Synapse Electricity Snapshot 2020

A review of the U.S. electric system through December 2019

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- Renewable capacity is now at 147 gigawatts (GW), exceeding both hydro and nuclear capacity. Renewables are now the third-largest resource on a capacity basis, behind natural gas and coal. Together, non-CO_2-emitting generating capacity makes up 29 percent of the nationwide total and accounts for 36 percent of all generation.
- Retirement of old and uneconomic coal plants has led to the lowest level of coal capacity since 1976.
- Just as in 2018, in 2019, natural gas generation surpassed coal generation during every month.
- Except for March, every month in 2019 set a record for the lowest level of observed monthly coal generation since the late 1970s. For the first time since the late 1970s, coal generation dropped below 1,000 TWh per year. For the first time since at least the 1940s, coal made up less than 25% of nationwide electricity generation.

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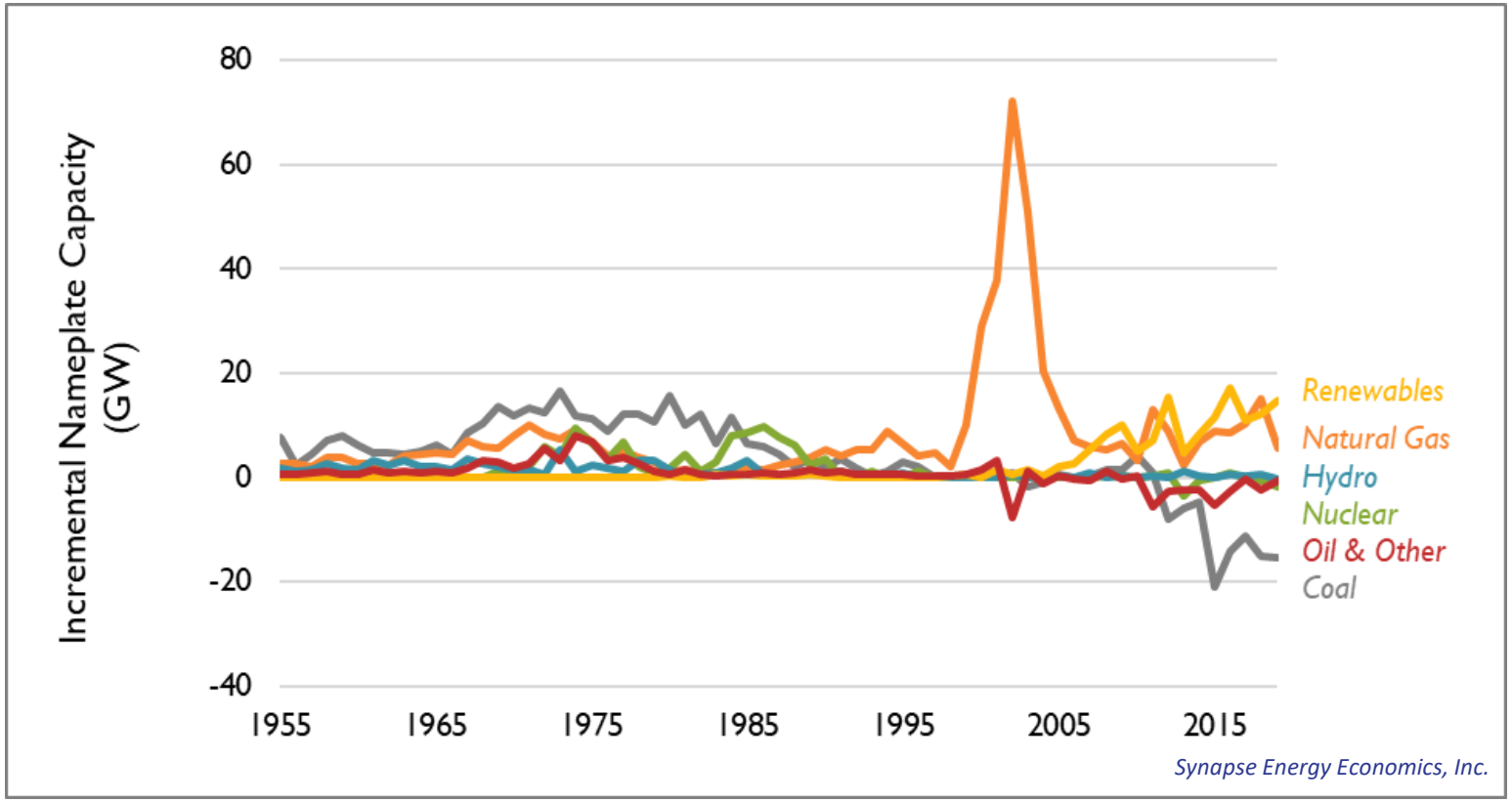
- Since 2010, annual growth in electric retail sales has averaged 0.4 percent per year.
- Electric-sector CO_2 emissions were 8 percent lower in 2019 than in 2018. Since hitting an all-time peak in 2007, electric sector CO_2 emissions have declined to 1,611 million metric tons in 2019, their lowest level since 1984. Electric sector CO_2 emissions are now below 1990 levels.
- Since 1990, the kg of CO_2 emitted per dollar of GDP has decreased by 56 percent from 0.17 to 0.08 kg per dollar.
- In 2019, electric vehicles made up 1.9 percent of light-duty vehicle sales.

All values in this document are based on preliminary 2019 data and are subject to updates.

