

Synapse
Energy Economics, Inc.

Synapse Electricity Snapshot 2023

A review of the U.S. electric system through December 2022

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Synapse Electricity Snapshot 2023

- For the first time, renewable capacity (inclusive of wind, solar, and battery storage resources) exceeds capacity from coal. As of the end of 2022, there were over 225 GW of renewable capacity installed, compared to coal's 216 GW.
- Non-CO₂-emitting generating capacity (renewables, nuclear and hydro) makes up 34 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.

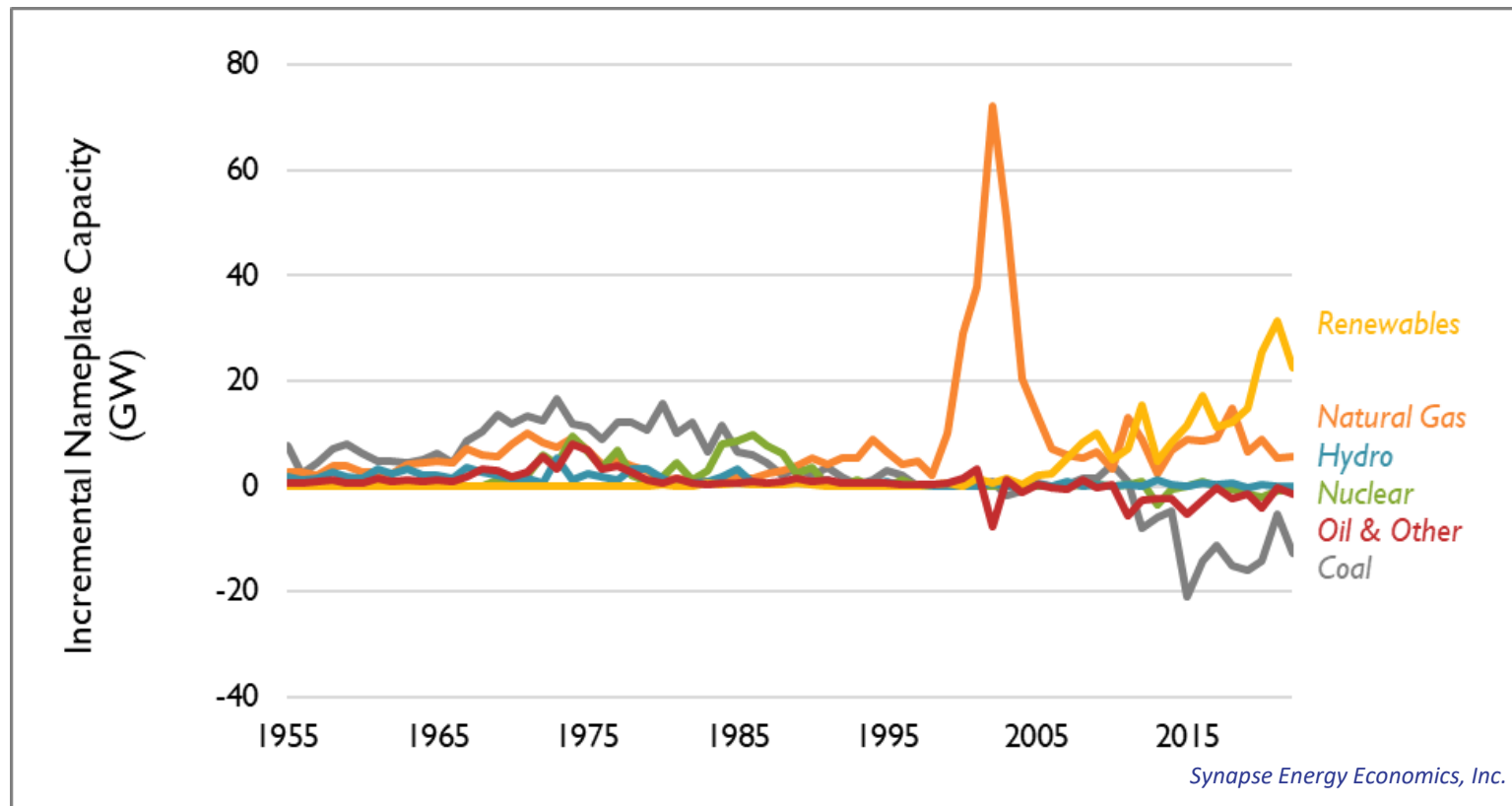
All values in this document are based on preliminary 2022 data are subject to future updates and revisions.

