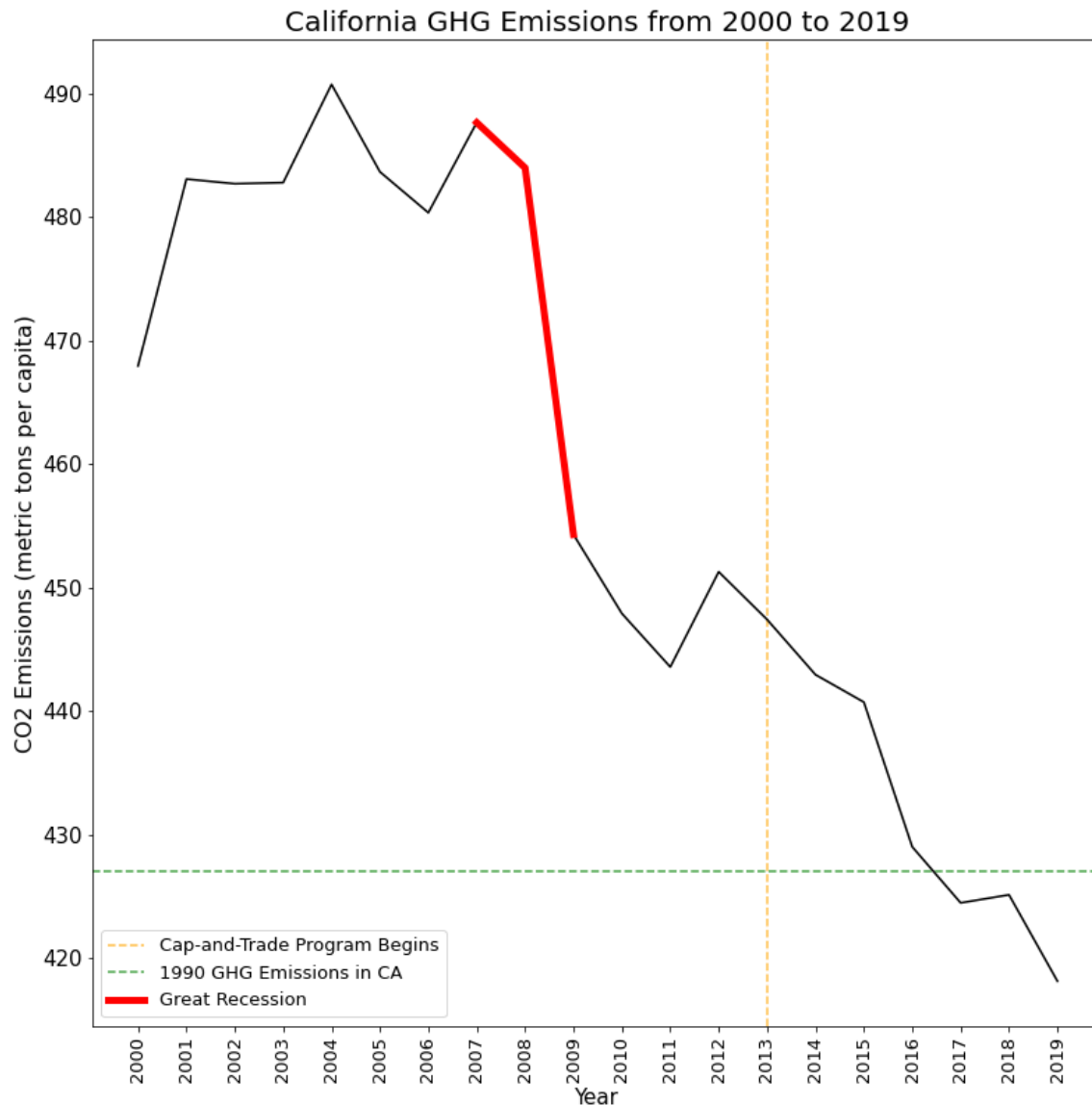


# Final Project – DATA 22700

## Introduction

This series of graphs covers four individual case studies (California, Sweden, Germany, and China) depicting each state/country's carbon emission levels, the time of an established policy (if it is singular) to address carbon emissions, and the carbon levels after the policies were established.

