World Consumption and Emission Analysis

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&
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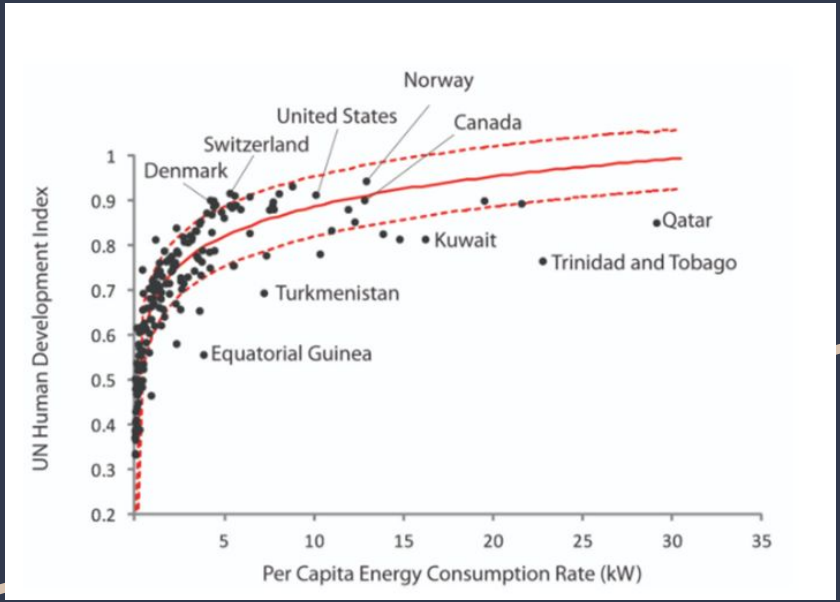
Background



https://www.researchgate.net/publication/49599352_Human_Capital_and_Sustainability

- Previous study conducted on the relationship between Energy Consumption Per Capita and Development Index planted the idea for **our** analysis
- Positive relationship between Energy consumption and Human Development Index (quality of life)
- Better energy access presents opportunities for higher standards of living, education, transportation and overall quality of life

- *An important byproduct of current energy derivation methods are Carbon emissions*

Data and Cleaning

	Country.Name <fctr>	Country.Code <fctr>	Indicator.Name <fctr>	Indicator.Code <fctr>	X1960 <dbl>	X1961 <dbl>
1	Aruba	ABW	CO2 emissions (kt)	EN.ATM.CO2E.KT	NA	NA
2	Afghanistan	AFG	CO2 emissions (kt)	EN.ATM.CO2E.KT	414.371	491.378
3	Angola	AGO	CO2 emissions (kt)	EN.ATM.CO2E.KT	550.050	454.708
4	Albania	ALB	CO2 emissions (kt)	EN.ATM.CO2E.KT	2024.184	2280.874
5	Andorra	AND	CO2 emissions (kt)	EN.ATM.CO2E.KT	NA	NA
6	Arab World	ARB	CO2 emissions (kt)	EN.ATM.CO2E.KT	59535.397	65119.821

variable <fctr>	value <dbl>	year <dbl>
Germany	1.155390e+11	1960
Germany	1.235250e+11	1961
Germany	1.325570e+11	1962
Germany	1.432220e+11	1963
Germany	1.551970e+11	1964
Germany	1.666800e+11	1965
Germany	1.762190e+11	1966
Germany	1.818290e+11	1967
Germany	1.994000e+11	1968
Germany	2.193330e+11	1969

Collected datasets from the website https://www.worldbank.org/ and google datasets

Number of Data sets - 5

Cleaning-

- Renaming Country Names to match other datasets
- Shifting columns and removing description
- Omitting missing values

Reshaping-

- Converting columns of data into rows.
- Combining multiple columns / Combining Data sets

Web Scraping-

- Used this for checking accuracy of map_data
- Correcting names for some countries

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Introduction

What is the effect of industrialization on different facets of the economy, planet and location?

Determined relationships between 5 values:

- GDP per country
- Population per country
- Carbon Emissions (kilotons) per country
- Electricity Consumption per country
- Geographical location (latitude and longitude)

Created a map of the world based on country location vs. Carbon Dioxide emissions and Electricity usage.

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Analysis

We found that CO_2 emissions, electricity usage, population, and GDP are all interconnected.

This is clearly visible in the upcoming Data Visualizations.

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Analysis

Calculations:

Electricity consumption by top countries compared to world:

World: 2.274005e+13 Kilowatt / hour

India: (1.042332e+12 / 2.274005e+13) * 100 = 4.6%

USA: (4.137101e+12 / 2.274005e+13) * 100 = 18.2%

China: (5.357549e+12 / 2.274005e+13) * 100 = 23.6%

-Top three makeup 46.3% of Electricity consumption

-The remaining 192 countries make up the other 53%

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Analysis

Calculations:

CO_2 Emissions by top countries compared to world:

World: 36138285.000 kilotons / year

India: (2238377.137 / 36138285.000) * 100 = 6.193%

USA: (5254279.285 / 36138285.000) * 100 = 14.539%

China: (10291926.880 / 36138285.000) * 100 = 28.479%

-Top three makeup 49.211% of Carbon emissions

-The remaining 192 countries make up the other 50%

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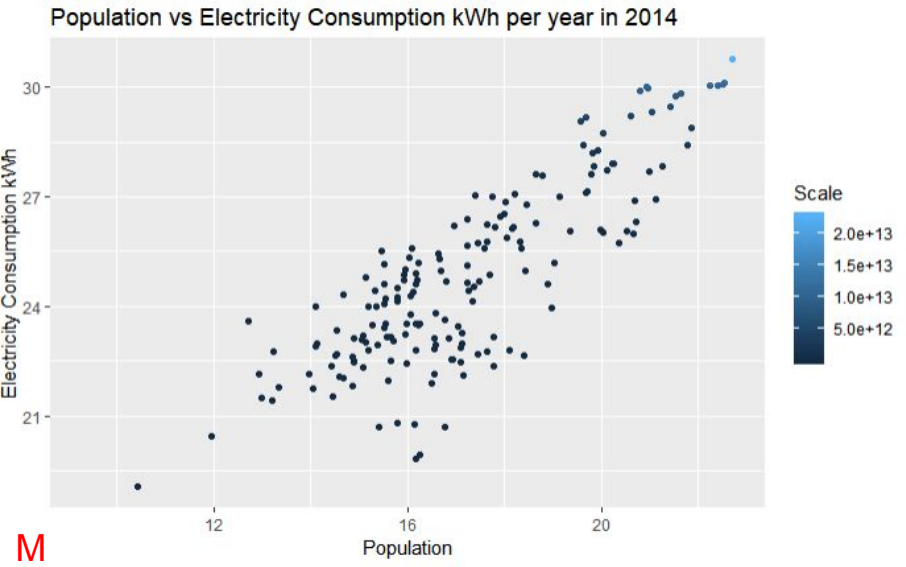
Population Vs. Energy Consumption



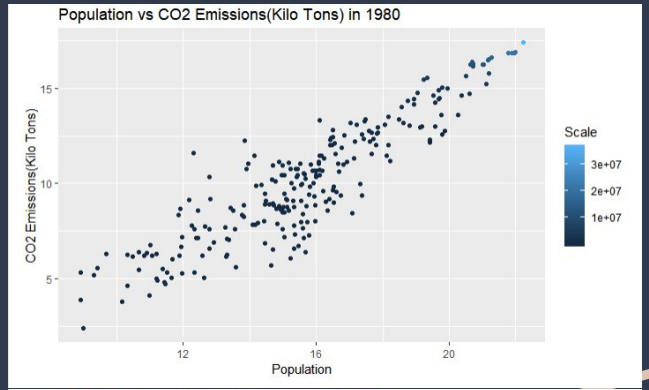
- Yields a positive-linear slope
- Light blue dot at top right of chart corresponds to the total world
- Used logarithmic scale

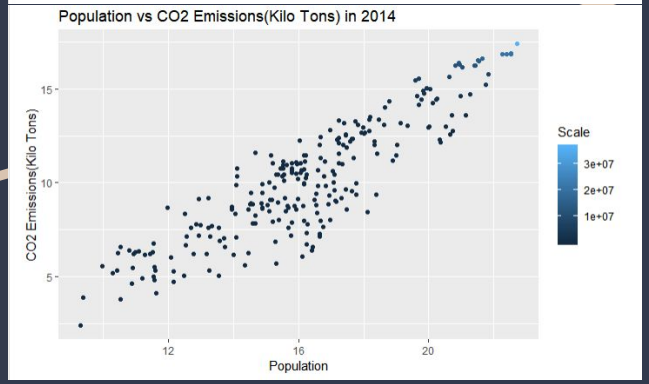
Summary:

As population increases, the electricity consumption increases correspondingly. The more people that a country must provide for, the more energy each country will need and therefore consume.

Makes sense.

Population Vs. CO_2 Emissions



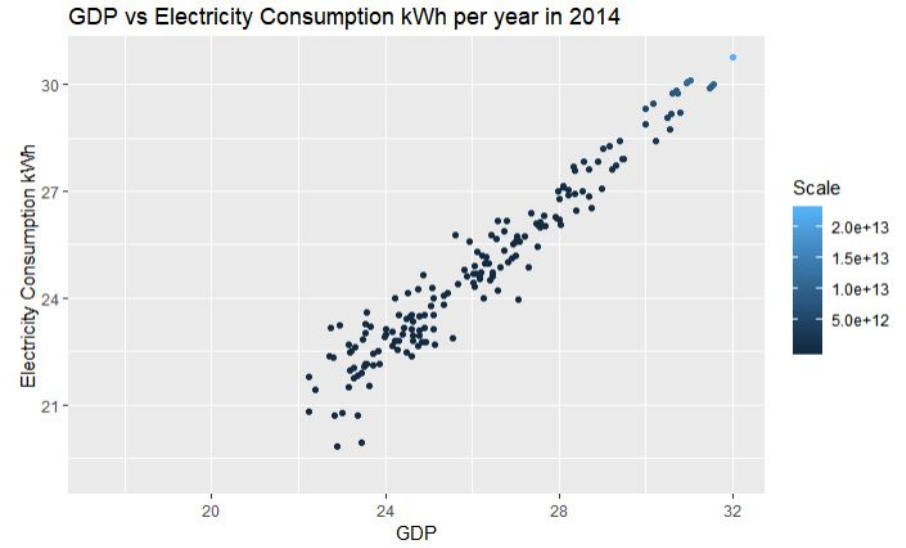


- Yields a positive-linear slope
- Light blue dot at top right of chart corresponds to the total world

Summary:

The time period is not a factor in the relationship of Population and Emissions. There is a strong positive correlation between country population and Carbon emissions, indicating that on average more populated countries release more emissions.

