



UNEARTHING THE ENVIRONMENTAL IMPACT OF HUMAN ACTIVITY : A GLOBAL CO2 EMISSION ANALYSIS

Project Based Experimental Learning program



Unearthing The Environmental Impact Of Human

Activity: A Gobal CO2 Emission Analysis

Milestone 1: Define Problem / Problem Understanding :

Activity 1: Specify the business problem.

Global warming is one of the biggest challenges currently being faced by the human race, although correlation is not causation, a likely cause of global warming is due to increased atmospheric carbon dioxide from human activities. **CO2 Emission** refers to the Carbon Dioxide emitted throughout the world. For this analysis we will be focusing on CO2 Emissions and its effect on the world we live in as well as some key factors and stats that may play a role in the emission of CO2 globally. Fossil fuel use is the primary source of CO2. The data throws light onto how much fossil fuels are burnt, per year per nation, which amounts to an increase in CO2 every year. This will help researchers and environment experts to predict global warming. So countries should set a goal to decrease this amount yearly.

Activity 2: Business requirements.

The business requirements for analysing the Co2 Emission Globally over time, identifying affecting factors, creating interactive dashboards and reports, identifying areas for improvement, making data-driven decisions, comparing to countries average and creating forecasting models for future performance. The ultimate goal is to gain insights and reduce the emission through data visualization techniques.

Activity 3: Literature Survey.

A literature survey is a method of researching existing literature and studies related to a specific topic. In the context of analyzing the Global Co₂ Emission, a literature survey would involve reviewing studies and articles that have been published on the topic of Emission, as well as studies specific to Co₂. The literature survey would include sources such as academic journals, industry reports, and online articles. It would aim to identify different internal and external factors that are responsible and commonly used to determine Co₂ Emission, as well as any best practices or strategies that have been identified for reducing emission. The literature survey would also explore any existing research on Co₂ Emission specifically, and would aim to identify any challenges or opportunities that the Countries can opt to reduce emission.

The survey articles :

- **CO₂ emissions: A quantitative analysis among the BRICS nations:**

Abstract

This study aims to examine the volume of carbon dioxide (CO₂) emissions by lag of the emissions and by the Gross Domestic Product (GDP) for the BRICS (Brazil, Russia, India, China, and South Africa) countries from 1980 to 2011. Due to the heterogeneity of CO₂ emission among the BRICS countries, we organized the countries into two groups. In Group 1 (Brazil and Russia), we identified that the main causes of the variation of CO₂ emission in time t are the emission of CO₂ in time $t-1$ and the annual GDP of the country. In Group 2 (China, India, and South Africa), the findings do not depend on the income

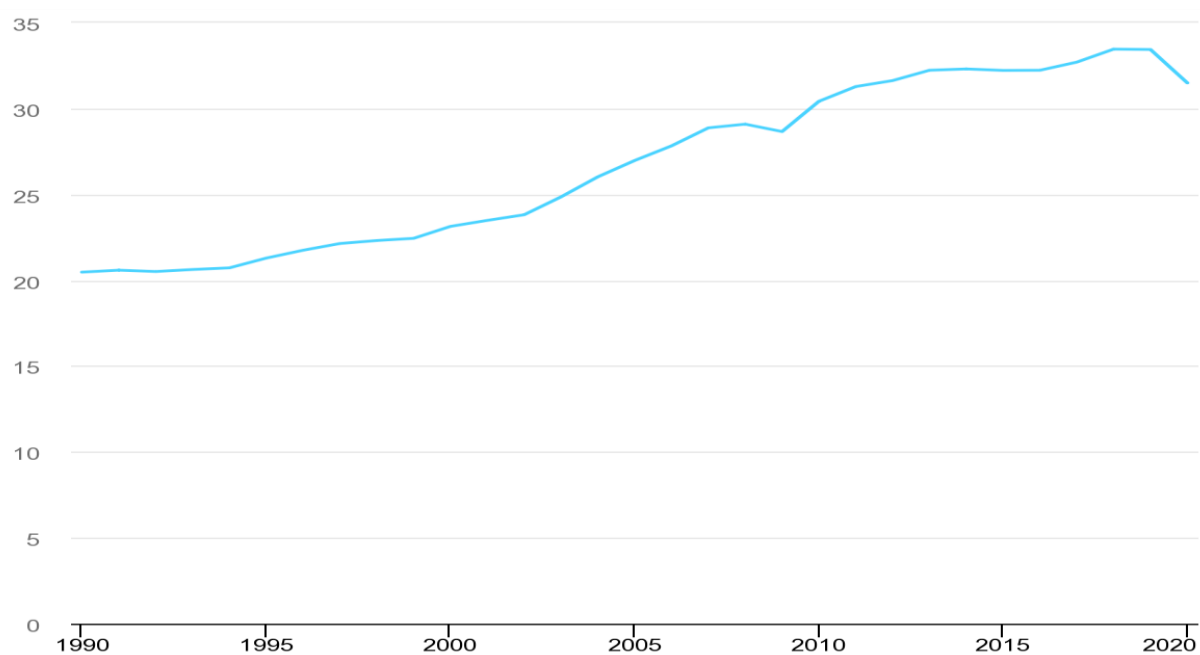
level of individual countries, but only from the emission of CO₂ in the lag period. Therefore, the main contribution of this study is that the environmental consequences of growing economic activity may be very mixed and must be examined on a case-by-case basis.

