

Synapse
Energy Economics, Inc.

Synapse Electricity Snapshot 2022

A review of the U.S. electric system through December 2021

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Synapse Electricity Snapshot 2022

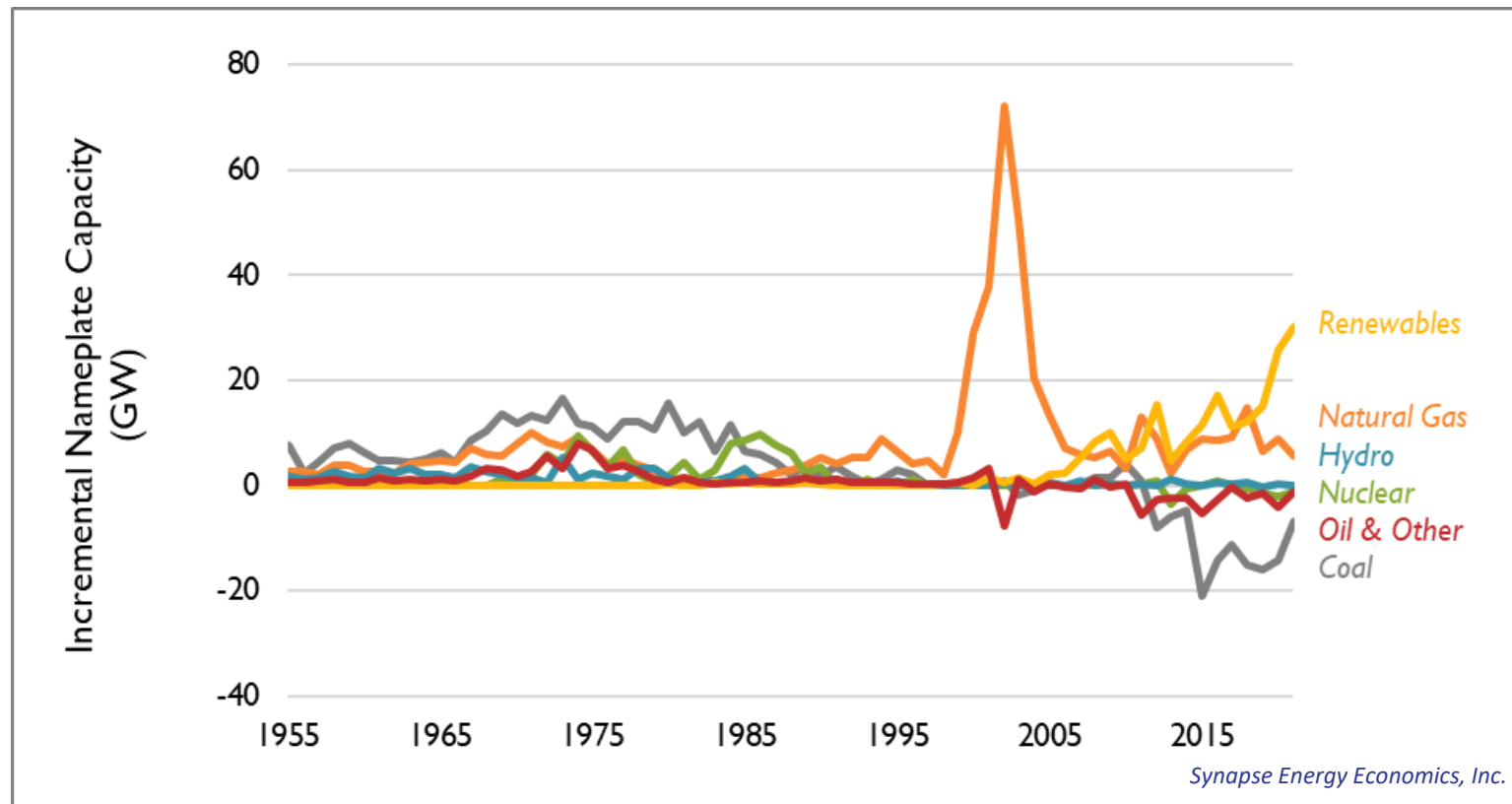
- Renewable capacity in the United States 202 gigawatts (GW), exceeding both hydro and nuclear capacity. Renewables are the third-largest resource on a capacity basis, behind natural gas and coal. Renewables now trail coal capacity by 25 GW. Together, non-CO₂-emitting generating capacity makes up 33 percent of the nationwide total and accounts for 38 percent of all generation.
- Retirement of old and uneconomic coal plants, coupled with the low marginal costs of other resources like gas, wind, and solar, has led to the lowest level of coal generation since the early 1970s.
- As in every month in 2018 through 2020, natural gas generation exceeded coal generation in every month in 2021.

All values in this document are based on preliminary 2021 data are subject to future updates and revisions.

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- From 2020 to 2021, annual sales increased by 2 percent, likely due to the easing of the COVID-19 pandemic.
- Electric-sector CO₂ emissions increased by 7 percent from 2020 to 2021. This rebound is tied to the increase in coal generation.
- Since reaching an all-time peak in 2007, electric sector CO₂ emissions have declined to 1,546 million metric tons in 2021, second behind in 2020 in terms of having the lowest level of emissions since the 1970s.
- Since 1990, CO₂ emitted per dollar of GDP has decreased by 59 percent, from 0.17 to 0.07 kg per dollar.

