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EVENT

DATE, 2017

GET THE FACTS: http://www.bcse.org/sustainableenergyfactbook #Factbook

About the BCSE

- The Business Council for Sustainable Energy (BCSE) is a coalition of companies and trade associations from the energy efficiency, natural gas and renewable energy sectors.

- The Council advocates for policies at state, national and international levels that:
  - increase the use of commercially-available clean energy technologies, products and services
  - support an affordable, reliable power system
  - reduce air pollution & greenhouse gas emissions

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2017

Sustainable Energy in America

FACTBOOK

Understanding the U.S. Energy Transformation

Clean energy wins for America by lowering costs, spurring economic growth and fostering job creation.

The 2017 edition of the Sustainable Energy in America Factbook – produced for the Business Council for Sustainable Energy by Bloomberg New Energy Finance, provides up-to-date, accurate market information about the broad range of industries — energy efficiency, natural gas and renewable energy— that are contributing to the country's move towards cleaner energy production and more efficient energy usage.

Get the 2017 Factbook

See State Spotlight

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THE SUSTAINABLE ENERGY TRANSFORMATION

Renewable energy is **22%** of the U.S. 2016 power fleet, with 244 GW of installed capacity across the country, an **83%** increase over 2007 levels.

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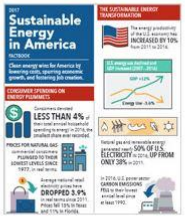
Infographic



Get the Facts

- In 2016, consumers devoted less than 4% of their total annual household spending to energy, the smallest share ever recorded.
- American energy productivity has increased by 10% from 2011 to 2016.
- Natural gas and renewable energy generated 50% of U.S. electricity in 2016, up from 38% in 2011.
- Renewable energy is a prominent part (22%) of the U.S. 2016 power fleet, with 244GW installed capacity across the country, a 83% increase over 2007 levels.

Executive Summary

Industry Focus: Energy Efficiency, Natural Gas, Renewable Energy

Quick Facts On: Alternative Fuel Vehicles, Biomass/ Waste-to-Energy, Carbon Capture & Storage, Combined Heat & Power, Fuel Cells, Hydropower

State Spotlight

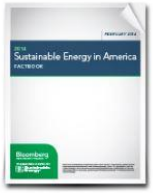
Learn about clean energy in the following states:

- Minnesota
- Nevada
- Pennsylvania
- Virginia
- See 2017 Factbook State & Regional Slides

Previous Factbook Editions

Download previous editions of the Factbook here.

2014



2015

2016

View the 2013 edition of the Factbook

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The Business Council for Sustainable Energy (BCSE) is a coalition of companies and trade associations from the energy efficiency, natural gas and renewable energy sectors. The Council membership also includes independent electric power producers, investor-owned utilities, public power, commercial end-users and project developers and service providers for energy and environmental markets.

For more information please contact Laura Tierney of BCSE at 202-785-0507

2017

Sustainable Energy in America

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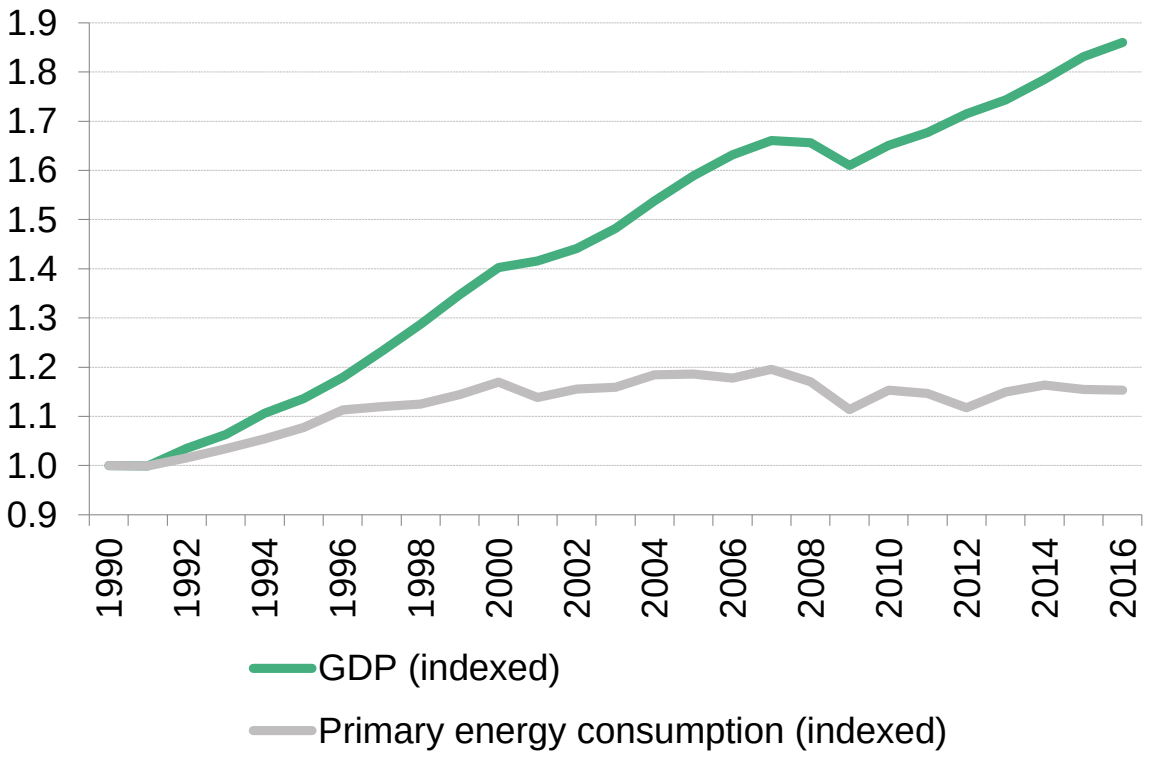
Highlights

- **2016 saw a number of new landmarks in US energy:**
  - GDP grew 1.6%, while energy consumption fell 0.2%
  - Record solar PV build (12.5GW)
  - The US became a natural gas net exporter
- **Sustainable energy is the new normal:**
  - 92% of power generating capacity built in the past 25 years is renewable or natural gas
  - Natural gas has displaced coal as the largest source of power
  - Renewables provided 15% of power, up from 8% in 2007
  - Power-sector emissions 24% below 2005 levels, economy-wide down 12%
- **Meanwhile, energy prices are low and falling:**
  - Wind and solar costs have fallen dramatically and are competitive with gas and coal in many regions of the country
  - Consumers are dedicating less of household spending to electricity, natural gas, and overall energy than any other time on record

