factors, such as the stringency of savings targets established within the EERS, program participation rates, and complementary measures that incentivize utilities to meet targets, such as rate reform and performance incentives.

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 US state and region, and natural gas program savings by state, 2015 (%)

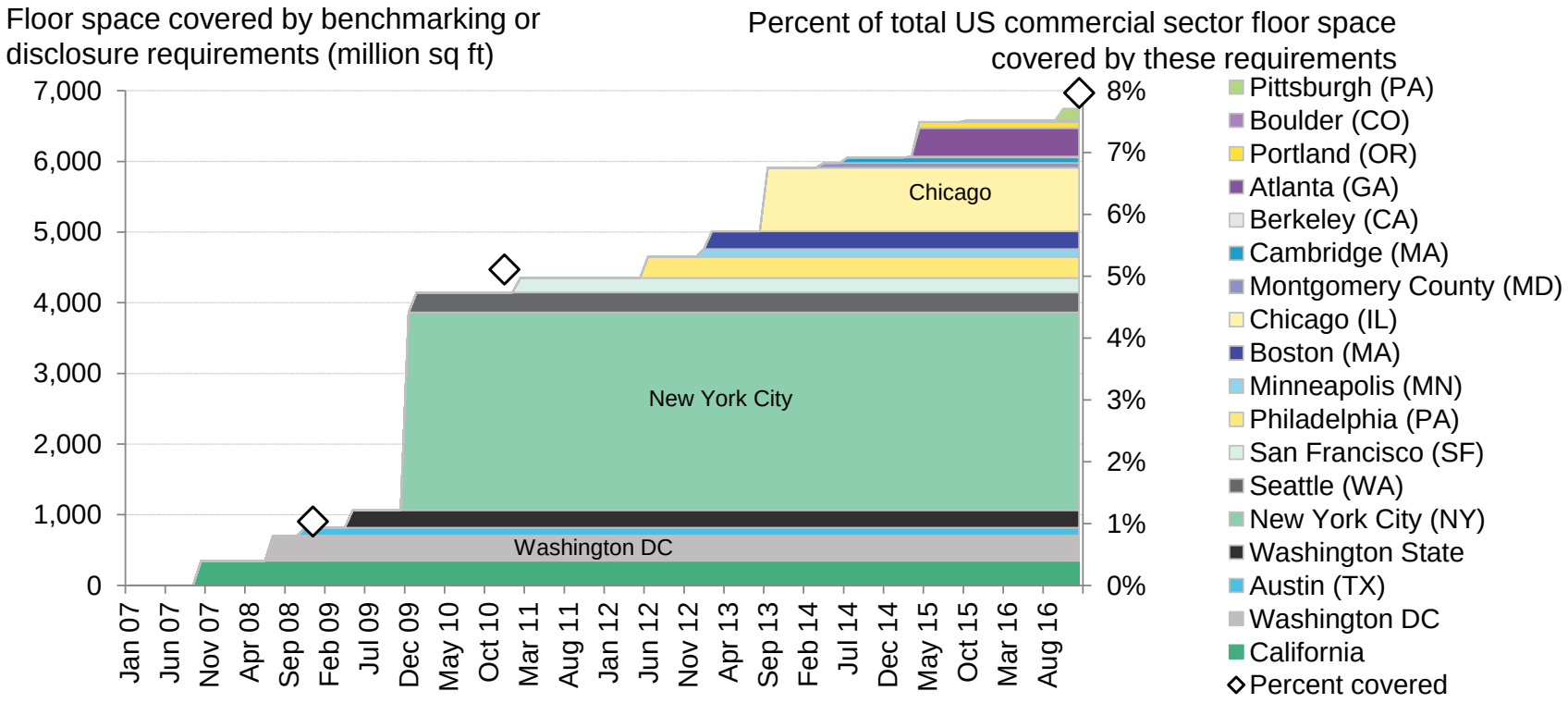


State-wide natural gas program savings as % of retail sales (2015)

- The Southeast and Southwest, which account for 46% of US gas (end-use) consumption, have the lowest levels of savings.
- Interestingly, the regional trends identified on the previous slide for electricity are less dominant. EERS policies appear more correlated with natural gas savings—states with EERS in a region with low savings (e.g. AZ, AR, KY) stand out from their neighbors, as do states with no EERS in high-savings regions (e.g. PA, OH).
- The Great Lakes' share of total natural gas consumption shrank one percentage-point between 2015 and 2016, while the Southeast's expanded by the same amount. The opposing direction of the changes in a region where EERS is popular (Great Lakes) versus a region where it is not (Southeast) suggests that efficiency programs have a material impact.

