

Pathways to a Greener Future: Tackling CO₂ Emissions Project

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Agenda

1. Background
2. Project Goals
3. Dataset
4. Analysis
5. Improvements
6. Conclusion



Background

- Carbon dioxide (CO₂) accounts for the largest share of greenhouse gases
 - Mainly stems **from burning of fossil fuels**, waste materials and wood. Also generated through industrial processes(i.e. cement)
- Increase in CO₂ emissions can lead to many factors
 - **Rising global temperatures,**
 - increase drought
acidification of the oceans

Project Overview

Our project focuses on highlighting the increase of global CO2 Emissions over the past few years and how the increase has led to rapid climate change, poses a risk for public health and global economy.

Our goal is to provide a detailed analysis on which countries are at higher contributors to environmental damage from greenhouse gases.



Define Phase

Project Statement

From 1960 to 2022 emissions from fossil fuel-based CO₂ has increased worldwide by 311%. Our goal is to reduce emissions by 15% by 2030.



Project Objective

- Identify High sources of Fossil Fuel based CO2 emissions
 - These include the burning of fossil fuels to produce Steel, Cement, Plastics.
 - Fuels burned from transportation (cars, trains, airplanes)
 - Greenhouse gas emitted from food sources
- Measure and compare the carbon footprint of different countries as a baseline for improvement



Justification



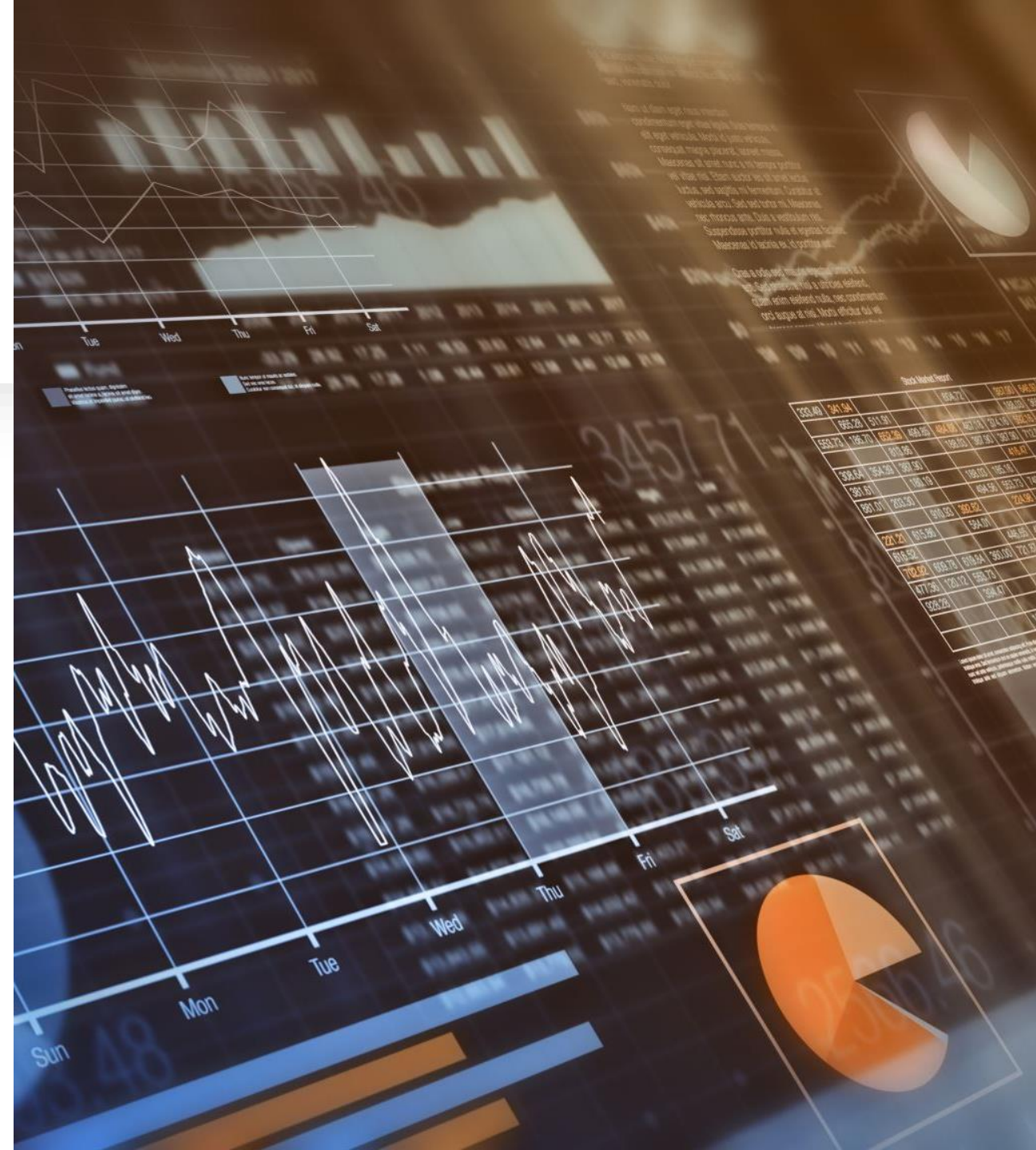
OUR FOCUS FOR THIS PROJECT IS TO BRING AWARENESS WITH THE CURRENT PROBLEM OF THE RISING GLOBAL TEMPERATURE DUE TO THE INCREASE OF GREENHOUSE GASES.