- **Global Energy Review: CO2 Emissions in 2020**
By IEA :

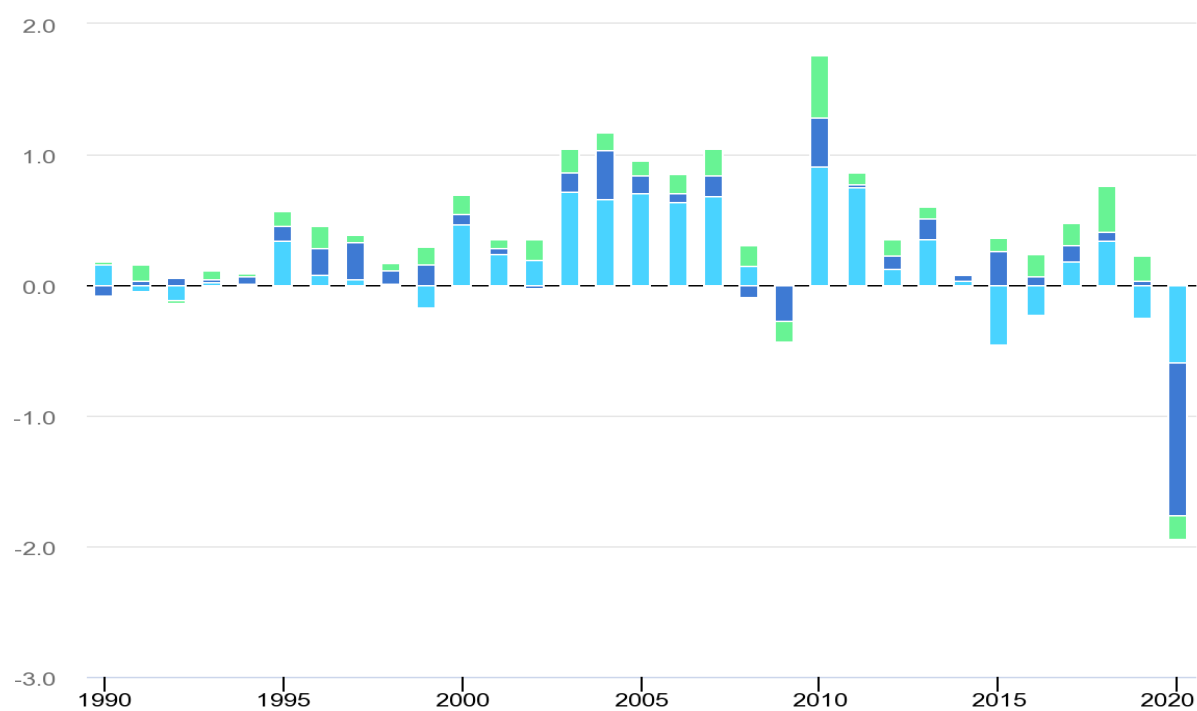
The Covid-19 pandemic and resulting economic crisis had an impact on almost every aspect of how energy is produced, supplied, and consumed around the world. The pandemic defined energy and emissions trends in 2020 – it drove down fossil fuel consumption for much of the year, whereas renewables and electric vehicles, two of the main building blocks of clean energy transitions, were largely immune.

