Memorandum

TO: PAT STANTON, E4THEFUTURE

FROM: DOUG HURLEY AND JACKIE LITYNSKI

DATE: NOVEMBER 24, 2020; REVISED FEBRUARY 19, 2021

RE: STATE CARBON DIOXIDE EMISSIONS AND GROSS STATE PRODUCT COMPARISONS

Introduction

In 2014 E4TheFuture – then Conservation Services Group – asked Synapse to compare and contrast several different metrics for the 50 states and the District of Columbia regarding energy usage, state-level economics, and carbon dioxide emissions. We had suspected at the time that national gross domestic product and its state counterpart – gross state product – were no longer linked to CO_2 emissions in the way they had been in the past. We were right. Six years ago, we found that across the U.S. the GDP had risen 70% from 1990 through 2012 but CO_2 emissions had only increased by 7% over that same time period.

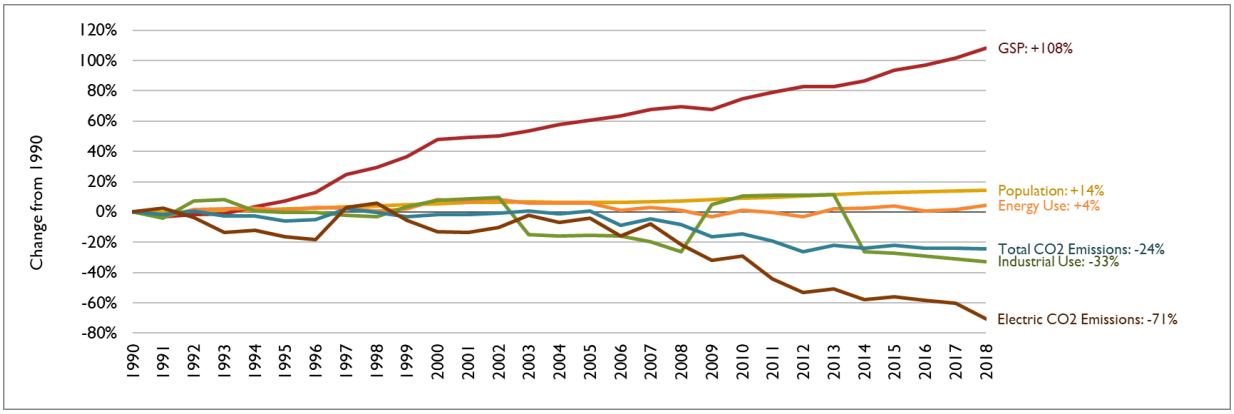
E4TheFuture has asked us to update that prior analysis with data through 2018, the most recent year available from the primary data source, the US Energy Information Administration (EIA). From that source and the U.S. census we have collected and analyzed for every state and the District of Columbia the gross state product, population, total energy use, energy use by the industrial sector, CO_2 emissions from the electric sector (that is, from power plants to create electric power), and total CO_2 emissions. These six metrics,[1] viewed over the 29-year period from 1990 through 2018, inclusive, provide a dashboard of how each state's economy and population has grown or shrunk, and the CO_2 emissions associated with those economic indicators.

Analysis and Results

We will begin at home, with the results for Massachusetts, which is both the most populous state in New England and the highest consumer of electricity. Figure 1 shows all six metrics for Massachusetts.

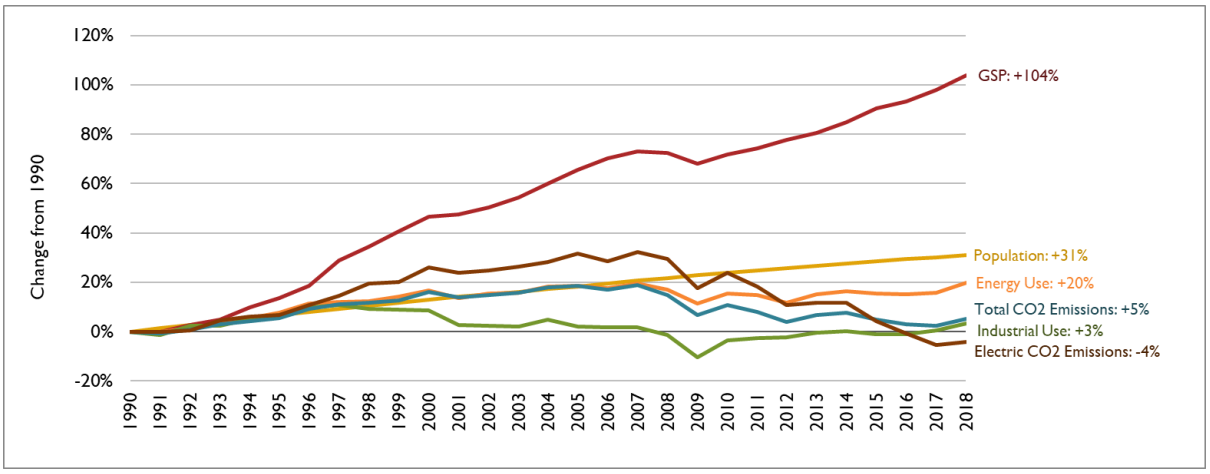
[1] See Appendix 1 for a glossary describing the six metrics.