Coal capacity continues to plummet below 1980s levels



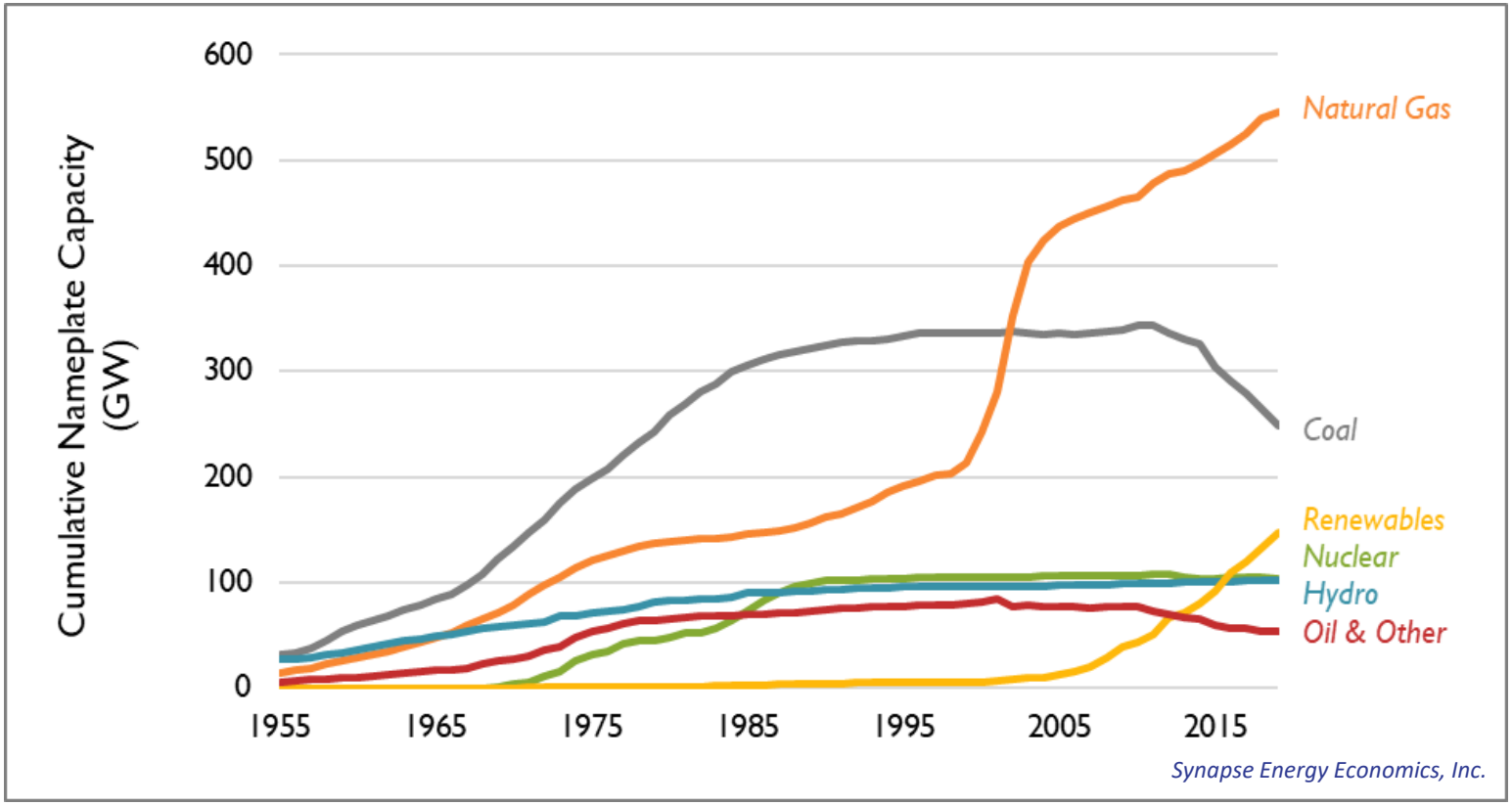
Note: This figure displays net nameplate values for utility-scale generators; annual capacity retirements are subtracted from annual capacity additions.

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.

2019 was the third-highest year in history for renewable capacity additions.

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 2019, renewable resources reached 12 percent of total U.S. generating capacity. In the 10 years since 2010, renewables have increased by 103 GW, compared to an 80 GW increase in natural gas over the same period. 94 GW of coal was retired over this same 10-year period.

In 2019, renewables represented the largest category of net capacity additions with over 14 GW added

Capacity (GW)	Installed		Retired		Net (installed less retired)	
	2018	2019	2018	2019	2018	2019
Coal	-	-	14.6	13.9	-14.6	-13.9
Natural Gas	21.8	8.4	7.7	4.0	14.1	4.4
Nuclear	-	-	0.6	1.7	-0.6	-1.7
Hydro	0.1	0.0	0.0	0.1	0.1	-0.1
Renewables	12.1	14.7	0.1	0.1	12.1	14.5
Geothermal	0.1	-	0.0	0.0	0.1	0.0
Storage	0.2	0.2	0.0	-	0.2	0.2
Solar	4.9	5.3	0.0	0.0	4.9	5.3
Wind	6.9	9.2	0.0	0.1	6.9	9.0
Oil and Other	0.1	0.3	2.7	0.9	-2.6	-0.7
Biomass	0.1	0.2	0.3	0.5	-0.2	-0.3
Oil	0.0	0.0	2.4	0.4	-2.3	-0.3
MSW	0.0	0.0	0.1	0.1	-0.1	-0.1
Other	0.0	0.1	0.0	-	0.0	0.1
Total	**34.2**	**23.3**	**25.7**	**20.8**	**8.5**	**2.5**

In 2019, renewables were the largest category of capacity additions with a net 14.5 GW of installations—including 5.3 GW from solar and 9.0 GW from wind.

Natural gas placed second, with 4.5 GW of net capacity additions, down from 14.1 GW in 2018.