US energy overview:
The economy is more energy productive than ever

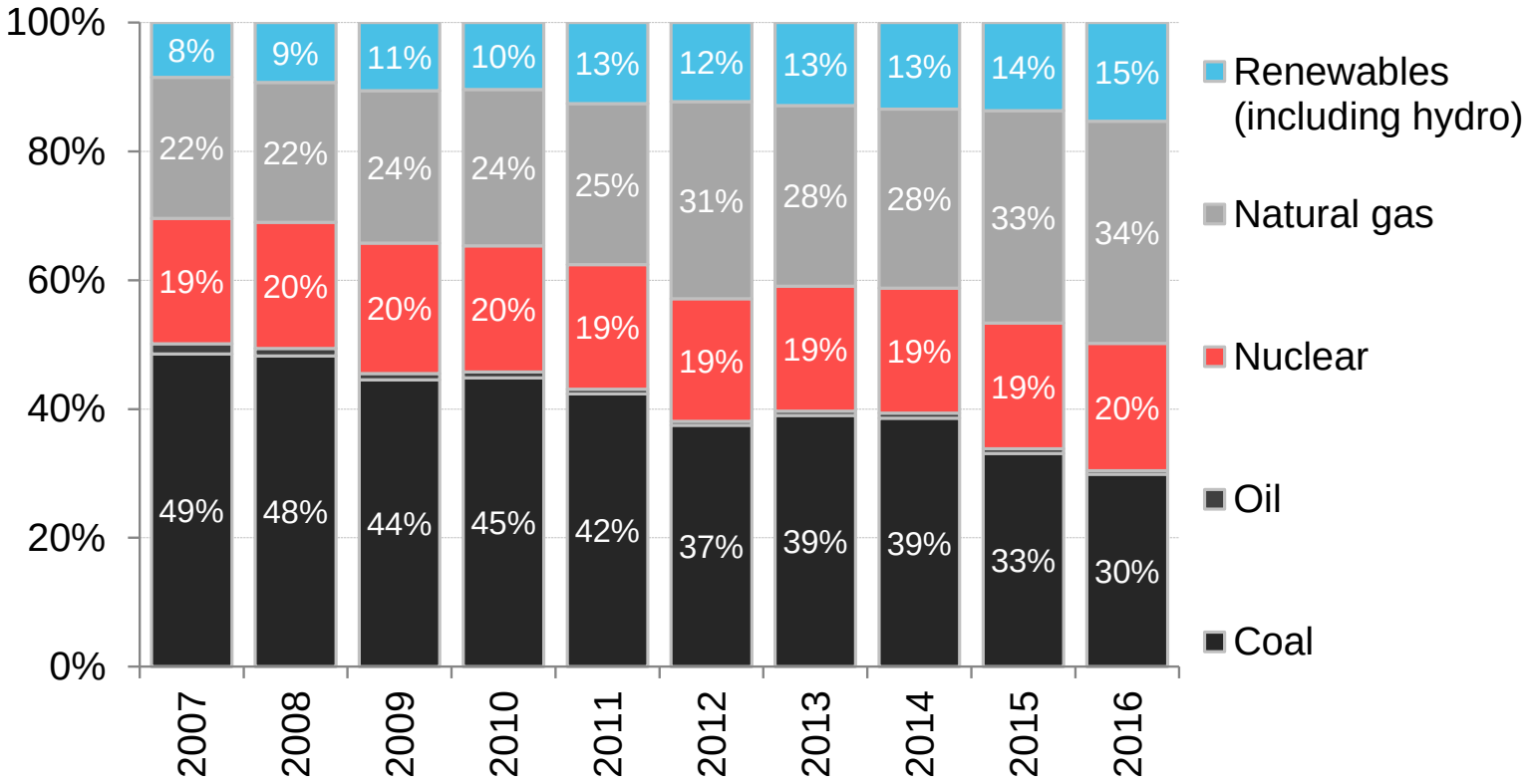


- Energy productivity continues to rise: in 2016, GDP rose 1.6% while total primary energy consumption fell by 0.2%.

Source: US Energy Information Administration (EIA), Bureau of Economic Analysis, Bloomberg Terminal

Notes: Values for 2016 energy consumption are projected, accounting for seasonality, based on latest monthly values from EIA (data available through October 2016). GDP is real and chained (2009 dollars); annual growth rate for GDP for 2016 is based on consensus of economic forecasts gathered on the Bloomberg Terminal as of January 2017.

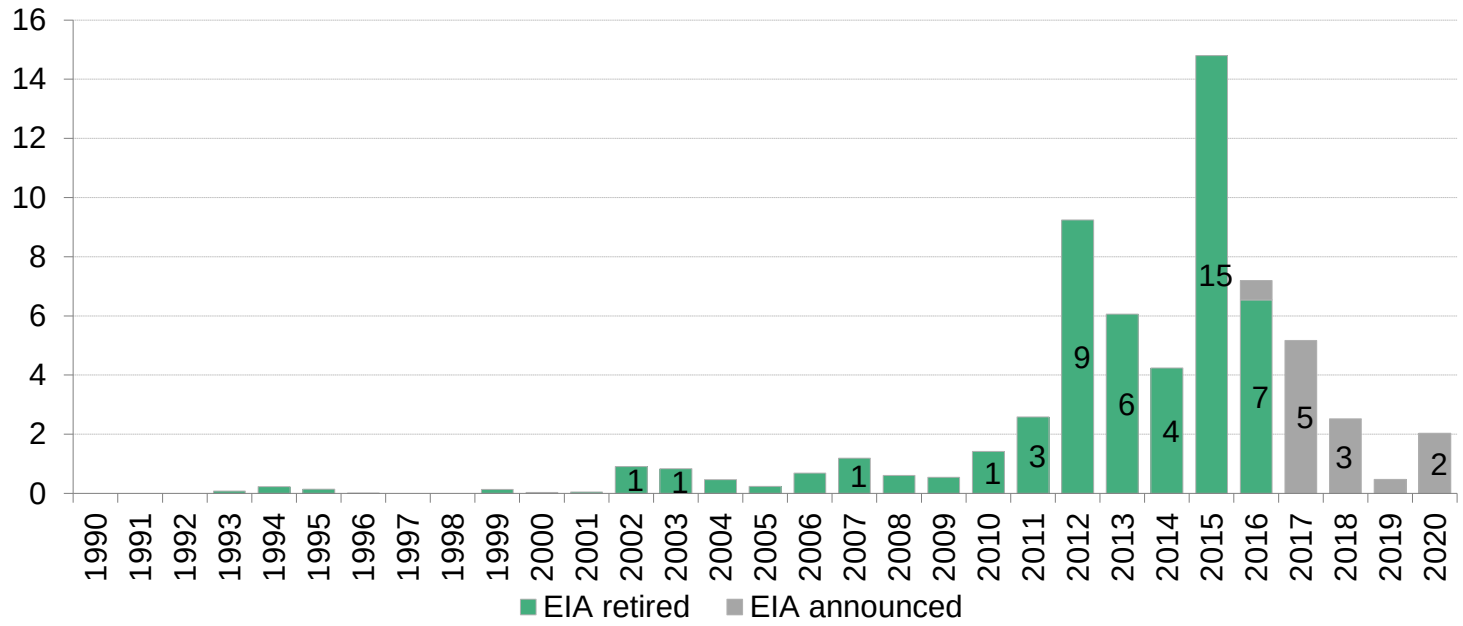
US energy overview:
Electricity generation mix



- Natural gas has eclipsed coal as the largest contributor to the US electricity mix, hitting 34% in 2016. Coal sank to second place, providing 30% of the mix – its lowest share on record.
- Since 2007: coal's share plummeted from 49% to 30%, while natural gas's grew from 22% to 34% and renewables from 8% to 15%.

Source: EIA Notes: Values for 2016 are projected, accounting for seasonality, based on latest monthly values from EIA (data available through November 2016). In chart at left, contribution from 'Other' is not shown; the amount is minimal and consists of miscellaneous technologies including hydrogen and non-renewable waste. The hydropower portion of 'Renewables' includes negative generation from pumped storage.

