

# Synapse Electricity Snapshot 2017

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A review of the U.S. electric system through December 2016

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Today's electric system looks remarkably different from how it looked ten—or even five—years ago.

- Renewable capacity now exceeds 100 gigawatts (GW) and exceeds both hydro and nuclear capacity. Renewables are now the third-largest resource on a capacity basis, behind natural gas and coal. Together, non-CO<sub>2</sub>-emitting generating capacity makes up 27 percent of the nationwide total and accounts for one-third of all generation.
- Retirement of old and uneconomic coal plants has led to the lowest level of coal capacity since 1983.
- Natural gas generation surpassed coal generation for the 10 out of the 12 months of 2016 and exceeded annual coal generation for the first time in U.S. history.

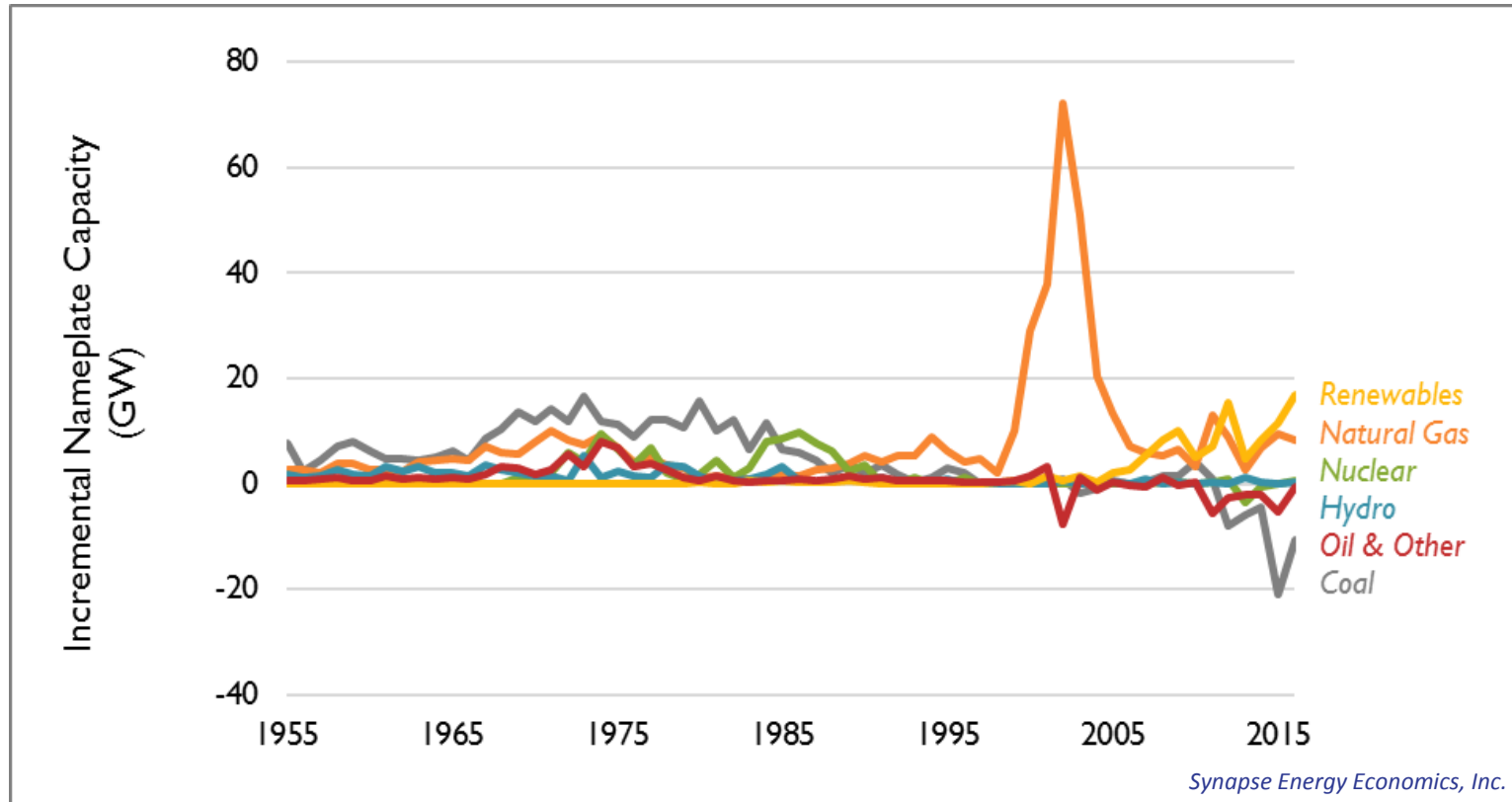
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- Since 2007, annual growth in electric retail sales has averaged -0.1 percent per year.
- Since hitting an all-time peak in 2007, electric sector CO<sub>2</sub> emissions have declined to 1,808 million metric tons in 2016, their lowest level since 1992.
- Since 1990, the total economic value produced for every metric ton of CO<sub>2</sub> emitted has increased by 85 percent from \$5,500 to \$10,300.