Once again, more renewable energy was installed in 2021 than in any previous year



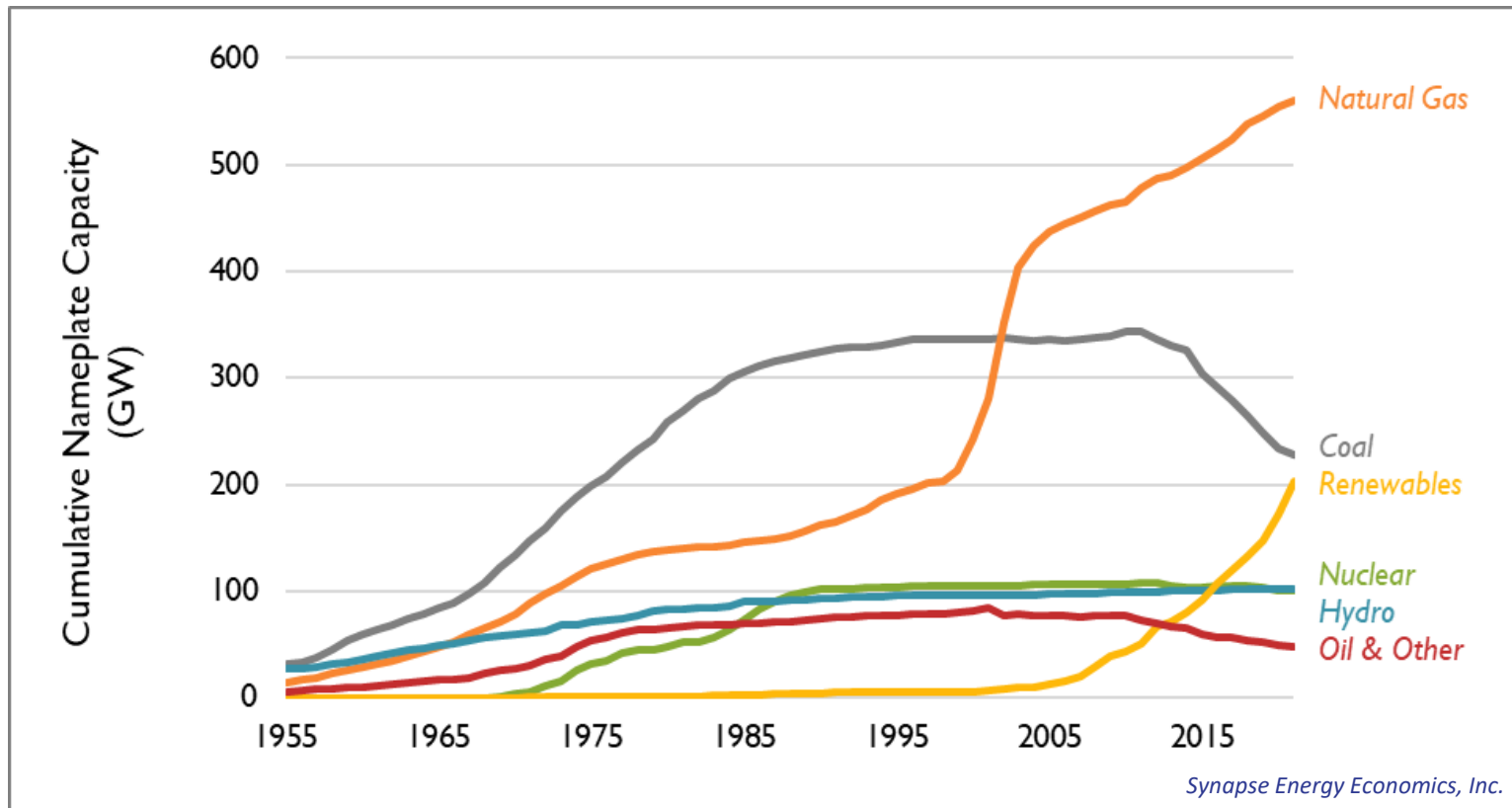
Note: This figure displays net nameplate values for utility-scale generators; annual capacity retirements are subtracted from annual capacity additions.

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

New renewable capacity installations exceeded 2019 levels by 18 percent. Further, new renewable capacity installations were double that of 2019 installations.

Coal retirements exceeded 6 GW for the seventh consecutive 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 2021, renewable resources reached 16 percent of total U.S. generating capacity. In the 10 years since 2012, renewables have increased by 137 GW, compared to a 72 GW increase in natural gas over the same period.

109 GW of coal was retired over this same 10-year period.

In 2021, renewables represented the largest category of net capacity additions with over 30 GW added

Capacity (GW)	Installed		Retired		Net (installed less retired)	
	2020	2021	2020	2021	2020	2021
Coal	<0.1	-	11.6	6.5	-11.6	-6.5
Natural Gas	7.2	6.4	3.6	1.0	3.6	5.3
Nuclear	-	-	2.0	1.0	-2.0	-1.0
Hydro	0.2	0.1	0.0	0.0	0.1	0.1
Renewables	25.6	30.4	0.3	0.3	25.4	30.1
<i>Geothermal</i>	0.0	0.0	0.0	-	0.0	0.0
<i>Storage</i>	0.5	3.1	0.0	0.0	0.5	3.1
<i>Solar</i>	10.4	13.2	-	0.3	10.4	13.0
<i>Wind</i>	14.7	14.0	0.2	0.0	14.4	14.0
Oil and Other	0.1	0.0	1.6	1.0	-1.5	-1.0
<i>Biomass</i>	0.1	0.0	0.1	0.2	0.0	-0.2
<i>Oil</i>	0.0	0.0	1.5	0.7	-1.4	-0.7
<i>MSW</i>	0.0	0.0	0.1	0.1	-0.1	-0.1
<i>Other</i>	-	-	-	-	0.0	0.0
Total	33.1	36.9	19.1	9.8	14.0	27.0