Source: ACEEE, EIA, Bloomberg New Energy Finance Notes: The shading for individual states indicates savings from utility natural gas programs as a fraction of retail sales. State codes highlighted in red indicate states with EERS requirements for natural gas utilities. Hawaii and Alaska are not depicted.

Policy: US building floor space covered under state or local building energy use benchmarking / disclosure policies



- States and cities have been creating building energy use policies, including building energy efficiency benchmarks and mandates to disclose energy consumption.
- As of the end of 2016, 6.7bn square feet of commercial floor space, or around 8% of total US commercial sector floor space, was covered by such policies. This represents an 3% uptick over the 2015 tally.
- In 2016, Pittsburgh and Portland, ME both enacted policies which will require large non-residential buildings to participate in benchmarking and transparency programs (Portland, ME not shown in graph due to lack of data). City buildings are also covered by the ordinances.

Source: Institute for Market Transformation (IMT), US DOE's Buildings Energy Data Book, Bloomberg New Energy Finance Notes: Accounts for overlap between cities and states (eg, 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 US commercial sector floor space covered. Diamonds are spaced out in irregular intervals since data for the denominator (total commercial sector floor space in the US) 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.

Policy: ACEEE state-by-state scorecard for energy efficiency policies, 2016

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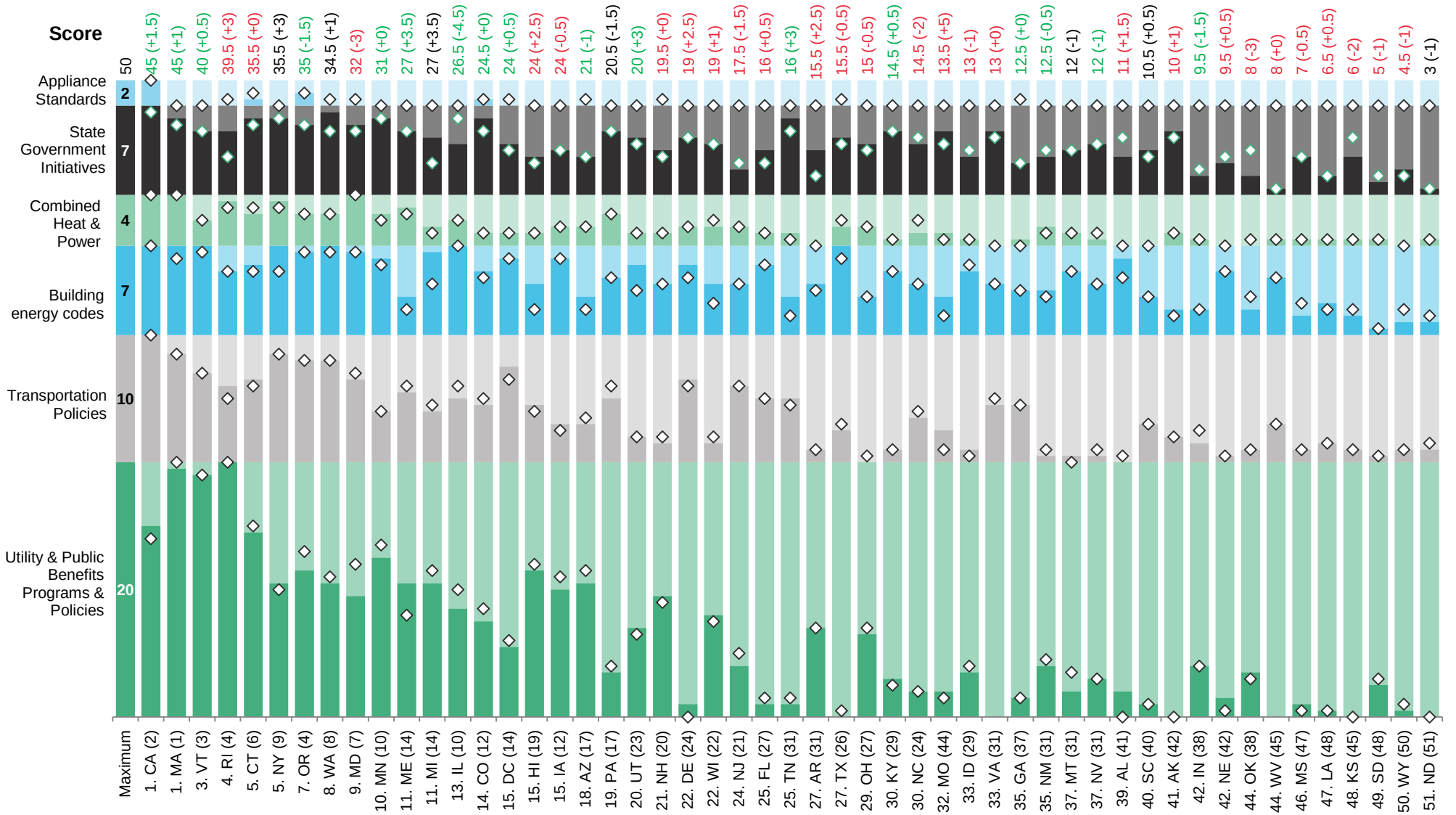
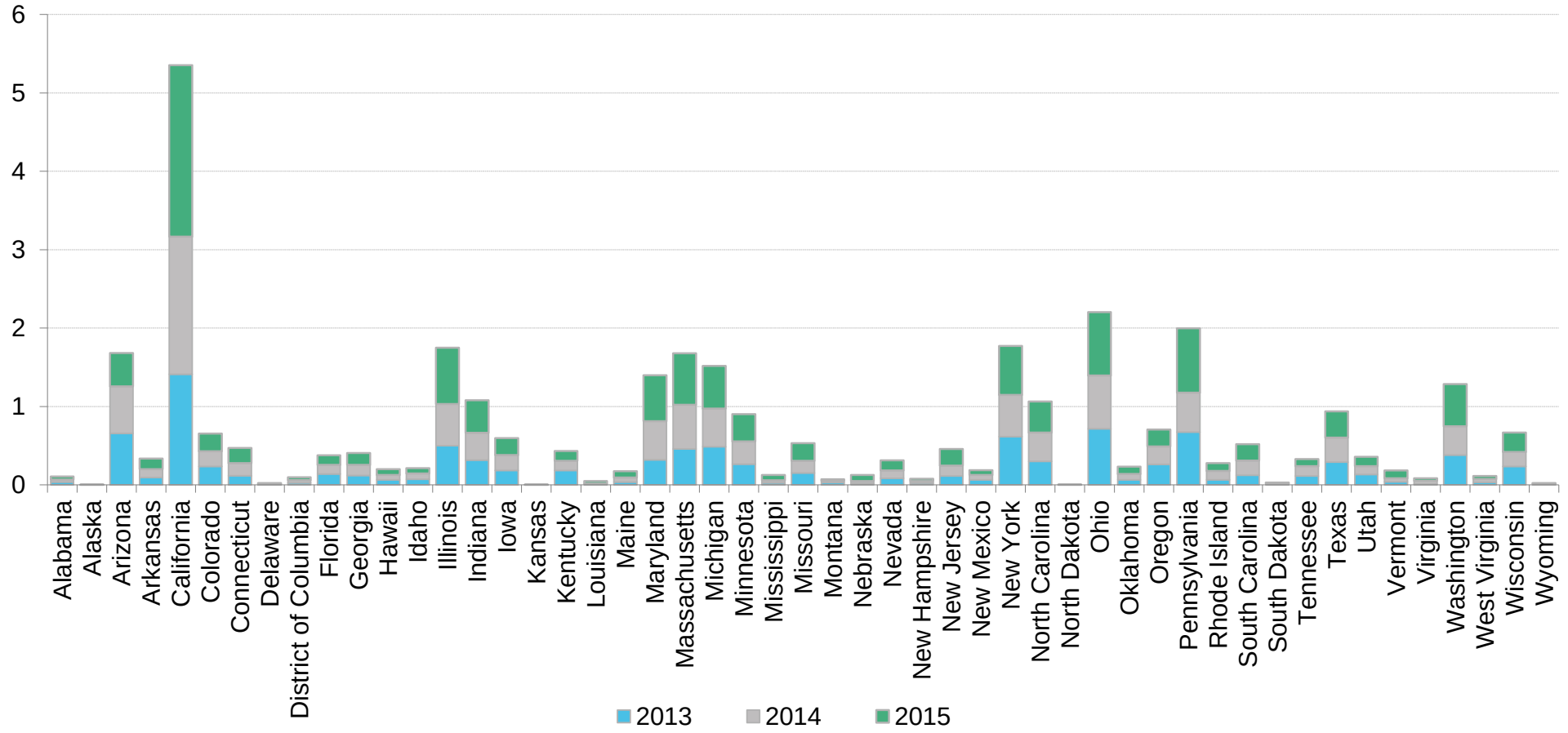


Source: ACEEE, EIA, Bloomberg New Energy Finance Notes: Numbers in parentheses at the bottom of the chart indicate 2015 ranking. Numbers in parenthesis at the top denote the change in score from 2015 levels. Diamond symbols indicate 2015 score within each category.