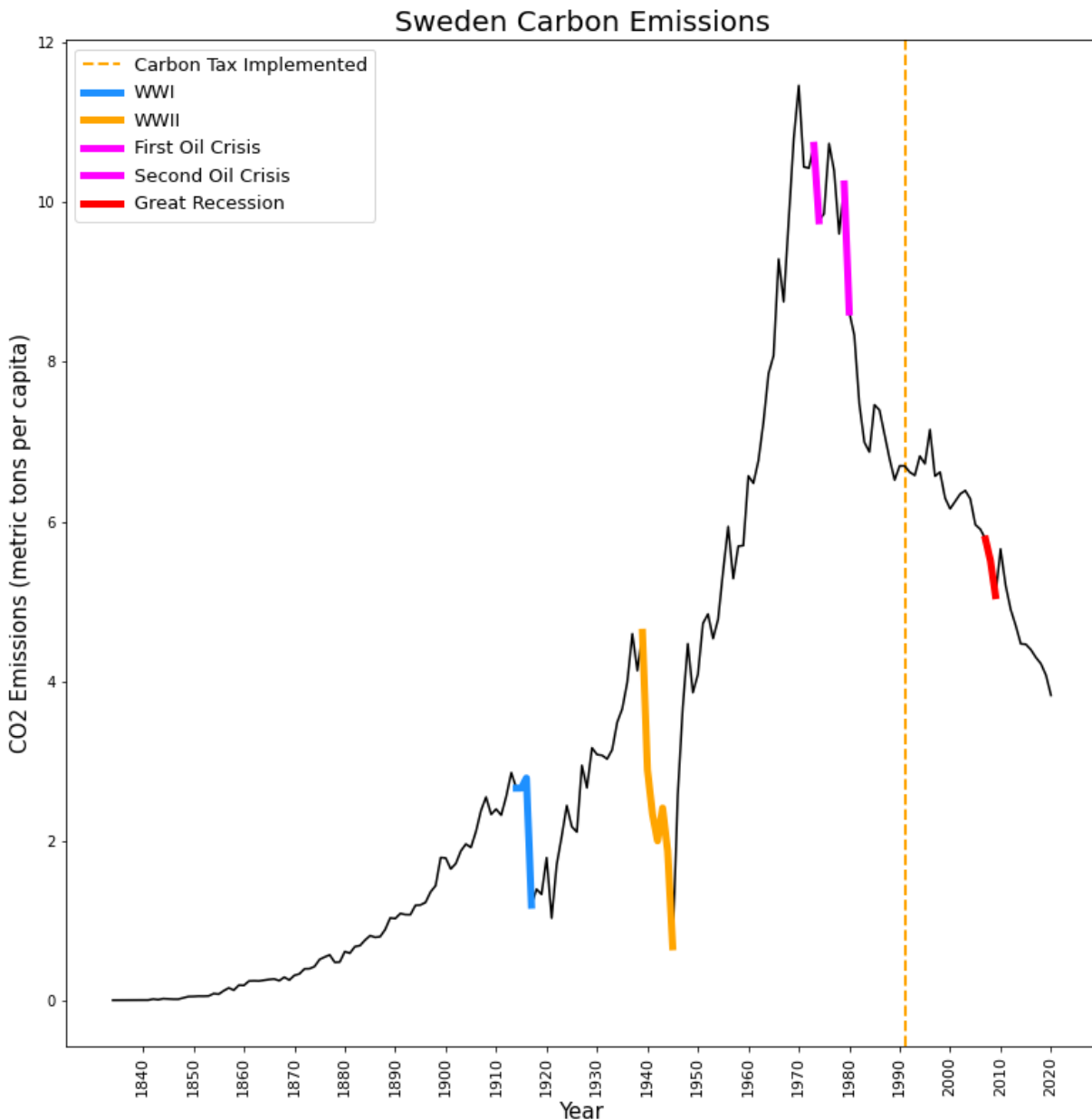
Figure 1: California



1. This figure illustrates the amount of greenhouse gasses produced by California from 2000 to 2019. GHG Emissions include CO<sub>2</sub>, N<sub>2</sub>O, and CH<sub>4</sub>. A significant fall in emission levels from 2007 to 2009 can be accounted for by the Great Recession, marked in red and blue. CA's Cap-and-Trade program, marked in yellow, was established in 2013 and contributed to the continual fall of GHG emissions to 1990 levels, marked in black.