In 2021, renewables were the largest category of capacity additions with a net 30 GW of installations—including over 13 GW from solar and 14 GW from wind. There were also over 3 GW of storage additions. This is the largest annual addition of renewables on record.

Natural gas saw 6.4 GW installed, down from 7.2 GW in 2020.

6.5 GW of coal retired in 2021, down from 11.6 GW of retirements in 2020.

Coal capacity is at its lowest level since 1977

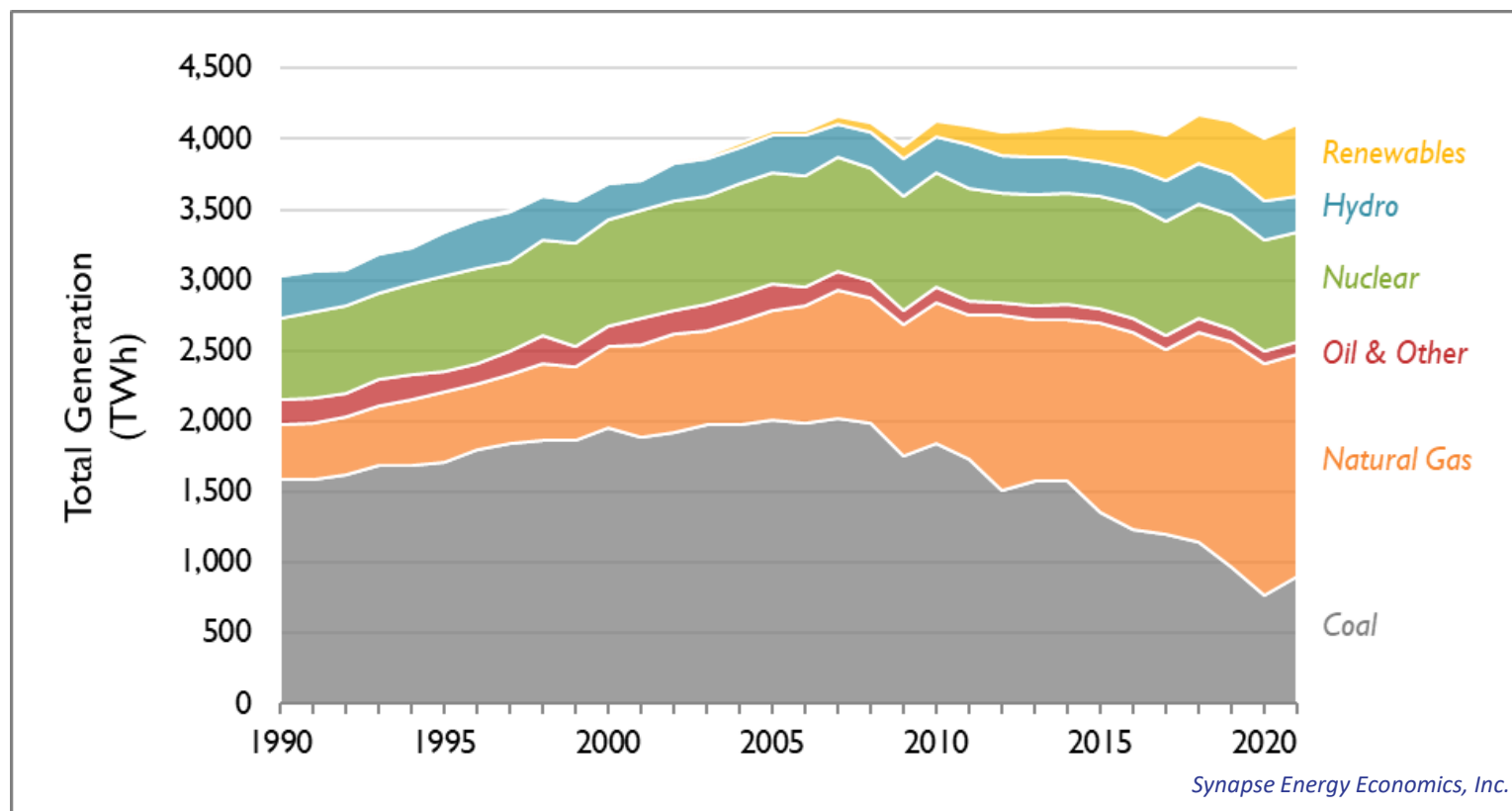
	State	Retired Capacity (Nameplate MW)
1	Indiana	1,678
2	Florida	809
3	Maryland	728
4	Louisiana	721
5	North Carolina	713
-	Other States	1,832
	Total	6,481

6.5 GW of coal retired in 2021.

Coal retirements took place in 12 states.

Since 2012, 109 GW of coal has retired (a decrease of 32 percent).

