**Technical Analysis Report**

**Introduction**

Climate change is one of the most urgent challenges facing our planet, driven largely by the rapid rise in greenhouse gas emissions. Understanding how emissions evolve, which countries contribute the most, and how energy choices shape these trends is essential for creating effective solutions. This project explores global emission patterns, energy usage, and the role of renewable sources to highlight where action is most needed and guide efforts toward a sustainable, low-carbon future.

**Problem Statement**

Despite global awareness of climate change, greenhouse gas emissions continue to rise, driven by heavy reliance on fossil fuels and slow adoption of renewable energy. This project aims to **analyze global emission trends, identify key contributors, and assess the impact of energy choices** to support **data-driven strategies for reducing emissions and achieving sustainability goals by 2050.**

**Objectives**

* Study how emissions change over time with renewable and fossil fuel use.
* Identify top and low emitters to see which countries contribute most and least to global emissions.
* Look at how much energy those countries use and where it comes from.
* Track per capita emissions over time to understand individual impact and progress.
* Suggest ways to reduce emissions using cleaner energy.

**Target Audience**

* + Environmental ministries or government agencies
  + Sustainability and ESG departments
  + Environmental NGOs
  + Energy companies

**Dataset**

**Dataset Source & Link**

* **Name:** *World Energy Consumption*
* **Platform:** Kaggle
* **URL:** [https://www.kaggle.com/datasets/pralabhpoudel/world-energy-consumption](https://www.kaggle.com/datasets/pralabhpoudel/world-energy-consumption?utm_source=chatgpt.com)
* **Description:** A comprehensive dataset covering energy consumption, emissions, and related metrics for many countries/regions over years.

**Data Dictionary & Key Columns**

Below is a summary of the important columns in the dataset, what they represent, and their likely data types. (You already shared the list of column headers, so I’m interpreting from that.)

|  |  |  |
| --- | --- | --- |
| **Column Name** | **Description** | **Data Type** |
| country | Name of the country or region / location | Text / String |
| year | Calendar year for the data point | Integer / Whole Number |
| iso\_code | Standard 2- or 3-letter country code | Text / String |
| population | Total population of that country in that year | Numeric (Integer / Big Number) |
| gdp | Gross Domestic Product (nominal) or economic output | Numeric (Decimal) |
| greenhouse\_gas\_emissions | Total greenhouse gas emissions (e.g. in tonnes or CO₂e) | Numeric |
| **Energy / Fuel Types / Shares / Consumption** |  |  |
| coal\_consumption | Energy consumption from coal | Numeric |
| oil\_consumption | Energy consumption from oil | Numeric |
| gas\_consumption | Energy consumption from natural gas | Numeric |
| renewables\_consumption | Total renewable energy consumption | Numeric |
| biofuel\_consumption | Biofuel energy consumption | Numeric |
| hydro\_consumption | Hydropower energy consumption | Numeric |
| nuclear\_consumption | Nuclear energy consumption | Numeric |
| other\_renewable\_consumption | Other types of renewable (excluding biofuel, hydro) | Numeric |
| **Electricity / Demand / Shares** |  |  |
| electricity\_generation | Total electricity generated | Numeric |
| electricity\_demand | Total demand for electricity | Numeric |
| renewables\_share\_energy | Share (percentage) of total energy from renewables | Numeric / Decimal |
| fossil\_share\_energy | Share of energy from fossil fuels | Numeric / Decimal |
| coal\_share\_energy | Share of energy from coal | Numeric / Decimal |
| gas\_share\_energy | Share of energy from gas | Numeric / Decimal |
| renewables\_share\_elec | Share of electricity generation from renewables | Numeric / Decimal |
| **Per Capita or Relative Metrics / Ratios** |  |  |
| energy\_per\_capita | Total energy consumption divided by population | Numeric / Decimal |
| fossil\_energy\_per\_capita | Fossil fuel energy consumption per person | Numeric / Decimal |
| low\_carbon\_share\_energy | Share of energy from low-carbon sources | Numeric / Decimal |
| **Change / Growth Columns** |  |  |
| coal\_cons\_change\_pct | Percent change in coal consumption relative to previous period | Numeric / Decimal |
| renewables\_cons\_change\_pct | Percent change in renewables consumption | Numeric / Decimal |
| gas\_cons\_change\_pct | Percent change in gas consumption | Numeric / Decimal |
| **Production / Output Related** |  |  |
| coal\_production | Amount of coal produced (not just consumed) | Numeric |
| gas\_production | Amount of gas produced | Numeric |
| oil\_production | Oil production | Numeric |
| **Other columns / Misc** |  |  |
| net\_elec\_imports | Net electricity imports (imports minus exports) | Numeric |
| net\_elec\_imports\_share\_demand | Share of imported electricity relative to demand | Numeric / Decimal |
| carbon\_intensity\_elec | Carbon emissions per unit electricity generated | Numeric / Decimal |

**Data Handling**

**Cleaning:**

**ADD:**

New custom column to get only the country names

New measure calculating emissions\_per\_capita .