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- From 2021 to 2022, annual sales increased by 3 percent, the highest year-on-year growth observed since the United States transitioned out of a recession in 2009 to 2010.
- Electric-sector CO₂ emissions remained flat at 1,534 million metric tons. Since reaching an all-time peak in 2007, electric sector CO₂ emissions have declined to one of the lowest observed levels since the 1970s.
- Since 1990, CO₂ emitted per dollar of GDP has decreased by 60 percent, from 0.15 to 0.06 kg per dollar.

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More new capacity continues to come from renewables than from any other resource



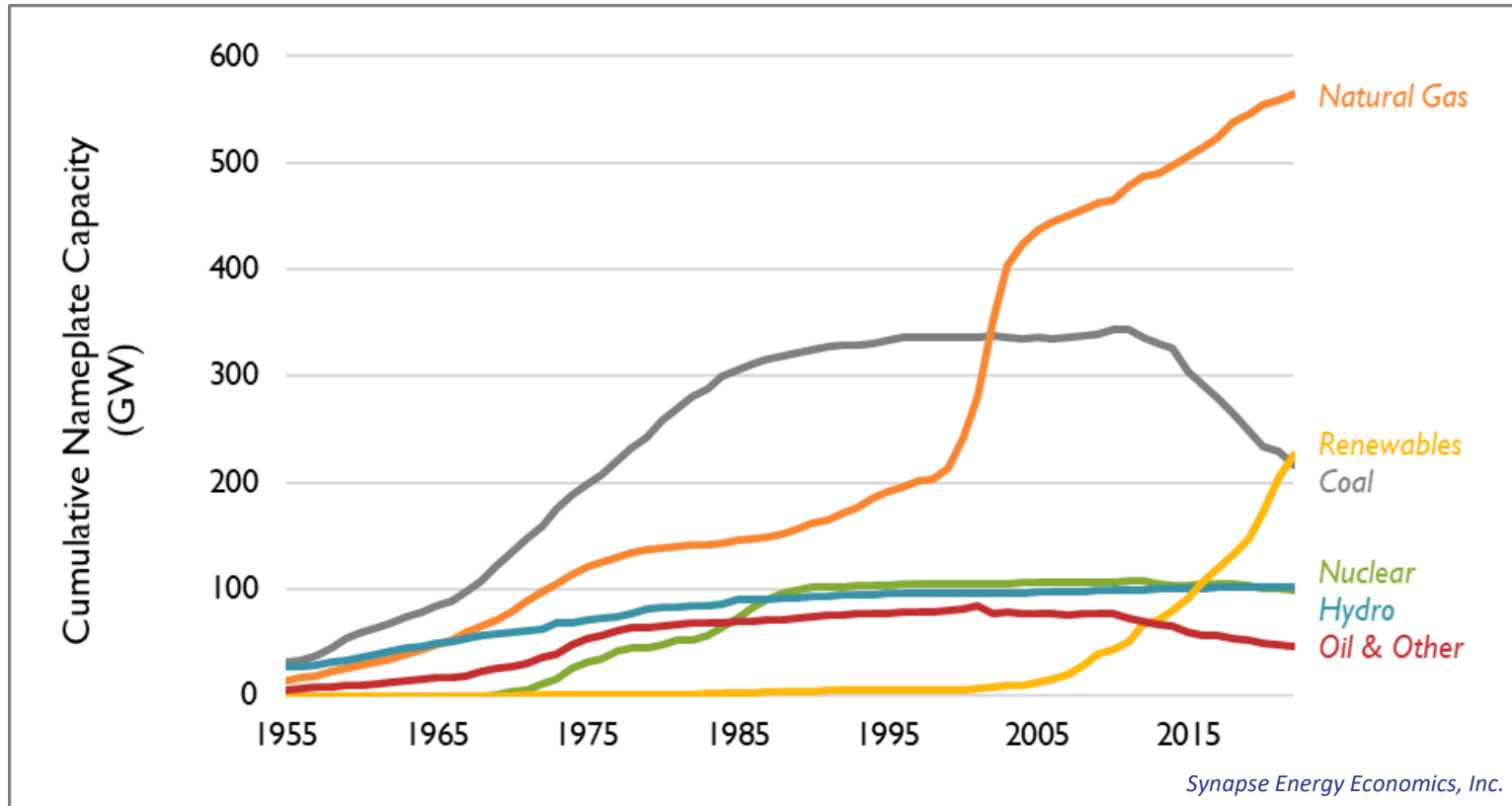
Note: This figure displays net nameplate values for utility-scale generators; annual capacity retirements are subtracted from annual capacity additions.