***All values in this document are based on preliminary 2016 data and are subject to updates.***

# Coal capacity continues to plummet below 1980s levels

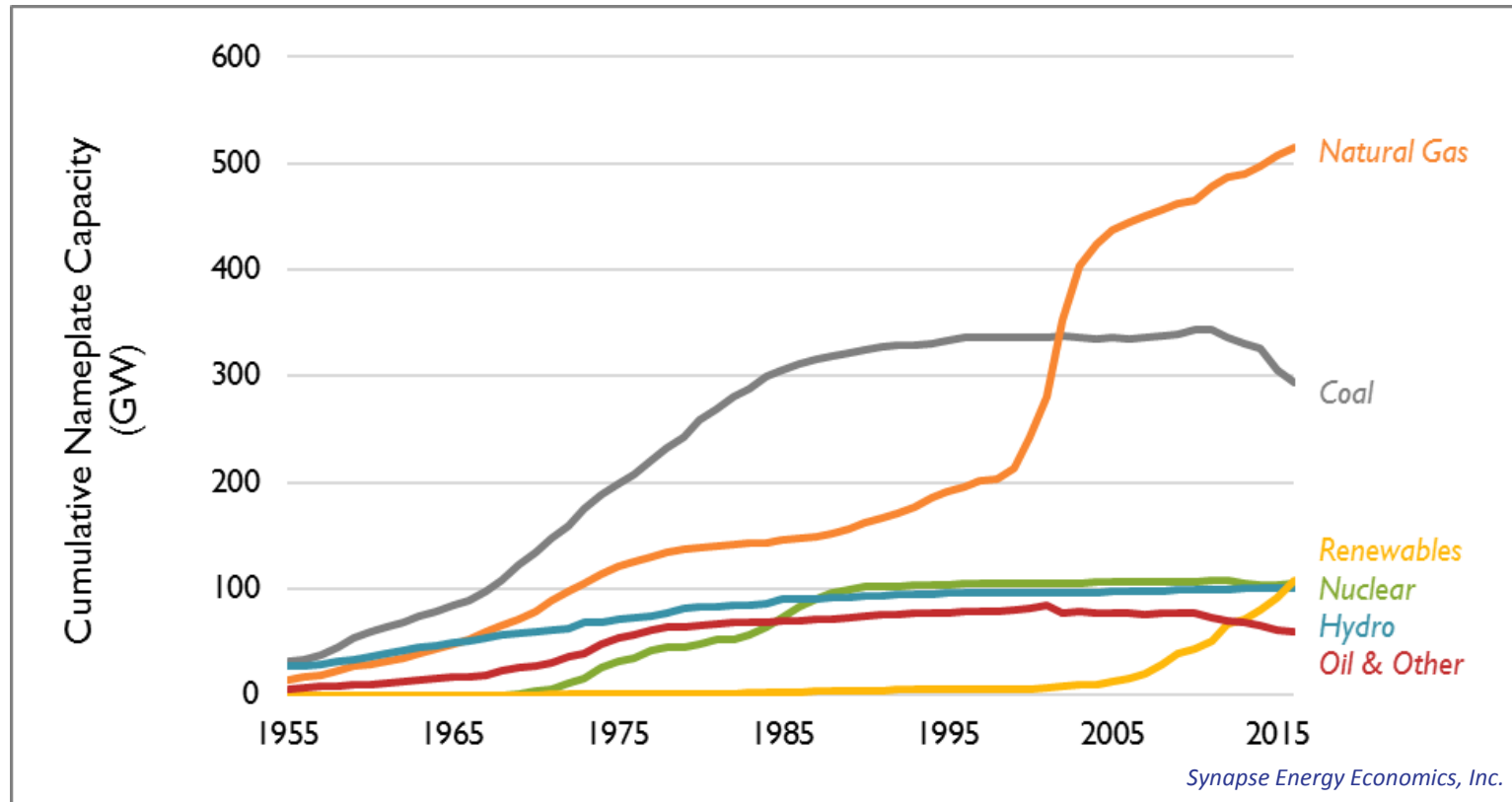


*Note: This figure displays net nameplate values for utility-scale generators; annual capacity retirements are subtracted from annual capacity additions.*

*In this and all other figures, "Renewables" contains wind, solar, geothermal, and storage. "Oil and Other" contains oil, biomass, and other misc. fuel types.*

While coal capacity and oil capacity are in decline, renewable and natural gas capacity grow every year. More renewable capacity was added in 2016 than in any prior year.

# Renewable energy capacity now surpasses both hydroelectric and nuclear capacity



*Note: This figure displays net nameplate values for utility-scale generators; annual capacity retirements are subtracted from annual capacity additions.*

In 2016, renewable resources reached 9 percent of total U.S. generating capacity. In the ten years since 2007, renewables have increased by 88 GW, compared to a 65 GW increase in natural gas over the same period. 42 GW of coal retired over these ten years.

# More new net capacity came from renewables than from any other resource—including natural gas

	Installed		Retired		Net (installed less retired)	
	2015	2016	2015	2016	2015	2016
Coal	0.0	0.1	16.6	7.9	-16.6	-7.9
Natural Gas	6.6	9.7	5.9	4.8	0.7	4.8
Nuclear	-	1.3	-	0.5	0.0	0.8
Hydro	0.1	0.4	0.1	0.1	0.0	0.3
Renewables	11.7	16.7	0.5	0.0	11.3	16.7
<i>Geothermal</i>	0.0	-	0.0	0.0	0.1	0.0
<i>Storage</i>	0.1	0.2	0.0	-	0.1	0.2
<i>Solar</i>	3.3	7.8	0.0	-	3.3	7.8
<i>Wind</i>	8.2	8.8	0.4	0.0	7.8	8.7
Oil and Other	0.3	0.1	1.7	0.6	-1.3	-0.4
<i>Biomass</i>	0.1	0.0	0.2	0.1	0.0	-0.1
<i>Oil</i>	0.0	0.0	1.4	0.4	-1.2	-0.4
<i>MSW</i>	0.1	0.0	0.1	0.0	0.0	0.0
<i>Other</i>	0.0	0.0	-	-	0.0	0.0
<b>Total</b>	<b>18.8</b>	<b>28.2</b>	<b>24.7</b>	<b>14.0</b>	<b>-5.9</b>	<b>14.3</b>

In 2016, the majority of renewable net capacity additions came from wind at 8.8 GW. Solar was close behind at 7.8 GW. Note that this does not include distributed renewable capacity additions.