Deployment: US coal power plant retirements completed and announced by year (GW)

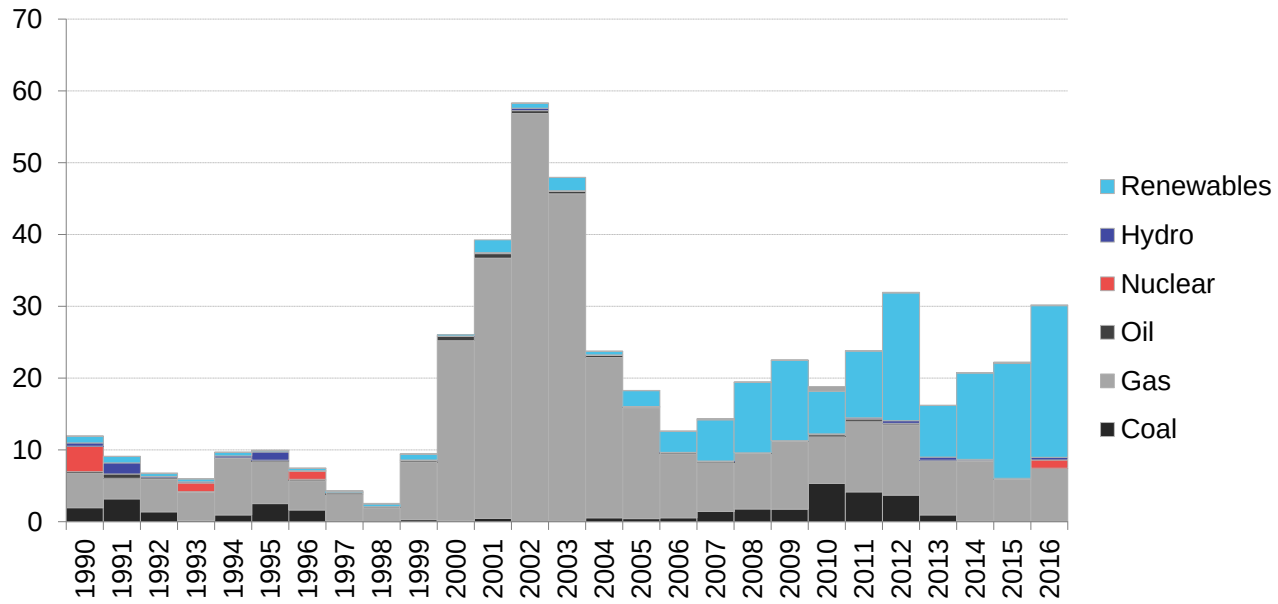


- 2016 saw another 7.2GW of coal-fired power plants drop offline, after 2015 marked the largest single year of coal retirements ever (at just under 15GW). Since 2011, the coal fleet has shrunk 12% from its peak size of 308GW.
- This does not account for coal plants that are mothballed or on standby – ie, not generating.

Source: Bloomberg New Energy Finance, EIA

Notes: 'Retirements' does not include conversions from coal to natural gas or biomass; includes retirements or announced retirements reported to the EIA through end-November 2016.

Electric generating capacity build by fuel type (GW)



- Last five years: 62% of new capacity additions have been renewable energy projects.
- Last 25 years: 92% has been natural gas plants or renewable energy projects.
- In 2016, renewables added 22GW of capacity, or roughly 70% of total build for the second straight year. Gas build totaled 7.4GW, and for the first time since the 1990s, there was also nuclear build of 1.1GW.

Source: EIA, Bloomberg New Energy Finance Note: All values are shown in AC except solar, which is included as DC capacity. “Renewables” here does not include hydro, which is shown separately. Last year’s Factbook included anticipated nuclear build; however, the Watts Bar reactor was in fact turned on in 2016; accordingly, the nuclear build is shown here in 2016.

Renewable energy generation by technology

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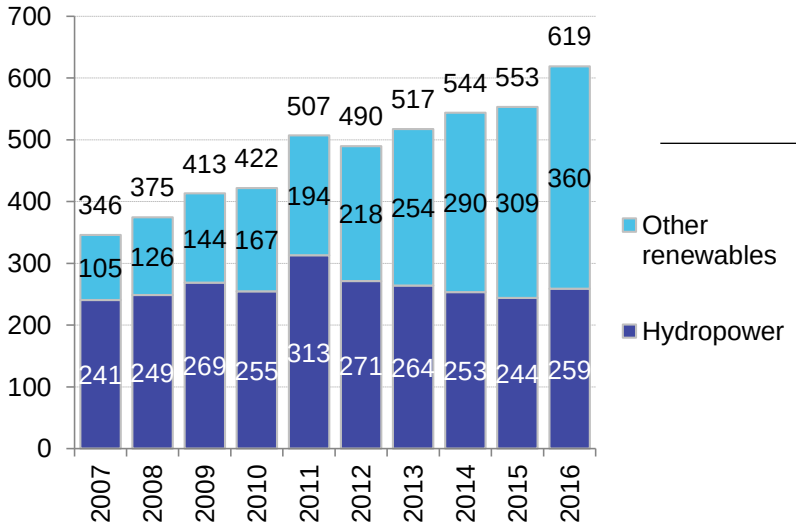
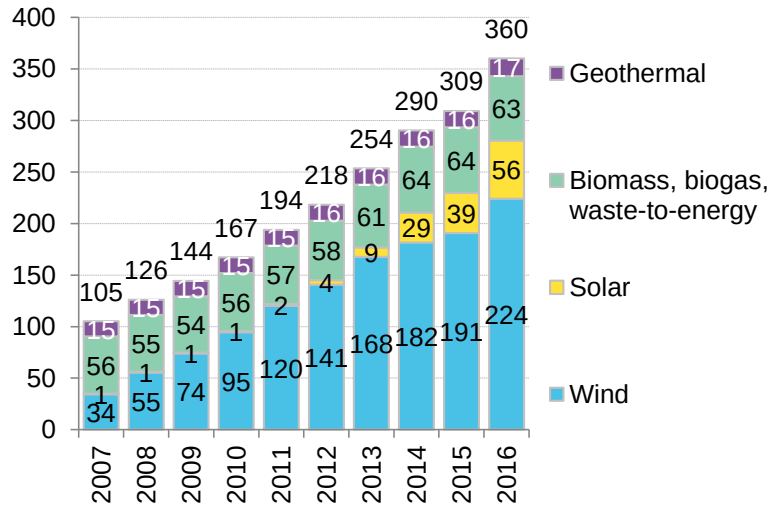
US renewable generation by technology (including hydropower) (TWh)



US non-hydropower renewable generation by technology (TWh)

