Global Historical Emissions Analysis

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Table of Contents

Background

Climate change and extreme weather patterns have disrupted our livelihood. Carbon emission is a leading cause for the increase of disastrous climate related events. We collected information from the Global Carbon Project, an organization that seeks to quantify global greenhouse gas emissions. We hope to use the database and analyze these carbon emission patterns to see which countries contribute large amounts of carbon emissions to our planet.

	A	B	C	D	E	F	G	H	I
1	Country	Data source	Sector	Gas	Unit	2019	2018	2017	2016
2	World	GCP	Total fossil fu	CO2	MtCO,ÇÇe	36440.76	36420.16	35694.69	35222.03
3	World	GCP	Coal	CO2	MtCO,ÇÇe	14362.56	14619.36	14414.18	14362.88
4	World	GCP	Oil	CO2	MtCO,ÇÇe	12354.11	12252.42	12175.47	11970.29
5	China	GCP	Total fossil fu	CO2	MtCO,ÇÇe	10174.68	9956.57	9750.73	9552.52
6	World	GCP	Gas	CO2	MtCO,ÇÇe	7615.71	7489.22	7115.49	6939.62
7	China	GCP	Coal	CO2	MtCO,ÇÇe	7235.95	7187.08	7137.26	7071.41
8	United State	GCP	Total fossil fu	CO2	MtCO,ÇÇe	5284.7	5424.88	5253.61	5292.27
9	European Un	GCP	Total fossil fu	CO2	MtCO,ÇÇe	2916.91	3054.49	3127.5	3103.52
10	India	GCP	Total fossil fu	CO2	MtCO,ÇÇe	2616.45	2591.32	2456.85	2392.36
11	United State	GCP	Oil	CO2	MtCO,ÇÇe	2342.54	2350.09	2301.97	2285.33
12	United State	GCP	Gas	CO2	MtCO,ÇÇe	1706.87	1653.04	1491.79	1509.03
13	Russia	GCP	Total fossil fu	CO2	MtCO,ÇÇe	1678.37	1691.36	1646.18	1618.3
14	India	GCP	Coal	CO2	MtCO,ÇÇe	1669.62	1670.5	1585.27	1541.44

Figure 1.
Sample of our CSV Data

Objectives

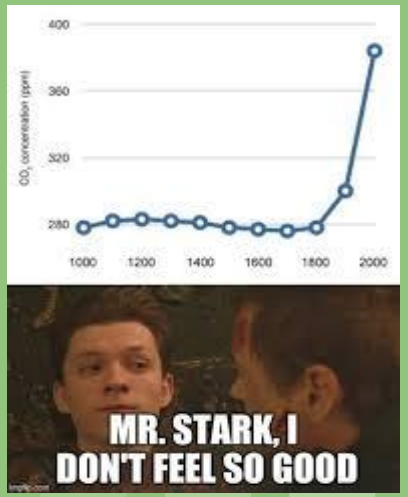
1. Which five countries produced the **largest** volume of carbon emissions from 1960 to 2019? Which five countries produced the **least**?

2. Is there a country that had a **decrease** in carbon emissions? If so, what context can be provided to explain the decline?

3. Which country has the **largest rate of carbon emissions** from 1960 to 2019?

4. Which of the carbon emitting sectors emitted the **most CO_2**?

5. Are we going to **perish**?



Original Data Frame

- Extraneous Columns
- Null Values
- Repeated Countries

```
In [46]: emission_data.head()
```

Out[46]:

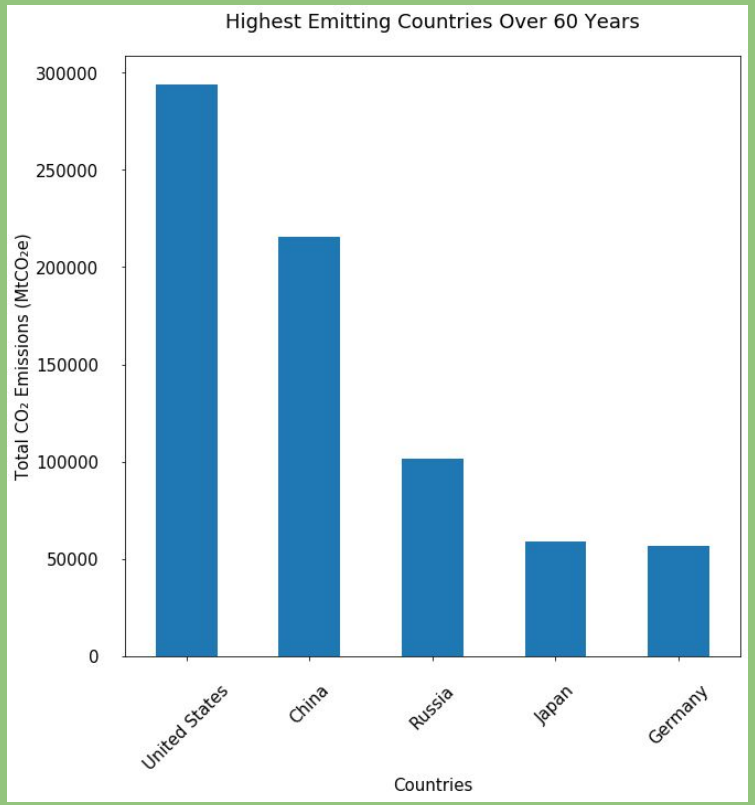
	Country	Data source	Sector	Gas	Unit	2019	2018	2017	2016	2015	...	1969	1968	1967	1966	1965	196
0	World	GCP	Total fossil fuels and cement	CO2	MtCO2e	36440.76	36420.16	35694.69	35222.03	35211.04	...	13692.37	12834.99	12171.81	11794.42	11270.46	10768.5
1	World	GCP	Coal	CO2	MtCO2e	14362.56	14619.36	14414.18	14362.88	14623.02	...	5503.33	5301.81	5243.18	5327.46	5279.82	5195.5
2	World	GCP	Oil	CO2	MtCO2e	12354.11	12252.42	12175.47	11970.29	11915.33	...	5964.99	5514.32	5063.65	4748.54	4411.46	4100.0
3	China	GCP	Total fossil fuels and cement	CO2	MtCO2e	10174.68	9956.57	9750.73	9552.52	9683.20	...	575.94	467.81	432.22	521.46	474.68	435.7
4	World	GCP	Gas	CO2	MtCO2e	7615.71	7489.22	7115.49	6939.62	6763.74	...	1711.09	1564.53	1436.29	1341.02	1234.77	1154.1