A significant fall in emission levels from 2007 to 2009 can be accounted for by the Great Recession, and continued emission decreases may be partially attributed to the establishment of CA's Cap-and-Trade program, which sets a yearly carbon allowance (which decreases every year) from which companies can auction for shares of the allowance. CA's goal was to reduce GHG levels to 1990 levels by 2020, but it reached this goal in 2016. This data could be used to support the implementation of a carbon tax or trading program in other large states.

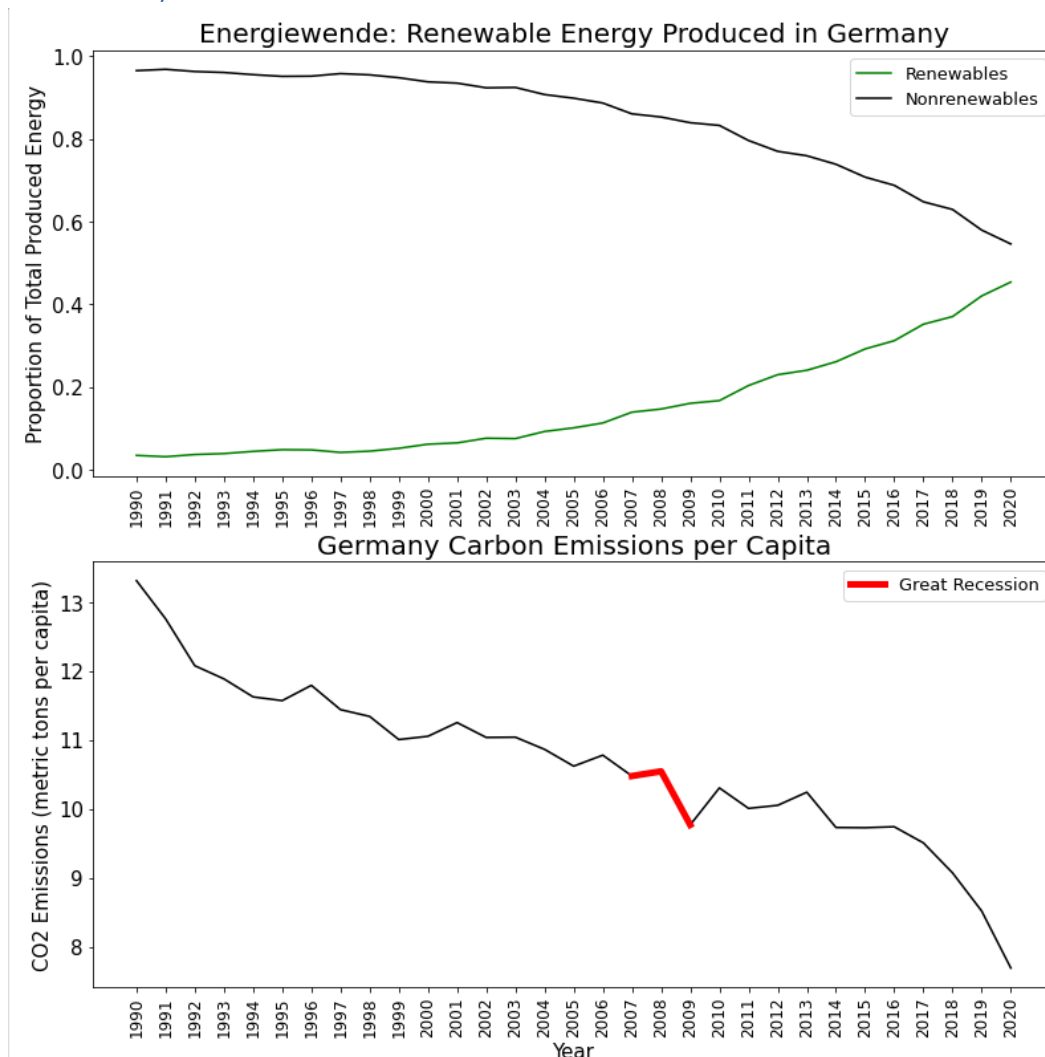
Figure 2: Sweden



2. This graph shows Sweden's CO2 emission per capita from 1834 to 2020 from ourworldindata.com (<https://ourworldindata.org/co2/country/sweden>). It includes the occurrences of several major historical world events and their effects on the carbon emissions of the Swedish people.