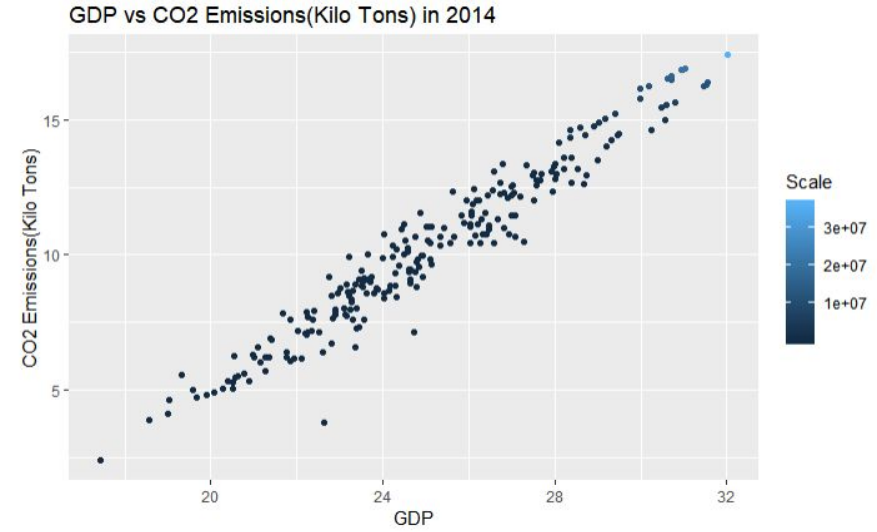
GDP Vs. Electricity Consumption



Summary:

Strong positive-linear relation between GDP and Electricity consumption. More economically stable countries have energy infrastructure that allows them to upscale their energy harvesting techniques and ultimately their energy consumption.

GDP Vs. CO_2 Emissions



Summary:

We observe a linear slope, describing a strong relationship between GDP and Carbon emissions. Similar to GDP vs. Electricity Consumption, countries with stronger economic stability release more emissions due to energy infrastructure.

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Analysis cont.

Now we will analyze individual countries.

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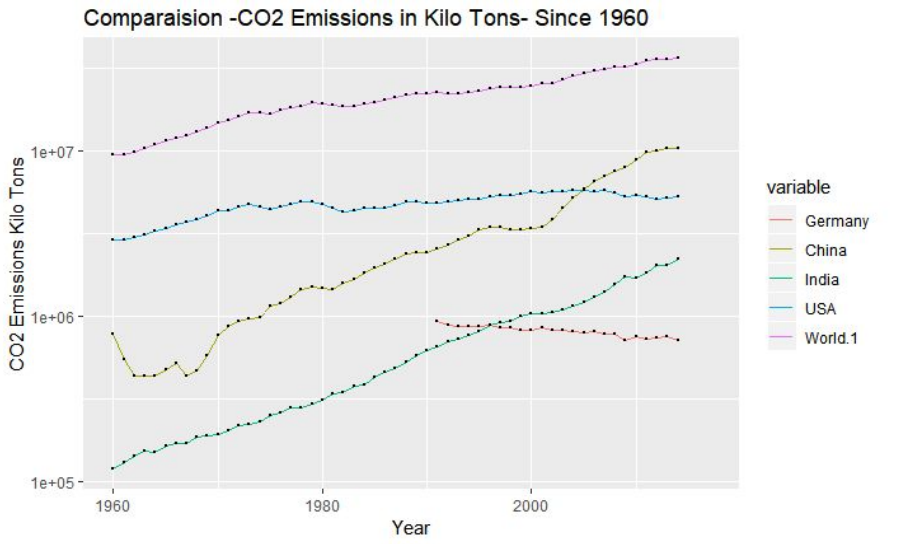
CO_2 Emissions



Summary:

The “Big Three” emitters of Carbon Dioxide are China, USA and India. Germany has made strong efforts to reduce emissions. In totality, the worlds emissions are on the rise, even with the actions of countries such as Germany.

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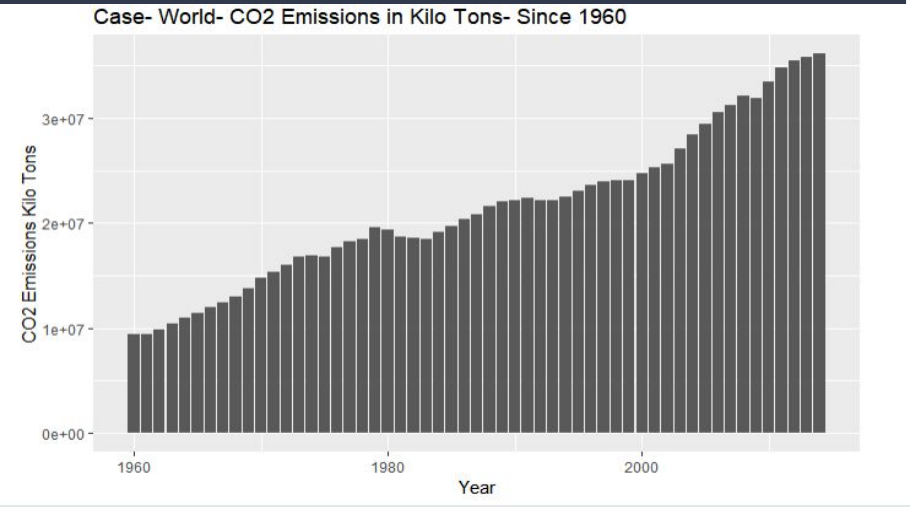
Summary



Carbon emissions are increasing linearly with time, this increase corresponds to individual areas of industrialization. For example, greater energy use.