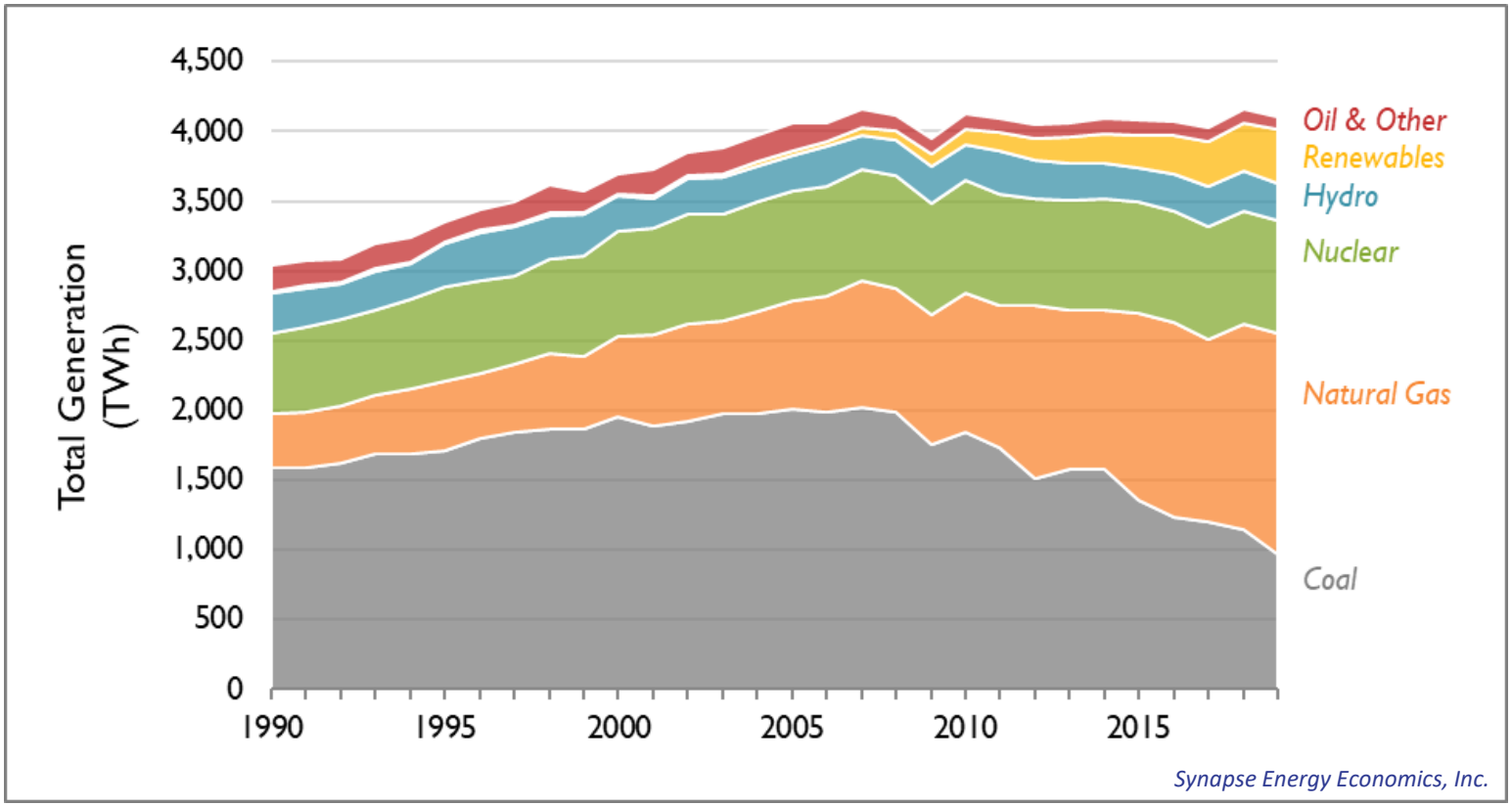
Nearly 14 GW of coal retired in 2019, a number similar to coal retirements in 2018.

Coal capacity is at its lowest level since 1979

	State	Retired Capacity (Nameplate MW)
1	Pennsylvania	2,856
2	Arizona	2,409
3	Illinois	2,241
4	Alabama	1,167
5	Georgia	1,131
-	Other States	4,131
	Total	**13,948**

- Nearly 14 GW of coal retired in 2019.
- Coal retirements took place in 15 states.
- Since 2010, 94 GW of coal has retired (a decrease of 27 percent).

Coal generation is at its lowest level since 1976



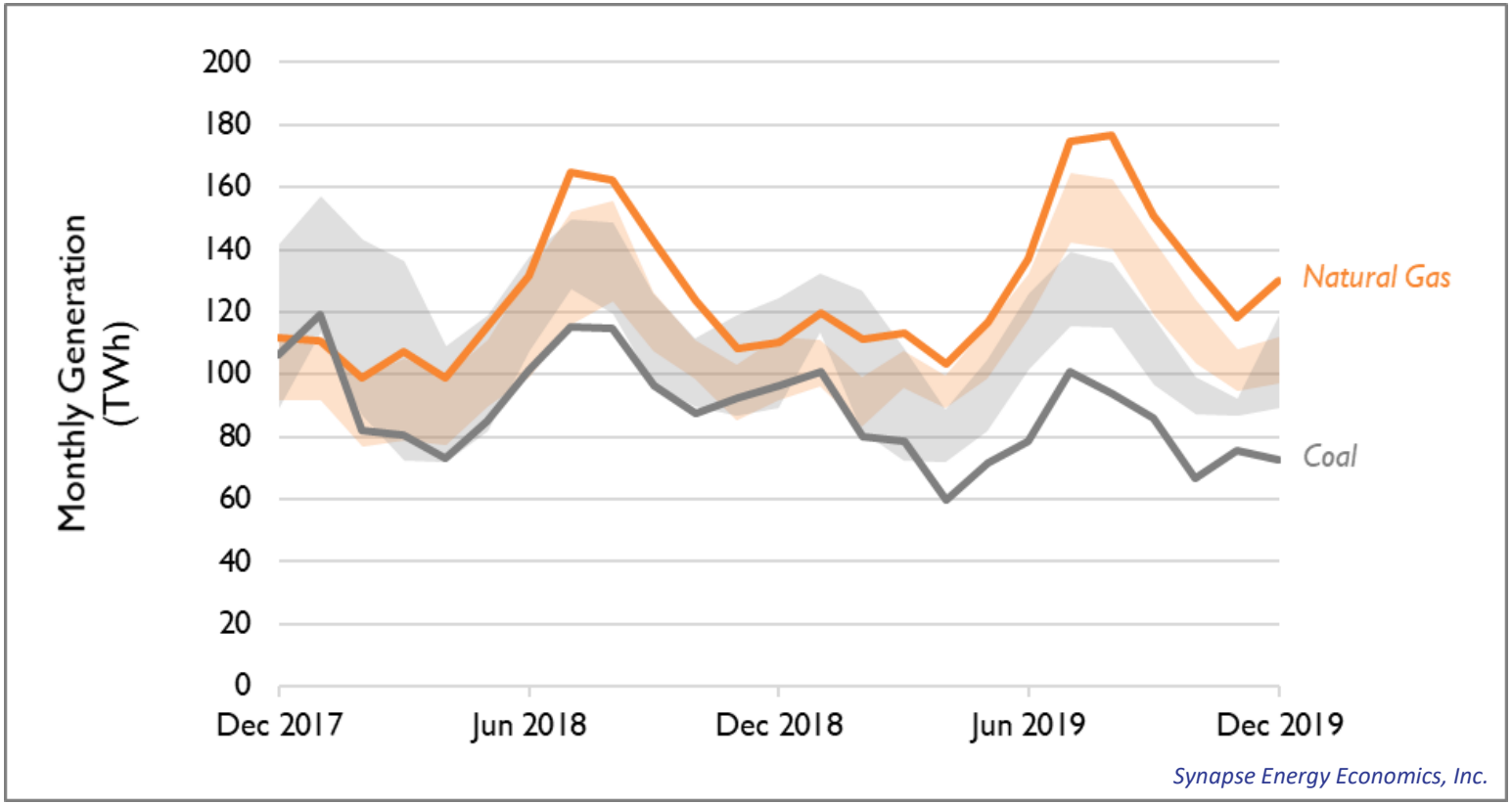
In 2019, the amount of electricity generated from natural gas exceeded that from coal by 64 percent, up from 29 percent in 2018.