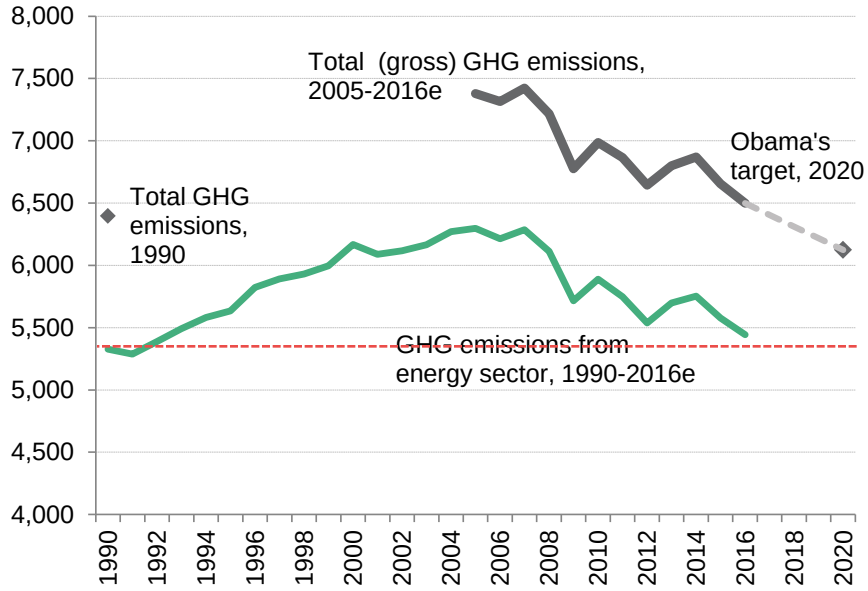


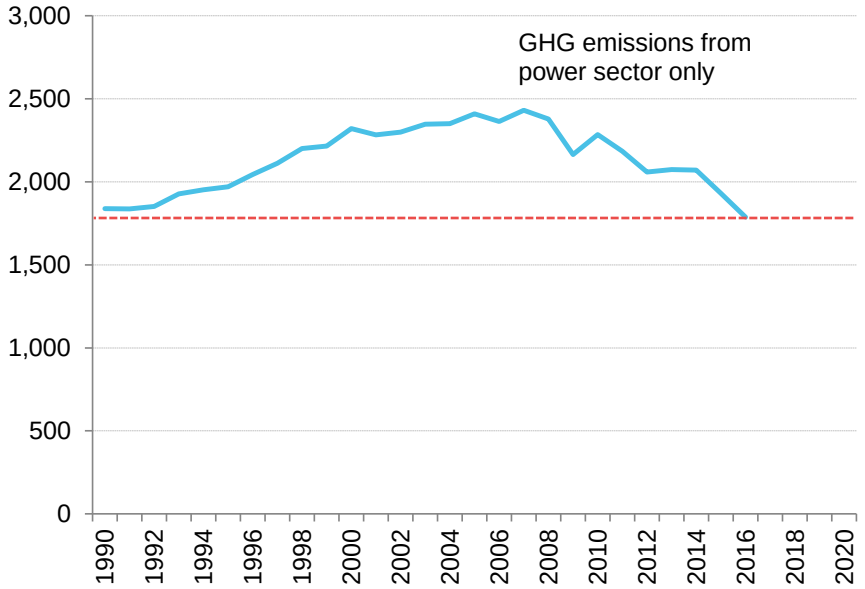
- Renewable generation surged in 2016, increasing 12% over 2015 levels. Hydropower remains the largest single source of renewable generation (42%), but wind (36%) is catching up quickly.
- Non-hydro renewable generation has more than tripled over the past ten years.

Source: Bloomberg New Energy Finance, EIA

Notes: Values for 2016 are projected, accounting for seasonality, based on latest monthly values from EIA (data available through November 2016). Includes net energy consumption by pumped hydropower storage facilities. Totals may not sum due to rounding. Beginning in 2014, numbers include estimated generation from distributed solar; generation from other distributed resources is not included.

Greenhouse gas emissions, power sector, energy sector and economy-wide (MtCO2e)





- US GHG emissions are at their lowest levels in 25 years, falling to an estimated 6.5GtCO2e in 2016, 12% below 2005 levels.
- In 2016, power-sector emissions shrank 5.3% year on year, bringing them to 24.1% below 2005 levels.

Source: Bloomberg New Energy Finance, EIA, EPA

Notes: 'Sinks' refer to forests and green areas which absorb carbon dioxide. Values may differ from last year's, due to recalculations and revisions published by the EPA, primarily to methane emissions. Values for 2016 are projected, accounting for seasonality, based on latest monthly values from EIA (data available through October 2016). 'Obama's target' refers to a pledge made in Copenhagen climate talks in 2009. The target shown here assumes 17% reduction by 2020 on 2005 levels of total GHG emissions, but the actual language of the announcement left vague whether the reductions applied to economy-wide emissions or just emissions of certain sectors. Data for total GHG emissions comes from EPA's Inventory of US Greenhouse Gas Emissions and Sinks (1990-2014), published April 2016. Data for CO2 emissions from the energy sector comes from the EIA's Monthly Energy Review.

Falling costs for consumers

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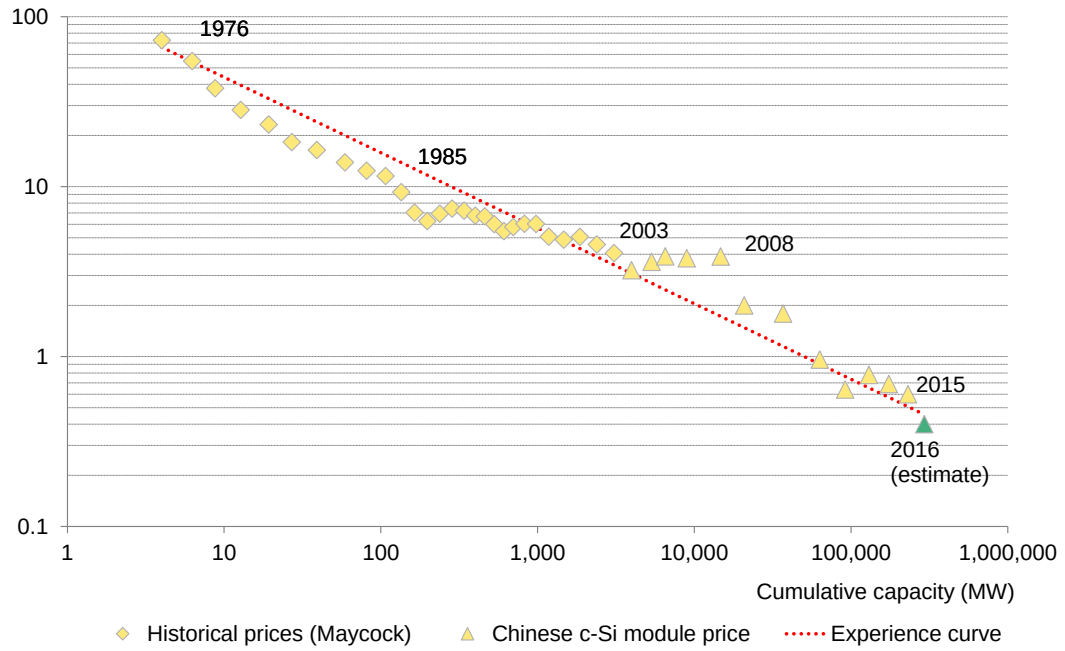
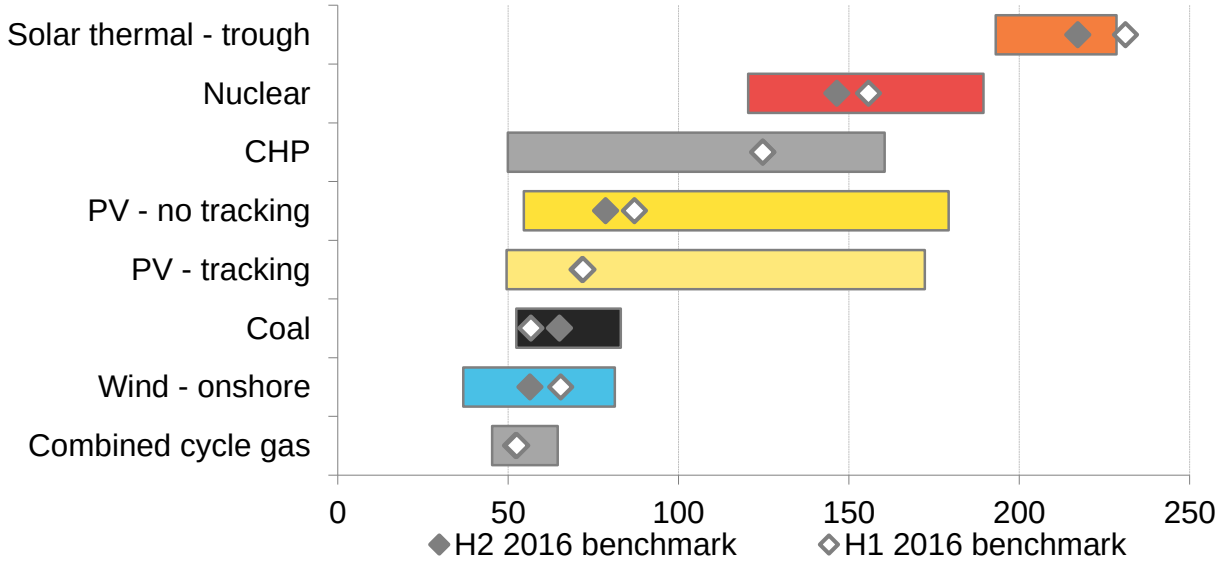
Economics: Price of solar modules and experience curve (2015$/W as function of global cumulative capacity)



- PV module prices have fallen 26.5%, on average, for every doubling of installed capacity
- At the end of 2016, the global average module price was $0.41/W, down 90% from 2008 levels ($3.88/W).
- Global oversupply will likely depress prices further in 2017.