This is a particularly interesting graph of Sweden's CO<sub>2</sub> emission per capita from 1834 to 2020 from ourworldindata.com. It includes the occurrences of several major historical world events and their effects on the carbon emissions of the Swedish people. War has obvious negative effects on all parts of the country, so it is no surprise that carbon emissions diminished during these periods. The Saudi Arabian Oil Crises also affected the world's oil economy, also leading to diminishing carbon emissions overall. The Great Recession affected economies globally, as well, but Sweden recovered very quickly from this. This puts the Swedish carbon tax into perspective, as Sweden was one of the first countries in the world to impose a carbon tax (– one of the steepest in the world to date). The tax's effects on carbon emissions, combined with the effects of other unlisted factors, are comparable to the effects as other historical events do, but not at the cost of war.

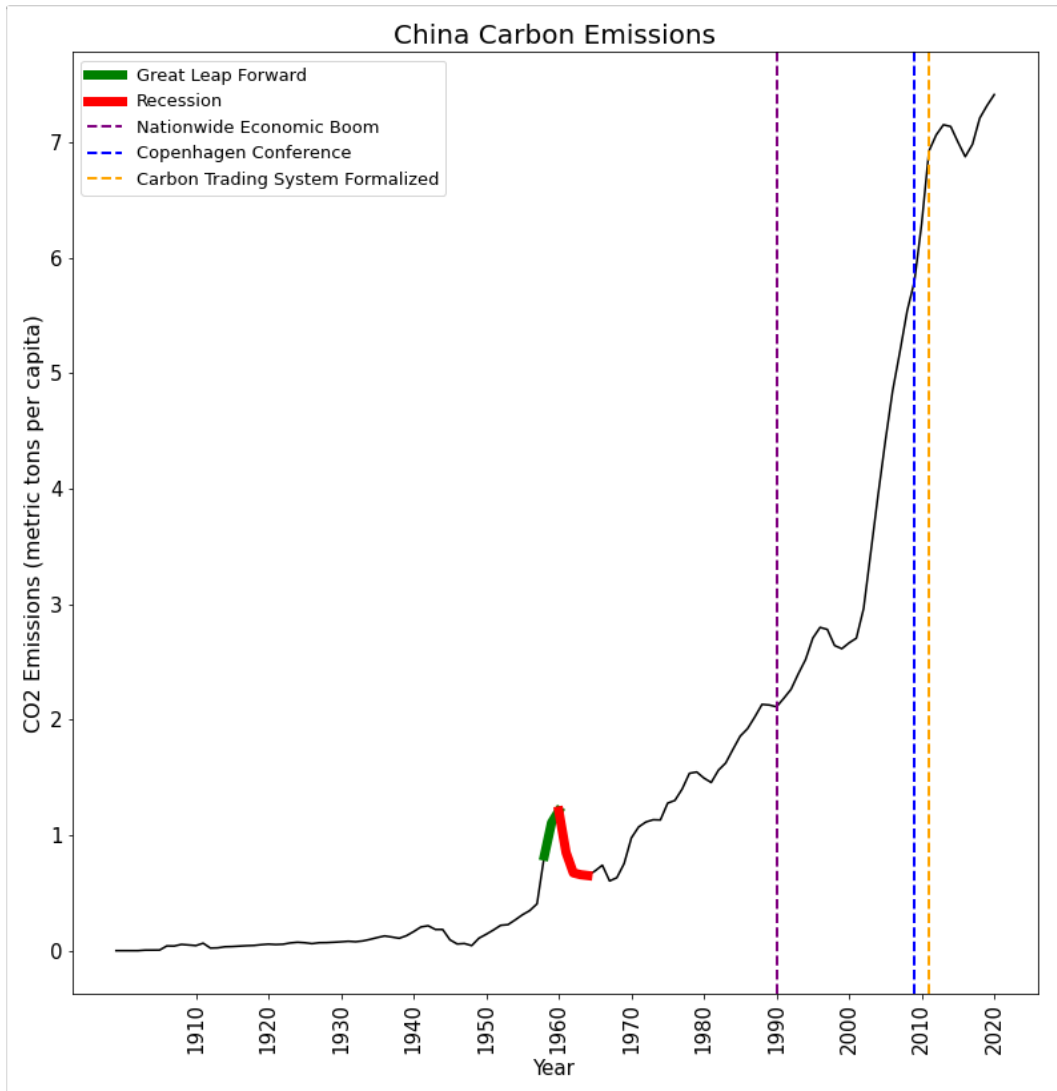
Figure 3: Germany



3. This set of graphs compares the change in the source of Germany's produced energy to the decrease of Germany's carbon emissions from 1990 to 2020. In 2010, Germany declared "Energiewende," a general shift in political and popular sentiment to tackle climate issues, but their efforts of reducing carbon emissions and dependencies on nonrenewable energy sources have been ongoing since the late 1990s.

The first graph in this set shows the shift in Germany's produced energy from nonrenewable sources to renewable ones every year. Germany is one of the top ten carbon producing countries in the world, so it is important to consider what carbon policies can do for such a large country. 30 years ago, Germany produced the majority of its energy from lignite, hard coal, and nuclear power plants. However, popular thinkers and politicians alike began to consider weaning off coal and lignite and abandoning nuclear energy completely. This sentiment grew, and following the decrease in the production of energy from nonrenewable resources, Germany's carbon emissions decreased as indicated in the second graph.

Figure 4: China