Since 2010, total annual U.S. generation has increased by less than 0.4 percent per year.

For the first time since the late 1970s, coal generation dropped below 1,000 TWh per year.

For the first time since at least the 1940s, coal made up less than 25% of nationwide electricity generation.

As in 2018, natural gas generation exceeded coal generation in every month of 2019

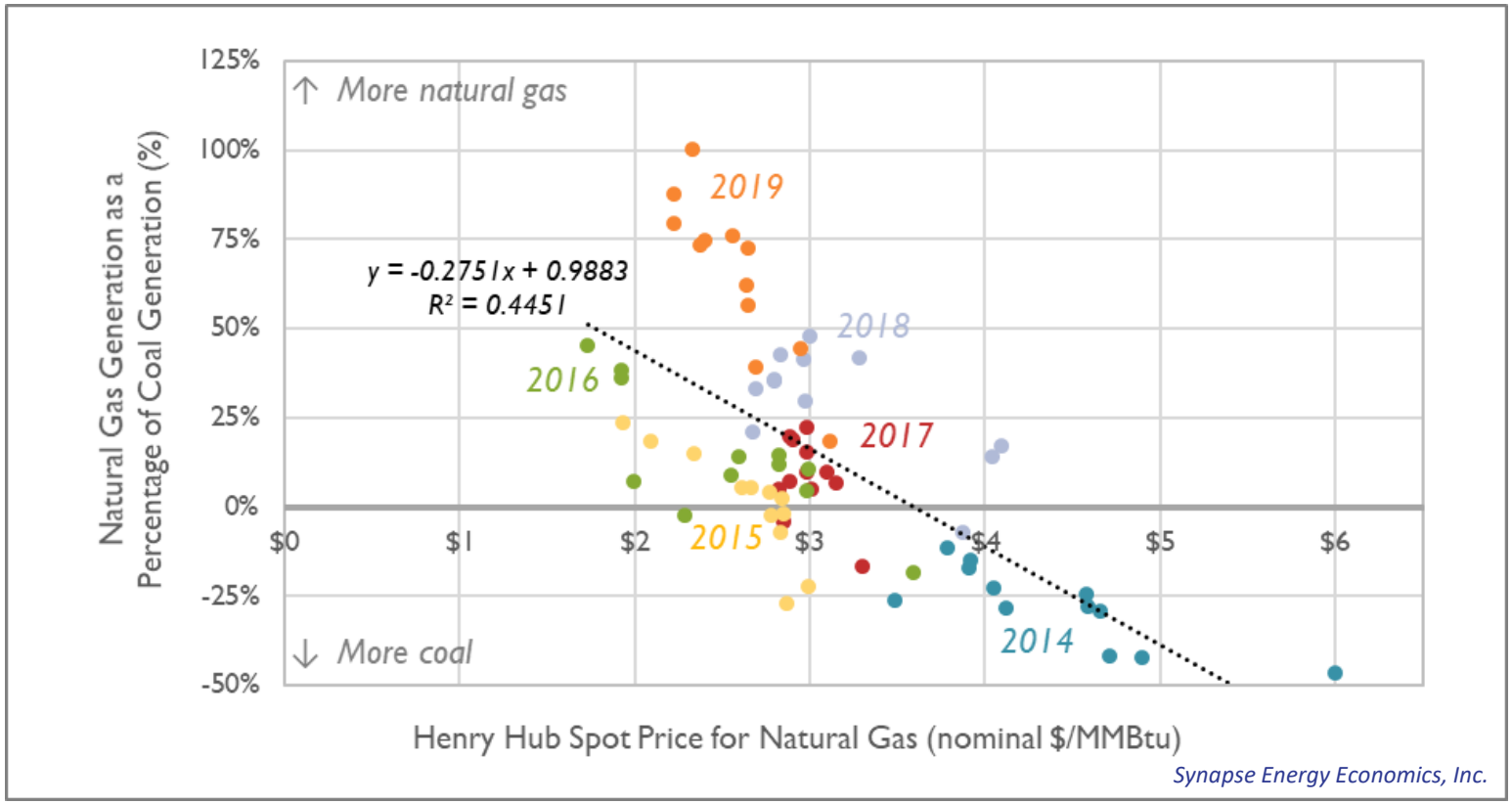


Note: This figure shows monthly generation compared to the previous four-year range.

For example, the December 2019 coal line is compared to the range of coal generation (grey shaded area) in Dec. 2015, Dec. 2016, Dec. 2017, and Dec. 2018.

Except for March, every month in 2019 set a record for the lowest amount of coal generation observed during that month since the late 1970s.

The ratio of natural gas generation to coal generation strongly depends on the price of natural gas