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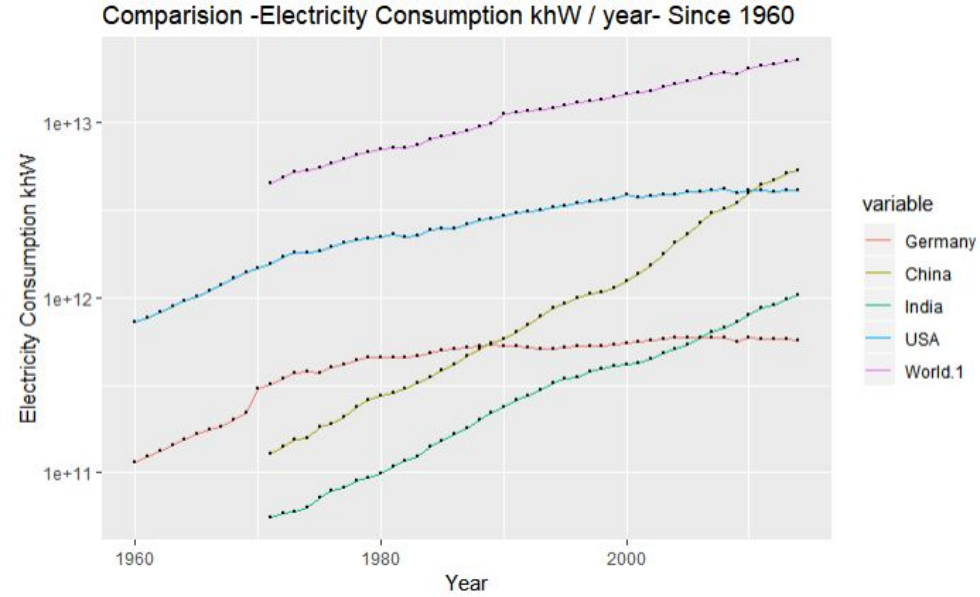
Electricity Usage



Summary:

Again, the top three consumers are China, United States and India. Germany has also limited energy use, but in total the energy consumption of the world is increasing.

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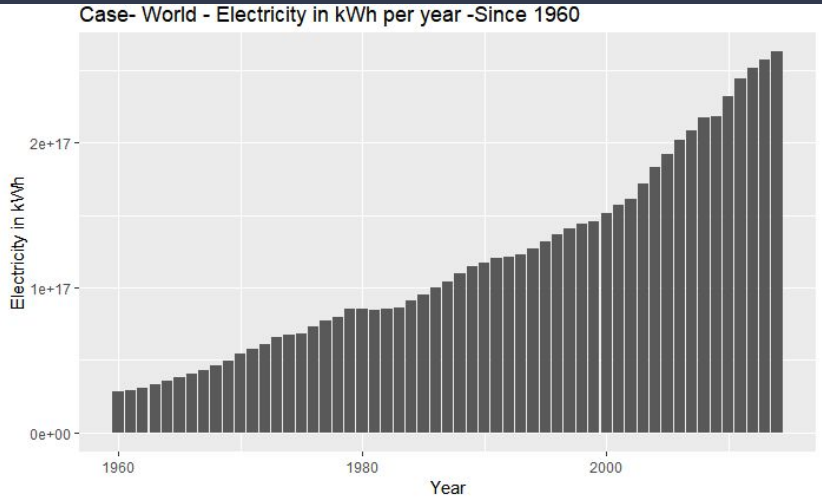
Summary



As time progresses, the amount of energy consumption is increasing drastically. There are many reasons why this is observed; increasing population and increasing energy need for influx of technology among many others.

Since Green Energy is still a relatively small percentage of the total energy generation/consumption, most of this energy comes from the burning of fossil fuels which releases copious amounts of Carbon emissions.

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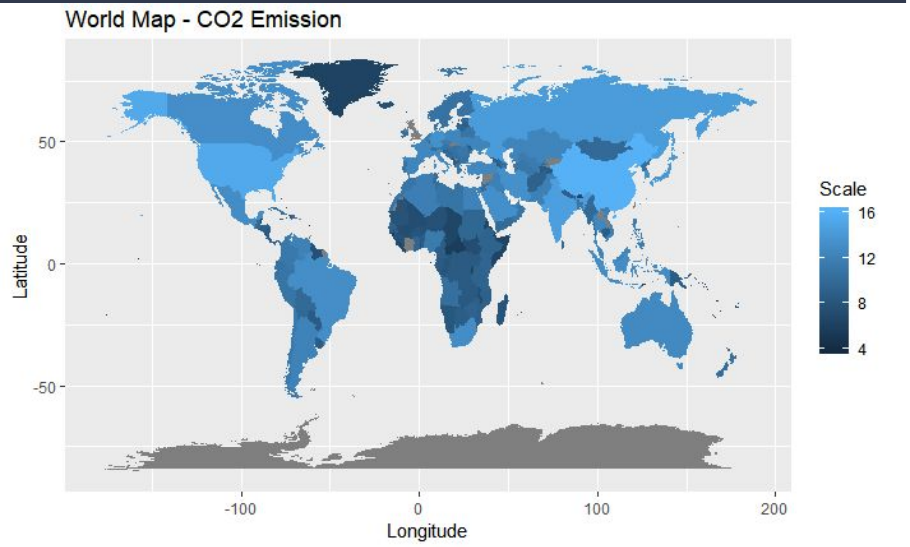
World Map - CO_2 Emissions



Summary:

We see China and the United States are leaders in Carbon emissions, we can also visualize countries that do not release many emissions such as African countries and Greenland.