THESE INCREASES CAN CAUSE AND/OR EXACERBATE EXTREME WEATHER EFFECTS LIKE WILDFIRES, HURRICANES AND DROUGHTS.

Deficiencies and Shortcomings

- Inaccuracy in Energy Consumption Reporting by Countries
 - Data is measured by several industry sectors (transportation, industries, households). If data is not properly recorded in each sector, data could be unreliable.
- Inaccurate Emission Factors
 - Using average or outdated emission factors instead of more precise ones (specific to the type of fuel or region) can lead to inaccurate emissions estimates.



Project Goals

Identify

Identify problem areas to find a path to successfully reduce human-based CO2 emissions from the highest producers

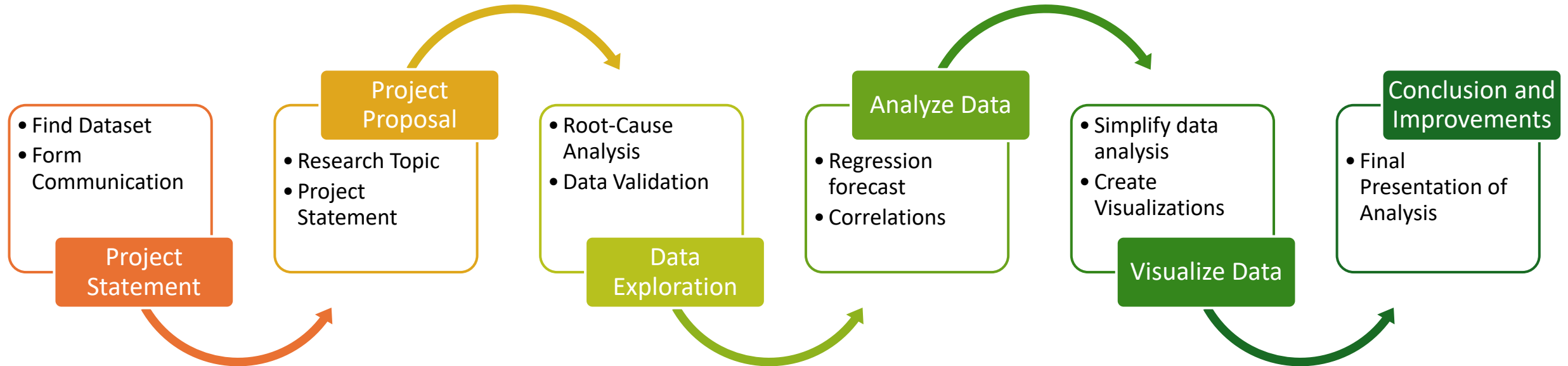
Compare

Compare data to identify where the country with the highest emissions with the could reduce carbon emissions

Target

Target Audience- Possible political advocates and government officials working on projects focusing on creating policies that focus on approaching the rise in CO2 emissions

Process Mapping



The image features a decorative background. At the top, a portion of a white laptop keyboard is visible, showing keys for 'return', 'shift', and arrow keys. Large, vibrant green monstera leaves are positioned on the left and right sides of the frame, partially overlapping a dark, solid-colored surface. In the center, a large white rectangle contains the text 'Measure Phase' in a black, serif font.

Measure Phase

Who collected the data and Why?

- Dataset – **OurWorldInData**
<https://github.com/owid/co2-data>
- OurWorldInData's mission is to “**publish the research and data to make progress against the world’s largest problems**”.
- Data compiled from several sources
 - **Global Carbon Budget (2023)**
 - **U.S. Energy Information Administration - International Energy Data (2023)**
 - **Climatewatchdata.org**

OWID Dataset Information

How many records?	1,678,654
How was it measured?	Multiple datasets including CO2 emissions statistics, sector, population data, country data and temperatures.
Variables?	79 separate variables CO2, Cement, Oil, Methane, Coal, GDP, CO2 per capita
KPI's.	Total Emissions per country, CO2 per Capita, CO2 totals per Emission Type, Change in temperature

Data collection plan

Why is this database relevant?