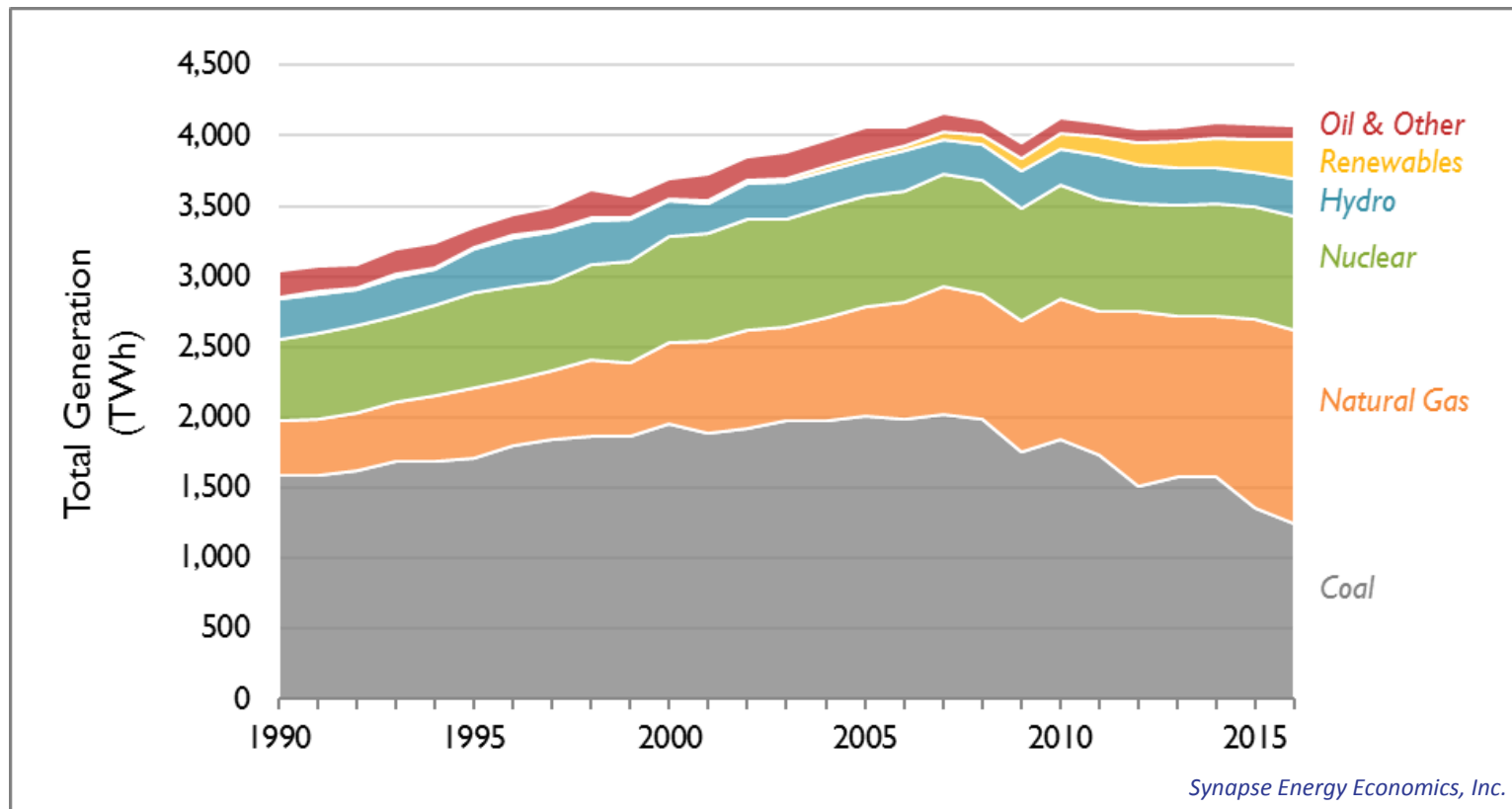
2016 saw the first new nuclear unit added in 20 years (Watts Bar 2 in Tennessee).

# Coal capacity is at its lowest point since 1983

State	Retired Capacity (Nameplate MW)
Alabama	1,350
Indiana	1,250
Florida	632
Illinois	500
Iowa	496
Other states	3,741
<b>Total</b>	<b>7,924</b>

Just under 8 GW of coal retired in 2016 (half as much as in 2015). Coal retirements took place in 16 states. Since 2007, 42 GW of coal has retired (a decrease of 12 percent).