**Split:**

Country (split by the parameter cause it have the company name in it )

**replace:**

replace the null values in population with zero

replace the null values in GDP with zero

replace the null values in fossil fuel consumption with zero

replace the null values in renewable consumption with zero

replace the null values in primary energy consumption with zero

replace the null values in nuclear consumption with zero

replace the null values in biofuel\_cons\_per\_capita with zero

replace the null values in biofuel\_consumption with zero

replace the null values in n biofuel\_elec\_per\_capita with zero

replace the null values in biofuel\_electricity with zero

replace the null values in biofuel\_share\_elec with zero

replace the null values in biofuel\_share\_energy with zero

replace the null values in carbon\_intensity\_elec with zero

replace the null values in coal\_cons\_per\_capita with zero

replace the null values in coal\_consumption with zero

replace the null values in coal\_elec\_per\_capita with zero

replace the null values in coal\_electricity with zero

replace the null values in coal\_prod\_per\_capita with zero

replace the null values in coal\_production with zero

replace the null values in coal\_share\_elec with zero

replace the null values in coal\_share\_energy with zero

replace the null values in electricity\_demand with zero

replace the null values in electricity\_generation with zero

replace the null values in electricity\_share\_energy with zero

replace the null values in energy\_per\_capita with zero

replace the null values in energy\_per\_gdp with zero

replace the null values in fossil\_elec\_per\_capita with zero

replace the null values in fossil\_electricity with zero

replace the null values in fossil\_energy\_per\_capita with zero

replace the null values in fossil\_share\_elec with zero

replace the null values in fossil\_share\_energy with zero

replace the null values in gas\_consumption with zero

replace the null values in gas\_elec\_per\_capita with zero

replace the null values in gas\_electricity with zero

replace the null values in gas\_energy\_per\_capita with zero

replace the null values in gas\_prod\_per\_capita with zero

replace the null values in gas\_production with zero

replace the null values in gas\_share\_elec with zero

replace the null values in gas\_share\_energy with zero

replace the null values in hydro\_elec\_per\_capita with zero

replace the null values in hydro\_electricity with zero

replace the null values in hydro\_energy\_per\_capita with zero

replace the null values in hydro\_share\_elec with zero

replace the null values in hydro\_share\_energy with zero

replace the null values in low\_carbon\_consumption with zero

replace the null values in low\_carbon\_elec\_per\_capita with zero

replace the null values in low\_carbon\_electricity with zero

replace the null values in low\_carbon\_energy\_per\_capita with zero

replace the null values in low\_carbon\_share\_elec with zero

replace the null values in low\_carbon\_share\_energy with zero

replace the null values in nuclear\_elec\_per\_capita with zero

replace the null values in nuclear\_electricity with zero

replace the null values in nuclear\_energy\_per\_capita with zero

replace the null values in nuclear\_share\_elec with zero

replace the null values in nuclear\_share\_energy with zero

replace the null values in oil\_consumption with zero

replace the null values in oil\_elec\_per\_capita with zero

replace the null values in oil\_electricity with zero

replace the null values in oil\_energy\_per\_capita with zero

replace the null values in oil\_prod\_per\_capita with zero

replace the null values in oil\_production with zero

replace the null values in oil\_share\_elec with zero

replace the null values in oil\_share\_energy with zero

replace the null values in other\_renewable\_exc\_biofuel\_electricity with zero

replace the null values in other\_renewables\_elec\_per\_capita\_exc\_biofuel with zero

replace the null values in other\_renewables\_share\_elec\_exc\_biofuel with zero

