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PROJECT ON

ENERGY CONSUMPTION ANALYSIS

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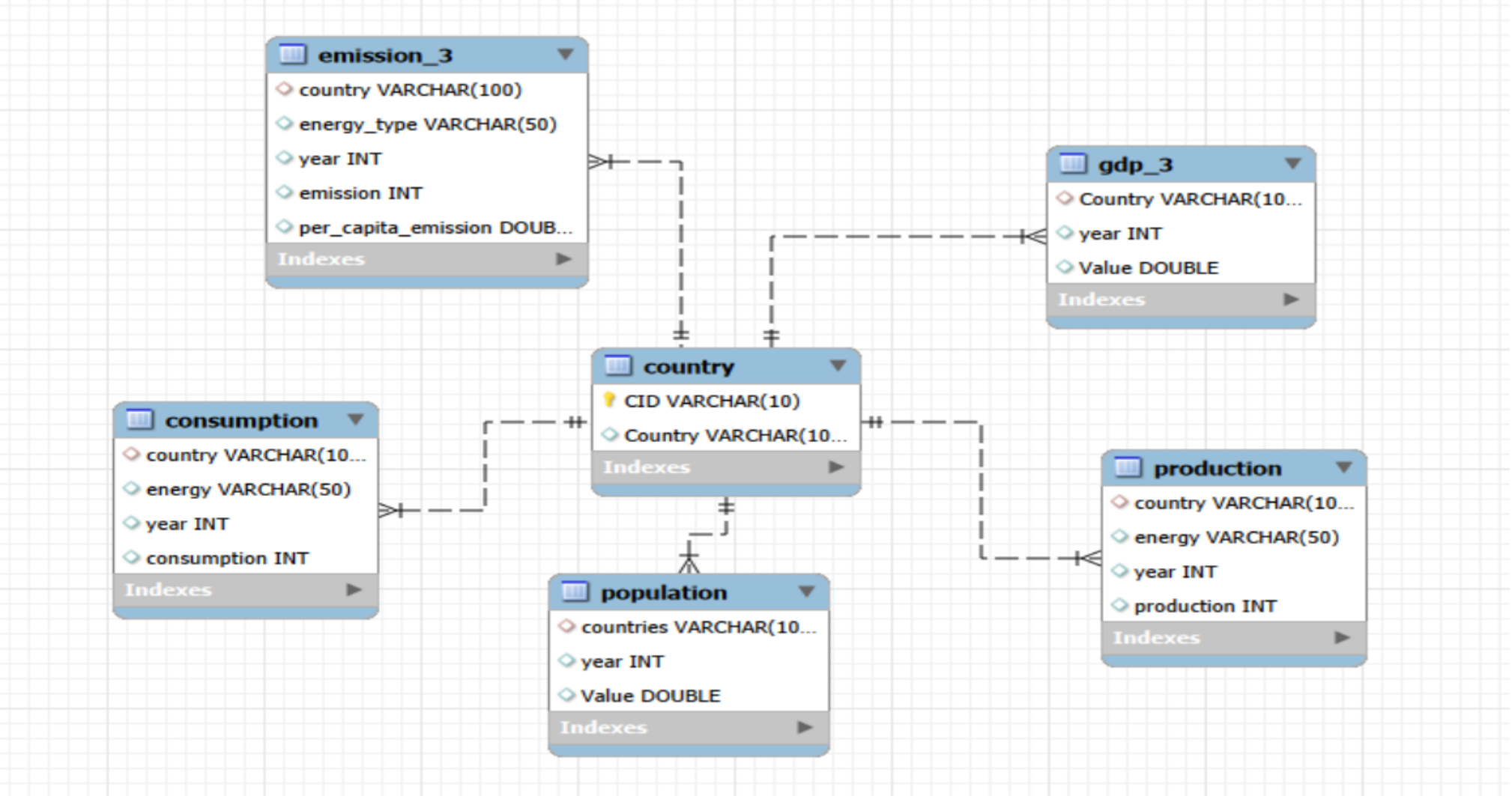
Objective of the Project:

- ✓ The main objective of this project is to understand global energy and environmental patterns by creating and analyzing a complete SQL database.The project focuses on organizing data related to countries, emissions, energy production, energy consumption, GDP, and population in a structured and relational format.

- ✓ Through SQL queries, the project examines how different countries produce and consume energy, how emissions change over time, how population growth impacts the environment, and how economic factors like GDP relate to energy usage.

- ✓ The goal is to turn raw global data into meaningful insights that help evaluate environmental performance, compare countries, and support better decision-making in sustainability and energy management.