# Coal generation is at its lowest level since 1982

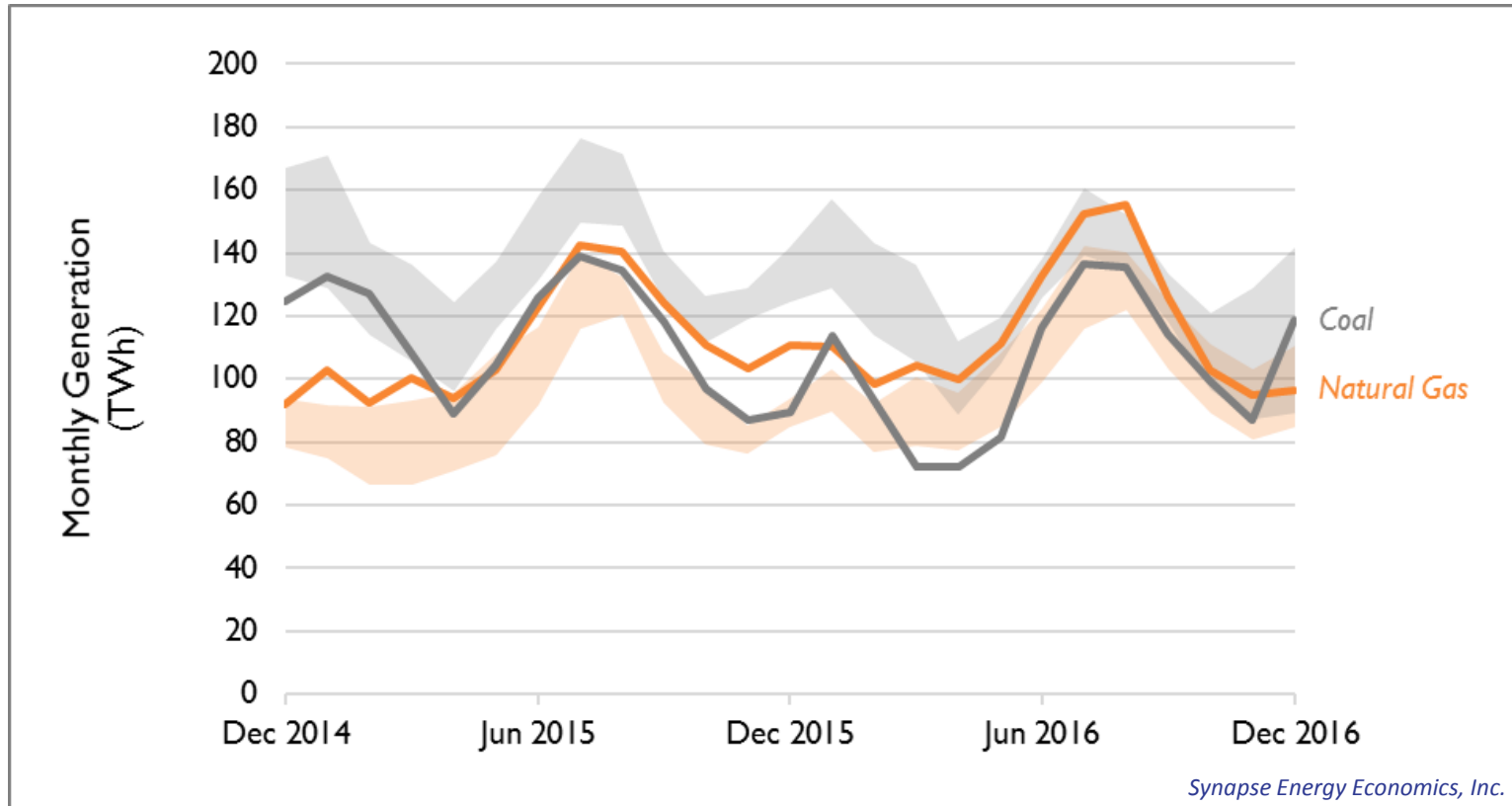


In 2016, the amount of electricity generated from natural gas exceeded that from coal by 12 percent.

Since 2007, total annual U.S. generation has remained flat, with an average annual growth rate of less than 0.04 percent per year.