As primary energy demand dropped nearly 4% in 2020, global energy-related CO₂ emissions fell by 5.8% according to the latest statistical data, the largest annual percentage decline since World War II. In absolute terms, the decline in emissions of almost 2000 million tonnes of CO₂ is without precedent in human history – broadly speaking, this is the equivalent of removing all of the European Union's emissions from the global total. Demand for fossil fuels was hardest hit in 2020 – especially oil, which plunged 8.6%, and coal, which dropped by 4%. Oil's annual decline was its largest ever, accounting for more than half of the drop in global emissions. Global emissions from oil use plummeted by well over 1100 Mt CO₂, down from around 11400 Mt in 2019. The drop in road transport activity accounted for 50% of the decline in global oil demand, and the slump in the aviation sector for around 35%. Meanwhile, low-carbon fuels and technologies, in particular, solar PV and wind, reached their highest ever annual share of the global energy mix, increasing it by more than one percentage point to over 20%.

Global energy-related CO2 emissions, 1990-2020 :



Change in CO2 emissions by fuel, 1990-2020 :



- Global Energy Review: CO₂ Emissions in 2021 By IEA :

Energy-related CO₂ emissions grew to 36.3 Gt in 2021, a record high

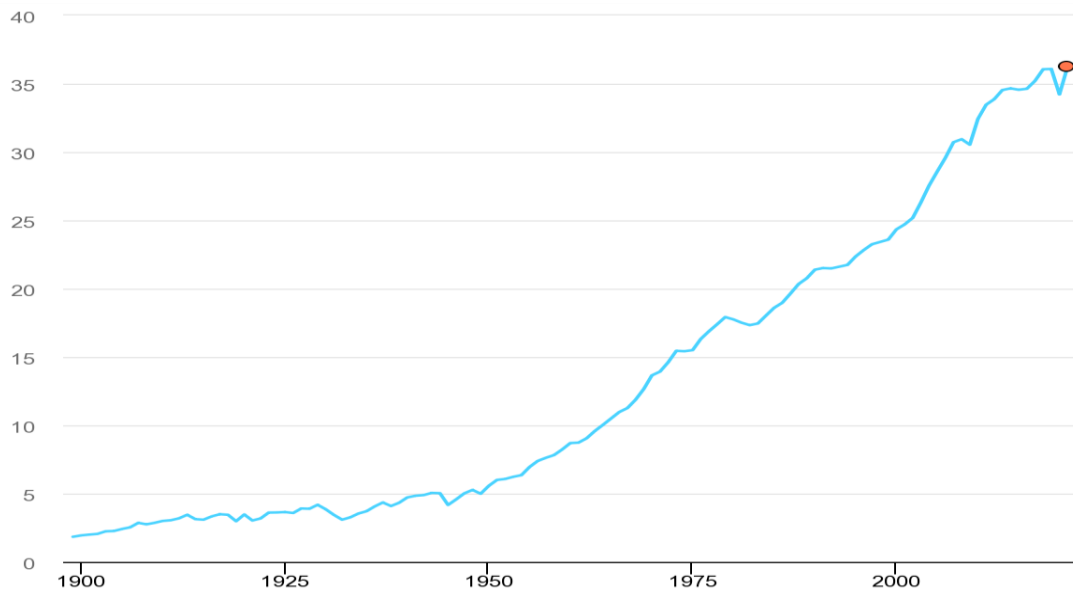
Global CO₂ emissions from energy combustion and industrial processes¹ rebounded in 2021 to reach their highest ever annual level. A 6% increase from 2020 pushed emissions to 36.3 gigatonnes (Gt), an estimate based on the IEA's detailed region-by-region and fuel-by-fuel analysis, drawing on the latest official national data and publicly available energy, economic and weather data.

The Covid-19 pandemic had far-reaching impacts on energy demand in 2020, reducing global CO₂ emissions by 5.2%. However, the world has experienced an extremely rapid economic recovery since then, driven by unprecedented fiscal and monetary stimulus and a fast – although uneven – roll-out of vaccines. The recovery of energy demand in 2021 was compounded by adverse weather and energy market conditions, which led to more coal being burnt despite renewable power generation registering its largest ever annual growth.

