**Executive Summary**

*This section provides an overview to the project. It should briefly touch on the motivation, data question, data to be used, along with any known assumptions and challenges:*

Current estimates indicate a strong correlation between the global response to COVID-19 and a reduction of greenhouse gas emissions[[1]](#footnote-1). As a result of the abrupt changes in global energy demand, climate scientists are predicting an unprecedented drop in carbon emissions[[2]](#footnote-2). The purpose of this analysis is to explore how the sources of carbon emissions in various economic sectors changed during the global response to the pandemic.[[3]](#footnote-3) I will obtain time-series data on national trends pertaining to residential/commercial energy demand, manufacturing, and transportation. The goal is to obtain these data for both 2019 and 2020 and compare the extent of the changes, if any, under the assumption that these economic activities are stand-in measures for carbon emissions.

**Motivation**

My hope is that this comparison may shed light on ways to leverage the benefits of specific high-reward, low-risk strategies initially intended to combat COVID-19, to meet the recommended emission goals proposed by the IPCC.

**Data Question**

How have the sources of carbon emissions changed amid global response to COVID?

**Minimum Viable Product (MVP)**

*Define your MVP. This should be a description of what your final capstone will look like, including visualizations, how the analysis will be presented, who the intended audience is, etc.*

My final capstone project will include a series of visualizations capturing the changes in the sources of greenhouse gas emissions before and after the initial implementation of lockdowns/stay-at-home orders by highlighting the duration and the extent of peak changes in economic activities such as residential/commercial energy demand, manufacturing, and transportation.

**Schedule (through 1/7/2021)**

1. Get the Data (12/07/20)
2. Clean & Explore the Data (12/14/20)
3. Create Presentation of your Analysis (12/22/20)

* Should be a presentation, but could include a Jupyter Notebook or dashboard in Excel, Tableau, or PowerBI

1. Internal demos (1/4/2021)
2. Demo Day!! (1/7/2021)

**Data Sources:**

**Residential/commercial electricity trends:**

The link below contains data on the consumption of fuels used to generate electricity by month. Datasets are available for both 2019 and 2020, and are categorized by energy source: coal, petroleum liquids, petroleum coke, natural gas. A screenshot of the data is in the appendix; see figure 1.

<https://www.eia.gov/electricity/data.php#consumption>

<https://www.eia.gov/electricity/data/browser/#/topic/5?agg=0,1&geo=vvvvvvvvvvvvo&endsec=vg&linechart=ELEC.SALES.TX-ALL.M~ELEC.SALES.TX-RES.M~ELEC.SALES.TX-COM.M~ELEC.SALES.TX-IND.M&columnchart=ELEC.SALES.TX-ALL.M~ELEC.SALES.TX-RES.M~ELEC.SALES.TX-COM.M~ELEC.SALES.TX-IND.M&map=ELEC.SALES.US-ALL.M&freq=M&start=201801&end=201906&ctype=linechart&ltype=pin&rtype=s&maptype=0&rse=0&pin=>

**Manufacturing trends:**

The link below contains data on manufacturing trends in the US. Datasets are available for shipments, new orders, unfilled orders, inventories, and stage of fabrication. For this analysis, I suspect that the “shipments” table will be the most relevant because it contains data on the value of manufacturers’ shipments broken down by industry. Energy use and the chemical operations involved to produce manufactured goods are believed to contribute to emissions. A screenshot of the data is in the appendix; see figure 2.

<https://www.census.gov/manufacturing/m3/index.html>

**Transportation trends:**

The link below contains data on traffic volume in the US. The data is available for both 2019 and 2020 and broken down by month/year. A screenshot of the data is in the appendix; see figure 3.

<https://www.fhwa.dot.gov/policyinformation/travel_monitoring/tvt.cfm?CFID=147420191&CFTOKEN=1accf655a8d5775c-A19E1E00-0504-DB9E-7E2201495257F5AA>

The link below contains data on traffic volume in select cities in the US. The data is available for both 2019 and 2020 and broken down by month/year. The datasets are different for each city. I will have to explore these data more to find out the information can be incorporated into the final presentation

<https://www.ite.org/about-ite/covid-19-resources/covid-19-traffic-volume-trends/>

The link below contains data on TSA checkpoint numbers for 2020 and 2019. A screenshot of the data is in the appendix; see figure 4.

<https://www.tsa.gov/coronavirus/passenger-throughput>

The link below contains a dataset on airline traffic in the US. There are twelve tables. I included a screenshot of one of the tables in appendix c; see figure 5. The data are available for 2019 and the first six months of 2020.

<https://www.bts.gov/newsroom/june-2020-us-airline-traffic-data>

<https://www.iata.org/en/publications/store/monthly-traffic-statistics/>

**Known Issues and Challenges**

*Explain any anticipated challenges with your project, and your plan for managing them. Be sure to include:*

* *I do not have direct measures of changes in carbon emissions for 2020, as these data are still being collected. Climate scientists generally agree that the primary sources of carbon emissions are economic activities involving the burning of fossil fuels. My assumption in this analysis, which is derived from conventional wisdom on this topic, is that economic activities like transportation, manufacturing, and residential/commercial energy use are the biggest contributors to emissions. One of my main challenges will be finding data on these trends that are available for both 2019 and 2020.*

Sources

Liu, Zhu, Philippe Ciais, Zhu Deng, Ruixue Lei, Steven J. Davis, Sha Feng, Bo Zheng et al. "Near-real-time monitoring of global CO 2 emissions reveals the effects of the COVID-19 pandemic." *Nature communications* 11, no. 1 (2020): 1-12.