# For 10 out of 12 months in 2016, natural gas generation exceeded coal generation

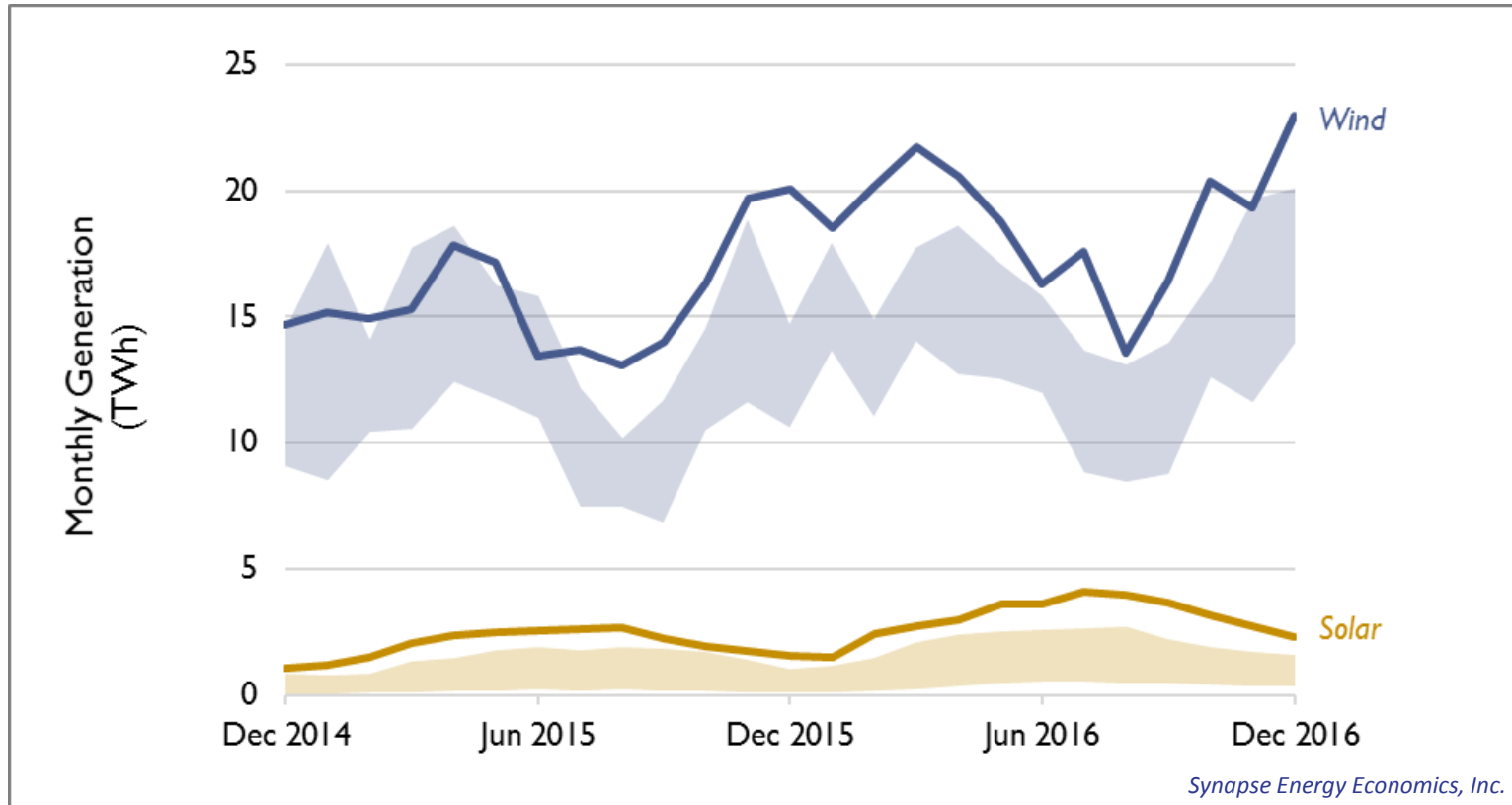


Note: This figure shows monthly generation compared to the previous four-year range.

For example, the December 2016 coal line is compared to the range of coal generation (grey shaded area) in Dec. 2012, Dec. 2013, Dec. 2014, and Dec. 2015.

In December 2016, low temperatures and elevated natural gas prices led to a rebound in coal generation, relative to previous trends.