Figure 1. Energy, Economic and Climate Indicators for Massachusetts, 1990 – 2018



As the figure shows, while the GSP rose by 108% over these 29 years, the energy use rose by only 4%, and total CO_2 emissions dropped by 24%. If we increase our scope to the entire country the theme is not entirely different, although the CO_2 emissions are not as enviable.

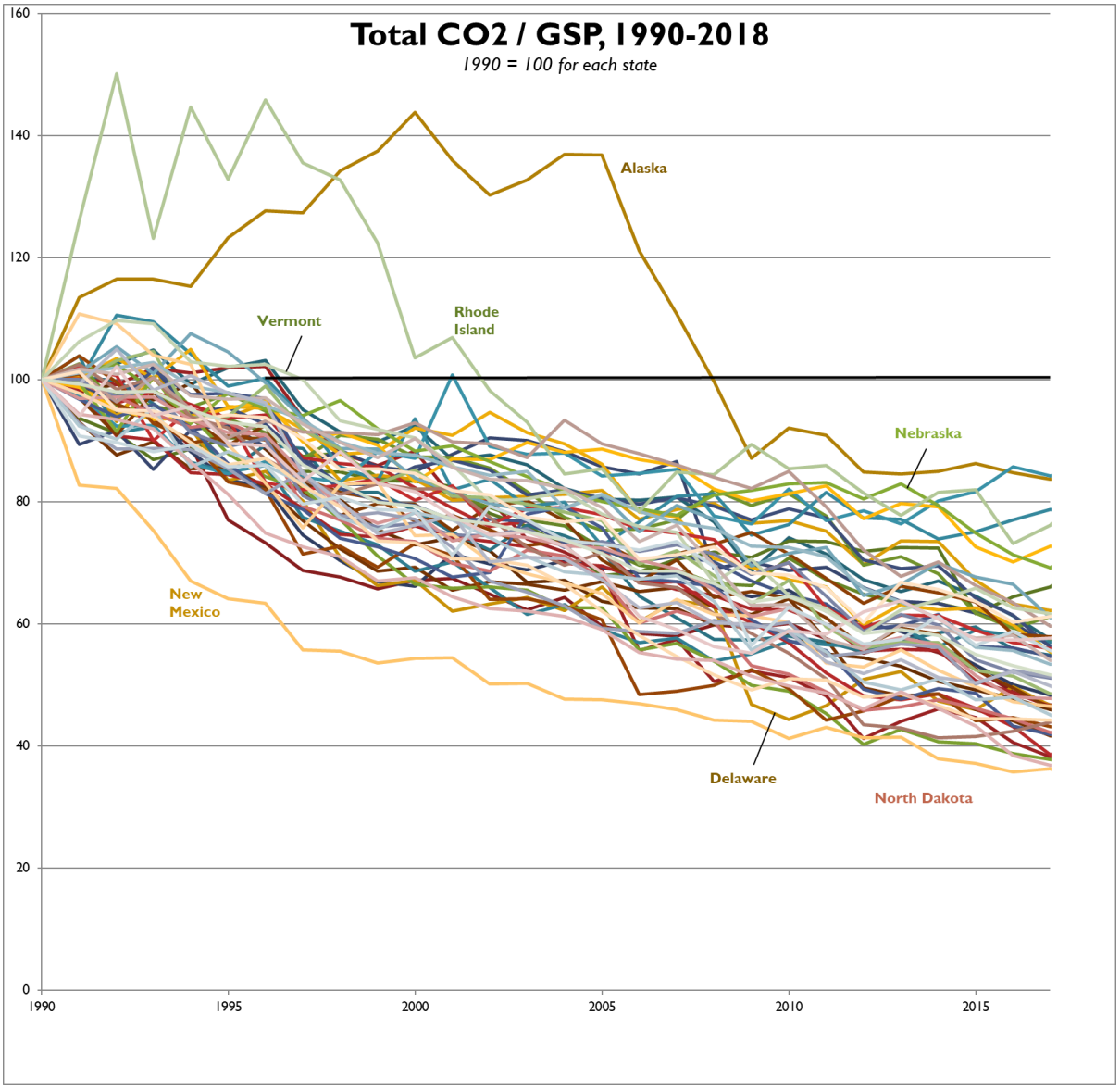
Figure 2. Energy, Economic and Climate Indicators for the Entire U.S., 1990 – 2018