- Contains data pertaining to global emissions including:
 - Data on CO2 emissions (annual, per capita, cumulative and consumption-based)
 - Different types of country data (per capita, consumption rates)
 - Different types of Emission data (CO2, Gas, Cement, Methane, Oil)
 - Temperature Data
- Contains a Data Dictionary with Sources for each category

Metrics	Reasons for Collection	Data Source	Sampling Method	Sample Size	How Validated?
Co2 Emissions by location	To Determine CO2 comparison by countries	OWID	Online Resource	1,678,654	Global Carbon Budget (2023)
Temperature	To Identify if there is a concern for the issue	OWID	Online Resource	1,678,654	Global Carbon Budget (2023)
CO2 Emissions by category	To generate a comparison between different co2 emissions types	OWID	Online Resource	1,678,654	Global Carbon Budget (2023)

Tools used

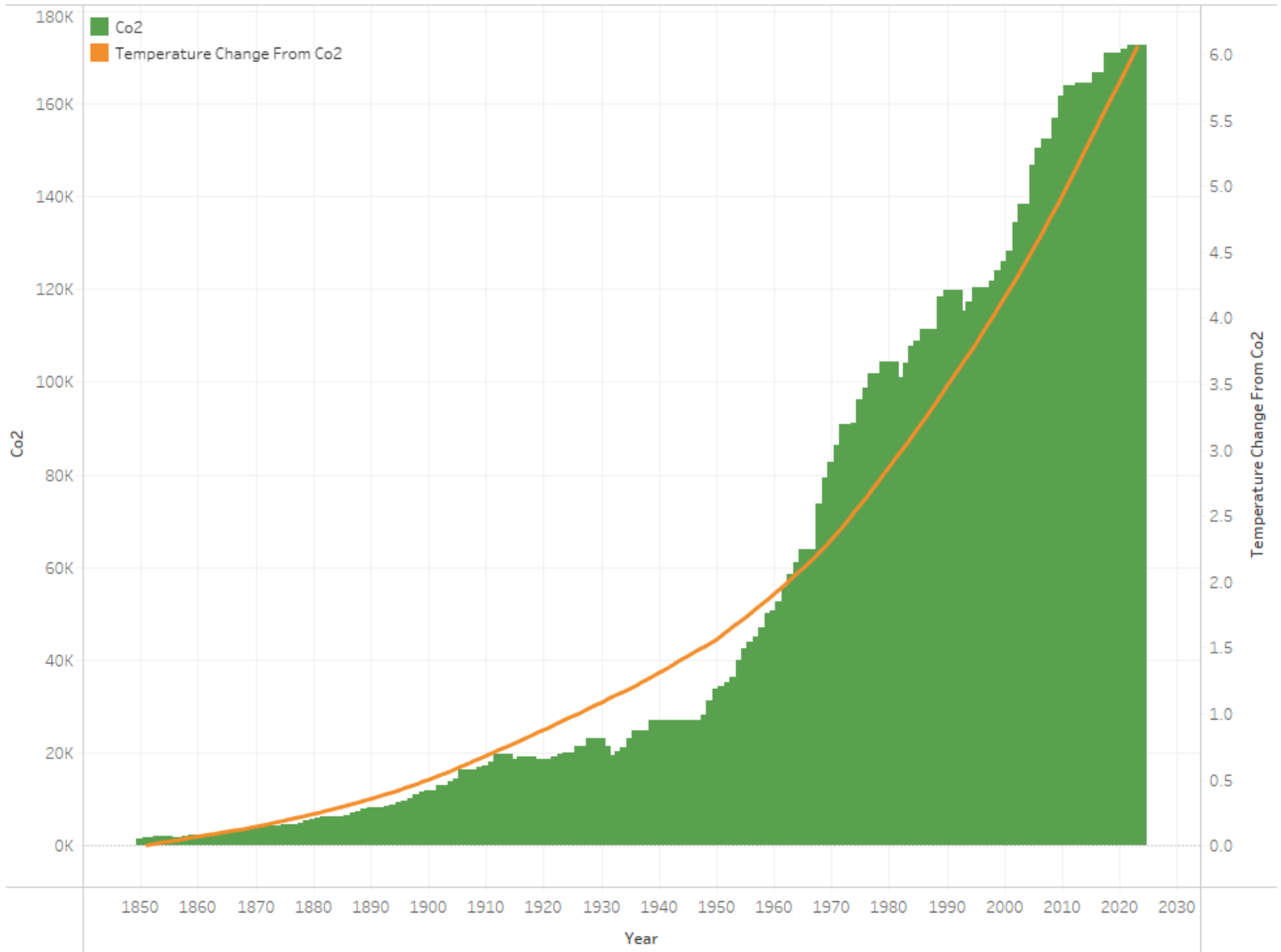
1. Excel – View Data, Pivot tables, and Data Cleaning
2. Tableau – Data exploration and Visualizations
3. PowerBI – Create Interactive Dashboards

Analyze Phase

Initial Analytics

Positive Linear
Correlation
between CO2
emission and the
rise of global
temperature
averages