# In 2016, wind made up more than 4/5 of total renewable generation

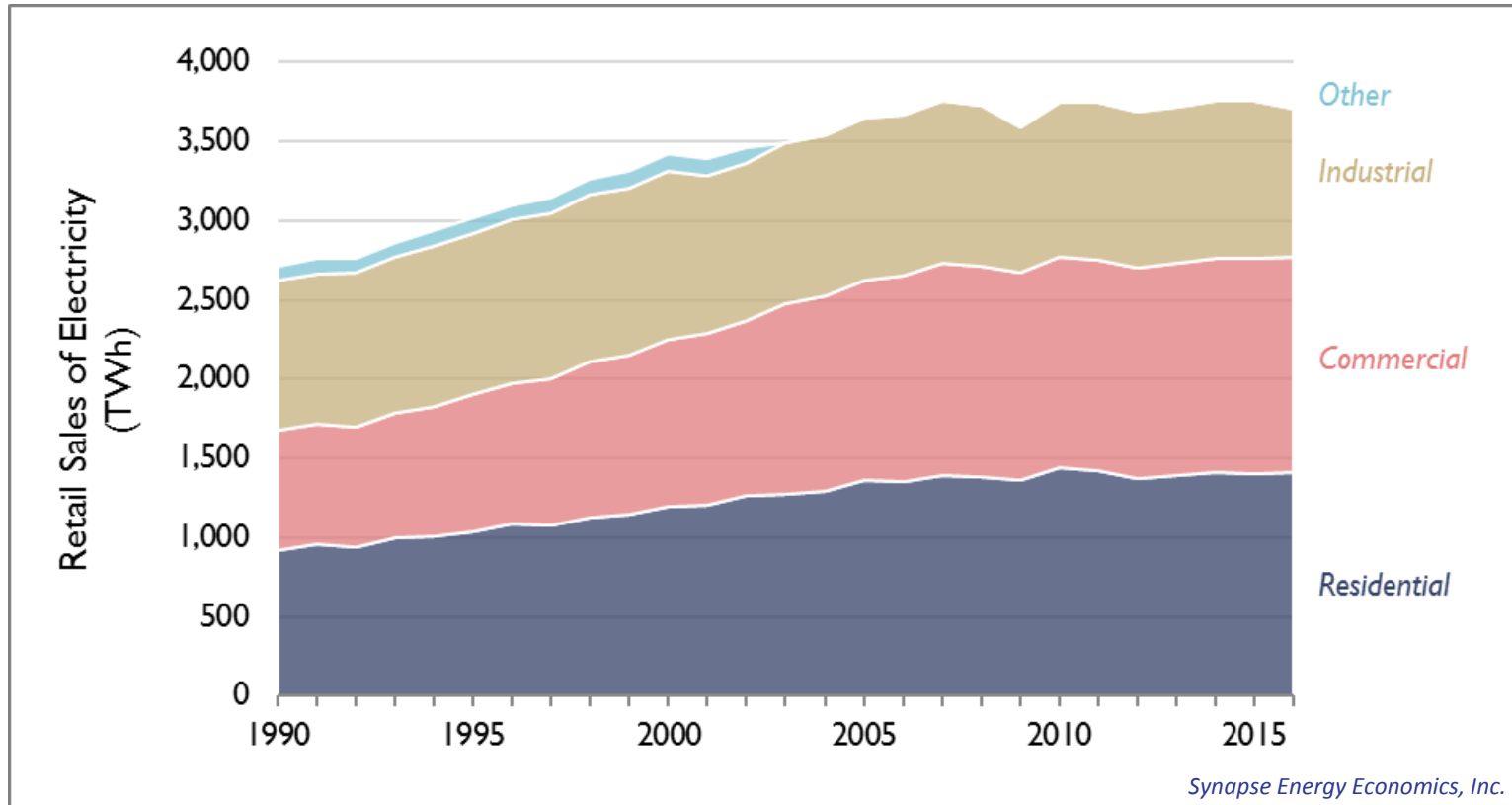


Note: This figure shows monthly generation compared to the previous four-year range.

For example, the December 2016 wind line is compared to the range of wind generation (purple shaded area) in Dec. 2012, Dec. 2013, Dec. 2014, and Dec. 2015).

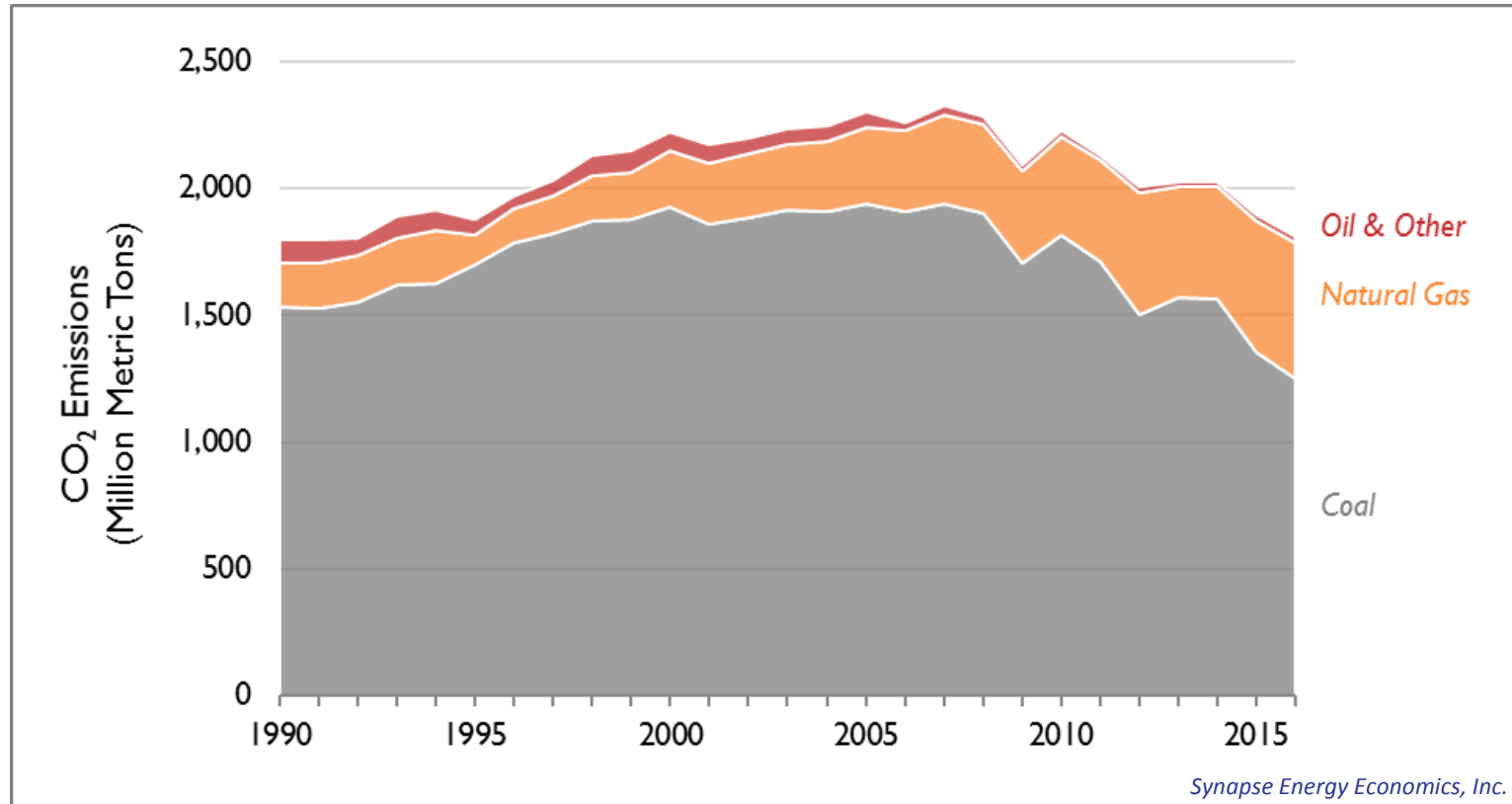
Annual wind generation increased by 19 percent in 2016, relative to 2015. At the same time, annual utility-scale solar generation grew by 48 percent. Both wind and solar reached historical peaks for monthly generation in 2016.