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

Compared to 2021, new renewable capacity installations fell by 28 percent to 22 GW. [Data from EIA](#) suggests that new renewable capacity installations in 2023 will grow to over 44 GW.

Coal retirements neared 13 GW in 2022. Coal retirements have exceeded 10 GW per year in seven out of the last eight years.

For the first time, renewable energy capacity now exceeds coal capacity



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

In 2022, renewable resources reached 18 percent of total U.S. generating capacity. In the 10 years since 2013, renewables have increased by 155 GW, compared to a 75 GW increase in natural gas over the same period.

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

In 2022, renewables represented the largest category of net capacity additions with over 22 GW added

Capacity (GW)	Installed		Retired		Net (installed less retired)	
	2021	2022	2021	2022	2021	2022
Coal	-	-	6.4	12.8	-6.4	-12.8
Natural Gas	7.3	6.5	1.1	1.8	6.2	4.7
Nuclear	-	-	1.0	0.8	-1.0	-0.8
Hydro	0.1	0.0	0.0	0.0	0.1	0.0
Renewables	31.7	22.4	0.5	0.2	31.2	22.3
<i>Geothermal</i>	0.0	0.1	-	-	0.0	0.1
<i>Storage</i>	3.3	4.1	0.0	0.0	3.2	4.0
<i>Solar</i>	13.5	10.0	0.3	0.0	13.2	10.0
<i>Wind</i>	15.0	8.2	0.2	0.1	14.7	8.1
Oil and Other	0.0	0.0	1.2	0.6	-1.1	-0.6
<i>Biomass</i>	0.0	0.0	0.2	0.0	-0.2	0.0
<i>Oil</i>	0.0	0.0	0.8	0.5	-0.8	-0.4
<i>MSW</i>	0.0	0.0	0.1	0.1	-0.1	-0.1
<i>Other</i>	-	-	-	0.0	0.0	0.0
Total	39.1	29.0	10.2	16.2	28.9	12.8

In 2022, renewables were the largest category of capacity additions with a net 22 GW of installations—including 10 GW from solar and 8 GW from wind. There were also 4 GW of storage additions. This is the third largest annual addition of renewables on record after 2021 and 2020.

There were net 6 GW of new natural gas capacity installed, down from almost net 5 GW in 2021.

Almost 13 GW of coal retired in 2022, almost twice the amount retired in 2021.