Deployment: GHG savings as a result of energy efficiency achievements by electric utilities to date, 2013-15 (MtCO2e)

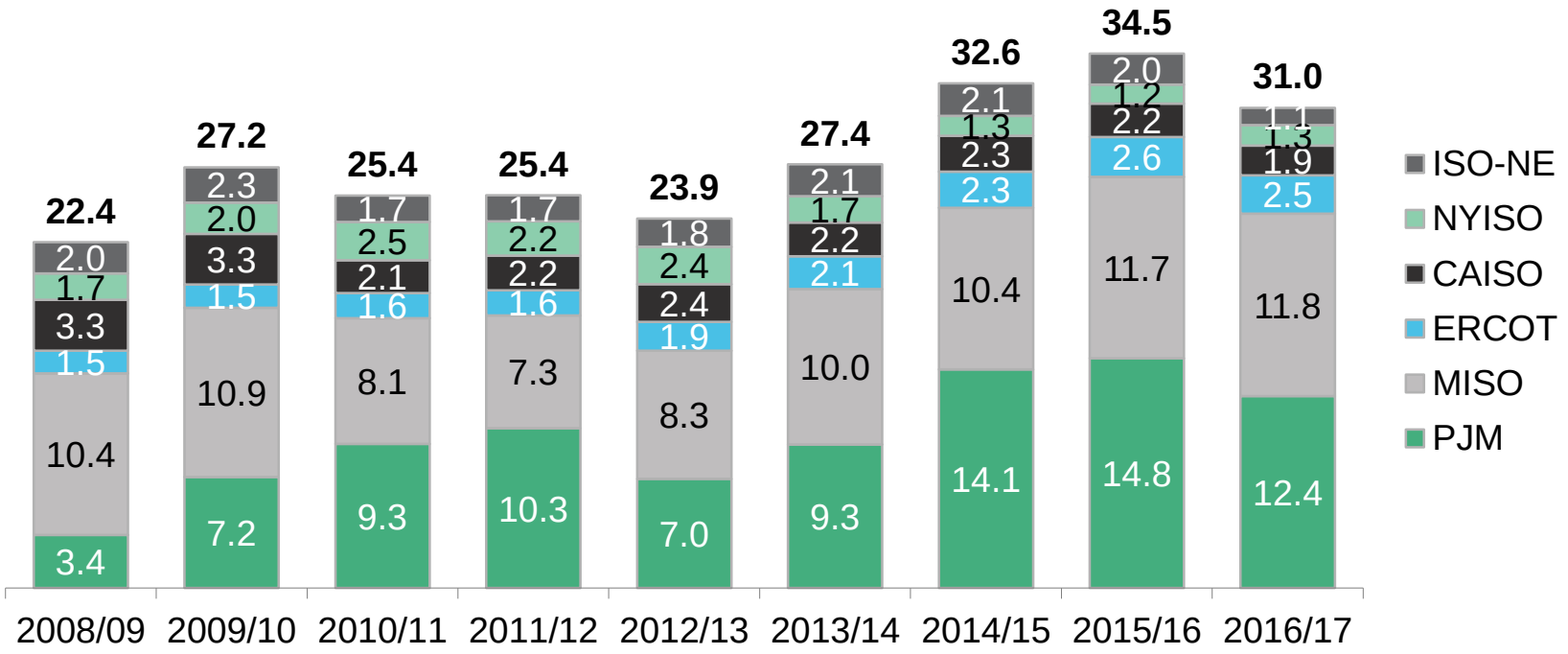


- Electric utility energy efficiency programs saved a total of 34.2MtCO2e in greenhouse gas emissions from 2013 to 2015. Nearly 16% of the savings were due to efforts made in California.
- Pennsylvania, Ohio and Illinois are the next largest savers, respectively, followed by Massachusetts and New York.

Source: Bloomberg New Energy Finance, ACEEE

Note: Uses ACEEE data on electric efficiency program savings and Bloomberg Terminal data on historical emissions factors. Emissions factors are calculated assuming that the displaced consumption would have been generated by the marginal natural gas combined-cycle unit; data on historical power and natural gas prices are used to calculate an implied heat rate for the marginal unit.

Deployment: Incentive-based demand response capacity by US ISO/RTO (GW), 2008/09–15/16



- Over 40% of US wholesale demand response (DR) is within the PJM capacity market – the largest opportunity for DR worldwide. 2015/16 represents a peak year as new rules introduced by PJM have limited the role of DR within the market. Volumes have subsequently declined in the three-year ahead auction; in the May 2016 auction, DR secured only 10.3GW.
- The bulk of MISO's DR capacity is emergency resources that are not directly dispatchable but operated through utility programs. CAISO's capacity is also administered by utilities but includes a large share of real-time and day-ahead dispatchable capacity.
- The resolution of FERC 745 has brought a measure of stability to the DR industry. Across the US, ISO/RTOs are exploring reforms and mechanisms that will increase the penetration of DR and aggregated distributed energy resources within their markets.

Source: Bloomberg New Energy Finance; ISO/RTOs

Notes: Capacity shown by delivery years which run June through May.

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