-Emission rates are therefore strongly-linked to GDP and moderately-linked to population per country.

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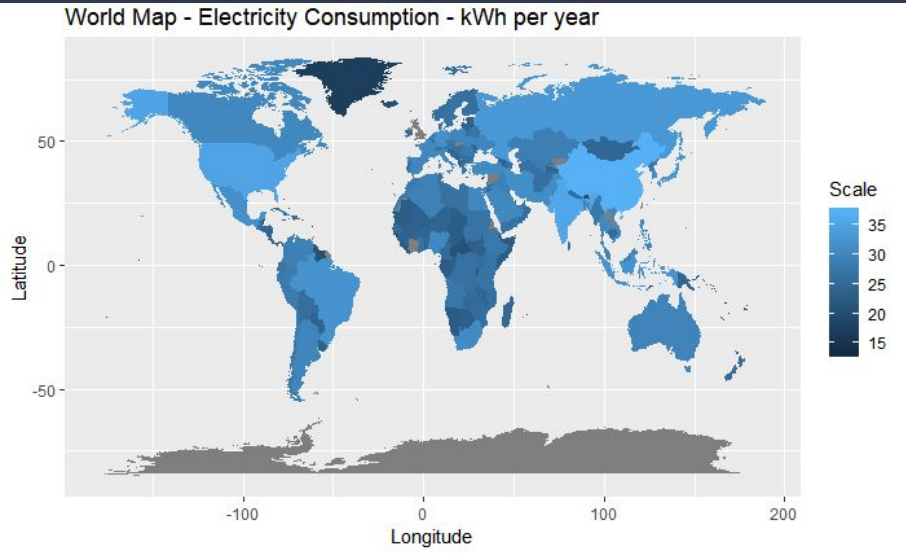
World Map -Electricity Usage



Summary:

World country energy usage is very similar to the corresponding countries Carbon emissions. As explained earlier, economically stable countries have room to consume more electricity.

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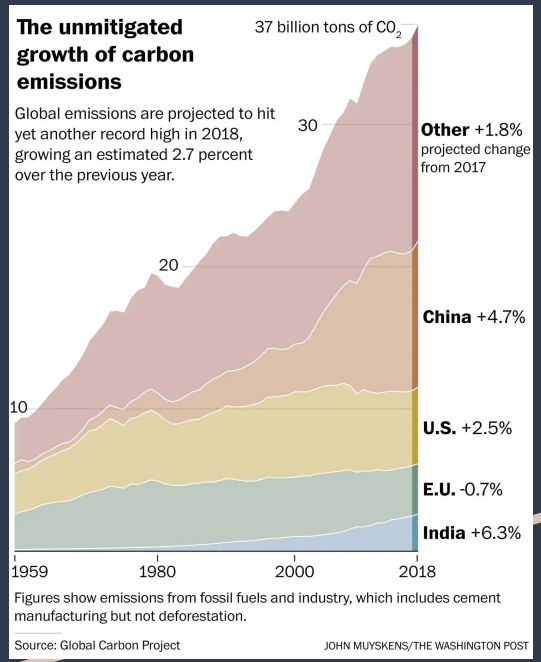
Conclusion



https://www.washingtonpost.com/energy-environment/2018/12/05/we-are-trouble-global-carbon-emissions-reached-new-record-high/?noredirect=on&utm_term=.70f2ac391869

In completing these analyzations, we were able to successfully document the idea that as a country modernizes many factors are subsequently affected.

For example, GDP and Carbon emissions are related. As the GDP of a country increases, in almost every case the amount of Carbon emissions also increases.

This relation shows that modernization drives the production of emissions, GDP growth and potentially the size of the population.