Source: Bloomberg New Energy Finance, Paul Maycock Notes: The precise learning rate depends on the end-point chosen, but we believe $0.41/W to be slightly below the experience curve at the end of 2016. Figures in real 2015 dollars.

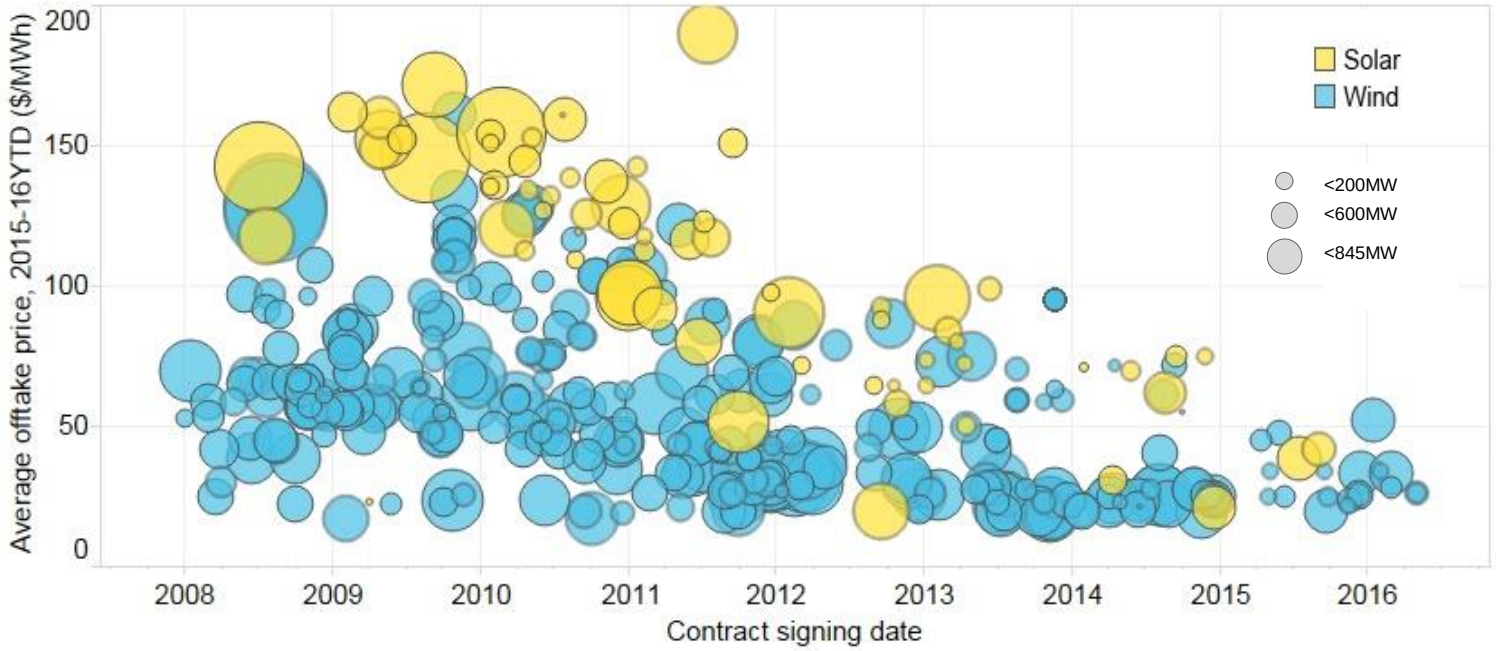
Economics: US levelized cost of electricity (*unsubsidized* across power generation technologies, H2 2016 ($/MWh)



- On a levelized cost basis, renewables are competitive with coal and natural gas-fired power.
- The *unsubsidized* LCOE for wind came in as low as $37/MWh in Texas, the cheapest of all technologies assessed. Solar PV can be built for as low as $50/MWh, again in Texas and the Southwest.
- Natural gas is cheaper to build than coal across most of the country.

Source: Bloomberg New Energy Finance, EIA

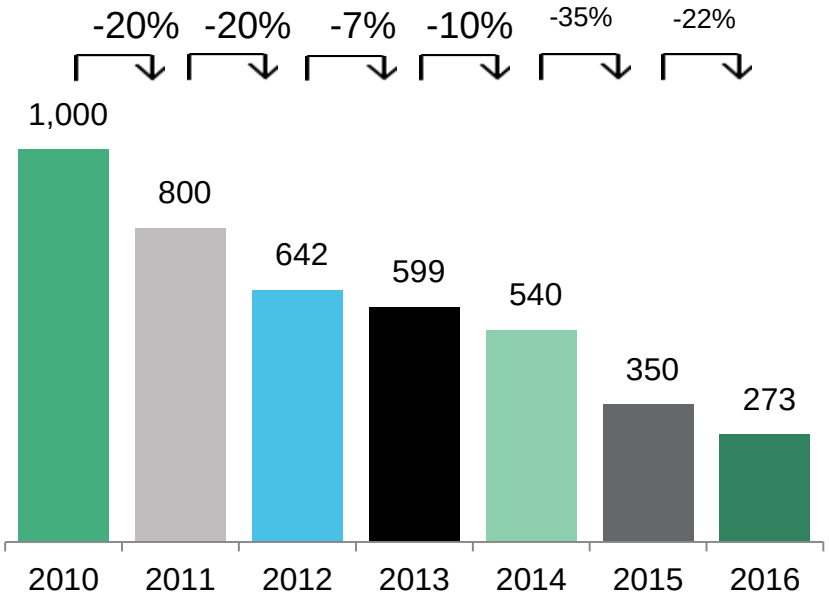
Economics: Average 2015-H1 2016 offtake prices for wind and solar PPAs by signing date ($/MWh)



- Lower levelized costs translate into lower offtake prices: prices paid for solar and wind have fallen dramatically since 2008-2010.

Source: Bloomberg New Energy Finance, FERC EQR

Economics: Lithium-ion battery pack prices, 2010-2016 ($/kWh)



- The costs of energy storage are also declining, with lithium-ion battery prices down 73% since 2010.
- Falling costs for battery packs are making battery electric vehicles competitive with traditional combustion engines, when accounting for purchasing incentives.