Coal capacity is at its lowest level since 1977

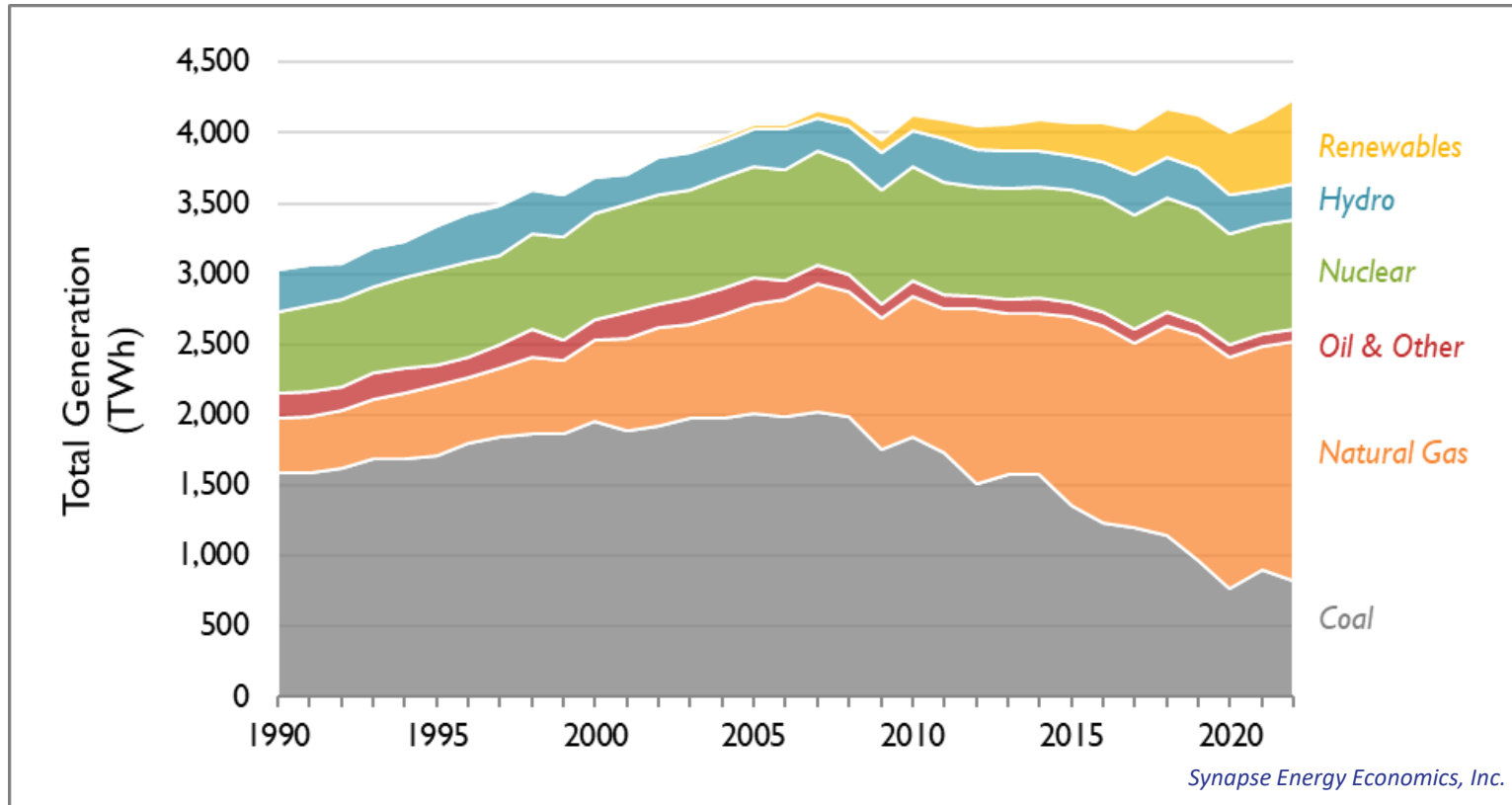
	State	Retired Capacity (Nameplate MW)
1	Illinois	3,024
2	Ohio	2,106
3	Michigan	1,745
4	Maryland	1,252
5	New Mexico	924
-	Other States	3,725
	Total	12,776

12.8 GW of coal retired in 2022.

Coal retirements took place in 13 states.

Since 2013, 114 GW of coal has retired (a decrease of 35 percent).