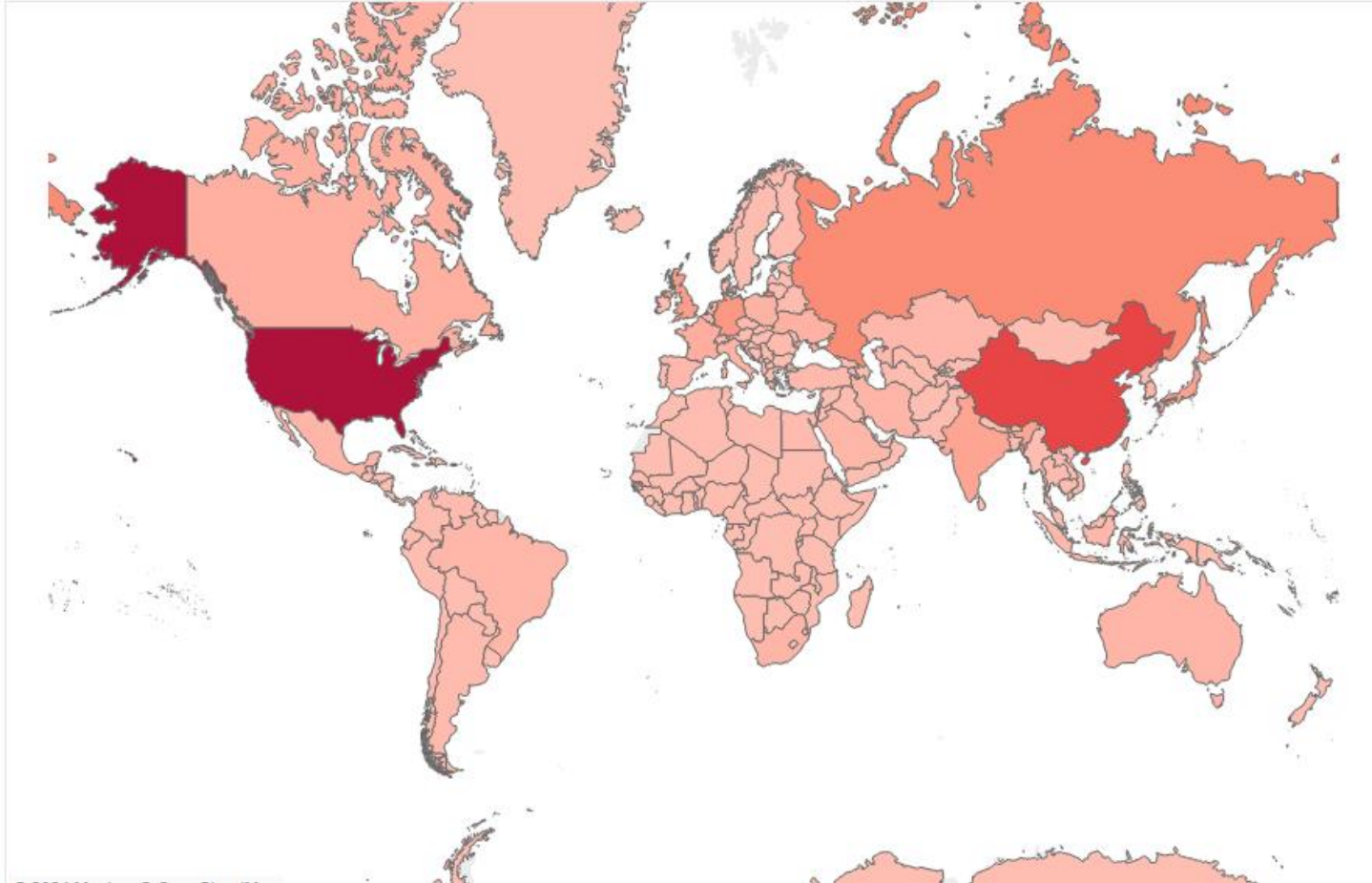
Annual CO2 Emissions compared to the growth in temperature since 1850



*Data from OWID database

Top Contributing Countries

Highest CO2 Contributors Worldwide



1. United States
2. China
3. India
4. Russia

*Data from OWID database

Data on Top Countries

Total

- More than **35 Billion Tons** of CO2 worldwide
- United states – **4.2 B** (24%)
- China – **2.6 B** (15%)