Source: Bloomberg New Energy Finance

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

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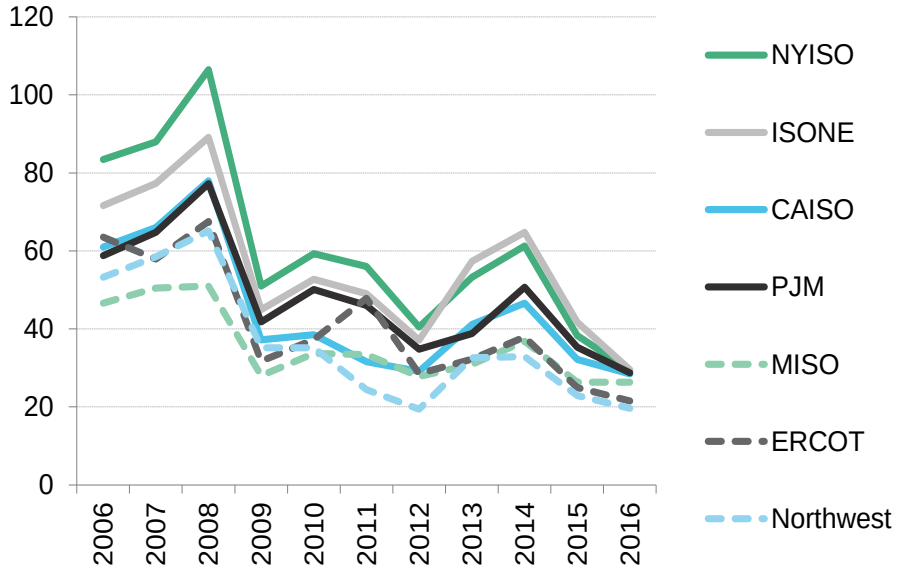
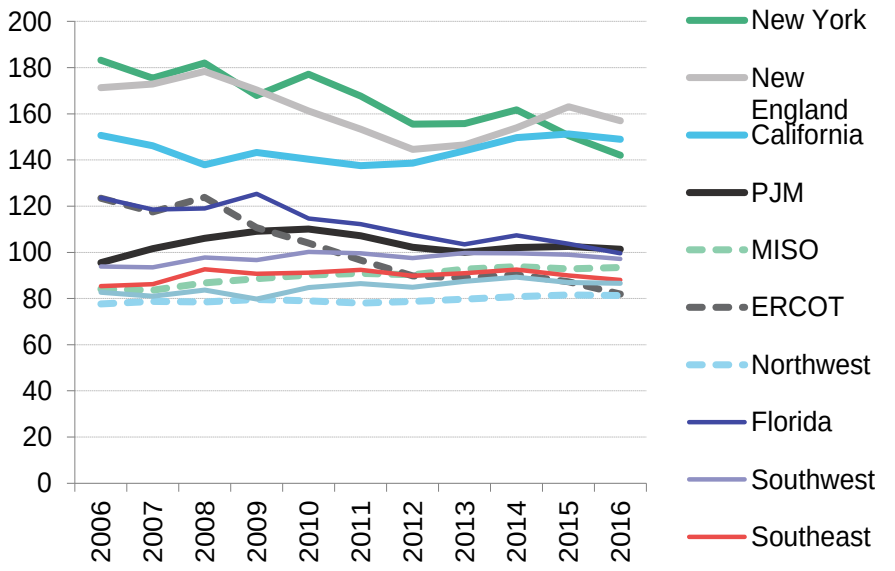
Wholesale power prices (2016 $/MWh)



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.

Energy as share of total US personal consumption expenditure

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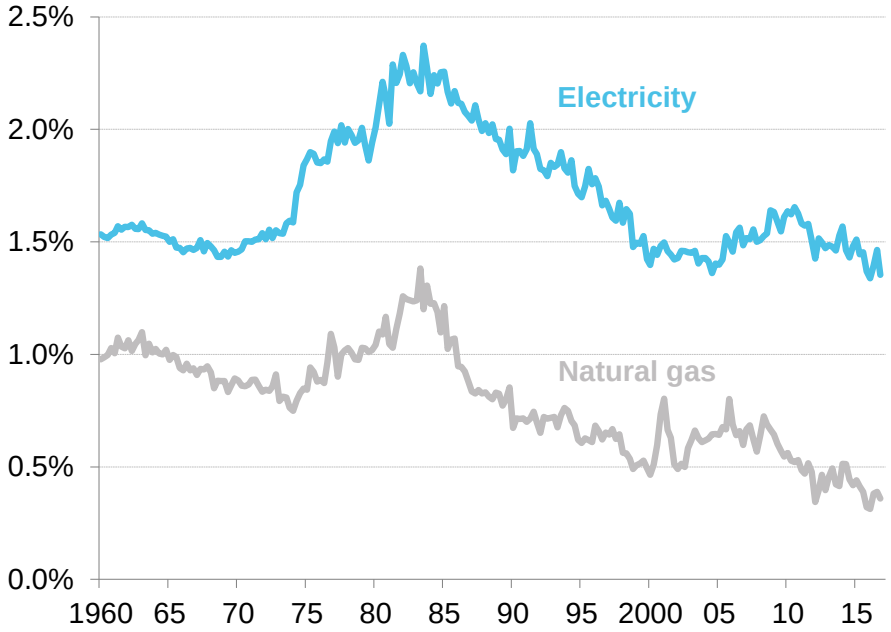
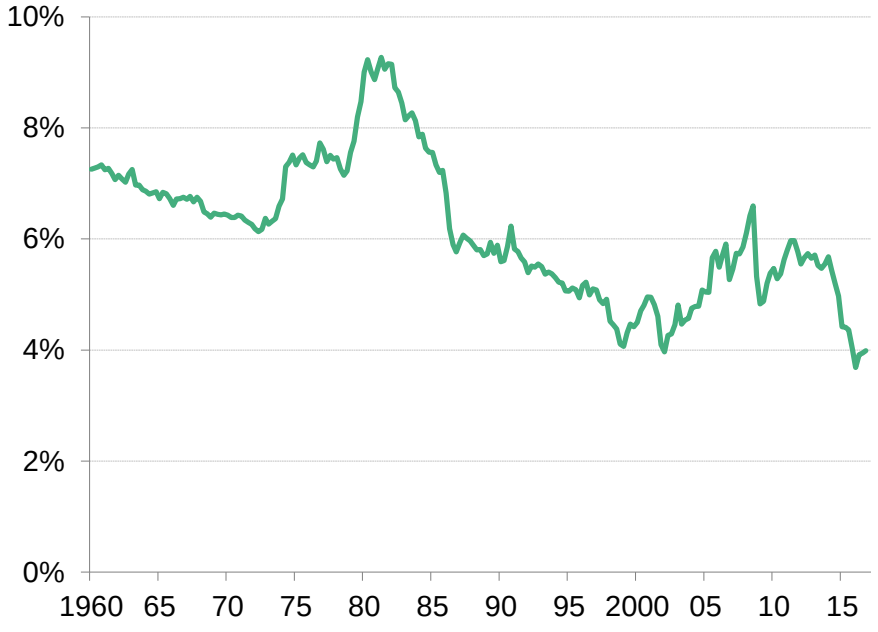
Electricity and natural gas as a share of total consumption expenditure



Total energy goods and services as a share of total consumption expenditure



- Americans are dedicating less of their household spending to energy than at any other time on record: energy consumption as a share of total consumption expenditures averaged 3.9% in 2016, the first year in which this measure came in below 4% since at least 1959.
- Consumption costs for natural gas and electricity reflect a similar trend: natural gas represented under 0.4% of total spending, and electricity came in at 1.4%, both the lowest totals on record.

Source: Bureau of Economic Analysis, Bloomberg New Energy Finance Notes: Values for the fourth quarter of 2016 are preliminary.