Coal generation rebounds from 2020, but remains below 2019 levels

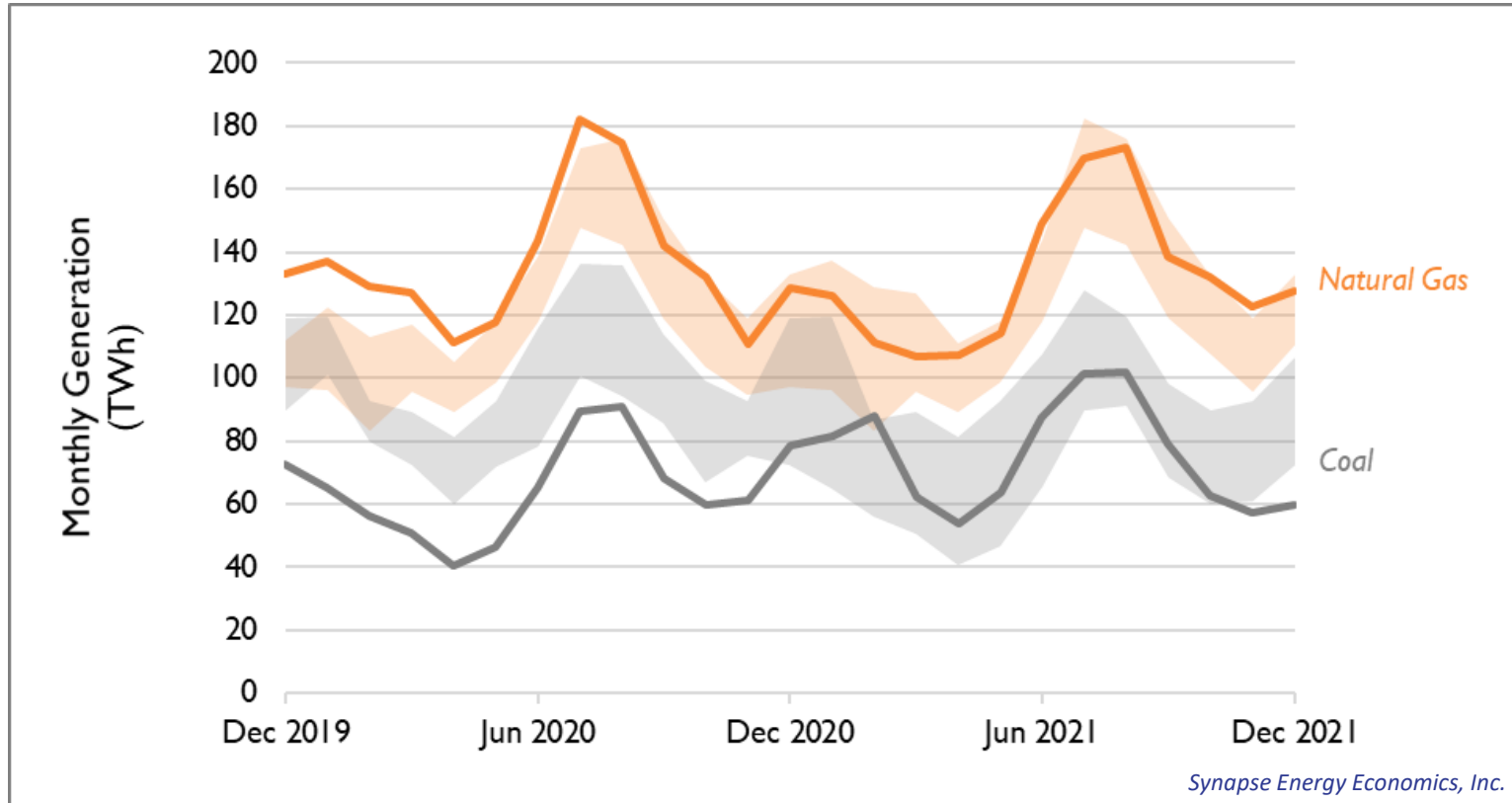


In 2021, coal generation rebounded following the easing of the COVID-19 pandemic. Coal continues to make up about one-fifth of electricity generation in the U.S.

Non-emitting generation (renewables, hydro, and nuclear) made up 38 percent of total generation in 2021.

In the 10 years since 2012, annual average growth in generation has held flat.