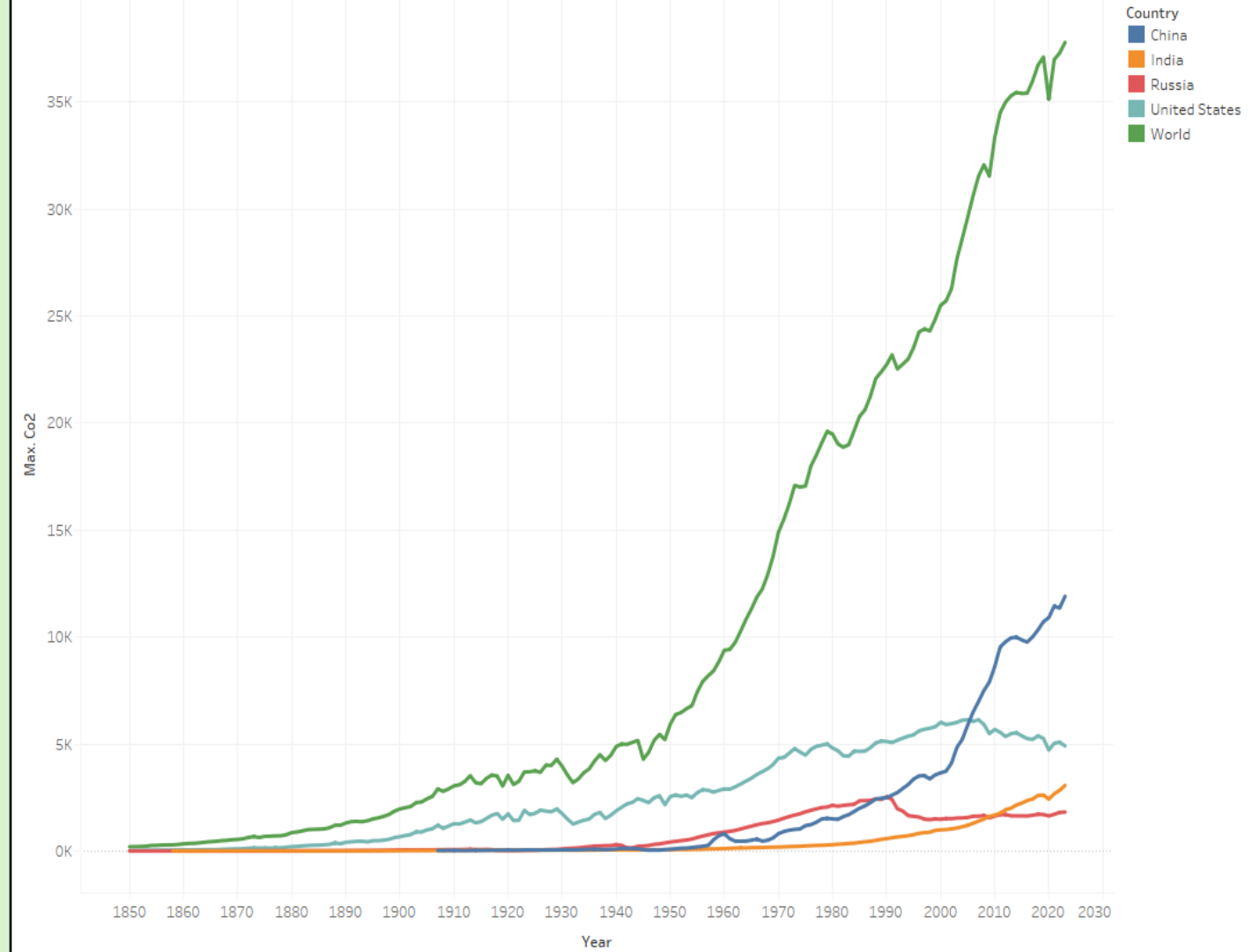
2023

China – **30%** of World total

United States – **14%** of World total

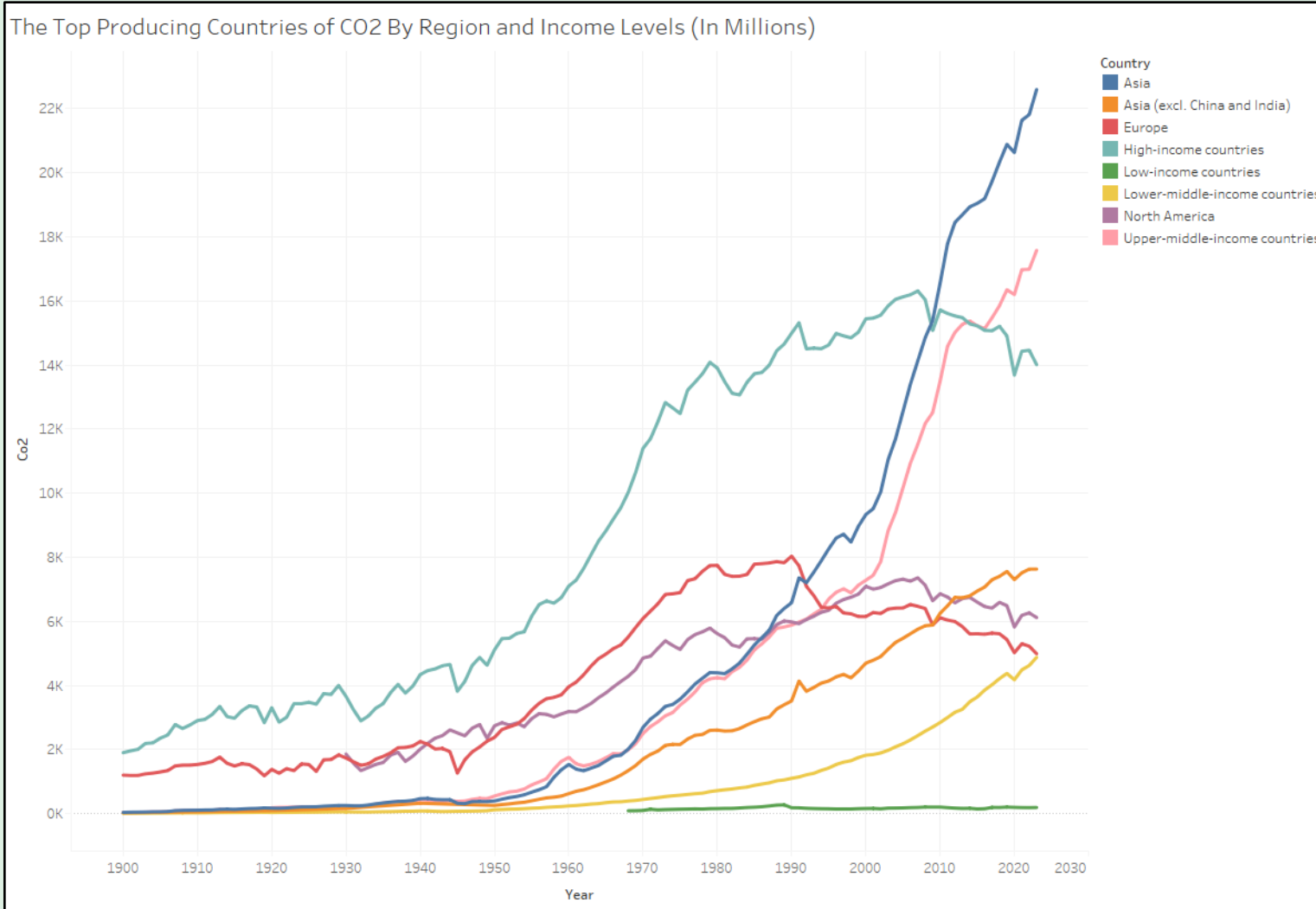
Global average **4.7 Tons** per person

Annual CO2 Emissions (In Millions)



The trend of maximum of Co2 for Year. Color shows details about Country. The data is filtered on sum of Co2, which keeps non-Null values only. The view is filtered on Country and Year. The Country filter keeps China, India, Russia, United States and World. The Year filter ranges from 1850 to 2023.

Region and Income Levels



Asia leads global emissions.