replace the null values in per\_capita\_electricity with zero

replace the null values in renewables\_elec\_per\_capita with zero

replace the null values in renewables\_electricity with zero

replace the null values in renewables\_energy\_per\_capita with zero

replace the null values in renewables\_share\_elec with zero

replace the null values in renewables\_share\_energy with zero

replace the null values in solar\_consumption with zero

replace the null values in solar\_elec\_per\_capita with zero

replace the null values in solar\_electricity with zero

replace the null values in solar\_energy\_per\_capita with zero

replace the null values in solar\_share\_elec with zero

replace the null values in solar\_share\_energy with zero

replace the null values in wind\_consumption with zero

replace the null values in wind\_elec\_per\_capita with zero

replace the null values in wind\_electricity with zero

replace the null values in wind\_energy\_per\_capita with zero

replace the null values in wind\_share\_elec with zero

replace the null values in wind\_energy\_per\_capita with zero

replace the null values in wind\_share\_energy with zero

**Drop:**

Drop the new column from the split country.2

Drop iso\_code

Drop biofuel\_cons\_change\_pct

Drop biofuel\_cons\_change\_twh

Drop coal\_cons\_change\_pct

Drop coal\_cons\_change\_twh

Drop coal\_prod\_change\_pct

Drop coal\_prod\_change\_twh

Drop energy\_cons\_change\_pct

Drop energy\_cons\_change\_twh

Drop fossil\_cons\_change\_pct

Drop fossil\_cons\_change\_twh

Drop gas\_cons\_change\_pct

Drop gas\_cons\_change\_twh

Drop gas\_prod\_change\_pct

Drop gas\_prod\_change\_twh

Drop hydro\_cons\_change\_pct

Drop hydro\_cons\_change\_twh

Drop low\_carbon\_cons\_change\_pct

Drop low\_carbon\_cons\_change\_twh

Drop nuclear\_cons\_change\_pct

Drop nuclear\_cons\_change\_twh

Drop oil\_cons\_change\_pct

Drop oil\_cons\_change\_twh

Drop oil\_prod\_change\_pct

Drop oil\_prod\_change\_twh

Drop other\_renewable\_consumption

Drop other\_renewable\_electricity

Drop other\_renewables\_cons\_change\_pct

Drop other\_renewables\_cons\_change\_twh

Drop other\_renewables\_elec\_per\_capita

Drop other\_renewables\_share\_elec

Drop renewables\_cons\_change\_pct

Drop renewables\_cons\_change\_twh

Drop solar\_cons\_change\_pct

Drop solar\_cons\_change\_twh

Drop wind\_cons\_change\_pct

Drop wind\_cons\_change\_twh

Drop net\_elec\_imports

Drop net\_elec\_imports\_share\_demand

**Change date type:**

fossil fuel consiption (change data type to decimal)

renewable energy cinsiption (change data type to decimal)

oil consuption (change data type to decimal)

greenhouse emision (change data type to decimal)

solar consuption (change data type to decimal)

wind consuption (change data type to decimal)

biofuel\_consumption (change data type to decimal)

coal\_consumption (change data type to decimal)

gas\_consumption (change data type to decimal)

hydro\_consumption (change data type to decimal)

low\_carbon\_consumption (change data type to decimal)

nuclear\_consumption (change data type to decimal)

biofuel\_cons\_per\_capita (change data type to decimal)

biofuel\_share\_energy (change data type to decimal)

coal\_cons\_per\_capita (change data type to decimal)

coal\_share\_energy (change data type to decimal)

fossil\_energy\_per\_capita (change data type to decimal)

fossil\_share\_energy (change data type to decimal)

gas\_energy\_per\_capita (change data type to decimal)

gas\_share\_energy (change data type to decimal)

hydro\_energy\_per\_capita (change data type to decimal)

hydro\_share\_energy (change data type to decimal)

low\_carbon\_energy\_per\_capita (change data type to decimal)

low\_carbon\_share\_energy (change data type to decimal)

nuclear\_energy\_per\_capita (change data type to decimal)

nuclear\_share\_energy (change data type to decimal)

oil\_energy\_per\_capita (change data type to decimal)

oil\_share\_energy (change data type to decimal)

renewables\_energy\_per\_capita (change data type to decimal)

renewables\_share\_energy (change data type to decimal)

solar\_energy\_per\_capita (change data type to decimal)

solar\_share\_energy (change data type to decimal)

wind\_energy\_per\_capita (change data type to decimal)

wind\_share\_energy (change data type to decimal)

**Analysis and Findings**

🌍 Emissions are rising: Global greenhouse gas emissions have more than doubled since

2000.

⚡ Fossil fuels dominate: Renewable energy is growing but still far behind fossil fuels, which remain the main source of emissions.

🏭 Top emitters: China, India, Japan, Russia, and Germany lead in emissions, energy use, GDP, and population.

👤 Per capita matters: Small countries like Bahrain, Qatar, and Kuwait have very high per-person emissions.

🌱 Low emitters use renewables: Countries with the lowest emissions rely more on clean energy and less on fossil fuels.

**Recommendations**

* Reducing Emissions: Transitioning to renewable energy ☀️ Solar , 💨 Wind , 💧 Hydro , 🌿 biofuel. And ☢️ Nuclear
* Enhance global cooperation and climate policies.
* Encourage sustainable lifestyles.
* 🚗 Choose sustainable transport – Walk, bike, use public transit.
* 🌱 Plant trees — they capture carbon, improve air quality.
* 🔌 Save energy – Turn off unused lights and reduce heating/cooling waste.

**Limitations and Assumptions**

* The data is till 2022
* We don’t have from where the emissions are coming from.

**References**

* <https://www.unep.org/interactives/emissions-gap-report/2023/ar/>
* <https://www.mun.gov.bh/newportal/en/municipal-affairs/new-studiesreport/mangrove-trees>
* https://www.alarabiya.net/aswaq/oil-and-gas/2024/11/13/%D8%AA%D9%82%D8%B1%D9%8A%D8%B1-%D8%A7%D9%86%D8%A8%D8%B9%D8%A7%D8%AB%D8%A7%D8%AA-%D8%A7%D9%84%D9%83%D8%B1%D8%A8%D9%88%D9%86-%D8%A7%D9%84%D8%B9%D8%A7%D9%84%D9%85%D9%8A%D8%A9-%D8%B3%D8%AA%D8%B5%D9%84-%D8%A7%D9%84%D9%89-%D9%85%D8%B3%D8%AA%D9%88%D9%89-%D9%82%D9%8A%D8%A7%D8%B3%D9%8A-%D9%81%D9%8A-2024