Despite rebounds, coal generation continues to be outpaced by gas



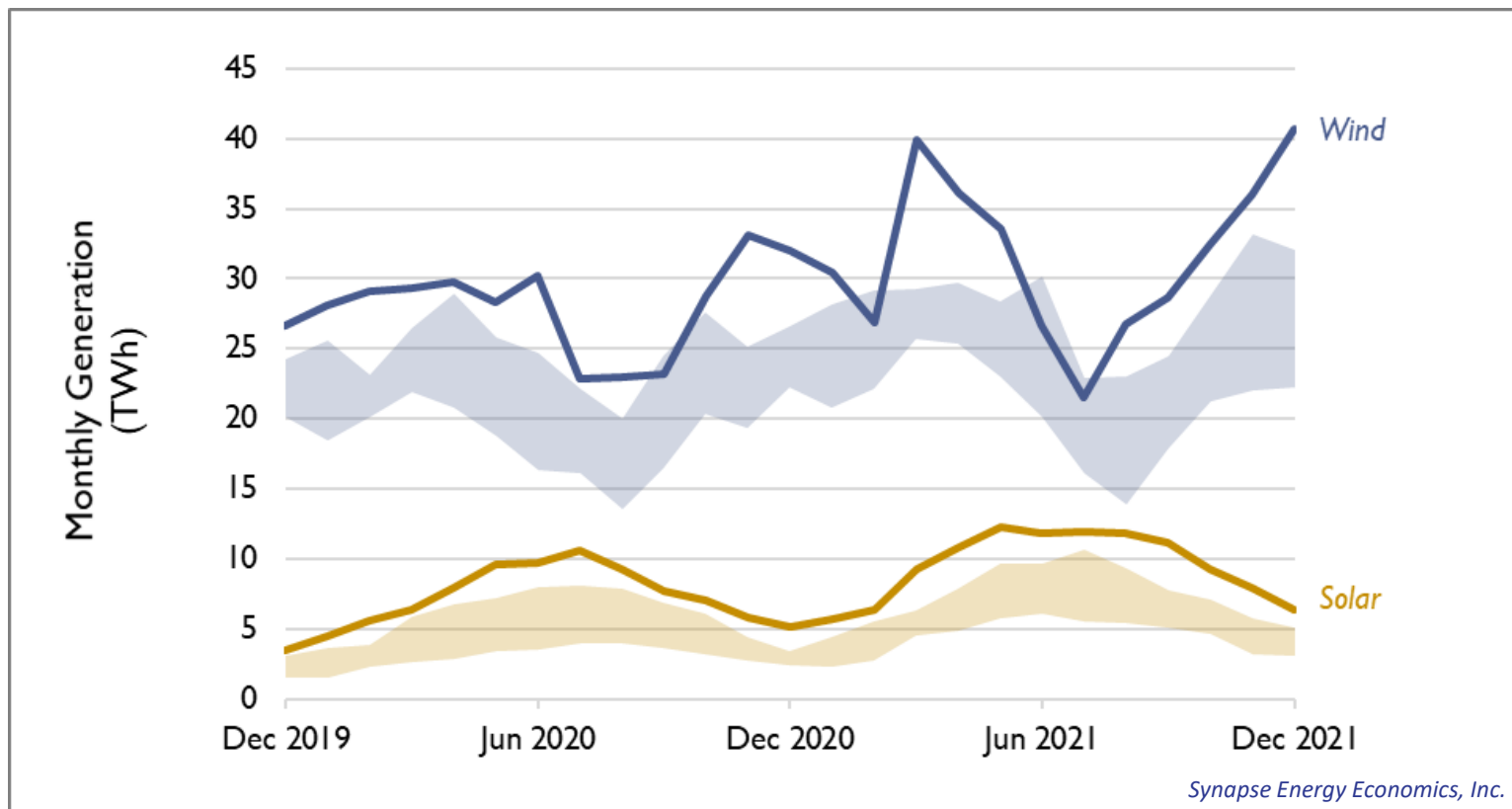
Note: This figure shows monthly generation compared to the previous four-year range.

For example, the December 2021 coal line is compared to the range of coal generation (grey shaded area) in Dec. 2017, Dec. 2018, Dec. 2019, and Dec. 2020.

As in the past three years, natural gas generation exceeded coal generation in every month of 2021.

Despite increases in the first quarter of the year, from summer 2021 onwards, coal generation was at or near record-low levels.