In 2018, Total CO_2 emissions for the entire United States rose by 5% from 1990 levels, while at the same time the GDP rose 104% during that same 29 years. Energy usage for our country rose 20%.

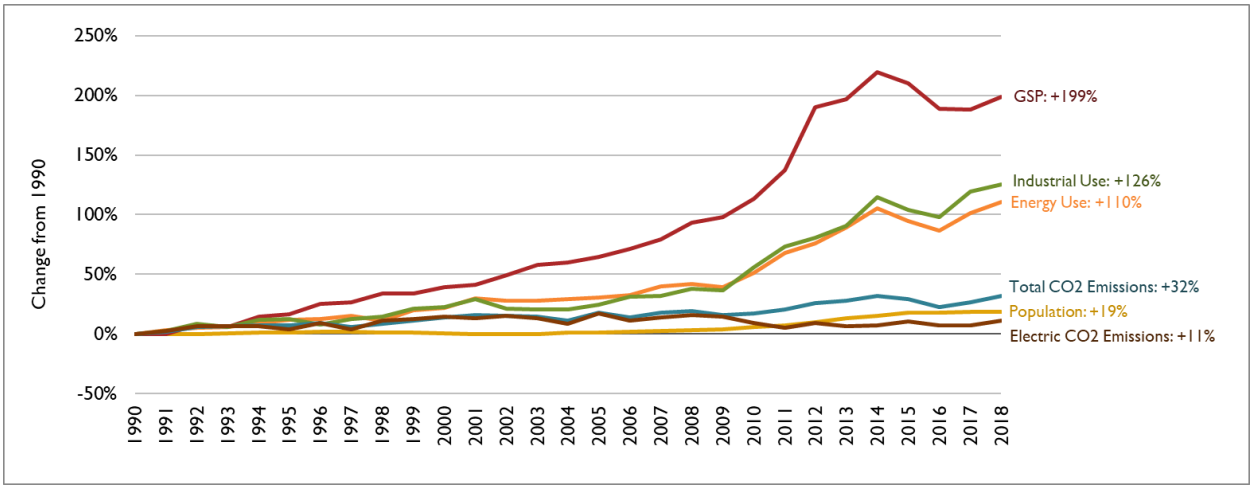
Now, as in our prior analysis, we find that to reach the heart of the issue of whether our economy can grow without also increasing CO_2 emissions we can divide the CO_2 emissions amount by the GSP. If we combine every state in the union and the District of Columbia, we see a clear trend, albeit with a few outliers.

Figure 3. CO_2 Emissions per unit of Gross State Product for all states, 1990-2018



The country as a whole, on a state-by-state basis, is on a clear trend, with 2018 showing Gross State Product per ton of CO_2 at approximately 60% of 1990 levels. This drop in emissions during a period of increased GSP over nearly three decades is a sign of increased efficiency, and even hope. Buried in the lines are a few states that are bucking the trend, each with its own unique story. North Dakota is one example.