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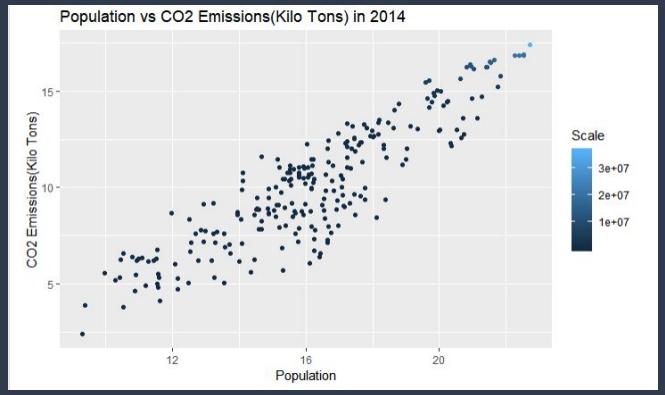
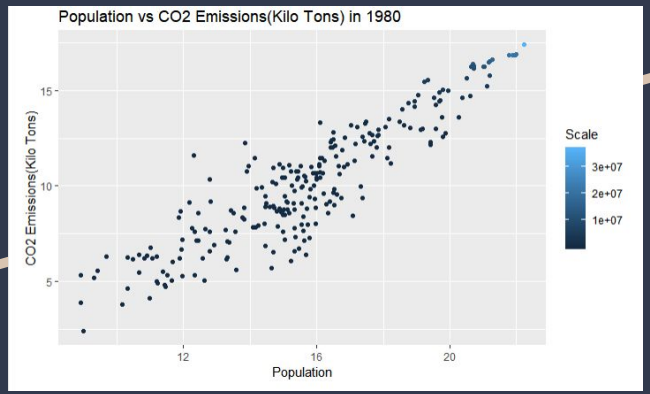
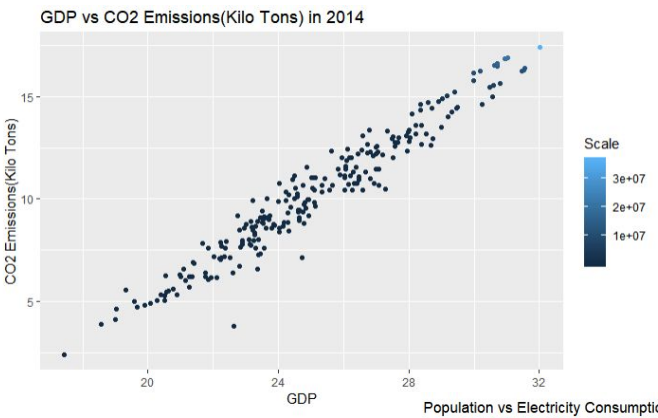
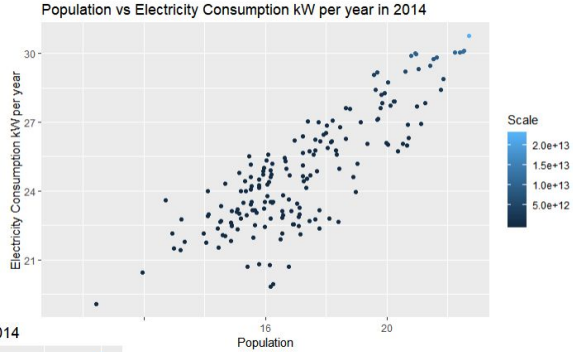
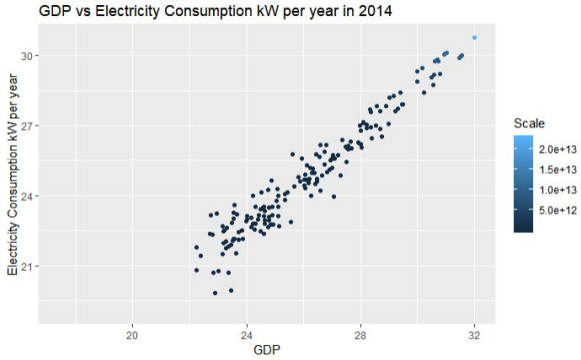
Questions

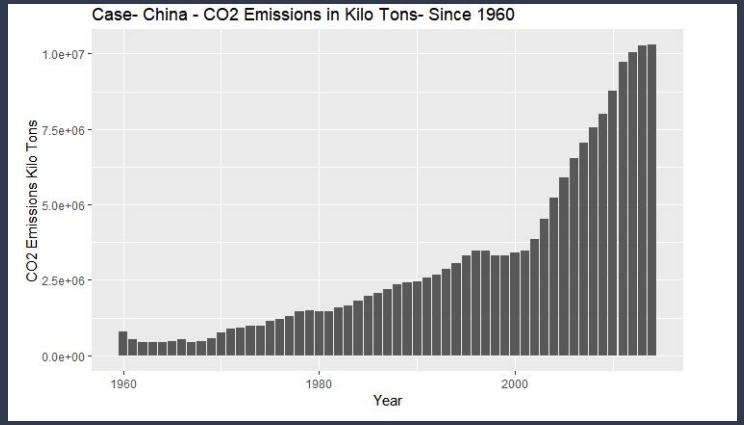

Population vs CO2 Emissions(Kilo Tons) in 2014
CO2 Emissions(Kilo Tons)
Population
Scale
3e+07
2e+07
1e+07

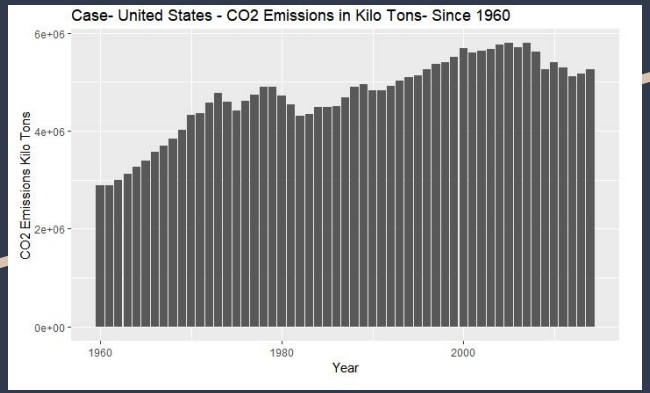

Population vs CO2 Emissions(Kilo Tons) in 1980
CO2 Emissions(Kilo Tons)
Population
Scale
3e+07
2e+07
1e+07

