DATA SET ANALYSIS

FIELD ANALYSIS

- **country**: Name of the country or region for which the data is recorded.
- **year**: The year the data corresponds to, indicating the time period of measurement.
- **iso_code**: Three-letter ISO code representing the country or region (e.g., AFG for Afghanistan).
- **population**: Total population of the country or region in the given year.
- **gdp**: Gross Domestic Product (GDP) in constant 2011 international dollars, reflecting economic output.
- **cement_co2**: CO2 emissions (in million tonnes) from cement production in the country.
- **cement_co2_per_capita**: Per capita CO2 emissions (in tonnes) from cement production per person.
- **co2**: Total CO2 emissions (in million tonnes) from fossil fuels and cement.
- **co2_growth_abs**: Absolute change in CO2 emissions (in million tonnes) from the previous year.
- **co2_growth_prct**: Percentage change in CO2 emissions compared to the previous year.
- **co2_including_luc**: Total CO2 emissions (in million tonnes), including land-use change emissions.
- **co2_including_luc_growth_abs**: Absolute change in CO2 emissions, including land-use change, from the previous year.
- **co2_including_luc_growth_prct**: Percentage change in CO2 emissions, including land-use change, from the previous year.
- **co2_including_luc_per_capita**: Per capita CO2 emissions (in tonnes), including land-use change, per person.
- **co2_including_luc_per_gdp**: CO2 emissions, including land-use change, per unit of GDP (kg per $).
- **co2_including_luc_per_unit_energy**: CO2 emissions, including land-use change, per unit of energy consumption (kg per kWh).
- **co2_per_capita**: Per capita CO2 emissions (in tonnes) from fossil fuels and cement per person.
- **co2_per_gdp**: CO2 emissions from fossil fuels and cement per unit of GDP (kg per $).
- **co2_per_unit_energy**: CO2 emissions from fossil fuels and cement per unit of energy consumption (kg per kWh).
- **coal_co2**: CO2 emissions (in million tonnes) from coal combustion in the country.
- **coal_co2_per_capita**: Per capita CO2 emissions (in tonnes) from coal combustion per person.

- **consumption_co2**: Consumption-based CO2 emissions (in million tonnes), accounting for trade-related emissions.
- **consumption_co2_per_capita**: Per capita consumption-based CO2 emissions (in tonnes) per person.
- **consumption_co2_per_gdp**: Consumption-based CO2 emissions per unit of GDP (kg per $).
- **cumulative_cement_co2**: Cumulative CO2 emissions (in million tonnes) from cement production since the first recorded year.
- **cumulative_co2**: Cumulative CO2 emissions (in million tonnes) from fossil fuels and cement since the first recorded year.
- **cumulative_co2_including_luc**: Cumulative CO2 emissions (in million tonnes), including land-use change, since the first recorded year.
- **cumulative_coal_co2**: Cumulative CO2 emissions (in million tonnes) from coal combustion since the first recorded year.
- **cumulative_flaring_co2**: Cumulative CO2 emissions (in million tonnes) from gas flaring since the first recorded year.
- **cumulative_gas_co2**: Cumulative CO2 emissions (in million tonnes) from natural gas combustion since the first recorded year.
- **cumulative_luc_co2**: Cumulative CO2 emissions (in million tonnes) from land-use change since the first recorded year.
- **cumulative_oil_co2**: Cumulative CO2 emissions (in million tonnes) from oil combustion since the first recorded year.
- **cumulative_other_co2**: Cumulative CO2 emissions (in million tonnes) from other sources since the first recorded year.
- **energy_per_capita**: Primary energy consumption per person (in kWh) in the country.
- **energy_per_gdp**: Primary energy consumption per unit of GDP (kWh per $).
- **flaring_co2**: CO2 emissions (in million tonnes) from gas flaring in the country.
- **flaring_co2_per_capita**: Per capita CO2 emissions (in tonnes) from gas flaring per person.
- **gas_co2**: CO2 emissions (in million tonnes) from natural gas combustion in the country.
- **gas_co2_per_capita**: Per capita CO2 emissions (in tonnes) from natural gas combustion per person.
- **ghg_excluding_lucf_per_capita**: Per capita greenhouse gas emissions (in tonnes CO2e), excluding land-use change and forestry.
- **ghg_per_capita**: Per capita greenhouse gas emissions (in tonnes CO2e), including land-use change and forestry.
- **land_use_change_co2**: CO2 emissions (in million tonnes) from land-use change activities (e.g., deforestation).
- **land_use_change_co2_per_capita**: Per capita CO2 emissions (in tonnes) from land-use change per person.