4. This graph shows the history of China's carbon emissions from 1899 to 2020. China is the leading country in carbon emissions, and air pollution from the country is a global threat. Implemented in 2011, the first explicit policy to address carbon reductions aimed to reduce carbon intensity (carbon emissions to GDP ratio) by 40% of 2005 levels. Carbon emission levels per capita are still rising in China, but the rate has decreased significantly.

China is the world's leading emitter of carbon, so it is the most important country to consider when attempting to reduce carbon emissions. Its first explicit policy to reduce carbon emissions was established in 2011 to reduce carbon intensity (carbon emissions to GDP ratio) by 40% of 2005 levels. This policy followed mass criticism for not establishing more aggressive policies earlier in China's economic boom. The steep increase in carbon emissions beginning in the late 1990s can be attributed to China's massive economic and societal growth, where they saw a 10% increase in GDP yearly.

Sources:

Graph 1:

CA GHG Emissions from 2000 to 2019: <https://ww2.arb.ca.gov/applications/greenhouse-gas-emission-inventory-0>

CA GHG Emissions in 1990: <https://laedc.org/wp-content/uploads/2012/04/TheAB32Challenge.pdf>.)

Graph 2:

Sweden Carbon Emissions: <https://ourworldindata.org/co2/country/sweden>

Graph 3:

First Oil Crisis:

[https://en.wikipedia.org/wiki/1973\\_oil\\_crisis#:~:text=By%20the%20end%20of%20the,politics%20and%20the%20global%20economy](https://en.wikipedia.org/wiki/1973_oil_crisis#:~:text=By%20the%20end%20of%20the,politics%20and%20the%20global%20economy).

Germany Carbon Emissions: <https://ourworldindata.org/co2/country/germany>

Germany Renewable Energy Production:

<https://www.macrotrends.net/countries/DEU/germany/renewable-energy-statistics>

Germany Renewable Energy Production 2: <https://www.iea.org/countries/germany>

Graph 4:

Chinese Climate Policy History:

<https://chineseclimatepolicy.energypolicy.columbia.edu/en/short-history-chinese-climate-policies>

China Economic History:

[https://en.wikipedia.org/wiki/Economic\\_history\\_of\\_China\\_\(1949%E2%80%93present\)](https://en.wikipedia.org/wiki/Economic_history_of_China_(1949%E2%80%93present))

China Carbon Emissions: <https://ourworldindata.org/co2/country/china>