# Retail sales have been flat since 2007, with an average annual growth rate of -0.1 percent



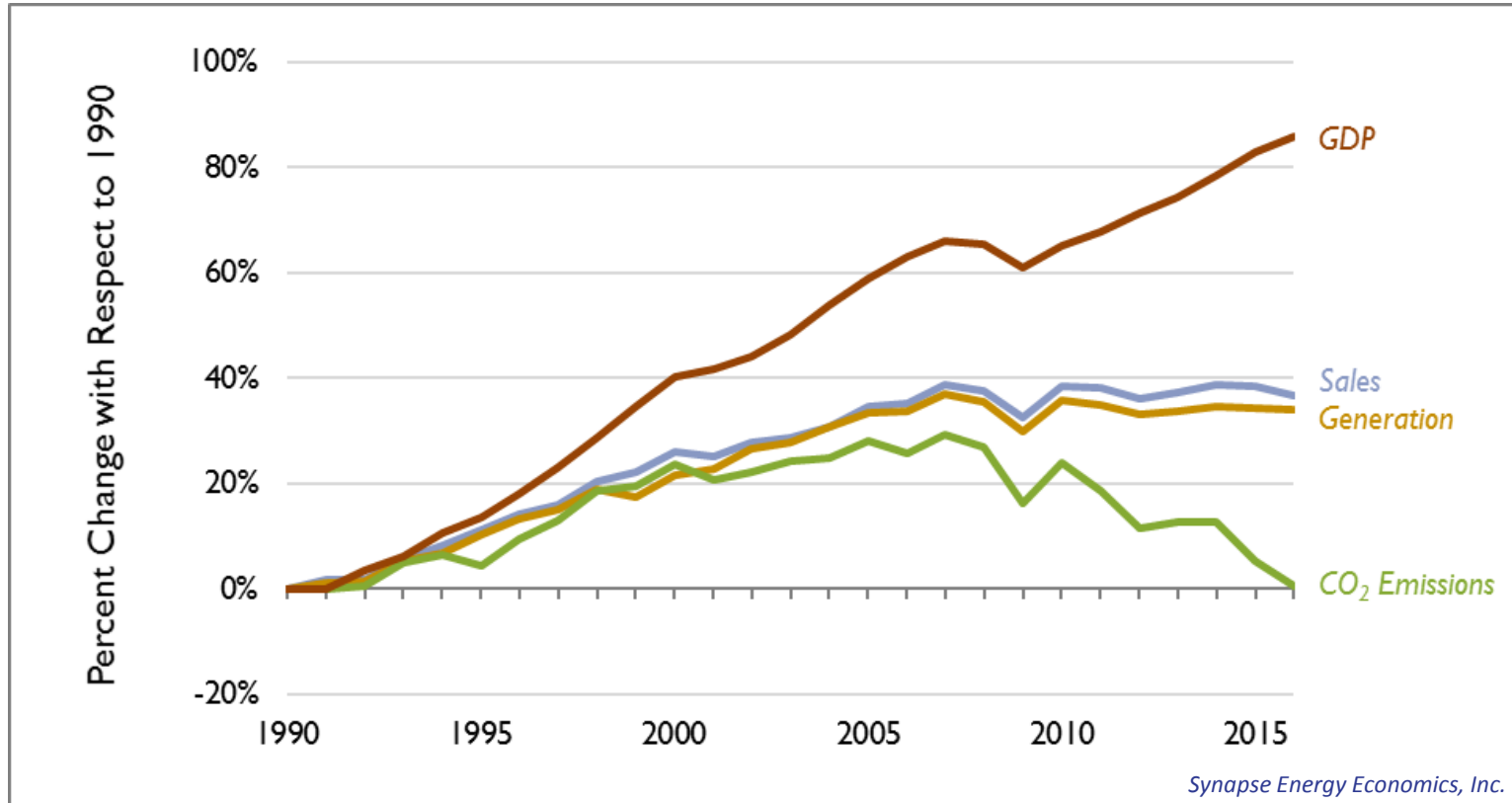
In many states, lower sales are linked to increases in energy efficiency measures or behind-the-meter PV. In 2016 the residential sector accounted for 38 percent of total retail sales; the commercial sector, 37 percent; and the industrial sector, 25 percent.

# U.S. electric-sector CO<sub>2</sub> emissions are at their lowest levels since 1992



Since hitting an all-time peak in 2007, nationwide CO<sub>2</sub> emissions from electric generation have fallen to 1992 levels. In 2016, half of fossil fuel generation but only 28 percent of CO<sub>2</sub> emissions came from natural gas.