- **methane**: Methane emissions (in million tonnes CO2e) from all sources in the country.
- **methane_per_capita**: Per capita methane emissions (in tonnes CO2e) per person.
- **nitrous_oxide**: Nitrous oxide emissions (in million tonnes CO2e) from all sources in the country.
- **nitrous_oxide_per_capita**: Per capita nitrous oxide emissions (in tonnes CO2e) per person.
- **oil_co2**: CO2 emissions (in million tonnes) from oil combustion in the country.
- **oil_co2_per_capita**: Per capita CO2 emissions (in tonnes) from oil combustion per person.
- **other_co2_per_capita**: Per capita CO2 emissions (in tonnes) from other sources per person.
- **other_industry_co2**: CO2 emissions (in million tonnes) from other industrial processes not specified elsewhere.
- **primary_energy_consumption**: Total primary energy consumption (in TWh) in the country.
- **share_global_cement_co2**: Country's share of global CO2 emissions from cement production (%).
- **share_global_co2**: Country's share of global CO2 emissions from fossil fuels and cement (%).
- **share_global_co2_including_luc**: Country's share of global CO2 emissions, including land-use change (%).
- **share_global_coal_co2**: Country's share of global CO2 emissions from coal combustion (%).
- **share_global_cumulative_cement_co2**: Country's share of global cumulative CO2 emissions from cement (%).
- **share_global_cumulative_co2**: Country's share of global cumulative CO2 emissions from fossil fuels and cement (%).
- **share_global_cumulative_co2_including_luc**: Country's share of global cumulative CO2 emissions, including land-use change (%).
- **share_global_cumulative_coal_co2**: Country's share of global cumulative CO2 emissions from coal (%).
- **share_global_cumulative_flaring_co2**: Country's share of global cumulative CO2 emissions from gas flaring (%).
- **share_global_cumulative_gas_co2**: Country's share of global cumulative CO2 emissions from natural gas (%).
- **share_global_cumulative_luc_co2**: Country's share of global cumulative CO2 emissions from land-use change (%).
- **share_global_cumulative_oil_co2**: Country's share of global cumulative CO2 emissions from oil (%).
- **share_global_cumulative_other_co2**: Country's share of global cumulative CO2 emissions from other sources (%).
- **share_global_flaring_co2**: Country's share of global CO2 emissions from gas flaring (%).

- **share_global_gas_co2**: Country's share of global CO2 emissions from natural gas combustion (%).
- **share_global_luc_co2**: Country's share of global CO2 emissions from land-use change (%).
- **share_global_oil_co2**: Country's share of global CO2 emissions from oil combustion (%).
- **share_global_other_co2**: Country's share of global CO2 emissions from other sources (%).
- **share_of_temperature_change_from_ghg**: Country's contribution to global temperature change from greenhouse gas emissions (%).
- **temperature_change_from_ch4**: Temperature change (in °C) attributed to methane emissions from the country.
- **temperature_change_from_co2**: Temperature change (in °C) attributed to CO2 emissions from the country.
- **temperature_change_from_ghg**: Total temperature change (in °C) attributed to all greenhouse gas emissions from the country.
- **temperature_change_from_n2o**: Temperature change (in °C) attributed to nitrous oxide emissions from the country.
- **total_ghg**: Total greenhouse gas emissions (in million tonnes CO2e), including land-use change and forestry.
- **total_ghg_excluding_lucf**: Total greenhouse gas emissions (in million tonnes CO2e), excluding land-use change and forestry.
- **trade_co2**: Net CO2 emissions (in million tonnes) from trade (exports minus imports).
- **trade_co2_share**: Share of consumption-based CO2 emissions attributed to trade (%).

Summary of owid CO2 dataset

The owid-co2-data.csv dataset provides a comprehensive set of metrics to analyze CO2 and greenhouse gas emissions across countries and time. Columns like country, year, iso_code, and population establish the geographic and temporal context, enabling researchers to track emissions trends, compare countries, and normalize data per capita. Metrics such as gdp, energy_per_gdp, and energy_per_capita link emissions to economic activity and energy consumption, offering insights into economic efficiency and individual energy use. These foundational columns are critical for understanding the scope and drivers of emissions, informing national climate policies, and assessing global climate equity by identifying high-emission regions and their socioeconomic contexts.

Emission-specific columns, including co2, co2_per_capita, co2_including_luc, and source-specific metrics like coal_co2, cement_co2, gas_co2, oil_co2, and flaring_co2, quantify emissions from fossil fuels, cement production, and land-use change. Per capita and per GDP variants (e.g., co2_per_gdp, co2_including_luc_per_capita) allow for normalized comparisons, highlighting emission intensity and individual contributions. Growth metrics like co2_growth_abs and co2_growth_prct track annual changes, while cumulative columns (e.g., cumulative_co2,

cumulative_luc_co2) assess historical responsibility. These columns guide targeted mitigation strategies, such as coal phase-outs or low-carbon cement innovations, and support international agreements by quantifying contributions to global warming.

Consumption-based emissions (consumption_co2, consumption_co2_per_capita, trade_co2) account for trade-related emissions, revealing the environmental impact of consumption patterns and informing sustainable trade policies. Greenhouse gas metrics (total_ghg, methane, nitrous_oxide) and their per capita counterparts broaden the scope to non-CO2 gases, critical for comprehensive climate strategies. Temperature change columns (temperature_change_from_ghg, temperature_change_from_co2, temperature_change_from_ch4, temperature_change_from_n2o) directly link emissions to climate impacts, aiding in assessing contributions to global warming. These columns drive policies promoting sustainable consumption, methane reduction, and accountability for climate impacts.

Global share columns (e.g., share_global_co2, share_global_cumulative_co2_including_luc) contextualize a country's emissions within the global total, highlighting major contributors and guiding international climate negotiations. Metrics like share_of_temperature_change_from_ghg quantify a country's role in global temperature rise, emphasizing historical responsibility. Collectively, these columns enable policymakers, researchers, and organizations to design evidence-based climate policies, prioritize decarbonization in high-impact sectors like coal or cement, promote renewable energy, and foster equitable global cooperation to mitigate climate change effectively.