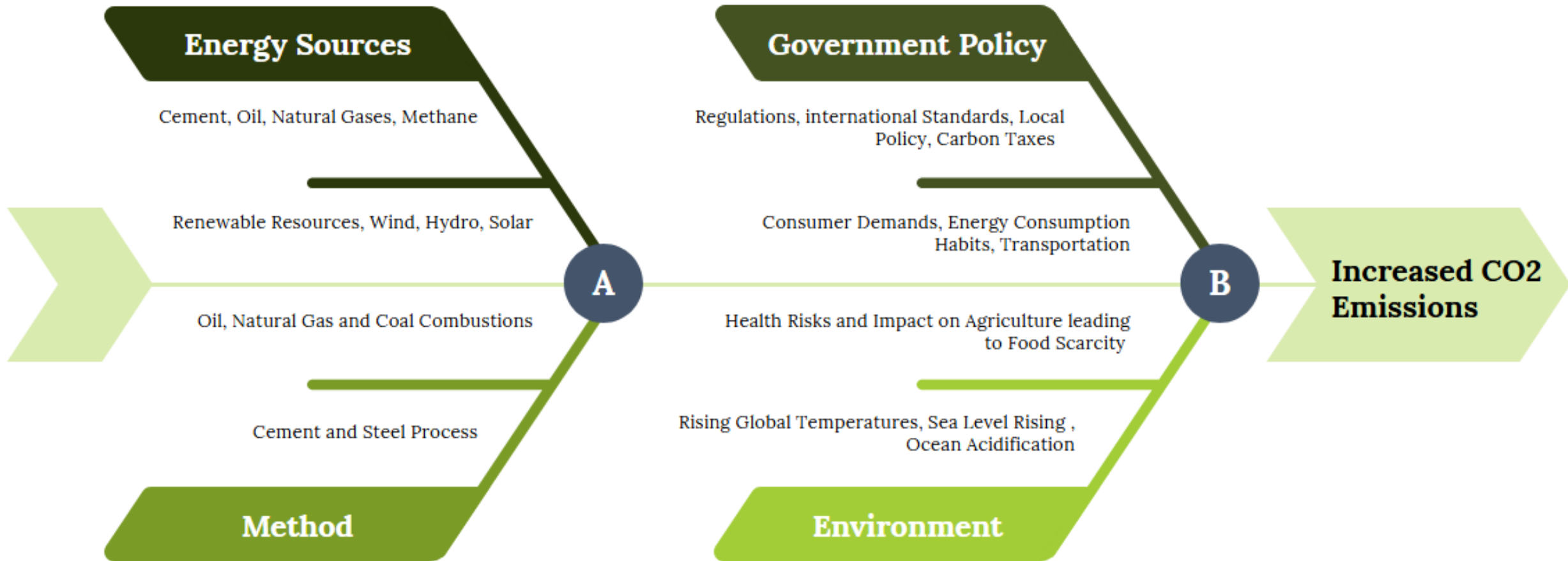
NA & EU are declining while Asia peaks.

Upper-middle-income emissions rising; high-income have plateaued.

*Data from OWID database

Technology and policy measures have a greater impact on reducing CO2 emissions than income levels alone

Fishbone Diagram



The background of the slide features a close-up, high-contrast photograph of green leaves. The leaves are layered, with some in sharp focus and others blurred, creating a sense of depth. The lighting is dramatic, with deep shadows and bright highlights on the leaf surfaces.