Coal generation falls, reaching the second-lowest year on record

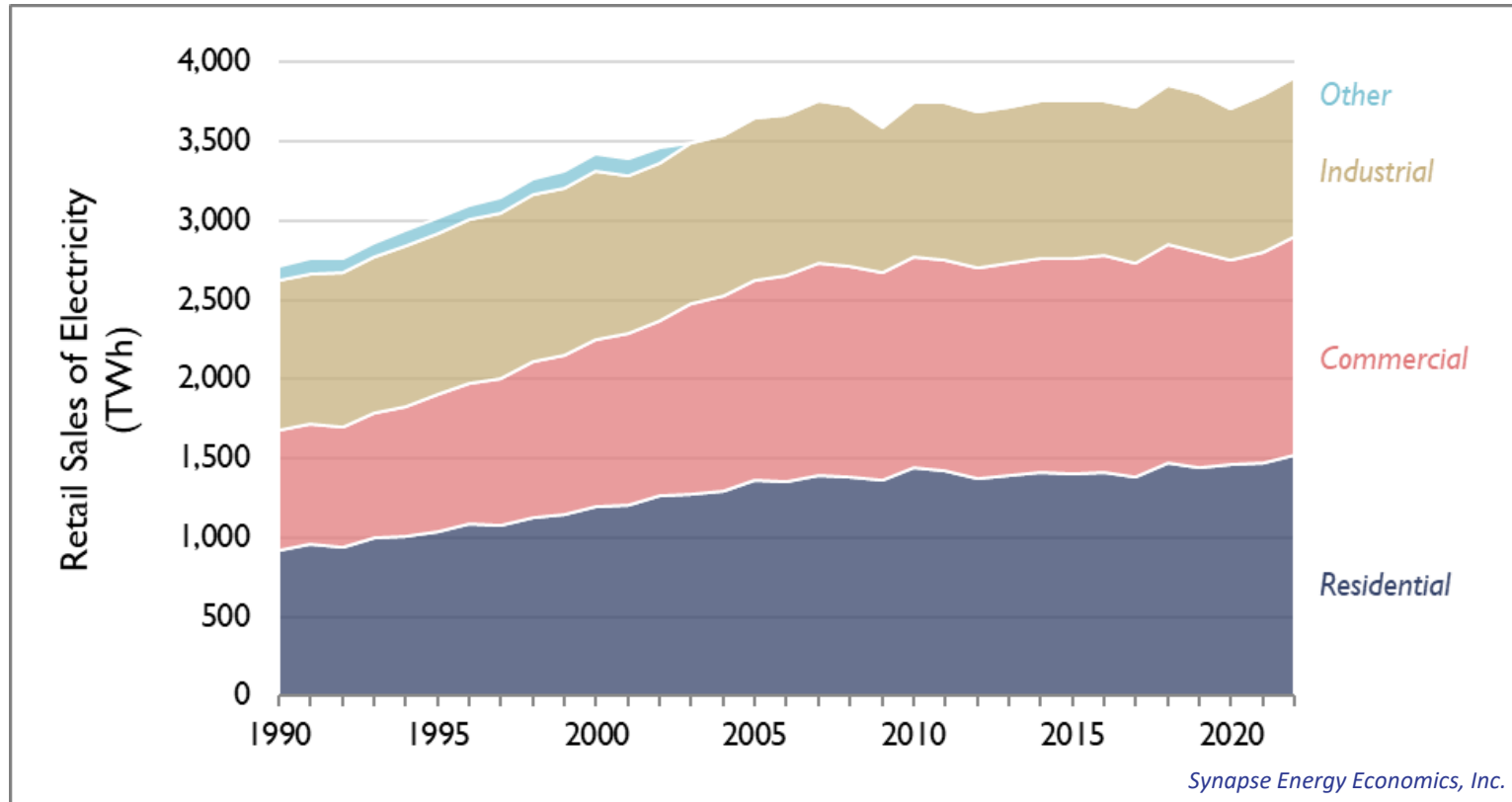


In 2022, coal generation fell compared to output in 2021. Coal continues to make up about one-fifth of electricity generation in the U.S.

Non-emitting generation (renewables, hydro, and nuclear) made up 38 percent of total generation in 2022.

In the 10 years since 2013, annual average growth in generation has increased by 0.5 percent.