As in past years, in 2021, wind made up about 4/5 of total renewable generation



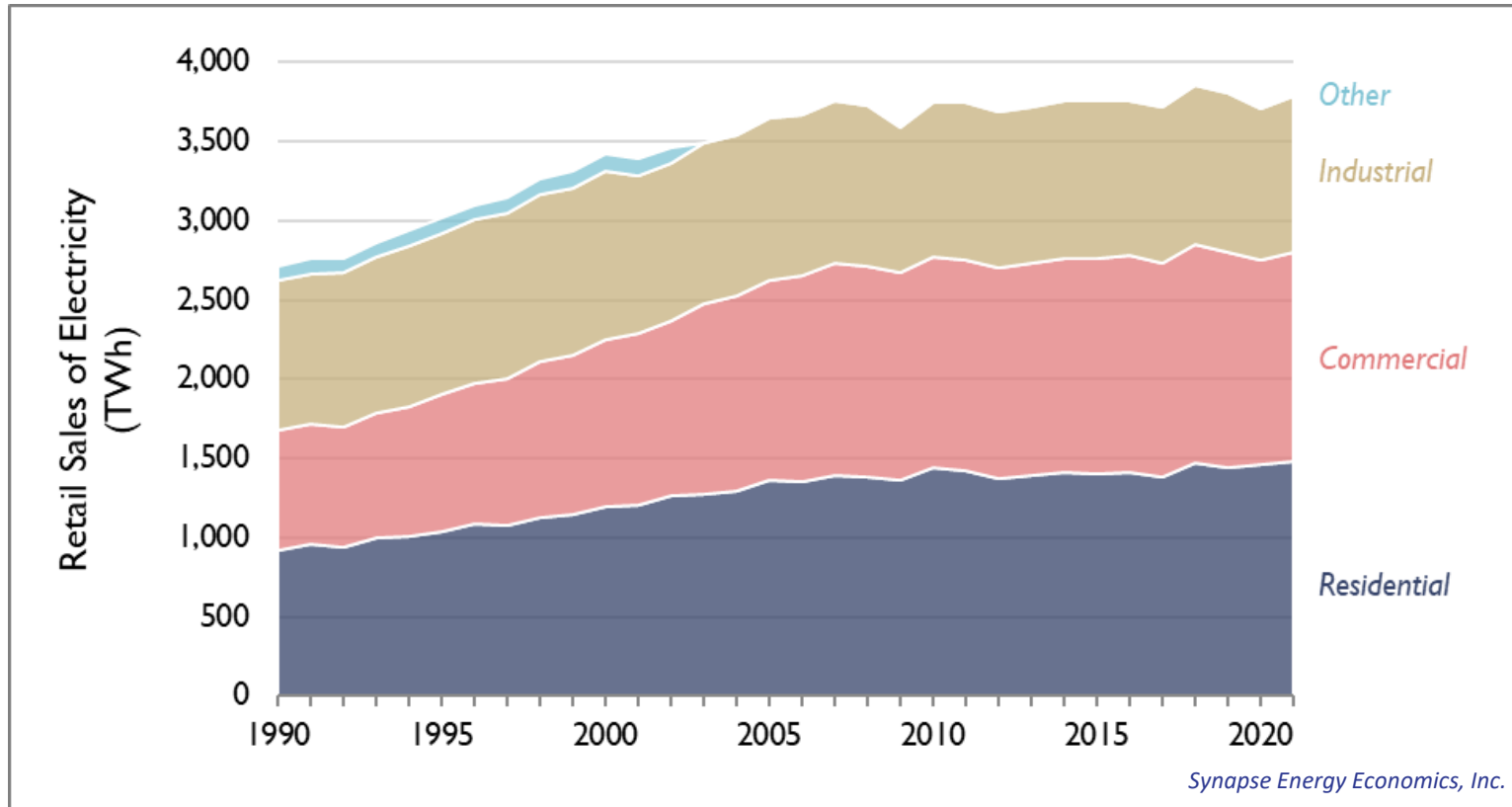
Note: This figure shows monthly generation compared to the previous four-year range.

For example, the December 2021 wind line is compared to the range of wind generation (purple shaded area) in Dec. 2017, Dec. 2018, Dec. 2019, and Dec. 2020.

Annual wind generation increased by 12 percent in 2021, relative to 2020. At the same time, annual utility-scale solar generation grew by 29 percent.

December 2021 set historical records for wind generation in any month (41 TWh). May 2021 set historical records for solar generation in any month (12 TWh). Solar generation in May, June, July, August, and September 2021 all exceeded the previous peak month for solar generation, set in July 2020.

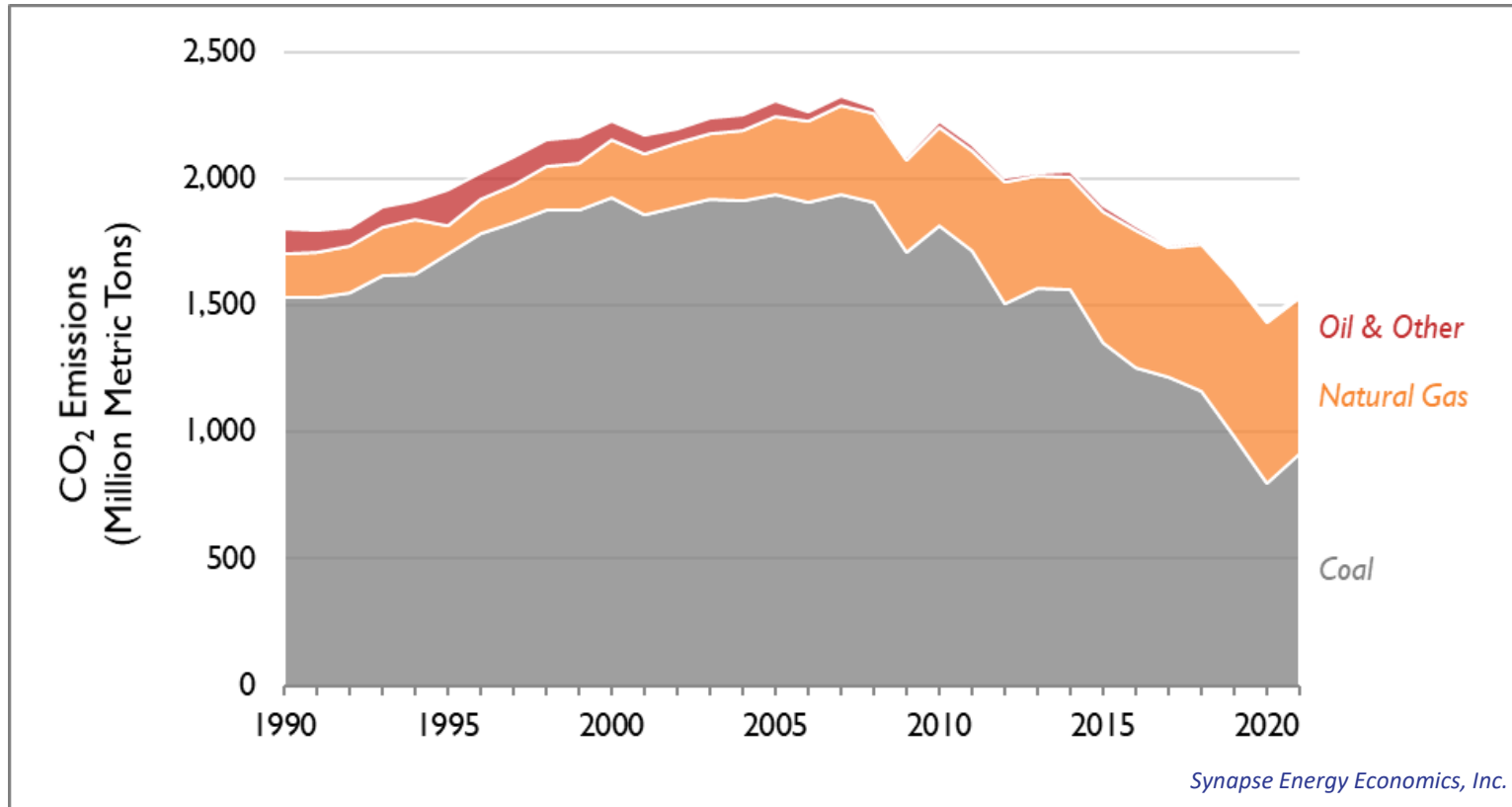
Retail sales have grown by an average of 0.1 percent per year in the 10 years since 2012