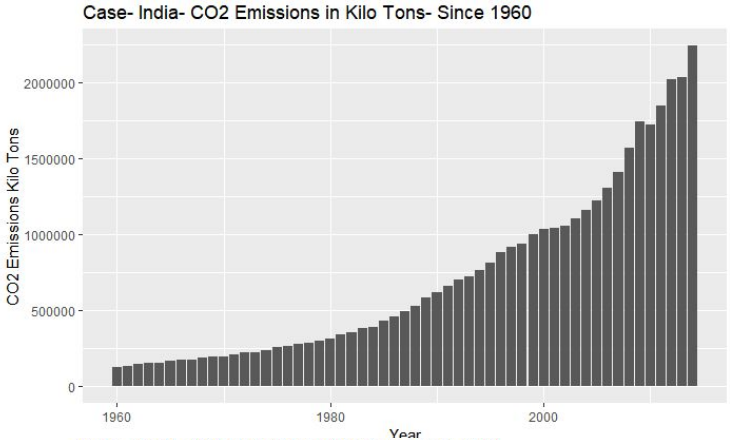

GDP vs CO2 Emissions(Kilo Tons) in 2014
CO2 Emissions(Kilo Tons)
GDP
Scale
3e+07
2e+07
1e+07

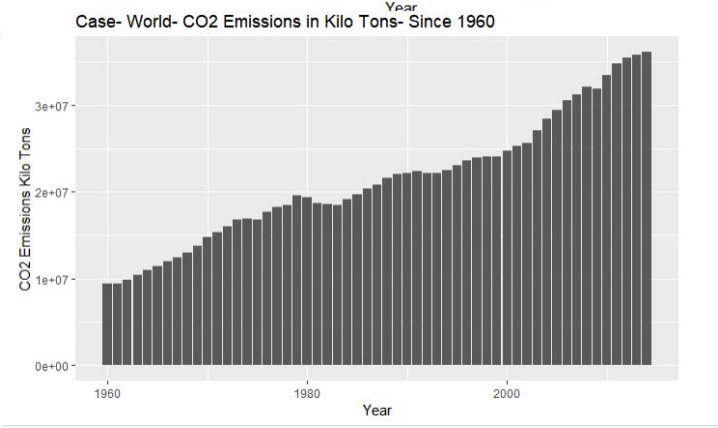

Population vs Electricity Consumption kW per year in 2014
Electricity Consumption kW per year
Population
Scale
2.0e+13
1.5e+13
1.0e+13
5.0e+12

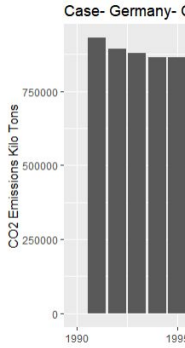

GDP vs Electricity Consumption kW per year in 2014
Electricity Consumption kW per year
GDP
Scale
2.0e+13
1.5e+13
1.0e+13
5.0e+12

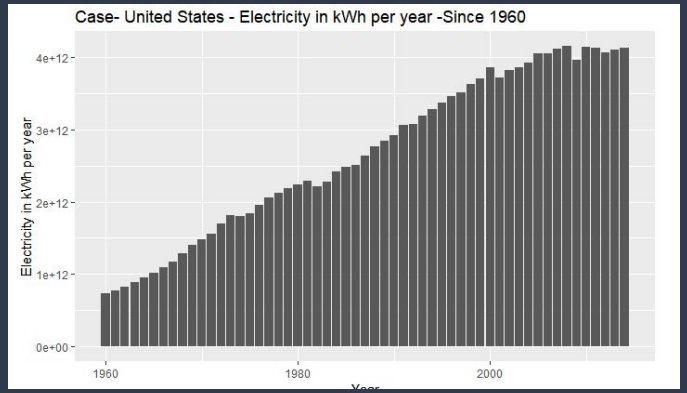

Case- China - CO2 Emissions in Kilo Tons- Since 1960
CO2 Emissions Kilo Tons
1.0e+07
7.5e+06
5.0e+06
2.5e+06
0.0e+00
1960
1980
2000
Year

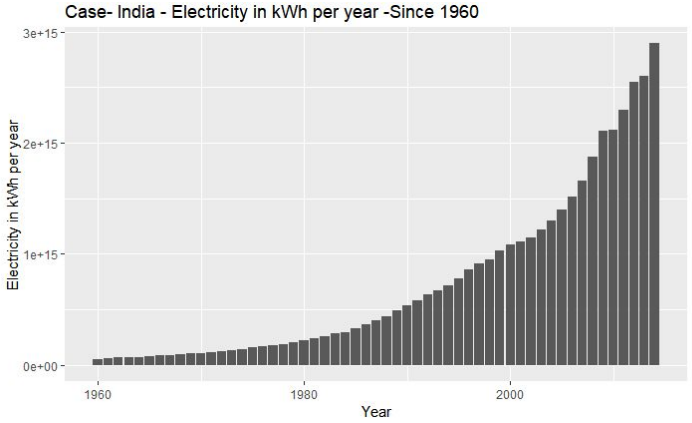

Case- United States - CO2 Emissions in Kilo Tons- Since 1960
CO2 Emissions Kilo Tons
6e+06
4e+06
2e+06
0e+00
1960
1980
2000
Year