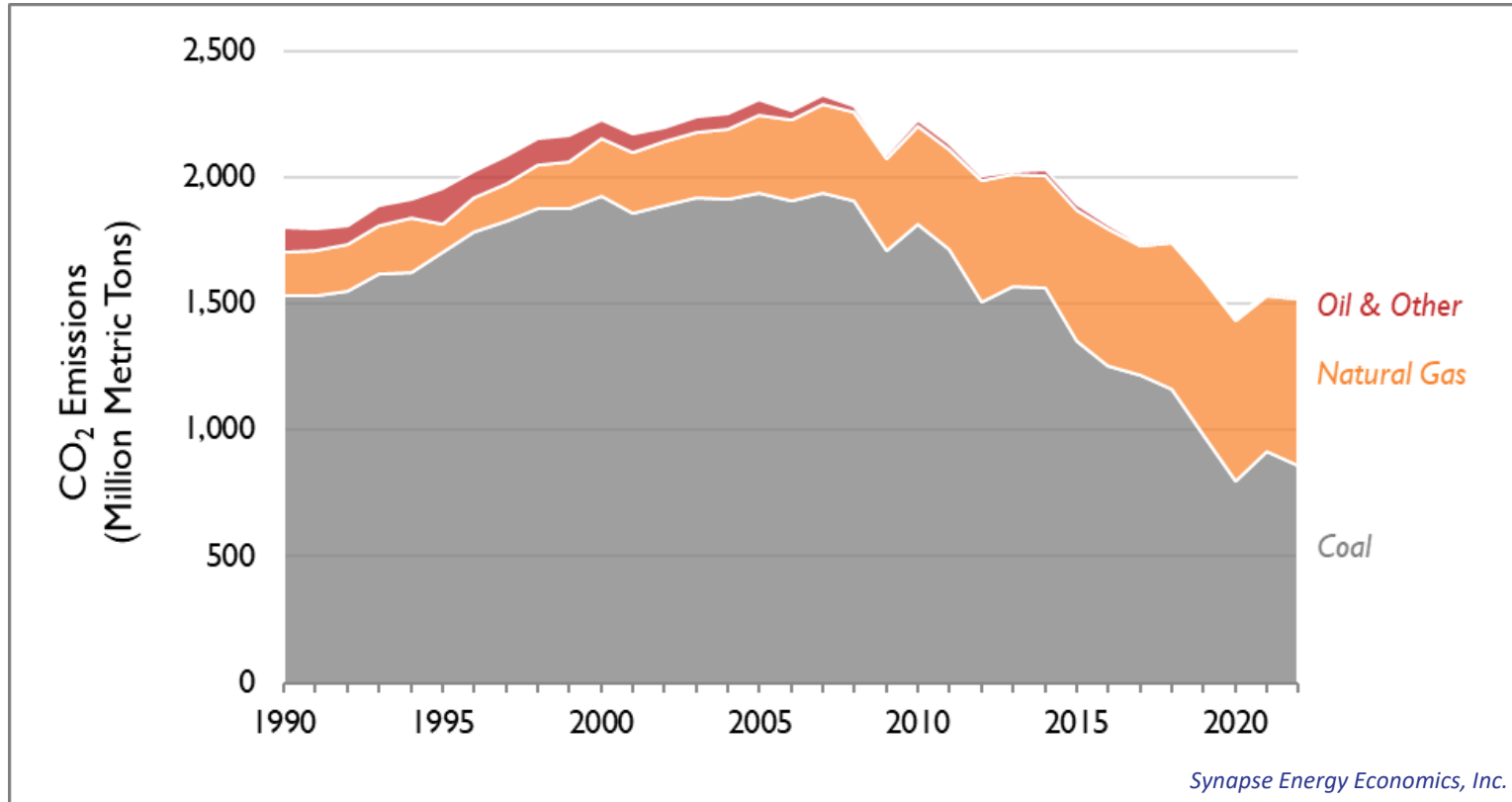
Retail sales have grown by an average of 0.6 percent per year in the 10 years since 2013



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

From 2021 to 2022, annual sales increased by 3 percent, the highest year-on-year growth observed since the United States transitioned out of a recession in 2009 to 2010.