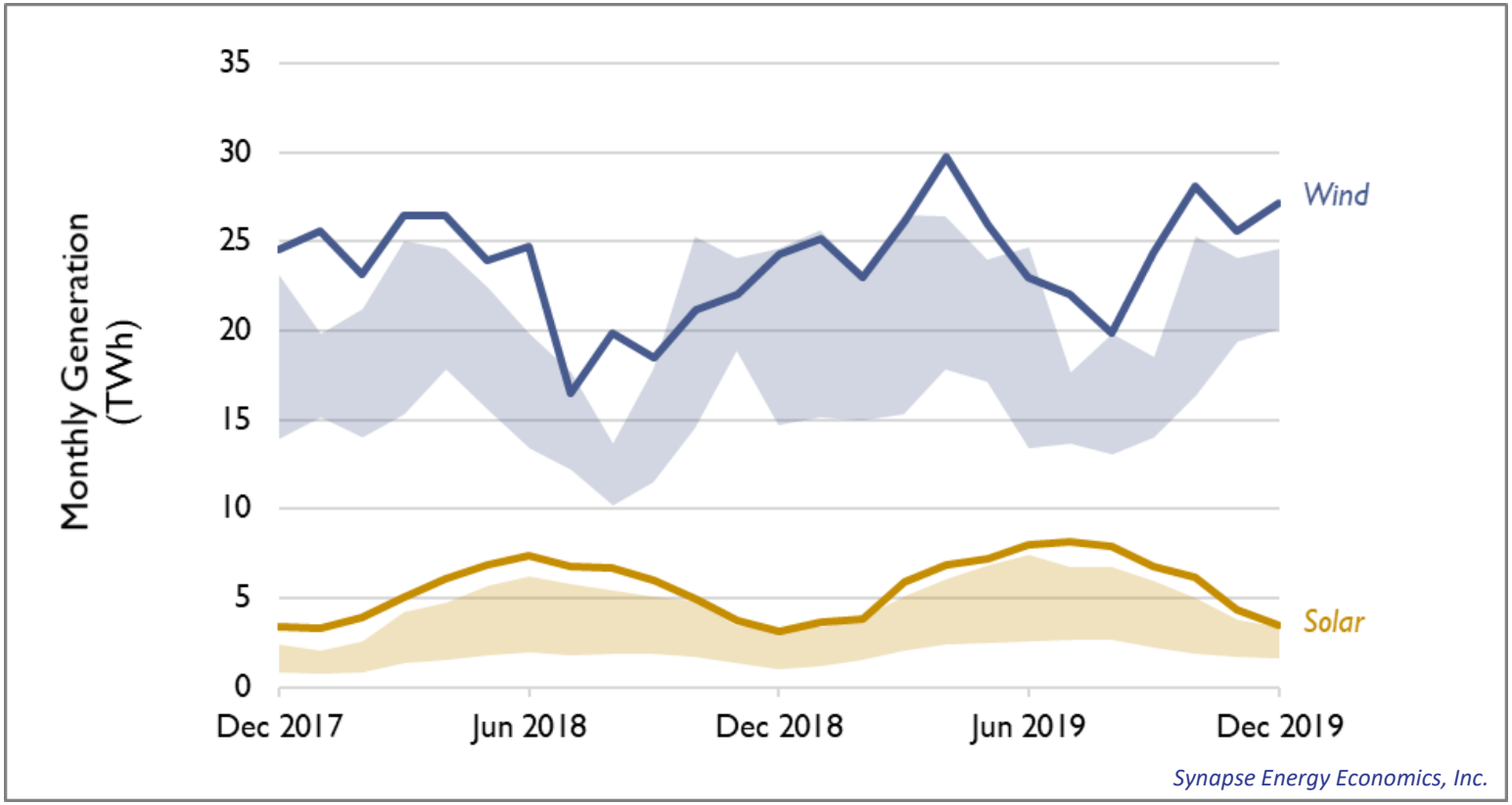


Note: Each circle represents a data point for a single month within the indicated year.

On a national basis, when the price of natural gas is below $3.59 per MMBtu, natural gas generation has historically exceeded coal generation.

This relationship is becoming increasingly uncorrelated as the quantity of natural gas capacity increases and coal plants retire.

In 2019, wind made up about 4/5 of total renewable generation



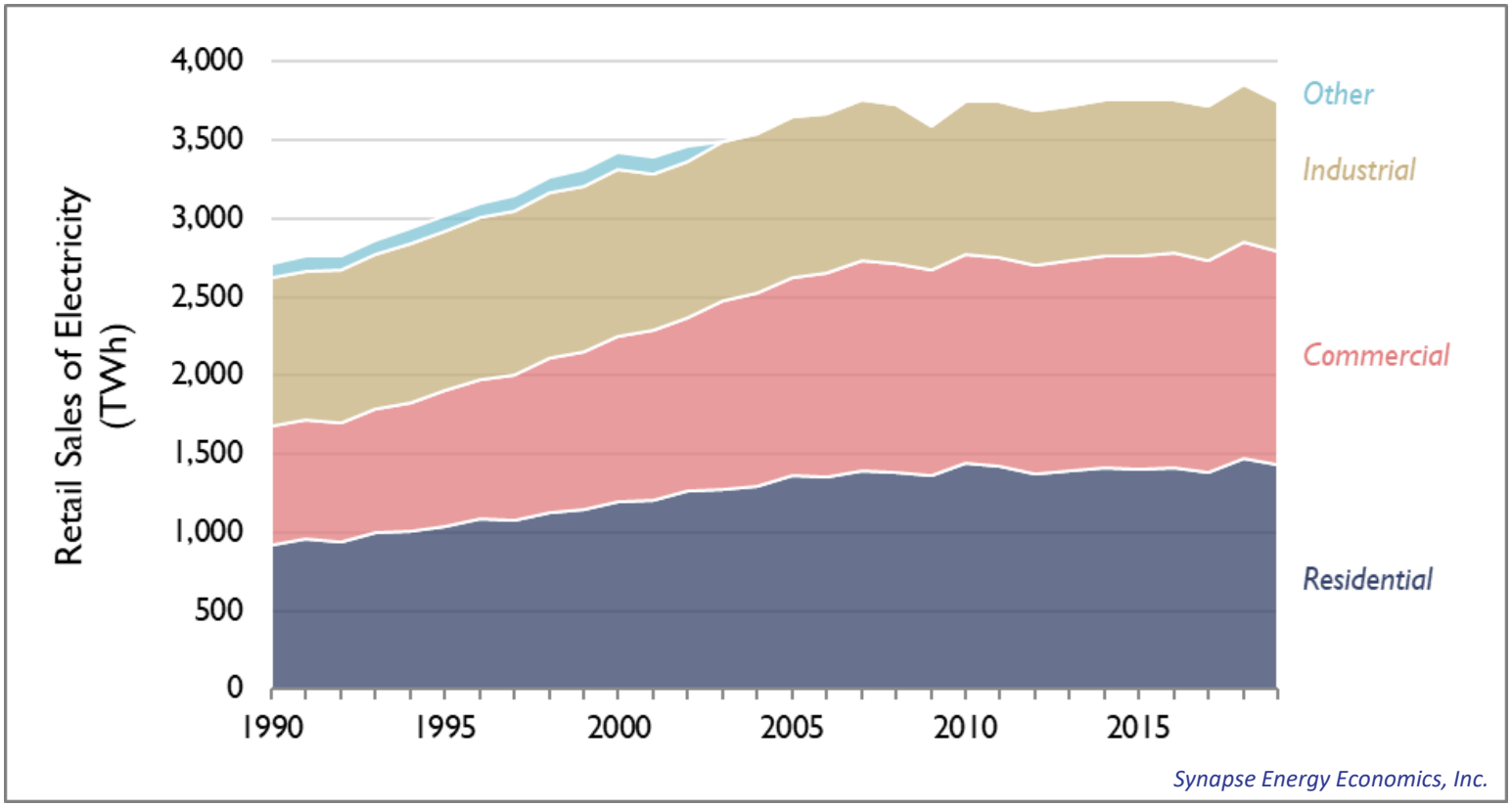
Note: This figure shows monthly generation compared to the previous four-year range.