Improve Phase

Kurzgesagt

“You can always switch to using electrical cars, but it won’t solve anything if we keep building roads the same way”

What is being done currently...

Alternative Energy resources

- In 2023, China doubled the amount of solar installations and wind turbines by 66%.

Green initiatives

- Federal Sustainability Plan-set to reduce greenhouse gases in the U.S by 50% by 2030
 - Introduced in 2021
- Paris Agreement-set to hold the global average temperature in 2015
 - Aimed to reduce the temperature by 43% by 2030
- 1+N policy- Aims to have CO2 emissions hit peak by 2030 and achieve carbon neutrality by 2060
 - Introduced in 2021

What we plan to do:

- Focus on promoting/encouraging people to switch to electric vehicles and renewable energy sources to promote clean energy
- Ensure to focus on places where air pollution level are generally the highest(cities)



Control Phase

Start by focusing on the leading countries

Our goal is to reduce CO2 emissions by 15% by 2030.

15.0 → 12.75

United States
Tons Per Person

8.0 → 6.8

China
Tons Per Person

*Data from OWID database

Create Benchmarks

United States

50% of new vehicle sales to be electric/hybrid by 2030¹

Increase in renewable energy² shares to **50%** from 21% by 2030

China

1,200 GW of Solar and Wind Capacity by 2030³

Increase **40%** of Electricity generation to renewable resources⁴

Sources

1. The White House (2021)
2. EIA 2024
3. You X (2024)
4. Yang, M (2024)

Dashboards for transparency

United States CO2 Summary

Total Emissions (2023)

4.8 Million Tons

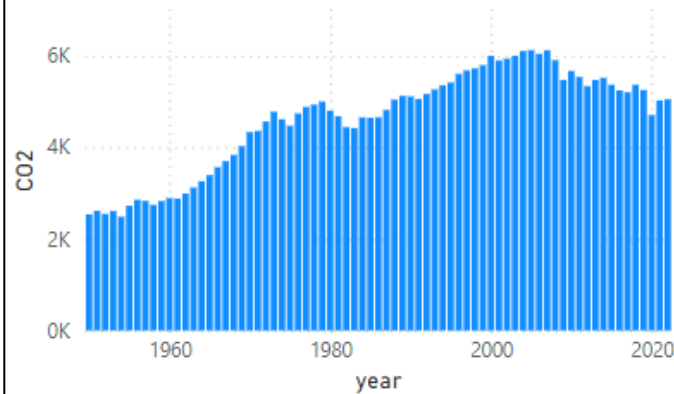
Change From 2022

-2.78%

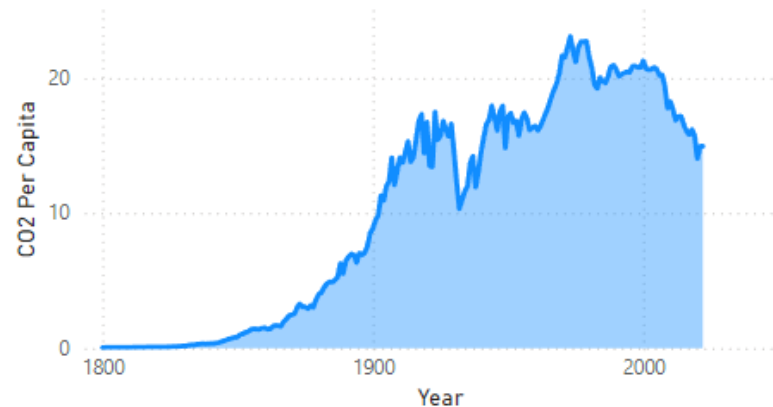
Current Goals

50% Electric Vehicle
Sales

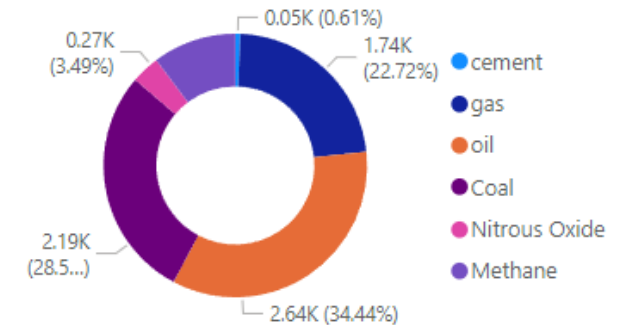
CO2 Emissions Per Year



CO2 Per Capita Per Year



Types of CO2 Emissions



Top Policy changes

EPA Publishes its 2024-2027 Climate Adaptation Plan

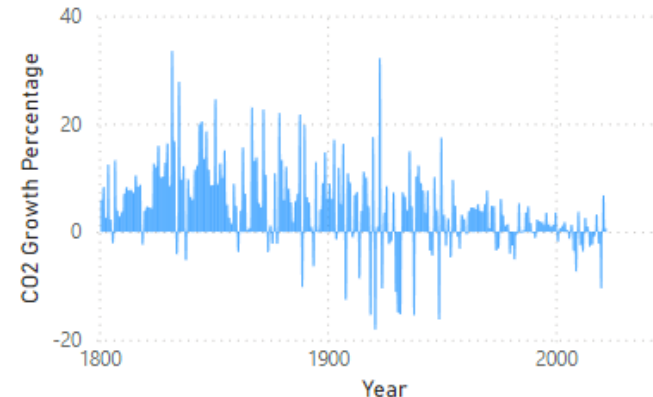
(<https://www.epa.gov/newsreleases/epa-publishes-its-2024-2027-climate-adaptation-plan-0>)