ER Diagram :



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Schema Explanation :

Each country acts as a master record that connects to multiple rows in the emission, population, production, consumption, and gdp tables through a foreign key (for example, country_id). This design creates a one-to-many relationship where one country can have many related records for emissions, population, energy production and consumption, and GDP over time, enabling multi-year, multi-country analysis of energy and economic trends.

country (1) → (many) emission

country (1) → (many) population

country (1) → (many) production

country (1) → (many) consumption

country (1) → (many) gdp

Key analysis questions (use cases) :

Total emission per country for the most recent year available

```
SELECT COUNTRY,SUM(EMISSION) AS TOTAL_EMISSION FROM EMISSION_3
WHERE YEAR=(SELECT MAX(YEAR) FROM EMISSION_3) GROUP BY COUNTRY
ORDER BY TOTAL_EMISSION DESC;
```

COUNTRY	TOTAL_EMISSION
China	24392
United States	9590
India	5642
Russia	3688
Japan	1920
Indonesia	1659
Iran	1646
Saudi Arabia	1313
South Korea	1288
Germany	1200
Canada	1171
South Africa	894
Mexico	882
Brazil	876
Turkiye	798
Australia	789
United Kingdom	682
Thailand	674

Top 5 countries by GDP in the most recent year

```
SELECT COUNTRY,VALUE AS GDP FROM GDP_3 WHERE
YEAR=(SELECT MAX(YEAR) FROM EMISSION_3)
ORDER BY GDP DESC LIMIT 5;
```

COUNTRY	GDP
China	27313.92
United States	22062.56
India	10937.52
Japan	5175.273
Germany	4473.126

Energy types that contributed most to emissions across all countries

```
SELECT ENERGY_TYPE, SUM(EMISSION) AS
TOTAL_EMISSION FROM EMISSION_3 GROUP BY
ENERGY_TYPE ORDER BY TOTAL_EMISSION DESC;
```

ENERGY_TYPE	TOTAL_EMISSION
CO2 emissions (MMtonnes CO2)	142723
Coal and coke (MMtonnes CO2)	63945
Petroleum and other liquids (MMtonnes CO2)	47297
Consumed natural gas (MMtonnes CO2)	31469

Change in global emissions over the years

```
SELECT YEAR,SUM(EMISSION) AS GLOBAL_EMMISION
FROM EMISSION_3 GROUP BY YEAR ORDER BY YEAR;
```

YEAR	GLOBAL_EMMISION
2020	67852
2021	70976
2022	72445
2023	74161

Trend in GDP for each country over the given years

```
SELECT COUNTRY, YEAR, VALUE AS GDP
FROM GDP_3 ORDER BY COUNTRY, YEAR;
```

COUNTRY	YEAR	GDP
Afghanistan	2020	83.21645
Afghanistan	2021	65.95827
Afghanistan	2022	61.84236
Afghanistan	2023	58.90645
Afghanistan	2024	57.83112
Albania	2020	36.78752
Albania	2021	40.04762
Albania	2022	41.99279

Change in total emissions in each country by population growth

```
SELECT P.COUNTRIES, E.YEAR, SUM(E.EMISSION) AS TOTAL_EMISSION,
ROUND(SUM(P.VALUE),2) AS POPULATION_GROWTH FROM POPULATION P
JOIN EMISSION_3 E ON P.COUNTRIES=E.COUNTRY AND P.YEAR=E.YEAR
GROUP BY P.COUNTRIES, E.YEAR ORDER BY P.COUNTRIES, E.YEAR;
```

COUNTRIES	YEAR	TOTAL_EMISSION	POPULATION_GROWTH
Afghanistan	2020	18	156275.92
Afghanistan	2021	20	120001.23
Afghanistan	2022	18	121736.52
Afghanistan	2023	16	124364.28
Albania	2020	6	11487.82
Albania	2021	8	11398.54
Albania	2022	9	11310.43

Change in energy consumption over the years for major economies

```
SELECT C.COUNTRY, C.YEAR, SUM(C.CONSUMPTION) AS ENERGY_CONSUMPTION
FROM CONSUMPTION C JOIN GDP_3 G ON C.COUNTRY=G.COUNTRY
AND C.YEAR=G.YEAR JOIN (SELECT COUNTRY FROM GDP_3 GROUP BY COUNTRY
ORDER BY SUM(VALUE) DESC LIMIT 10) AS TOP_GDP ON
C.COUNTRY = TOP_GDP.COUNTRY GROUP BY C.COUNTRY, C.YEAR ORDER BY
SUM(G.VALUE) DESC;
```

COUNTRY	YEAR	ENERGY_CONSUMPTION
China	2023	177
China	2022	168
China	2021	165
China	2020	156
United States	2023	111
United States	2022	112
United States	2021	112
United States	2020	106
India	2023	38

Average yearly change in emissions per capita for each country

```
SELECT COUNTRY, AVG(PER_CAPITA_EMISSION) AS
AVG_YEARLY_CHANGE FROM EMISSION_3 GROUP BY COUNTRY;
```

COUNTRY	AVG_YEARLY_CHANGE
Afghanistan	0.007126095999999999
Albania	0.007126095999999999
Algeria	0.007126095999999999
American Samoa	0.007126095999999999
Angola	0.007126095999999999
Antarctica	0.007126095999999999
Antigua and Barbuda	0.007126095999999999
Argentina	0.007126095999999999