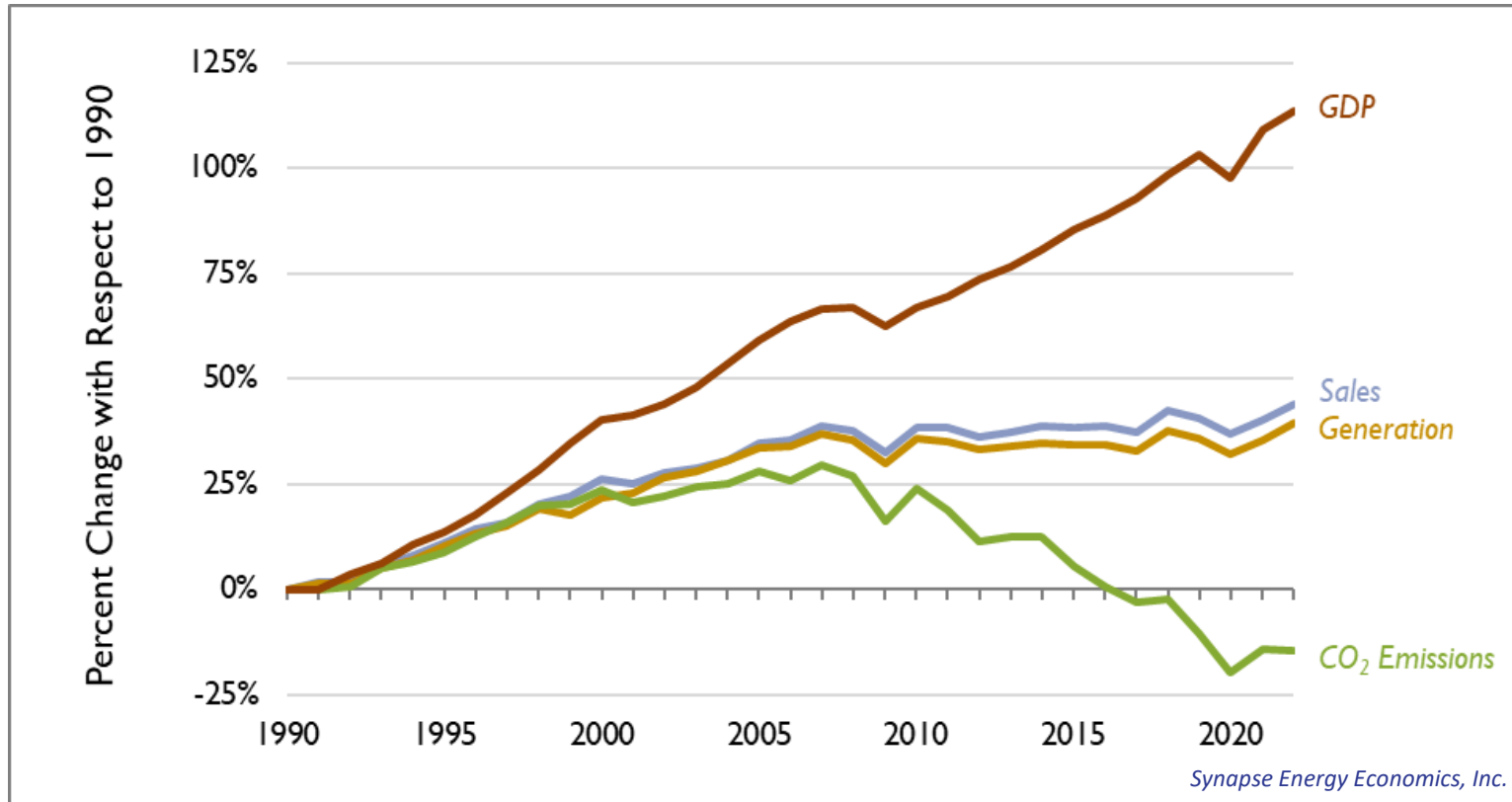
Total U.S. electric-sector CO₂ emissions remained flat from 2021 to 2022



Between 2021 and 2022, CO₂ emissions from coal fell by 6 percent while emissions from gas increased by 7 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