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

From 2020 to 2021, annual sales increased by 2 percent, likely due in part to the easing of the COVID-19 pandemic.

U.S. electric-sector CO₂ emissions increased by 7 percent in 2021

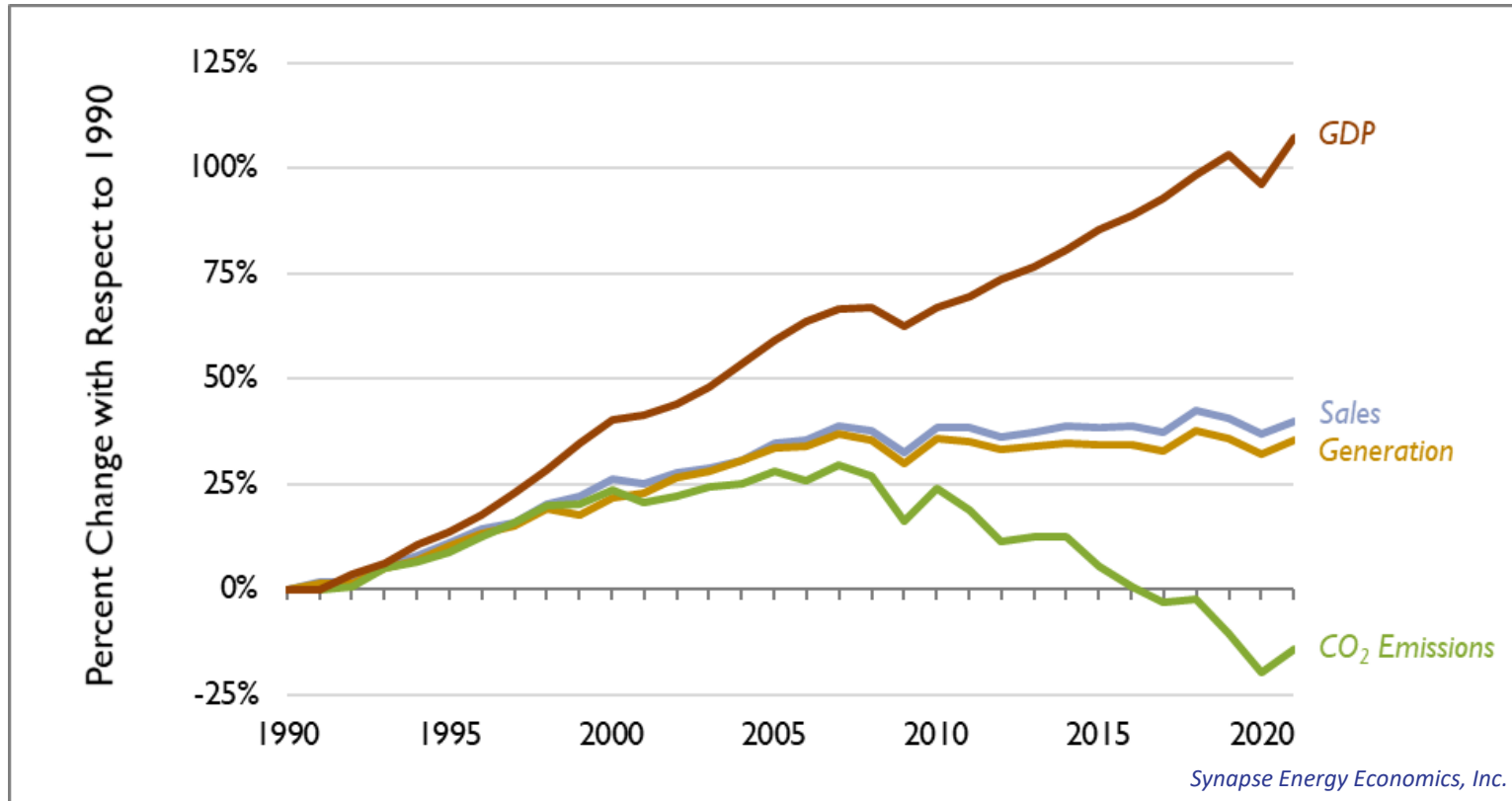


Note: Emissions in 1995 and later years are only inclusive of CO₂ emissions from plants larger than 25 MW.