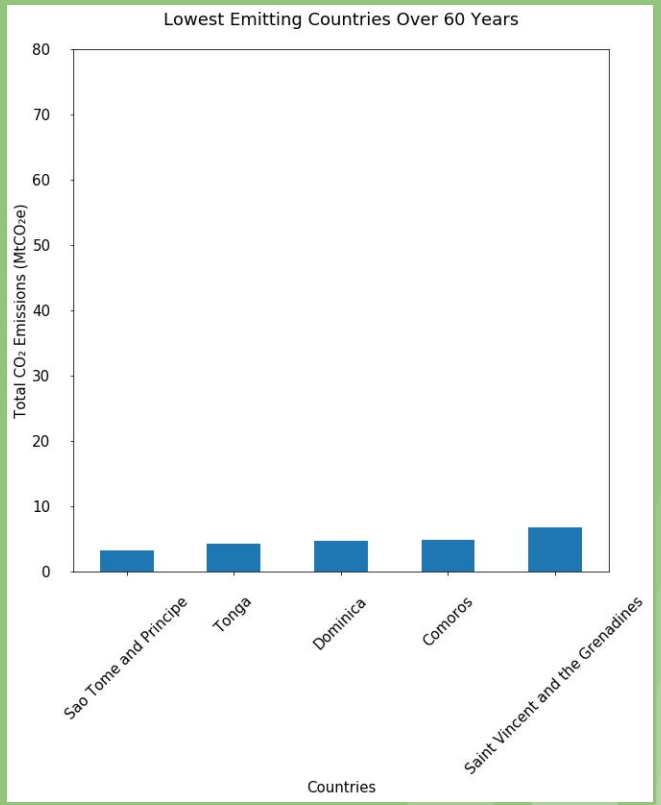
Filtered Data Frame

- Filtered by decade
- Column with 60-year sum for each country

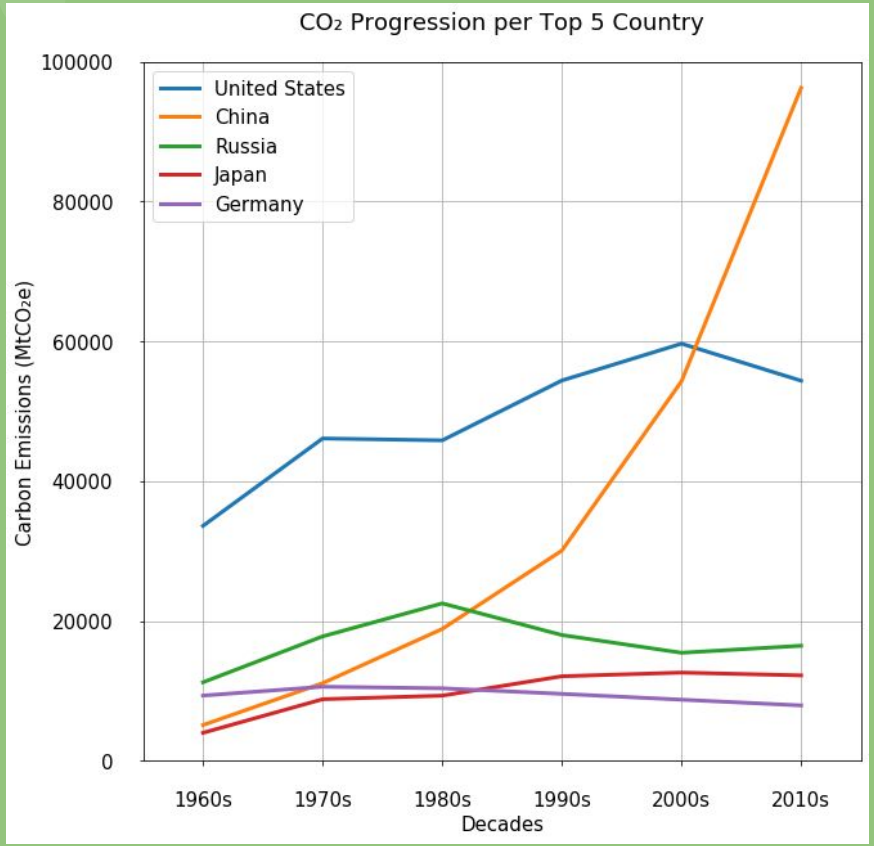
Years Country	1960s	1970s	1980s	1990s	2000s	2010s	60 Year Total
China	5112.61	11103.65	18859.98	30070.05	54280.75	96257.23	215684.27
United States	33608.45	46111.01	45839.88	54401.25	59673.69	54374.56	294008.84
India	1472.42	2281.89	3962.21	7524.23	12056.71	21914.11	49211.57
Russia	11234.13	17794.55	22521.42	17992.29	15453.35	16456.29	101452.03
Japan	4002.04	8808.81	9321.44	12092.77	12618.98	12217.37	59061.41
Iran	551.19	1357.87	1501.07	2659.15	4580.50	6542.76	17192.54
Germany	9330.92	10596.09	10370.94	9576.75	8744.49	7920.29	56539.48
Indonesia	249.00	605.61	1150.43	2199.38	3458.50	5090.93	12753.85
South Korea	257.27	848.57	1744.39	3422.96	4729.49	5996.23	16998.91
Saudi Arabia	126.94	924.85	1791.90	2500.73	3751.53	5670.76	14766.71

Which five countries produced the ***largest*** volume of carbon emissions from 1960 to 2019? Which five countries produced the ***least***?