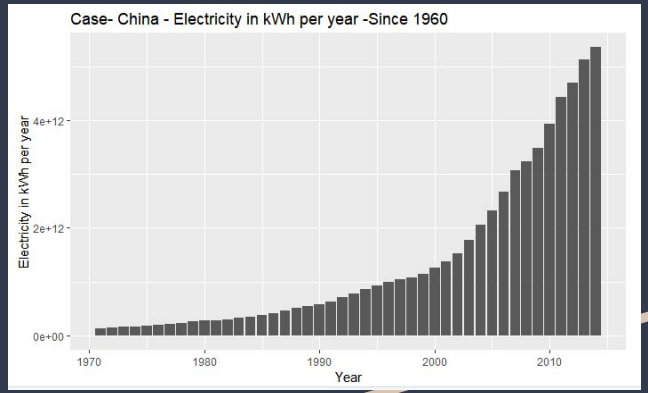

Case- India- CO2 Emissions in Kilo Tons- Since 1960
CO2 Emissions Kilo Tons
2000000
1500000
1000000
500000
0
1960
1980
2000
Year

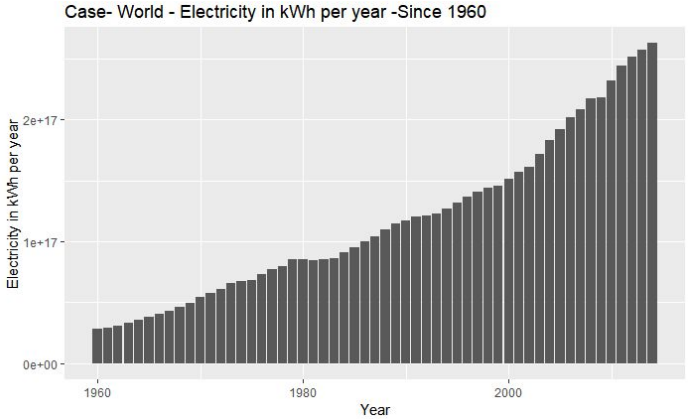

Case- World- CO2 Emissions in Kilo Tons- Since 1960
CO2 Emissions Kilo Tons
3e+07
2e+07
1e+07
0e+00
1960
1980
2000
Year

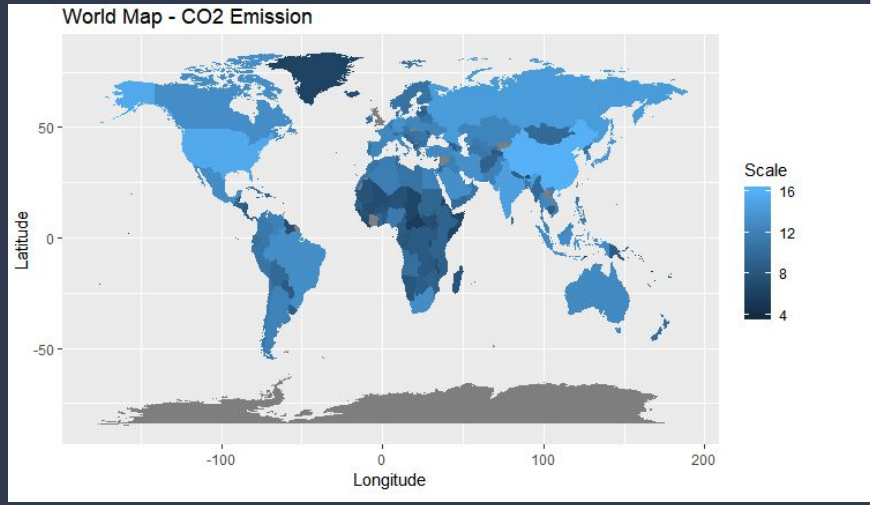

Case- Germany-
CO2 Emissions Kilo Tons
750000
500000
250000
0
1990

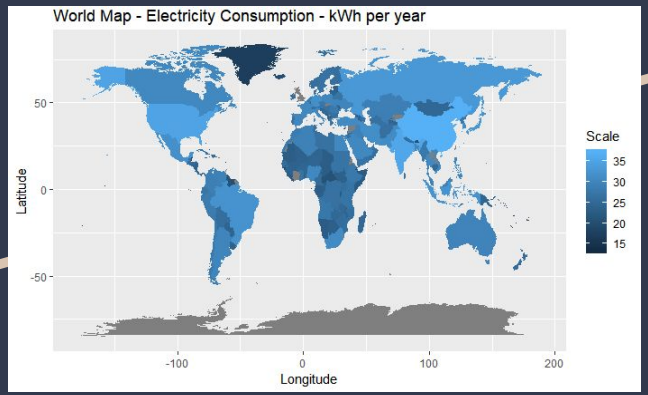

Case- United States - Electricity in kWh per year -Since 1960
Electricity in kWh per year
4e+12
3e+12
2e+12
1e+12
0e+00
1960
1980
2000


Case- India - Electricity in kWh per year -Since 1960
Electricity in kWh per year
3e+15
2e+15
1e+15
0e+00
1960
1980
2000
Year


Case- China - Electricity in kWh per year -Since 1960
Electricity in kWh per year
4e+12
2e+12
0e+00
1970
1980
1990
2000
2010
Year


Case- World - Electricity in kWh per year -Since 1960
Electricity in kWh per year
2e+17
1e+17
0e+00
1960
1980
2000
Year


World Map - CO2 Emission
Latitude
50
0
-50
-100
0
100
200
Longitude
Scale
16
12
8
4


World Map - Electricity Consumption - kWh per year
Latitude
50
0
-50
-100
0
100
200
Longitude
Scale
35
30
25
20
15