Figure 5. Energy, Economic, and Climate Indicators for North Dakota, 1990-2018

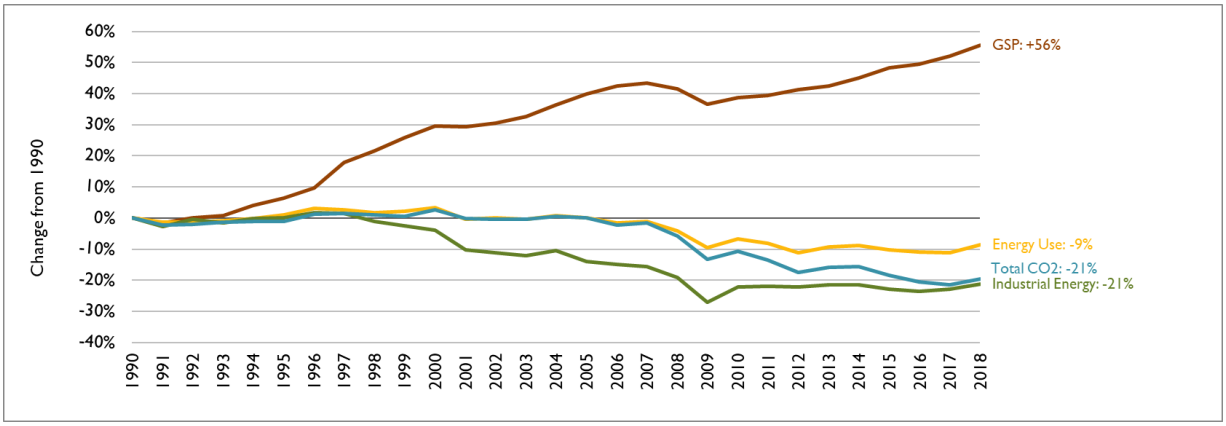


We expect that North Dakota's rapid rise in GSP just after 2010 is linked to the production of oil and gas in that state. While the GSP has risen almost 200% since 1990 the increase in energy use is also significant at 110%. Their total CO_2 emission rose by 32% during this timeframe. The population also rose 20%, perhaps reflecting the additional workforce necessary to extract the oil and gas resource there. More investigation would be necessary to confirm or correct these presumptions. In all, 33 states saw an increase in CO_2 emission from 1990 until 2018. Idaho was the leader with a 66% increase.

Per Capita Trends

As Figure 2 reminds us, all of this is happening amidst the backdrop of a population that has increased by 31% since 1990. While atmospheric science does not change with the number of people in the U.S., the energy and economic metrics are more encouraging when viewed per capita.

Figure 6. Per Capita Energy, Economic, and Climate Indicators for the U.S., 1990-2018



While the total CO_2 emissions for the country rose by 5%, on a per capita basis it dropped by 21%. Each of us, on average, are emitting fewer tons of CO_2 to live our lives, but not enough to outpace the growth in population.

Conclusion

Across the entire United States, compared to 1990 levels, we have reduced per capita CO_2 emissions by an impressive 21% while growing the traditional metric of the overall health of the economy by 56%. That is good news indeed, showing that we are becoming more efficient while being more productive, but not good enough. Population growth has outpaced our gains in individual efficiency. Total U.S. CO_2 emissions have risen by 31% during that time. Still, the GDP rose by a far larger amount, just over 100%, showing that economic gains are no longer directly linked to greenhouse gas emissions. Efforts at a more efficient economy are working. Individual states vary widely in their own efforts, based upon efficiency efforts, geopolitical influences, local resource availability, and other factors.

Appendix 1: Glossary of Metrics

Gross State Product

The Gross State Product value represents the market value for all final goods and services within the state for a given year. This value was provided in million chained 2012 US dollars and originates from the "All Consumption Estimates in Btu" file by the EIA's State Energy Data Systems.[2]

Population

The population indicates the number of residents in the state for any given year. This value was provided in number of residents and originates from the "All Consumption Estimates in Btu" file by the EIA's State Energy Data Systems.

Total Energy Use

Total energy use indicates the total energy consumed within a state in a given year in all sectors (includes: transportation, commercial, electric power, industrial, and residential sectors). This data was provided in billion Btu and originates from the "All Consumption Estimates in Btu" file by the EIA's State Energy Data Systems.

Energy Use by the Industrial Sector

This value represents the total energy used by the industrial sector within a state each year. This data is a subset of the "Total Energy Use" metric. It was provided in billion Btu and originates from the "All Consumption Estimates in Btu" file by the EIA's State Energy Data Systems.

CO_2 Emissions from the Electric Sector

This value represents CO_2 emissions that originate in the electric power sector for a given state each year. The electric power sector includes power plants that produce electricity. This data is a subset of the "Total CO_2 Emissions" metric. This data was originally provided in million metric tons of CO_2 and compiled from the "State Carbon Dioxide Emissions from Fossil Fuel Tables" from the EIA's Energy-Related CO_2 Emission Data Tables.[3]

Total CO_2 Emissions

This value represents all CO_2 emissions in a state from all sources (includes: transportation, commercial, electric power, industrial, and residential sectors). This data was originally provided in million metric tons of CO_2 and compiled from the "State Carbon Dioxide Emissions from Fossil Fuel Tables" from the EIA's Energy-Related CO_2 Emission Data Tables.

[2] https://www.eia.gov/state/seds/seds-data-fuel.php?sid=US#DataFiles

[3] https://www.eia.gov/environment/emissions/state/