For example, the December 2019 wind line is compared to the range of wind generation (purple shaded area) in Dec. 2015, Dec. 2016, Dec. 2017, and Dec. 2018).

Annual wind generation increased by 10 percent in 2019, relative to 2018. At the same time, annual utility-scale solar generation grew by 13 percent.

Both wind and solar reached historical peaks for monthly generation at some point in 2018 (April for wind, and July for solar).

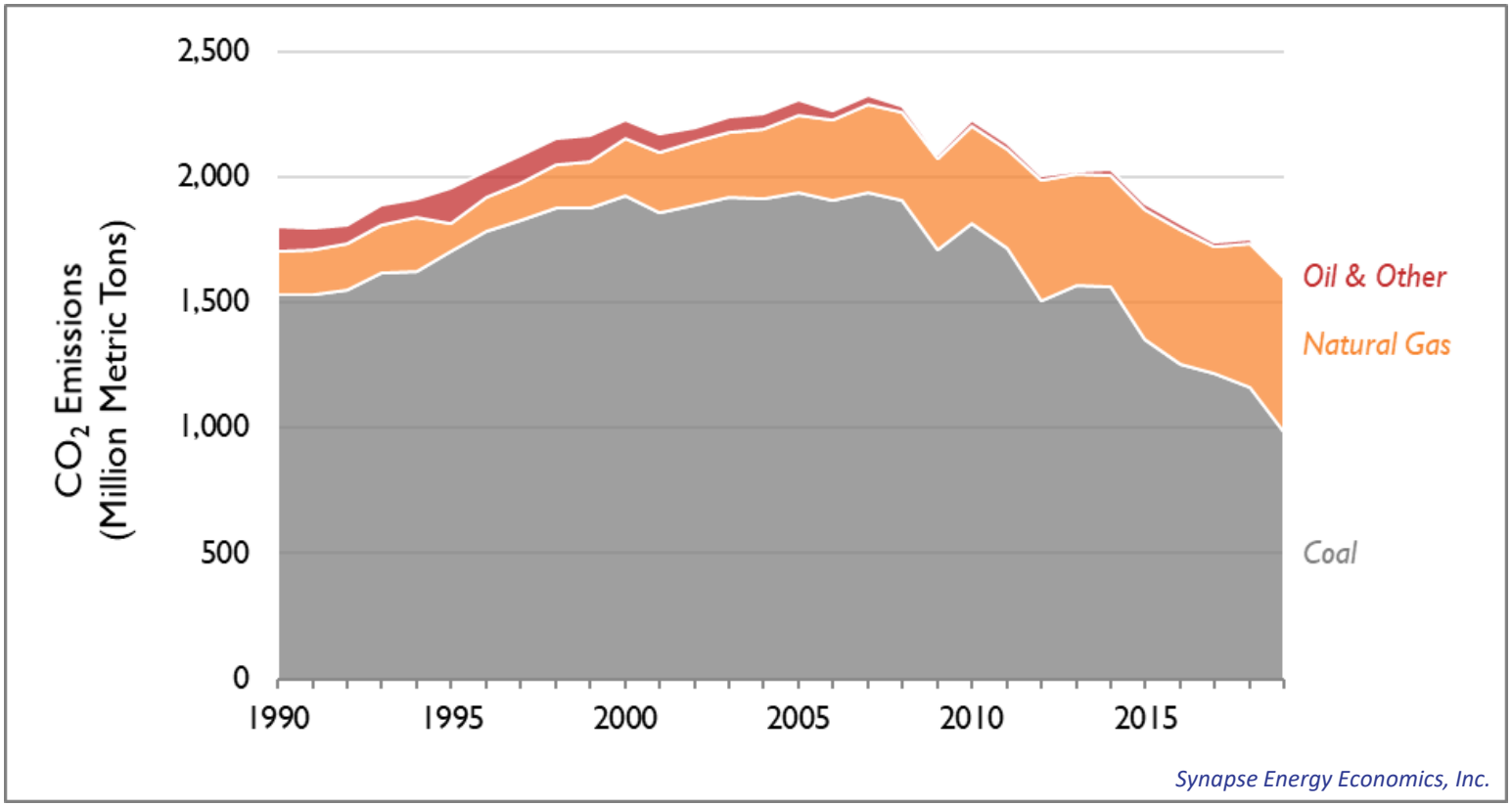
Retail sales have been largely flat since 2010, with an average annual growth rate of 0.4 percent



In many states, sustained lower sales are linked to increases in energy efficiency measures and behind-the-meter solar.

From 2018 to 2019, annual sales decreased by 3 percent, in part due to milder weather compared to the previous year.