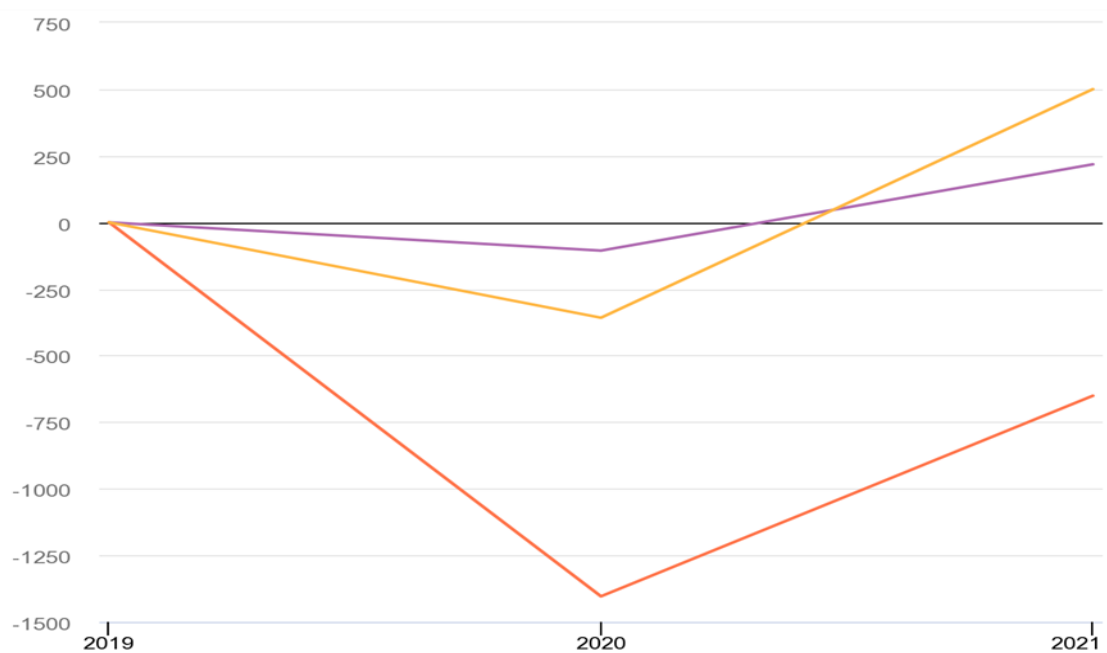
Emissions increased by almost 2.1 Gt from 2020 levels. This puts 2021 above 2010 as the largest ever year-on-year increase in energy-related CO₂ emissions in absolute terms. The rebound in 2021 more than reversed the pandemic-induced decline in emissions of 1.9 Gt experienced in 2020. CO₂ emissions in 2021 rose to around 180 megatonnes (Mt) above the pre-pandemic level of 2019.

The 6% increase in CO₂ emissions in 2021 was in line with the jump in global economic output of 5.9%. This marks the strongest coupling of CO₂ emissions with Gross domestic product (GDP) growth since 2010, when global emissions rebounded by 6.1% while economic output grew by 5.1% as the world emerged from the Global Financial Crisis.

CO2 emissions from energy combustion and industrial processes, 1900-2021:



Change in CO2 emissions by fossil fuel, relative to 2019 levels, 2019-2021:



- **CO2 Emissions in 2022 By IEA :**

- Global energy-related CO2 emissions grew by 0.9% or 321 Mt in 2022, reaching a new high of over 36.8 Gt. Following two years of exceptional oscillations in energy use and emissions, caused in part by the Covid-19 pandemic, last year's growth was much slower than 2021's rebound of more than 6%. Emissions from energy combustion increased by 423 Mt, while emissions from industrial processes decreased by 102 Mt.
- In a year marked by energy price shocks, rising inflation, and disruptions to traditional fuel trade flows, **global growth in emissions was lower than feared**, despite gas-to-coal switching in many countries. Increased deployment of clean energy technologies such as renewables, electric vehicles, and heat pumps helped prevent an additional 550 Mt in CO2 emissions. Industrial production curtailment, particularly in China and Europe, also averted additional emissions.
- **Specific challenges in 2022 contributed to the growth in emissions.** Of the 321 Mt CO2 increase, 60 Mt CO2 can be attributed to cooling and heating demand in extreme weather and another 55 Mt CO2 to nuclear power plants being offline.
- **CO2 growth in 2022 was well below global GDP growth of 3.2%**, reverting to a decade-long trend of decoupling emissions and economic growth that was broken by 2021's sharp rebound in emissions. Improvements in the CO2 intensity of energy use were slightly slower than the past decade's average.
- **Emissions from natural gas fell by 1.6% or 118 Mt**, following continued tightening of supply exacerbated by Russia's invasion of Ukraine. Reductions in emissions