Global context

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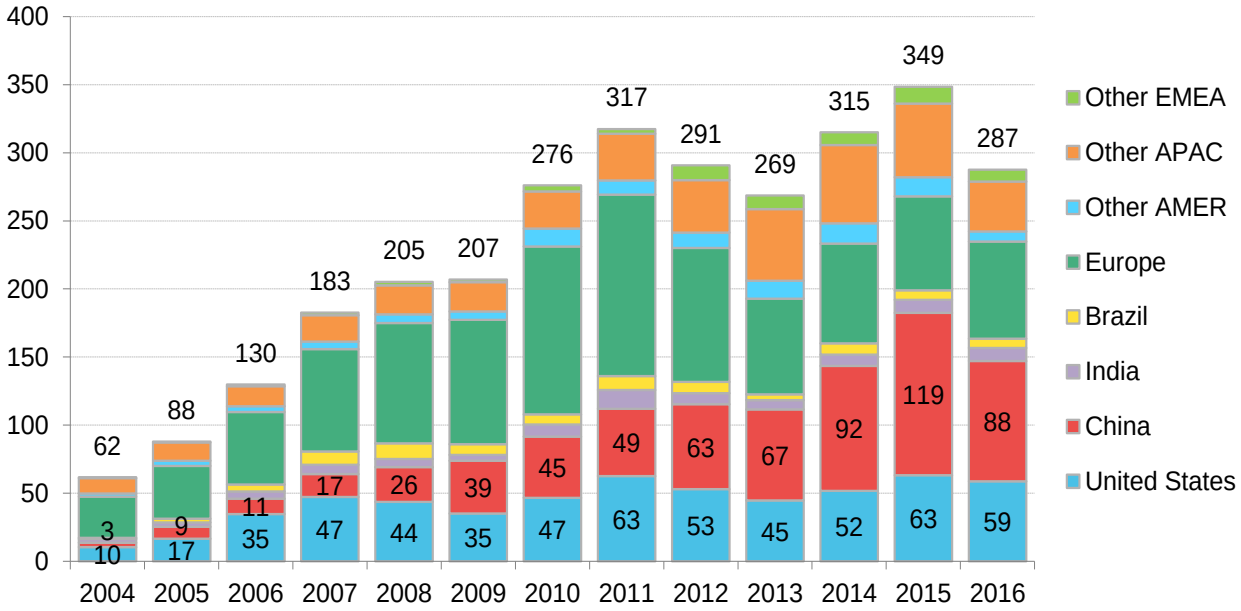
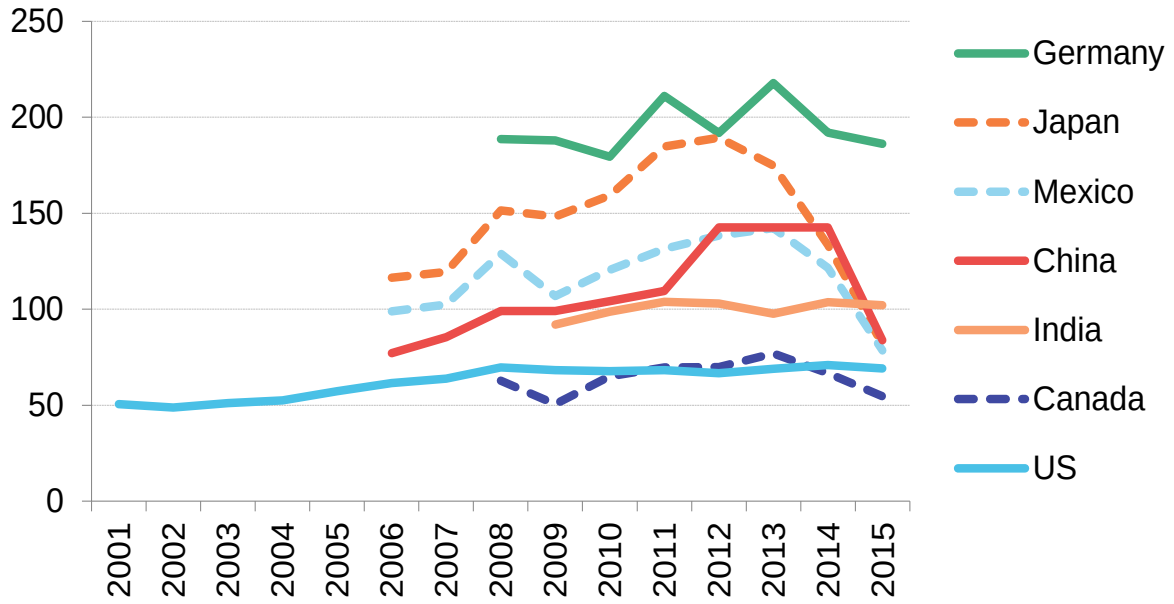
Global context: Total new investment in clean energy by country or region ($bn)



- Total global new investment in clean energy ebbed 18% in 2016 to $287.5bn, after hitting a record high of $348.5bn in 2015. The dropoff partly reflects steep declines in equipment prices, especially for solar PV.
- The most significant retreat in absolute terms occurred in China, where investment shrank $31bn (-26%) from 2015 levels. China is stepping back from building new utility-scale renewables and instead taking time to integrate existing renewable capacity. Investment stayed roughly the same in India while falling $17bn (32%) in the rest of APAC.
- In the US, investment fell 7% to $59bn, after an exceptional 2015. For details, please see section 2.2.
- European clean energy investments climbed by $2.4bn (+3%) in 2016.

Source: Bloomberg New Energy Finance Notes: For definition of clean energy, see slide in Section 2.2 of this report titled “Finance: US clean energy investment (1 of 2) – total new investment, all asset classes ($bn)” . AMER is Americas; APAC is Asia-Pacific; EMEA is Europe, Middle East, and Africa. Investment figures are nominal.

Global context: Energy prices – average electricity rates for the industrial sector by country ($/MWh)



- The US – and North America in general – has among the lowest costs of electricity in the world for industrial customers (6.91¢/kWh for the US industrial sector in 2015, according to the EIA).
- Regions in the US with the lowest costs of power include the Midwest, Southwest and Northwest.
- The steep power price declines in Japan, Mexico and China in 2015 are to a large extent due to the depreciation of their currencies against the US dollar. Similarly, the weakening of the Indian rupee over the past year has limited the extent of India's power price increase when represented in USD (as the chart above does).

Source: Bloomberg New Energy Finance, government sources (EIA for the US)

Notes: Prices are averages (and in most cases, weighted averages) across all regions within the country.