Emissions increases are due to increases in coal generation. Coal emissions increased by 15 percent while natural gas emissions decreased by 3 percent.

Since hitting an all-time peak in 2007, CO₂ emissions from the electric sector have dropped by 34 percent.

Electric sales and CO₂ emissions are increasingly unrelated to GDP growth

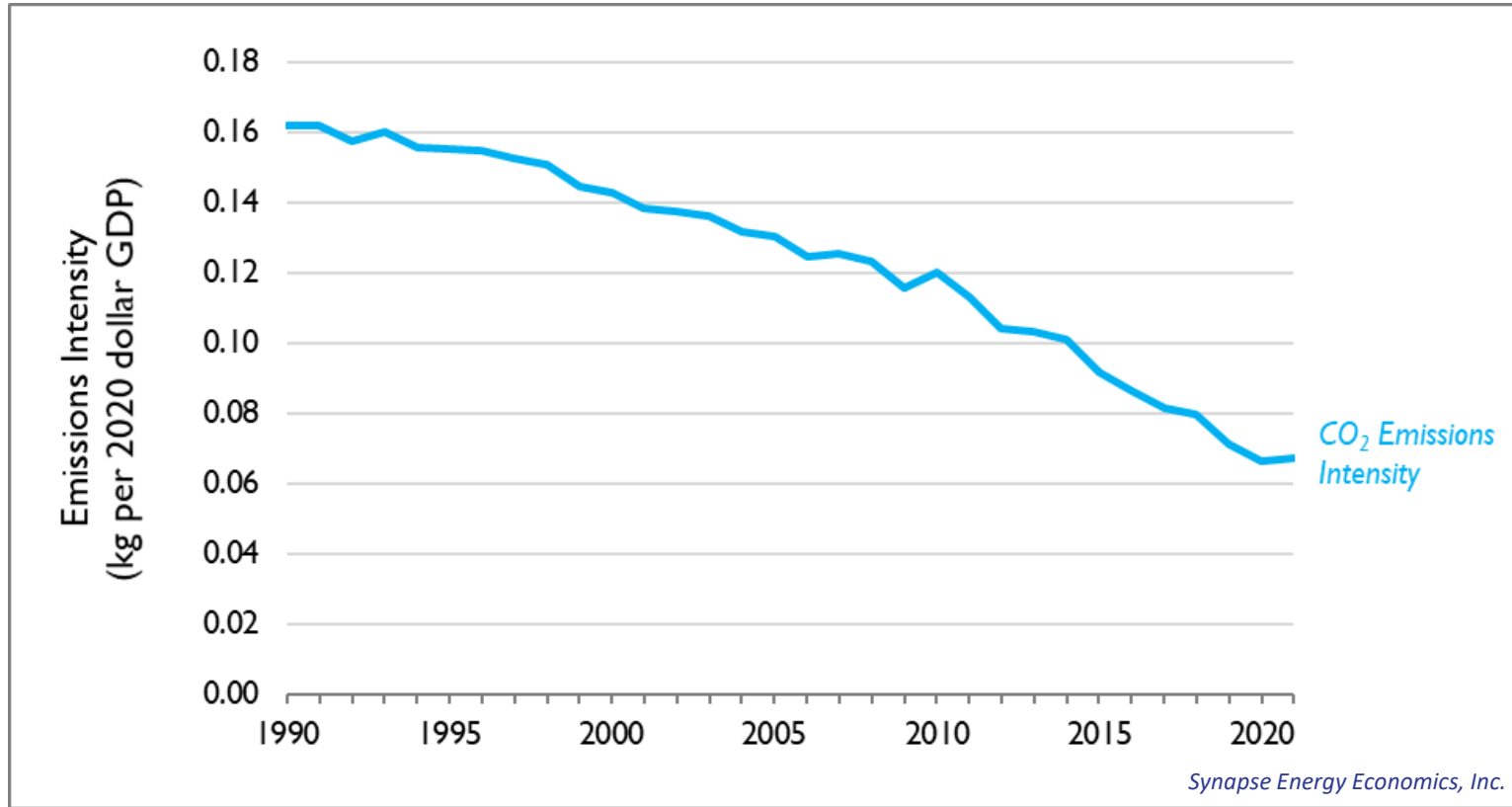


Following the easing of the COVID-19 pandemic, GDP increased in 2021. GDP has increased by 107 percent compared to 1990.

Meanwhile, CO₂ emissions rebound to being 14 percent below 1990 levels.

Retail sales and generation have grown by 35-40 percent since 1990, and have remained largely constant since 2006.

Carbon intensity (CO₂ per GDP) continues to decline



Note: GDP values are described in 2021 dollars.

Since 1990, the kg of CO₂ emitted per dollar of GDP has fallen by 59 percent, from 0.17 to 0.07 kg/\$.

Notes and Sources

All 2021 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, 1990-2021.

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, 2001-2021.

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, 1990-2021.

Emissions: CO₂ emission values for 1995-2021 are from U.S. Environmental Protection Agency Air Markets Program Data (note that data only includes emissions from plants that are 25 MW or larger). CO₂ 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 March 2021.

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