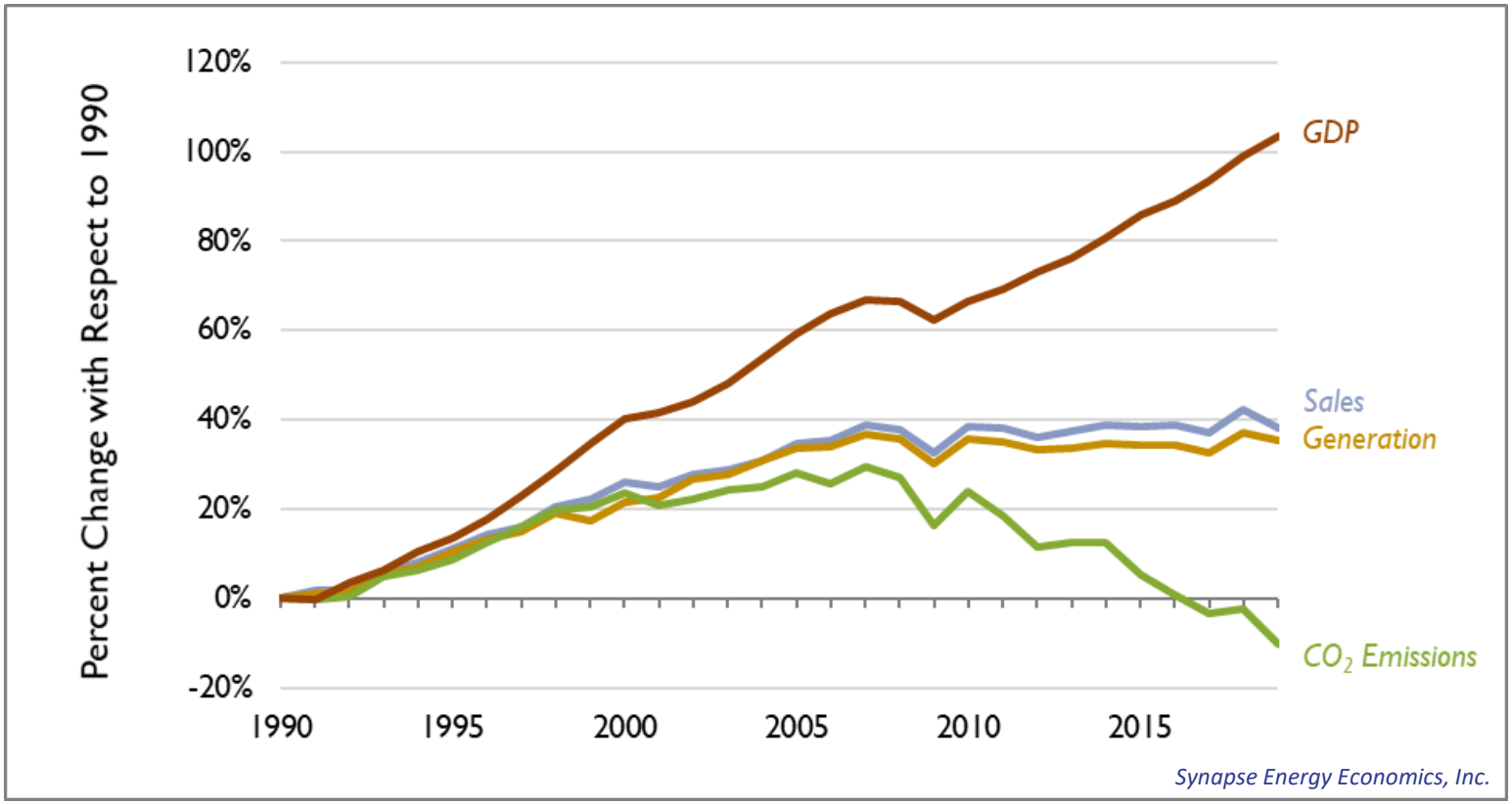
U.S. electric-sector CO_2 emissions are at their lowest levels since 1984



Since hitting an all-time peak in 2007, CO_2 emissions have dropped by 31 percent.

In 2019, coal represented 24 percent of generation, and comprised 61 percent of CO_2 emissions.

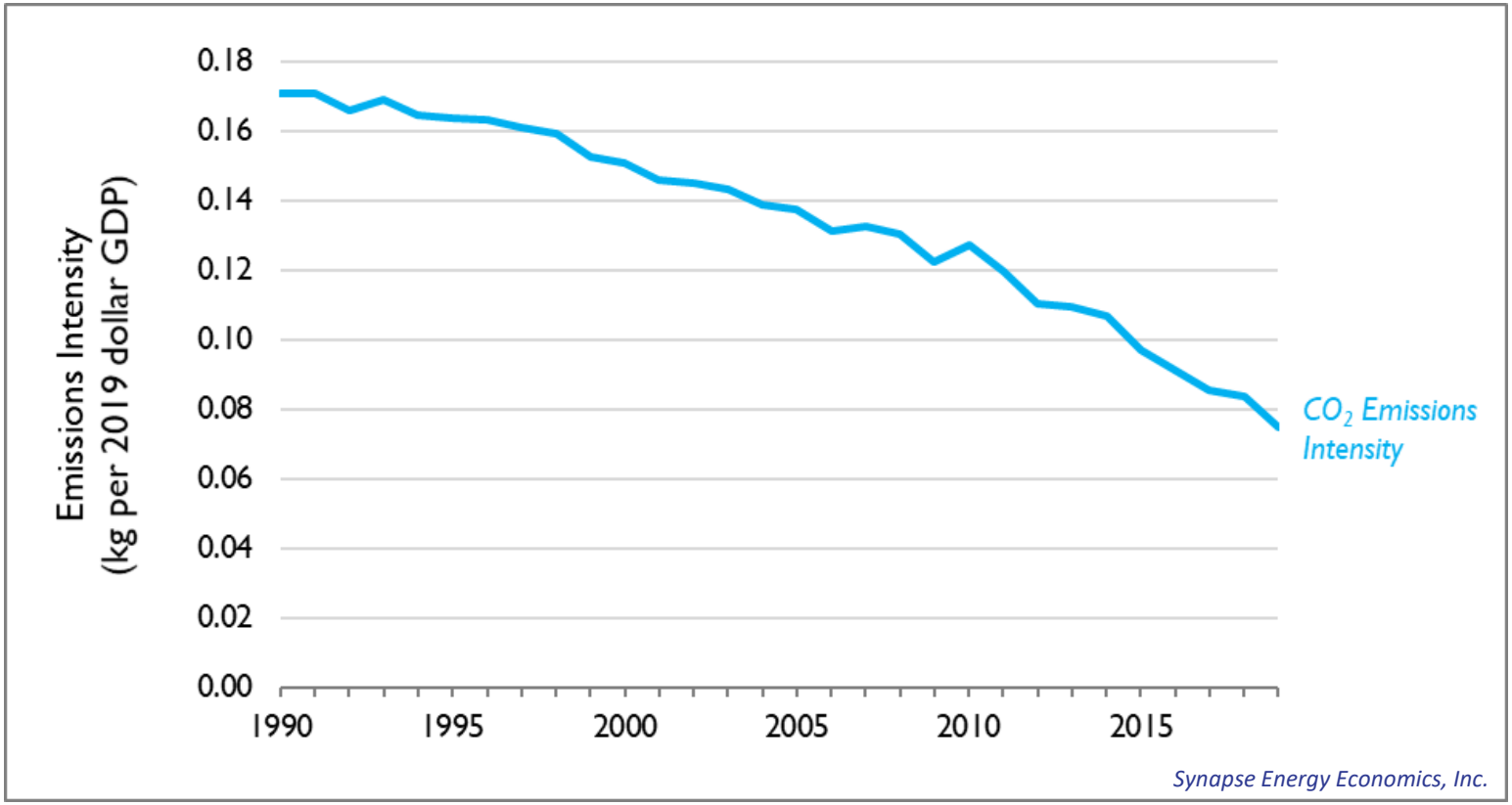
Electric sales and CO_2 emissions are increasingly unrelated to GDP growth



Note: Values for GDP have been adjusted for inflation and are in constant –year dollars.