Ludden, Jennifer, and Brady, Jeff. “Greenhouse Gas Emissions Predicted to Fall Nearly 8% - Largest Decrease Ever.” *NPR*. <https://www.npr.org/sections/coronavirus-live-updates/2020/04/30/848307092/greenhouse-gas-emissions-predicted-to-fall-nearly-8-largest-decrease-ever>

“Sources of Greenhouse Gas Emissions.” *EPA*. <https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions>

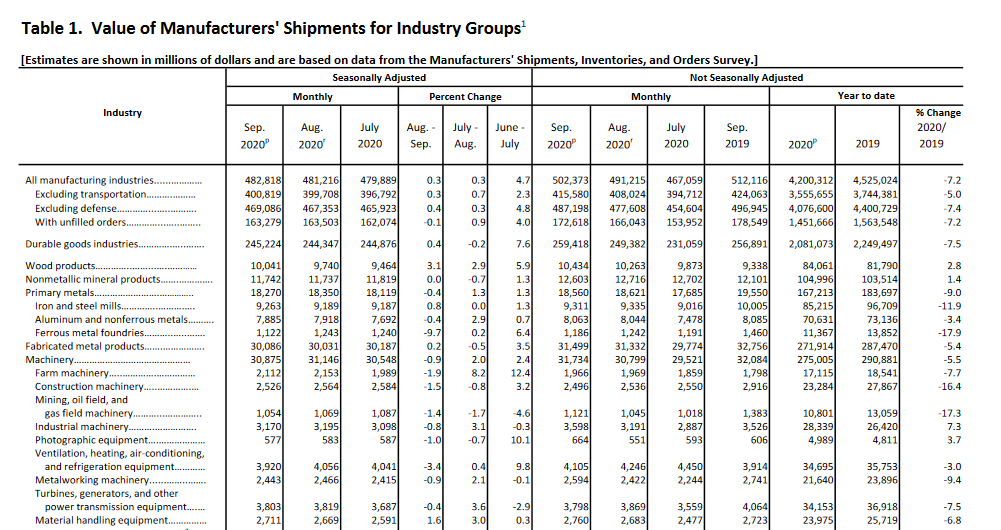
Appendix A – Residential and Commercial Energy Trends

Figure 1. Consumption of fuels used to generate electricity from the US EIA



Appendix B – Manufacturing Trends

Figure 2. Manufacturing Trends from the Department of Commerce



Appendix C – Transportation Trends

Figure 3. Airline Traffic Trends from the US BTS



Figure 4. TSA Checkpoint Data

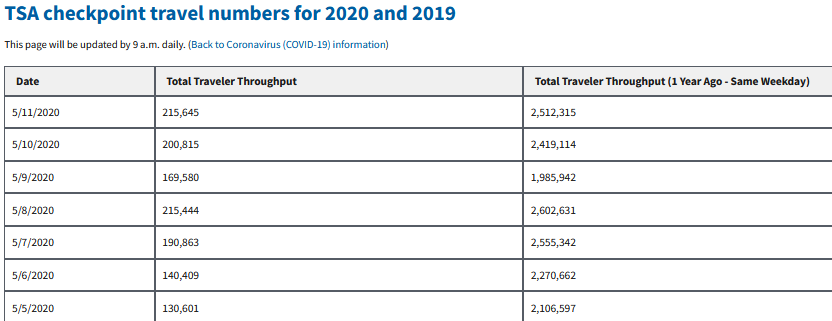
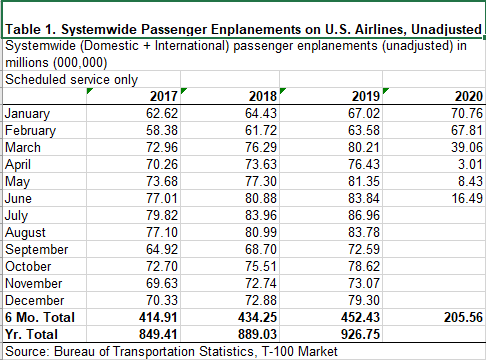


Figure 5. TSA Checkpoint Data



1. https://www.nature.com/articles/s41467-020-18922-7 [↑](#footnote-ref-1)
2. <https://www.npr.org/sections/coronavirus-live-updates/2020/04/30/848307092/greenhouse-gas-emissions-predicted-to-fall-nearly-8-largest-decrease-ever> [↑](#footnote-ref-2)
3. The EPA emphasizes the “burning of fossil fuels for electricity, heat, and transportation” as the most significant contributor of carbon emissions. See https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions [↑](#footnote-ref-3)