Carbon Pollution Standards for Power Plants May 2024

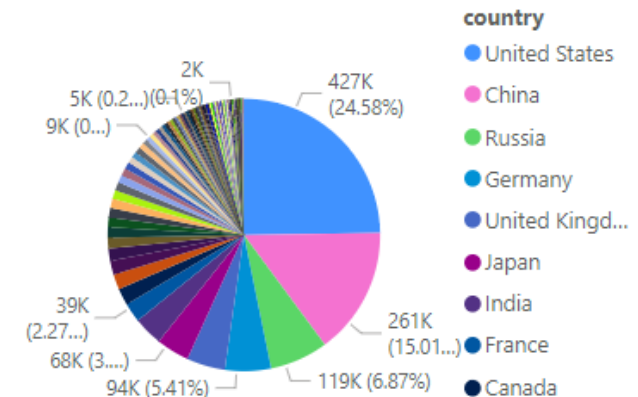
(<https://www.epa.gov/climate-change/climate-change-regulatory-actions-and-initiatives>)

Biden Outline Target of 50% Electric Vehicle Sales Share

CO2 Growth Percentage by Year



Top Contributing Countries



Budget

- In 2022, The energy subsidies for United States Federally totaled **53%** for Renewable energy, with **47%** going to fossil-based fuel
- In contrast, energy subsidies for China were around **38%** for renewable sources, while **62%** went to fossil-based fuel sources

International Energy Agency (IEA) estimates that there is **\$7 Trillion** global subsidies backing Fossil fuel-based initiatives, while **\$1.34 trillion** supporting clean energy investments.

Conclusion

- This report points out the role high-emission nations like the United States and China need to take to lead change.
- Achieving the proposed 15% reduction by 2030 will require the collaboration of governments around the world, as it is a shared responsibility among all of humanity to prevent the rise of CO2 emissions



Work Breakdown Schedule

Task Level	WBS	Task Description	Assigned To	Completion Date	Week Due	Notes
1	1	Define				
2	1.1	Identify Project Dataset	Team	8/22/2024	Week 1	
2	1.2	Research Topic	Team	8/29/2024	Week 1	
3	1.2.1	Project statement	Team	9/19/2024	Week 2	Project statement presentation due week 3 in class
3	1.2.2	Create Work Breakdown schedule	Team	9/5/2024	Week 1	
4	1.2.2.1	Team Contract	Nandini	8/29/2024	Week 1	
4	1.2.2.2	Form Communication Channel	Robert	8/29/2024	Week 1	
4	1.2.2.3	Process Mapping	Robert	9/5/2024	Week3	
2	1.3	Project Proposal Presentation	Team	9/19/2024	Week 4	Project Proposal submission due 9/18 on canvas
1	2	Measure				
2	2.1	Data Collection Process	Nandini	9/26/2024	Week 7	
3	2.1.1	Data Definition/Data Dictionary	Robert	10/10/2024	Week 8	
1	3	Analyze				
2	3.1	Fishbone analysis	Nandini	10/10/2024	Week 7	
3	3.1.1	Tableau Analysis	Robert	9/26/2024	Week 5	
4	3.1.1.1	Excel Analysis	Team	9/26/2024	Week 5	
2	3.2	Second Presentation-Measure	Team	10/10/2024	Week 8	Presentation submission due 10/9 on canvas
1	4	Improve				
2	4.1	Brainstorm Solutions	Nandini	11/16/2024	Week 14	
3	4.1.1	Process Control	Nandini	11/19/2024	Week 14	
4	4.1.1.1	Research Policies	Team	11/16/2024	Week 14	
		Third Presentation - Improve/Control	Team	11/21/2024	week 14	Presentation submission due 11/20/2024
1	5	Control				
2	5.1	Lesson Learned	Robert	11/21/2024	Week 14	
3	5.2	Improvements	Robert	11/21/2024	Week 16	
4	5.3	Finalize Define phase	Nandini	12/1/2023	Week 16	
5	5.4	Finalize Measure Phase	Team	12/3/2024	Week 16	
6	5.5	Finalize Analyze phase	Robert	12/1/2024	Week 16	
7	5.6	Finalize Improve Phase on Report	Nandini	11/30/2024	Week 16	
8	5.7	Finalize Control Phase on Report	Robert	12/3/2024	Week 16	
		Final Project/ Report	Team	12/5/2024	Week 16	Report and Final Project both due on 12/4

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Thank you!