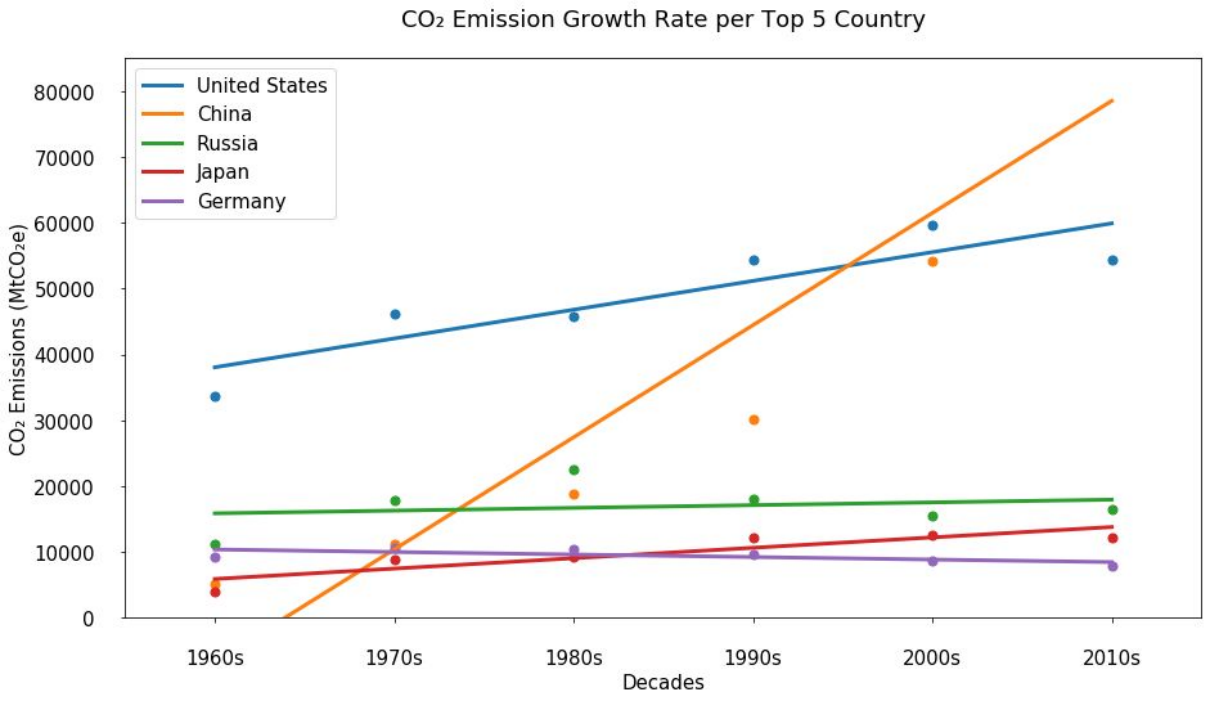
Is there a country that had a ***decrease*** in carbon emissions? If so, what context can be provided to explain the decline?



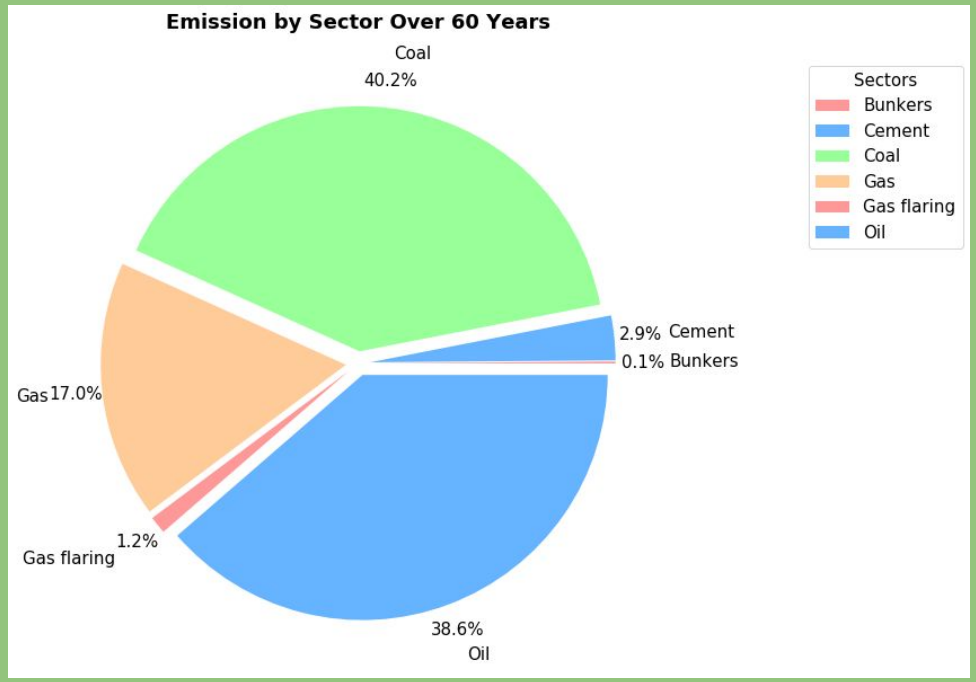
- Germany - Nuclear program expansion
- Russia - Fall of the Soviet Union
- U.S.A. - Continues to produce higher than other countries
- China - A large growth from 2000s. Can be considered as a large factor to other countries emission decreasing

Which country has the ***largest rate of carbon emissions*** from 1960 to 2019?