GDP has increased by 104 percent compared to 1990, while CO_2 emissions continue to fall below 1990 levels. Retail sales and generation have grown by 38 percent and 35 percent, respectively, and have remained largely constant since 2006.

Carbon intensity (kg of CO_2 per dollar of GDP) continues to drop

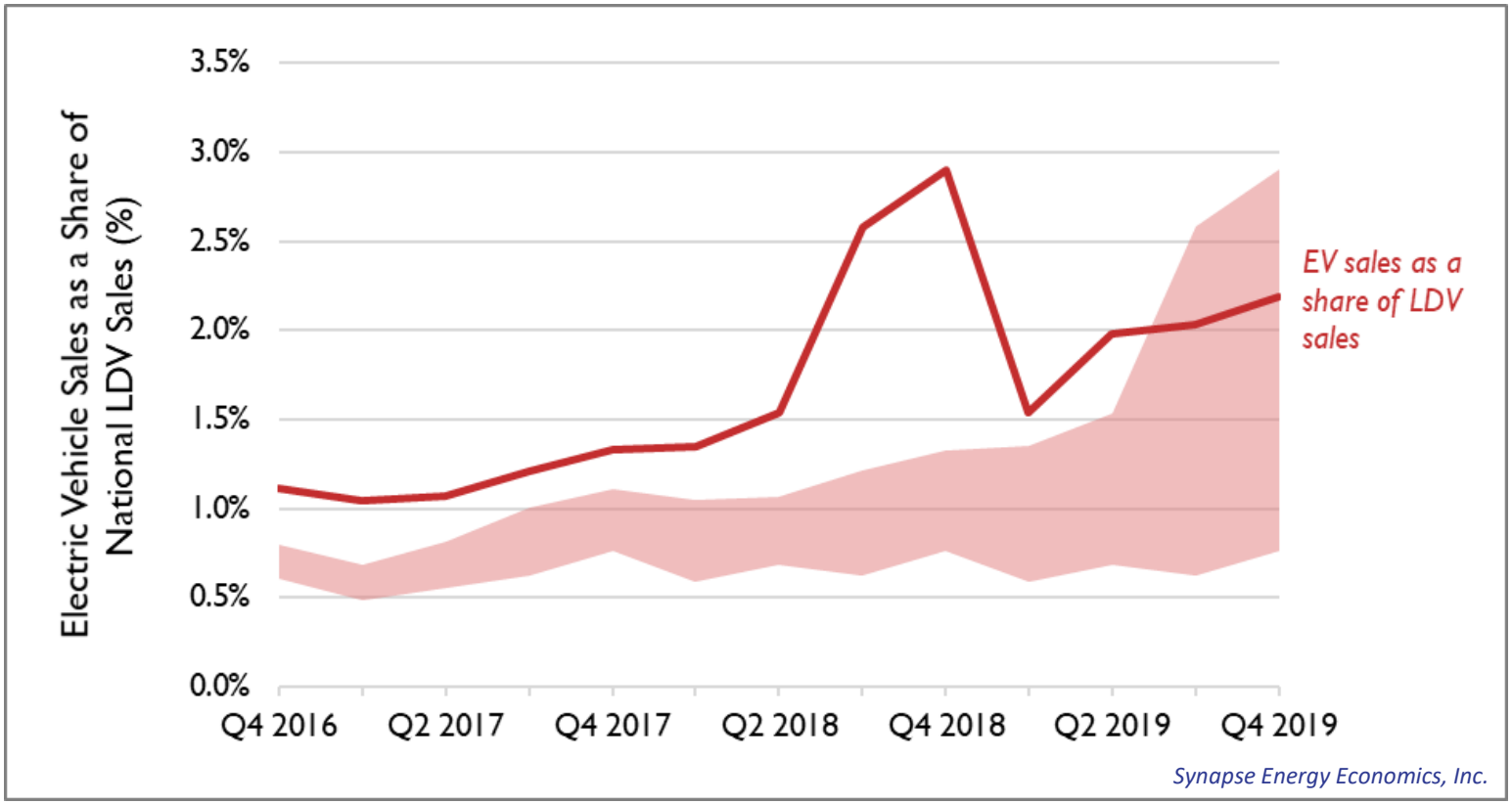


Note: GDP values are described in 2019 dollars.

Since 1990, the kg of CO_2 produced per dollar of GDP has dropped by 56 percent from 0.17 to 0.08 kg/$.

Economic growth continues to require fewer and fewer emissions.

In 2019, electric vehicles made up 1.9 percent of all light-duty vehicle sales



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

For example, the Q4 2019 line is compared to the range of sales percentages (red shaded area) in Q4 2015, Q4 2016, Q4 2017, and Q4 2018).

The total number of EV sold in 2019 fell by 9 percent, relative to 2018.

Annual light-duty vehicle (cars, SUVs, and pickup trucks) sales have been largely unchanged since 2015 with about 17.2 million sales per year.

Notes and Sources

All 2019 values are preliminary and are subject to future updates and revisions.

"Renewables" contains wind, solar, geothermal, and storage, unless defined otherwise.

"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, 1990-2019.

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, 2001-2019.

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, 1990-2019.

Emissions: CO_2 emission values for 1995-2019 are from U.S. Environmental Protection Agency Air Markets Program Data. CO_2 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 2019.

Natural gas prices: Monthly natural gas prices are from EIA's Henry Hub Natural Gas Spot Price dataset.
Electric vehicles: EV sales data from insideevs.com. All vehicle sales data from Federal Reserve Bank of St. Louis.

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