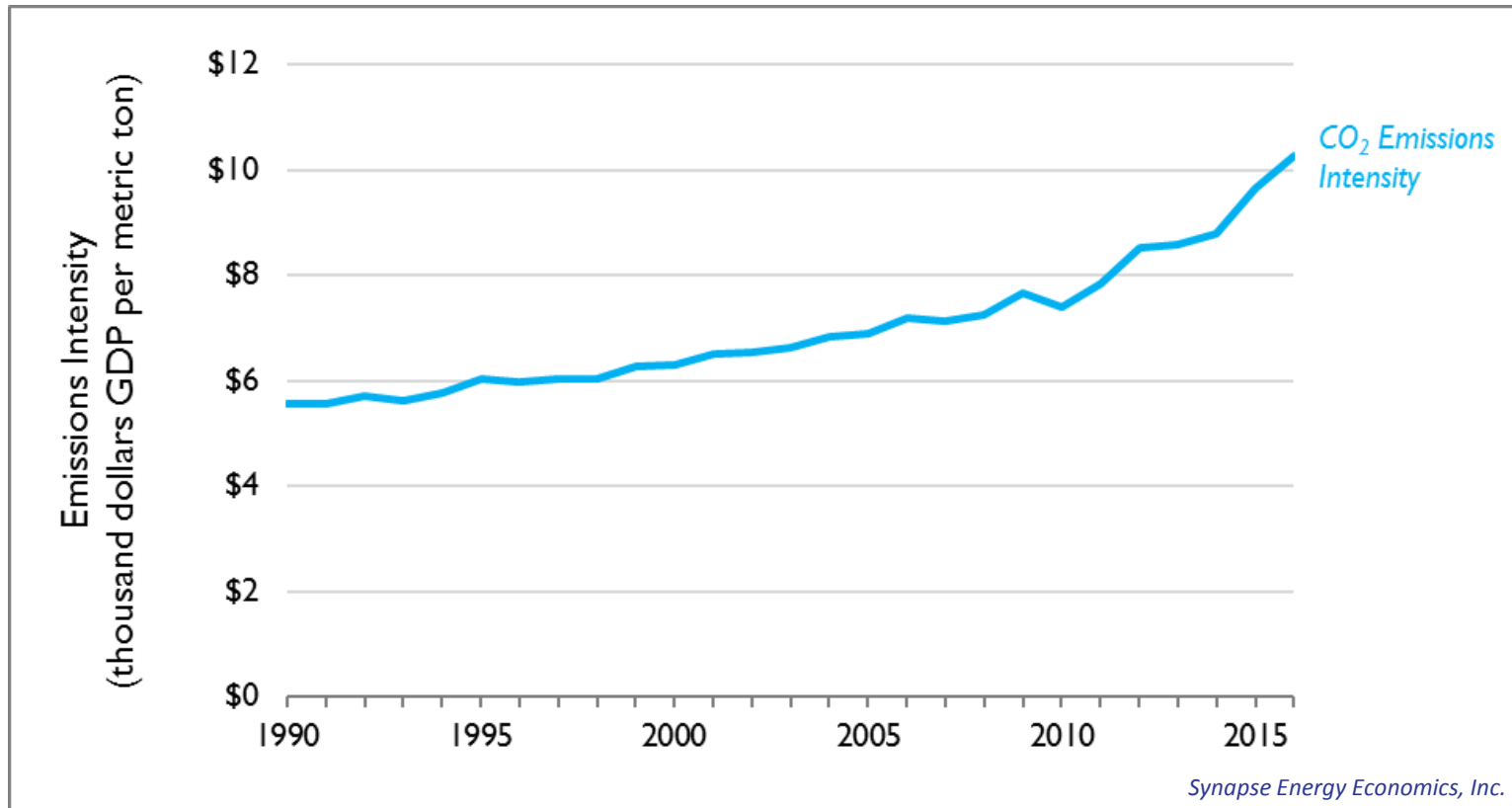
# Electric sales and CO<sub>2</sub> emissions are increasingly unrelated to GDP growth



*Note: Values for GDP have been adjusted for inflation.*

GDP has increased by 86 percent compared to 1990, while CO<sub>2</sub> emissions have fallen nearly to 1990 levels. Retail sales and generation have grown by 37 percent and 34 percent, respectively.

# Carbon intensity (dollars of GDP per metric ton of CO<sub>2</sub>) is on the rise



*Note: GDP values are reported in 2016 dollars.*

Since 1990, U.S. GDP produced from a single metric ton of CO<sub>2</sub> has grown by 85 percent from \$5,500 to \$10,300. Economic growth has not required more emissions.

# Notes and Sources

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All 2016 values are preliminary and are subject to future updates and revisions.

"Renewables" contains wind, solar, geothermal, and storage.

"Oil and Other" contains oil, biomass, petcoke, solid waste, landfill gas, tires, purchases, and other miscellaneous fuel types.

**Generation:** All generation values are utility-scale and do not include distributed generation (e.g., rooftop PV) or energy efficiency. Generation values are from the U.S. Energy Information Agency (EIA), form EIA 923, 1990-2016.

**Capacity:** All capacity values are utility-scale nameplate capacity. These values do not include distributed generation (e.g., rooftop PV) or energy efficiency. Capacity values are from EIA 860 and EIA Electric Power Monthly, 2001-2016.

**Sales:** Prior to 2003, "other" sales included sales to transportation, public street and highway lighting, sales to public authorities, agricultural irrigations, and other miscellaneous sales. After 2003, this category only includes sales to transportation—all other miscellaneous sales types were re-distributed to either the industrial, commercial, or residential sectors. Sales values are from EIA 826, 1990-2016.

**Emissions:** CO<sub>2</sub> emission values for 1995-2016 are from U.S. Environmental Protection Agency Air Markets Program Data. CO<sub>2</sub> emission values prior to 1995 are electric sector emissions from EIA's State Carbon Dioxide Emissions database.

**Gross Domestic Product:** GDP values are from the Bureau of Economic Analysis, National Economic Accounts, accessed February 2017.

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