- China has a drastically different rate of growth in carbon emissions over the last 60 years
- China emitted ~5000 metric tons in 1960s
- China emitted ~96,000 metric tons in 2010s

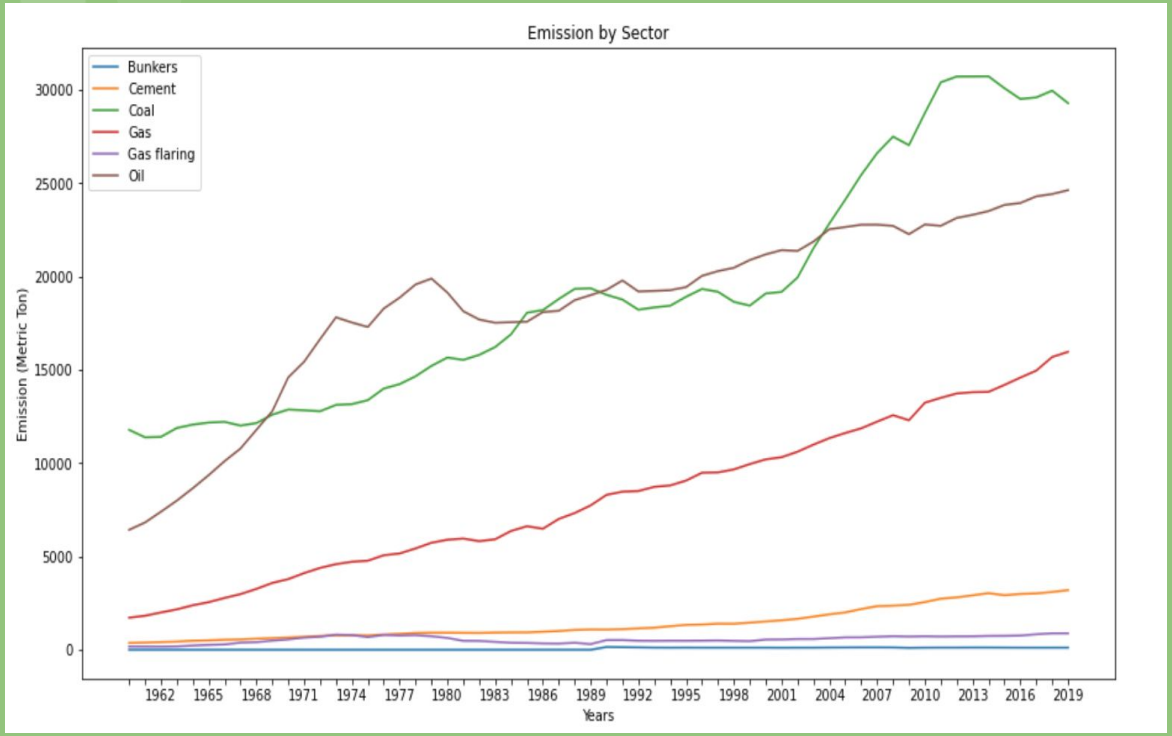


Which of the carbon emitting sectors produced the the most CO_2?



- Coal and oil are the top producers of carbon emissions over the past 60 years

Which of the carbon emitting sectors emitted the ***most CO_2***?