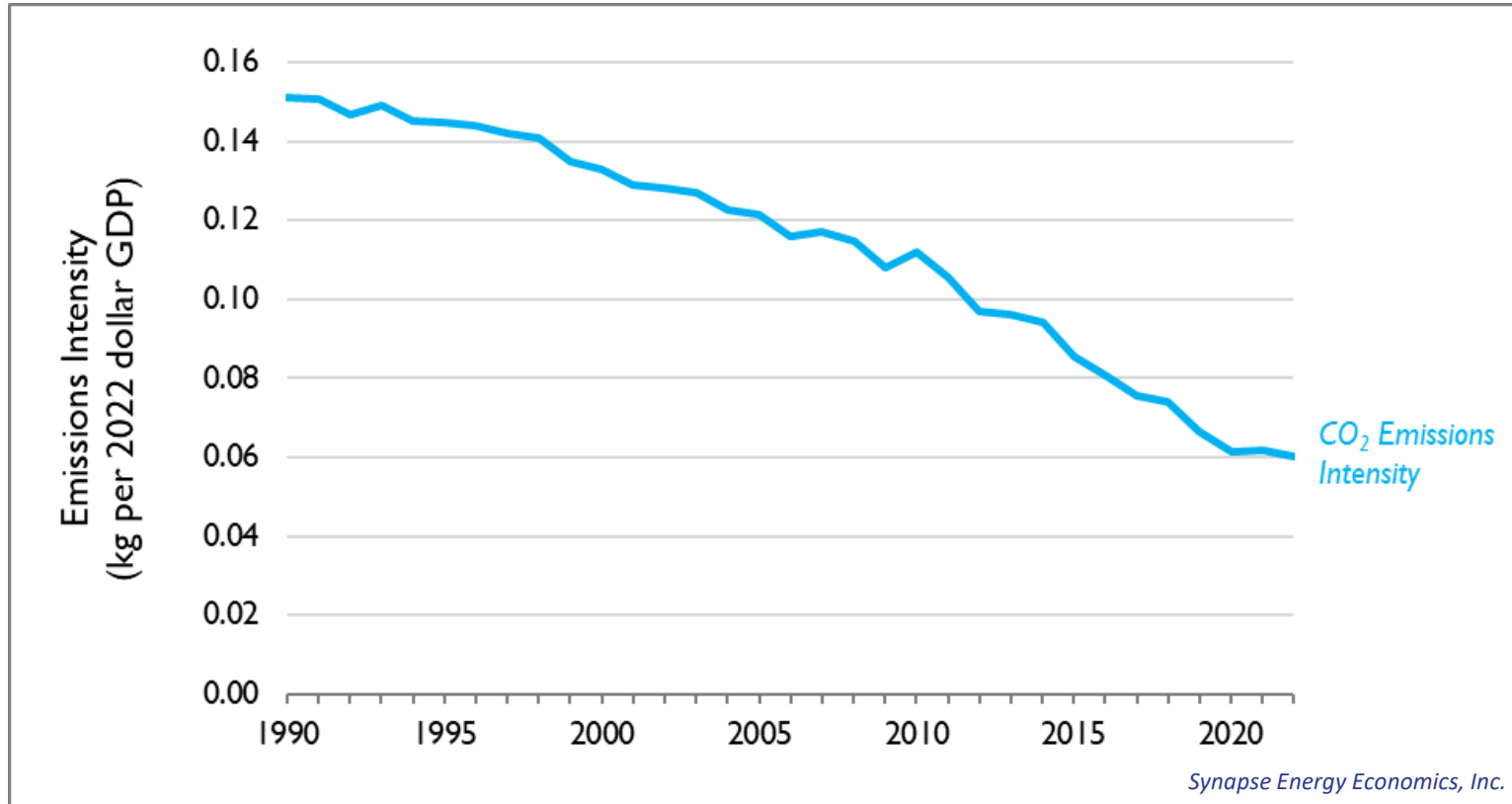
Note: Values for GDP have been adjusted for inflation and are in constant-year dollars.

GDP grew by 2.1 percent compared to 2021. GDP has increased by 114 percent compared to 1990.

Meanwhile, CO₂ emissions are 15 percent below 1990 levels.

Retail sales and generation have grown by 40-45 percent since 1990 and have remained largely constant since the mid-2000s.

Carbon intensity (CO₂ per GDP) continues to decline



Note: GDP values are described in 2022 dollars.

Since 1990, the kg of CO₂ emitted per dollar of GDP has fallen by 60 percent, from 0.15 to 0.06 kg/\$.

Notes and Sources

All 2022 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, 1990-2022.

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, 2001-2022.

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, 1990-2022.

Emissions: CO₂ emission values for 1995-2022 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 2022.

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