Emission-to-GDP ratio for each country by year

```
SELECT E.COUNTRY, E.YEAR, SUM(E.EMISSION)/SUM(G.VALUE) AS
EMISSION_TO_GDP_RATIO FROM EMISSION_3 E JOIN GDP_3 G ON
E.COUNTRY=G.COUNTRY AND E.YEAR=G.YEAR GROUP BY E.COUNTRY,
E.YEAR ORDER BY E.COUNTRY, E.YEAR;
```

COUNTRY	YEAR	EMISSION_TO_GDP_RATIO
Afghanistan	2020	0.05407584678269742
Afghanistan	2021	0.10107400734838355
Afghanistan	2022	0.09702087695230259
Afghanistan	2023	0.09053903831131113
Albania	2020	0.04077469750611077
Albania	2021	0.04994054578024861
Albania	2022	0.0535806265789913
Albania	2023	0.040108434872611023

Top 10 countries by population and their respective emissions

```
SELECT P.COUNTRIES AS COUNTRY, P.YEAR, P.VALUE AS
POPULATION, SUM(E.EMISSION) AS TOTAL_EMISSIONS
FROM POPULATION P JOIN EMISSION_3 E ON
P.COUNTRIES = E.COUNTRY AND P.YEAR = E.YEAR GROUP BY
P.COUNTRIES, P.YEAR, P.VALUE ORDER BY P.VALUE DESC
LIMIT 10;
```

COUNTRY	YEAR	POPULATION	TOTAL_EMISSIONS
India	2023	1438070	5642
China	2021	1426437	22884
China	2020	1426106	22094
India	2022	1425423	5158
China	2022	1425180	22968
China	2023	1422585	24392
India	2021	1414204	4766
India	2020	1402618	4657

Global share (%) of emissions by country

```
SELECT COUNTRY, ROUND(SUM(EMISSION)/(SELECT SUM(EMISSION)
FROM EMISSION_3 WHERE YEAR=(SELECT MAX(YEAR) FROM EMISSION_3))*100,2)
AS EMISSION_SHARE_PERCENT FROM EMISSION_3 WHERE
YEAR=(SELECT MAX(YEAR) FROM EMISSION_3) GROUP BY COUNTRY
ORDER BY EMISSION_SHARE_PERCENT DESC;
```

COUNTRY	EMISSION_SHARE_PERCENT
China	32.89
United States	12.93
India	7.61
Russia	4.97
Japan	2.59
Indonesia	2.24
Iran	2.22
Saudi Arabia	1.77
South Korea	1.74
Germany	1.62
Canada	1.58
South Africa	1.21

Global average GDP, Emission and Population by year

```
SELECT YEAR, ROUND(AVG(GDP), 2) AS AVG_GDP, ROUND(AVG(EMISSION), 2)
AS AVG_EMISSION, ROUND(AVG(POPULATION), 2) AS AVG_POPULATION
FROM ( SELECT G.YEAR, G.VALUE AS GDP, E.EMISSION, P.VALUE AS POPULATION
FROM GDP_3 G JOIN EMISSION_3 E ON G.COUNTRY = E.COUNTRY AND G.YEAR = E.YEAR
JOIN POPULATION P ON G.COUNTRY = P.COUNTRIES AND G.YEAR = P.YEAR ) T
GROUP BY YEAR ORDER BY YEAR;
```

YEAR	AVG_GDP	AVG_EMISSION	AVG_POPULATION
2020	629.03	85.40	39656.2
2021	671.04	89.44	39986.57
2022	694.6	91.29	40345.81
2023	717.93	93.46	40711.66

Countries with highest Energy Consumption for their relative GDP

```
SELECT C.COUNTRY, SUM(C.CONSUMPTION)/SUM(G.VALUE) AS
ENERGY_CONSUMPTION_FOR_GDP FROM CONSUMPTION C JOIN GDP_3 G
ON C.COUNTRY=G.COUNTRY AND C.YEAR=G.YEAR GROUP BY C.COUNTRY
ORDER BY ENERGY_CONSUMPTION_FOR_GDP DESC LIMIT 10;
```

COUNTRY	ENERGY_CONSUMPTION_FOR_GDP
Trinidad and Tobago	0.005099936962229178
North Korea	0.00449693840563702
Turkmenistan	0.0033838534189143694
Bahrain	0.00215693175422634
Kuwait	0.001707026316627264
Iran	0.001685192014275675
Qatar	0.0014942435760476342

Key Insights From the Energy & Emissions SQL Analysis

- The database organizes global data on emissions, energy production, consumption, GDP, and population for each country.
- SQL queries help analyze global trends, such as rising or falling emissions and energy usage patterns.
- The project shows how energy types, economic growth, and population influence a country's environmental impact.
- High-emission countries and energy types contributing most to pollution are easily identified through aggregated queries.
- The overall analysis supports better sustainability decisions, highlighting the need for clean energy, efficient use of resources, and balanced economic development.

Conclusion:

This project creates a comprehensive SQL database to study global patterns in emissions, energy production and use, GDP, and population. By organizing the data into structured tables and running analytical queries, it highlights insights such as which countries are the largest emitters, how energy consumption connects to economic growth, and how population levels influence environmental pressure. These insights transform raw data into practical evidence that can guide more sustainable planning and better-informed policy decisions.

THANK YOU

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