- Oil had a steady increase in carbon emissions until the 1970s
- Coal had a large increase in emissions near the 2000s
- Gas has been linearly increasing over time

Challenges

- Transposing data frame created a loss of access to certain indexes

Before

Out[27]:

Sector	2019	2018	2017	2016	2015	2014	2013	2012	2011	2010	...
Bunkers	115.12	113.58	113.58	113.58	117.25	120.91	120.91	117.25	117.25	113.58	...
Cement	3195.62	3095.72	3019.66	2990.11	2921.53	3031.86	2916.78	2806.70	2736.31	2554.88	...
Coal	29275.66	29945.75	29583.86	29500.28	30076.02	30713.13	30706.11	30702.52	30392.30	28744.10	...
Gas	15959.61	15680.81	14951.96	14577.75	14186.42	13813.84	13796.60	13726.80	13493.59	13231.50	...
Gas flaring	880.78	879.97	829.13	762.99	746.85	742.26	720.13	718.66	709.57	723.29	...
Oil	24616.77	24409.53	24284.35	23927.95	23825.08	23495.33	23295.24	23128.28	22706.65	22778.26	...

6 rows × 60 columns

In [41]:
```
sector_sum.columns
```

Out[41]:
```
Index(['2019', '2018', '2017', '2016', '2015', '2014', '2013', '2012', '2011',
       '2010', '2009', '2008', '2007', '2006', '2005', '2004', '2003', '2002',
       '2001', '2000', '1999', '1998', '1997', '1996', '1995', '1994', '1993',
       '1992', '1991', '1990', '1989', '1988', '1987', '1986', '1985', '1984',
       '1983', '1982', '1981', '1980', '1979', '1978', '1977', '1976', '1975',
       '1974', '1973', '1972', '1971', '1970', '1969', '1968', '1967', '1966',
       '1965', '1964', '1963', '1962', '1961', '1960', '60 Year Total'],
      dtype='object')
```

Challenges

- Problem: Transposing data frame created a loss of access to certain indexes
- Solution: Created new column to combat

After

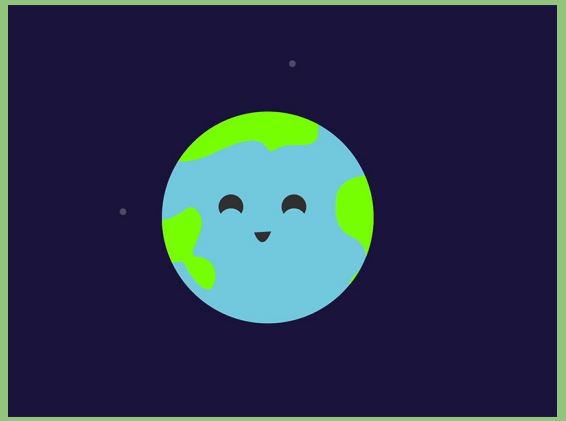
```
In [52]: sector_sum["Sector"] = ['Bunkers', 'Cement', 'Coal', 'Gas', 'Gas flaring', 'Oil']
         sector_sum
```

Out[52]:

)15	2014	2013	2012	2011	2010	...	1968	1967	1966	1965	1964	1963	1962	1961	1960	Sector
.25	120.91	120.91	117.25	117.25	113.58	...	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	Bunkers
.53	3031.86	2916.78	2806.70	2736.31	2554.88	...	595.97	556.12	537.76	504.03	481.67	436.70	413.39	386.45	366.08	Cement
.02	30713.13	30706.11	30702.52	30392.30	28744.10	...	12141.88	12005.89	12208.00	12170.07	12059.47	11878.49	11403.62	11379.98	11780.67	Coal
.42	13813.84	13796.60	13726.80	13493.59	13231.50	...	3261.35	2981.27	2776.00	2550.33	2383.11	2164.66	1998.52	1821.37	1720.63	Gas
.85	742.26	720.13	718.66	709.57	723.29	...	409.22	381.55	287.68	262.76	226.91	182.56	170.50	174.16	177.10	Gas flaring
.08	23495.33	23295.24	23128.28	22706.65	22778.26	...	11778.75	10777.88	10103.25	9352.80	8650.09	7988.82	7392.77	6816.44	6424.22	Oil

Conclusions

- We *might* perish…..
- The US and China are the largest emitters
- The rate that China is increasing every decade is unsustainable
- As expected, coal and oil are the largest sources of carbon emissions



Sources & Citations

- https://www.climatewatchdata.org/data-explorer/historical-emissions?historical-emissions-data-sources=gcp&historical-emissions-gases=&historical-emissions-regions=&historical-emissions-sectors=&page=1&sort_col=sector&sort_dir=ASC

Questions & Comments