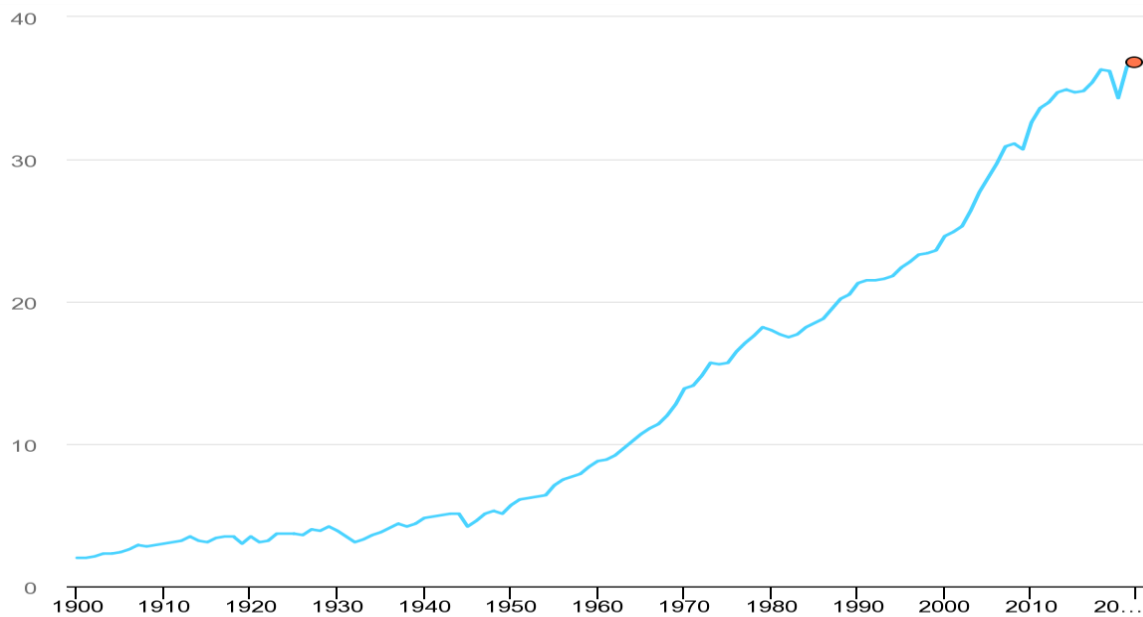
from gas were particularly pronounced in Europe (-13.5%). The Asia Pacific region also saw unprecedented reductions (-1.8%).

- **Increased emissions from coal more than offset reductions from natural gas.** Amid a wave of gas-to-coal switching during the global energy crisis, CO₂ emissions from coal grew by 1.6% or 243 Mt, far exceeding the last decade's average growth rate, and reaching a new all-time high of almost 15.5 Gt.
- **Emissions from oil grew even more than emissions from coal, rising by 2.5% or 268 Mt to 11.2 Gt.** Around half of the increase came from aviation, as air travel continued to rebound from pandemic lows, nearing 80% of 2019 levels. Tempering this increase, electric vehicles continued to gain momentum in 2022, with over 10 million cars sold, exceeding 14% of global car sales.
- **The biggest sectoral increase in emissions in 2022 came from electricity and heat generation,** whose emissions were up by 1.8% or 261 Mt. In particular, global emissions from coal-fired electricity and heat generation grew by 224 Mt or 2.1%, led by emerging economies in Asia.
- **A strong expansion of renewables limited the rebound in coal power emissions.** Renewables met 90% of last year's global growth in electricity generation. Solar PV and wind generation each increased by around 275 TWh, a new annual record.
- **Emissions from industry declined by 1.7% to 9.2 Gt last year.** While several regions saw manufacturing curtailments, the global decline was largely driven by a 161 Mt CO₂ decrease in China's industry emissions, reflecting a 10% decline in cement production and a 2% decline in steel making.
- **China's emissions were relatively flat in 2022, declining by 23 Mt or 0.2%.** Growing emissions from combustion were offset by declines from industrial processes.