Corporate action

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Finance: Corporate procurement of clean energy

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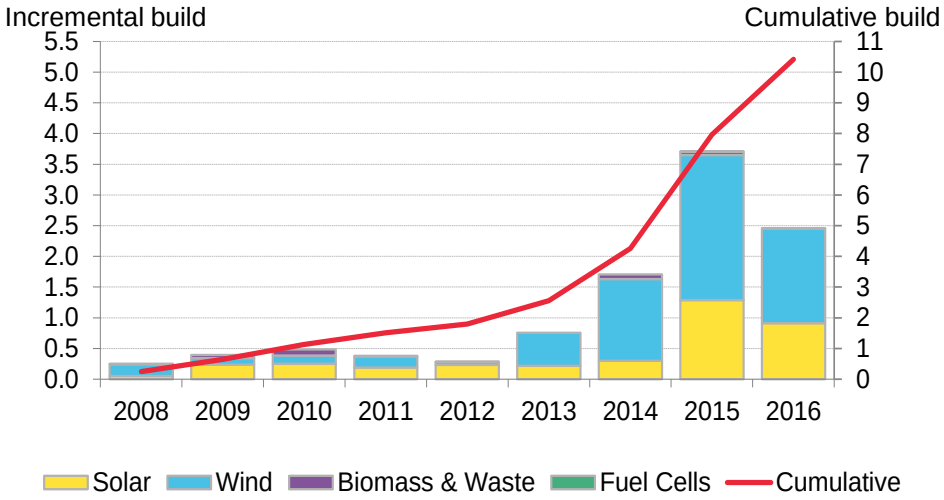
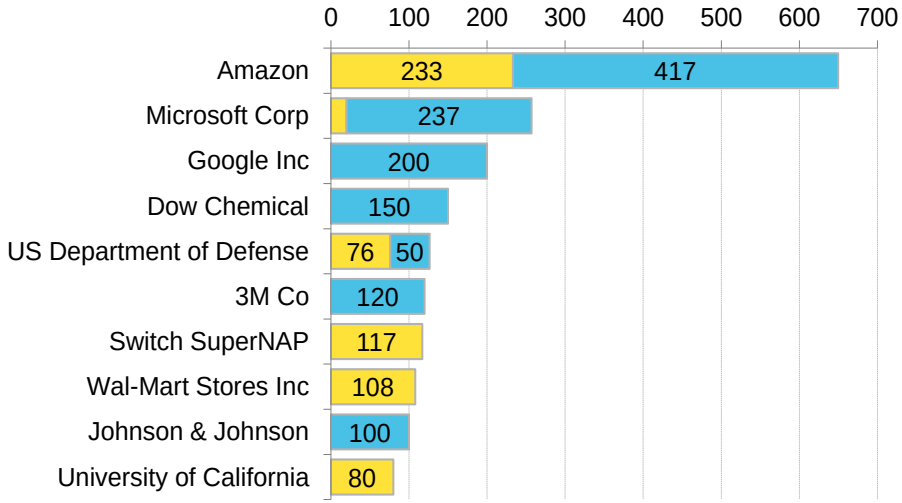
Renewable capacity contracted by corporations, by technology, 2008-16 (MW)



Largest corporate offtakers, 2016 (MW)



- Corporate PPA volumes fell to 2.5GW in 2016, from the 2015 record of 3.7GW. The extension of the ITC and PTC relieved the pressure for offtakers and developers to finalize deals, which was one of the major factors driving high activity in 2015.
- Low power prices also continue to undermine the economic incentives for corporates to sign long-term virtual PPAs. But ERCOT and SPP have emerged as hotspots for corporates signing such contracts, since wind costs are lower in these regions.
- Corporate sustainability remains a key driver of activity in the space.
- Amazon signed PPAs for 0.65GW of clean energy in 2016, more than double the amount of the second largest company, Microsoft. Amazon's 228MW PPA with Lincoln Clean Energy for the Amazon Wind Farm Texas was the largest signed in 2016 and brings Amazon's cumulative US deals to 1.2GW. Companies like Google (1.9GW signed in total), Microsoft (0.5GW) and Wal-Mart (0.5GW) also continue to lead in this space.
- Green tariff programs have emerged as a common way for corporates to buy clean energy in regulated utility service territories.

Source: Bloomberg New Energy Finance, company announcements

Finance: Corporate procurement of clean energy

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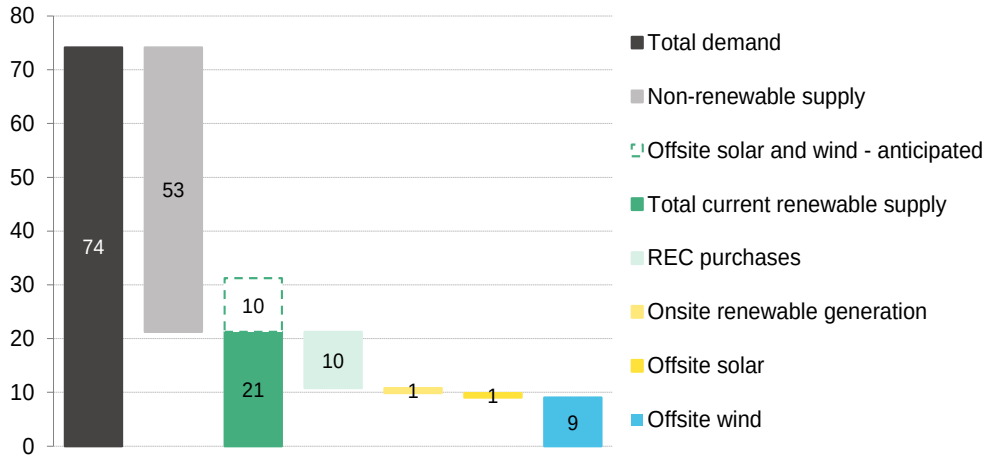
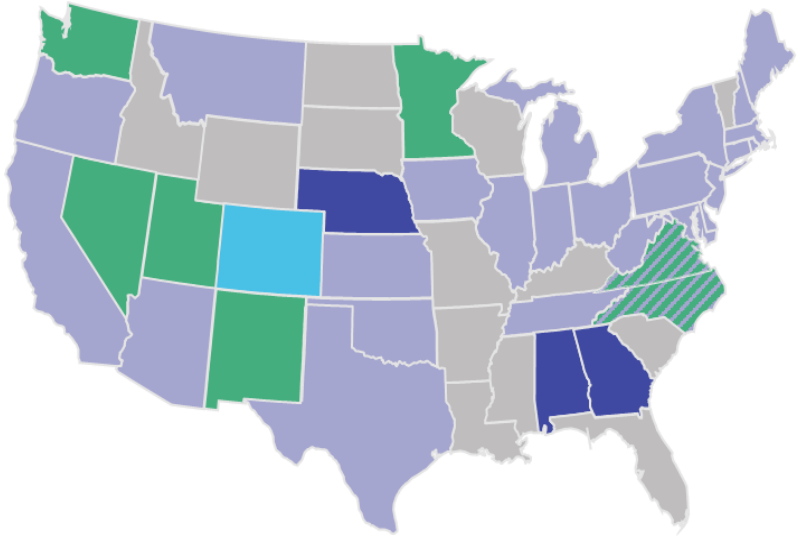
Global and US electricity supply and demand fundamentals of 50 'first-movers', 2016 (TWh)



How corporates procure clean energy, by state



- 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

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.

Finance: Corporate procurement of clean energy and energy efficiency

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Key players: corporate clean energy procurement

Key players: corporate energy efficiency

- Corporate clean energy procurement has continued to gain momentum. 83 companies have pledged to source 100% of their energy consumption from renewables by signing onto the “RE100” initiative. Notable signees include Apple, BMW, HP, Johnson & Johnson, Kingspan, and P&G. Google also announced in 2016 that it is on track to meet this milestone by 2017.
- Corporations are also increasingly taking action on energy efficiency, with more companies adopting ISO 50001, an energy management systems standard for reducing costs and carbon emissions. The US Department of Energy Superior Energy Performance program, which certifies facilities that have implemented the ISO 50001 standard, continued to expand in 2016: new buildings certified include multiple facilities from Schneider Electric and 3M, and the JW Marriott in Washington, DC. In addition, the new “EP100”, an initiative where companies pledge to double their energy productivity, launched in early 2016. Member companies include Johnson Controls and Swiss Re.

Source: Bloomberg New Energy Finance, company announcements, DOE. Note: The key corporate energy efficiency players displayed here are drawn from EP100 members and the list of ISO 50001 certified facilities. ISO 50001 certification means that a company has met established efficiency standards at one or more of its facilities.

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