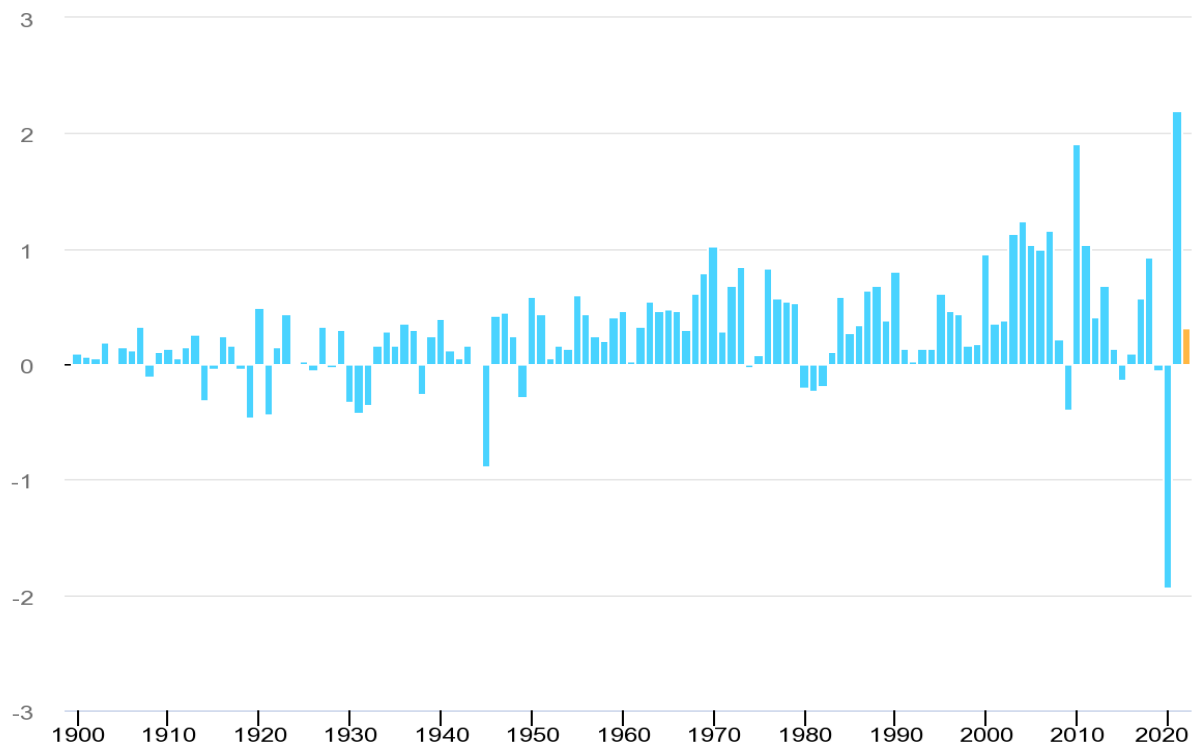
Weaker economic growth, declining construction activity, and strict Covid-19 measures led to reductions in industrial and transport emissions. Power sector emissions growth slowed compared with the average of the past decade but still reached 2.6%.

- **The European Union saw a 2.5% or 70 Mt reduction in CO₂ emissions** despite oil and gas market disruptions, hydro shortfalls due to drought, and numerous nuclear plants going offline. Buildings sector emissions fell markedly, helped by a mild winter. Although power sector emissions increased by 3.4%, coal use was not as high as anticipated. For the first time, electricity generation from wind and solar PV combined exceeded that of gas or nuclear.
- **US emissions grew by 0.8% or 36 Mt. The buildings sector saw the highest emissions growth, driven by extreme temperatures.** The main emissions reductions came from electricity and heat generation, thanks to unprecedented increases in solar PV and wind, as well as coal-to-gas switching. While many other countries reduced their natural gas use, the United States saw an increase of 89 Mt in CO₂ emissions from gas, as it was called upon to meet peak electricity demand during summer heat waves.
- **Emissions from Asia's emerging market and developing economies, excluding China, grew more than those from any other region in 2022,** increasing by 4.2% or 206 Mt CO₂. Over half of the region's increase in emissions came from coal-fired power generation.

Global CO₂ emissions from energy combustion and industrial processes, 1900-2022 :



Annual change in global CO₂ emissions from energy combustion and industrial processes, 1900-2022 :



Activity 4: Social or Business Impact.

Social impact :

Carbon dioxide emissions are the primary driver of global climate change. It's widely recognised that to avoid the worst impacts of climate change, the world needs to urgently reduce emissions. As the impacts of climate change mount, millions of vulnerable people face disproportionate challenges in terms of extreme events, health effects, food, water, and livelihood security, migration and forced displacement, loss of cultural identity, and other related risks.

Business Model/Impact :

By conducting an analysis the countries can identify areas for improvement and take steps to reduce factors that are responsible for Co2 Emission for environmental sustainability by improving the efficiency and transitioning to low carbon alternatives. **Higher carbon footprint is indicative of greater energy costs.** Expenditure on energy bills could be channeled to other areas of the business that require more attention

