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RESEARCH LABS

INNOVATION. AUTOMATION. ANALYTICS

**SQL
PROJECT ON**

ENERGY CONSUMPTION ANALYSIS

INTRODUCTION

➤ **Energy is a key factor that drives Economic growth, Industrialization, and Human lifestyle.**

➤ **We have collected the data of World Wide Energy Consumption which is provided by the U.S. Energy Information Administration (EIA) which elaborates about worldwide data on energy consumption, production, emissions, and renewable energy usage.**

OBJECTIVES

➤ **Through MYSQL we have created new data base which include tables of Country, Production, Consumption, Emission, GDP and Population.**

➤ **In this project we have stored, managed, and analyzed global energy data.**

➤ **To derive global insights and patterns connecting economy, energy, and environment we have done some queries.**

TABLES

Country Table

```
-- 1. country table
CREATE TABLE country (
    CID VARCHAR(10) PRIMARY KEY,
    Country VARCHAR(100) UNIQUE
);
DESC country;
```

Field	Type	Null	Key	Default	Extra
CID	varchar(10)	NO	PRI	NULL	
Country	varchar(100)	YES	UNI	NULL	

GDP Table

```
CREATE TABLE gdp_3 (
    Country VARCHAR(100),
    year INT,
    Value DOUBLE,
    FOREIGN KEY (Country) REFERENCES country(Country)
);
DESC gdp_3;
```

Field	Type	Null	Key	Default	Extra
Country	varchar(100)	YES	MUL	NULL	
year	int	YES		NULL	
Value	double	YES		NULL	

Production Table

```
CREATE TABLE production (
    country VARCHAR(100),
    energy VARCHAR(50),
    year INT,
    production INT,
    FOREIGN KEY (country) REFERENCES country(Country)
);
DESC production;
```

Field	Type	Null	Key	Default	Extra
country	varchar(100)	YES	MUL	NULL	
energy	varchar(50)	YES		NULL	
year	int	YES		NULL	
production	int	YES		NULL	

Consumption Table

```
CREATE TABLE consumption (
    country VARCHAR(100),
    energy VARCHAR(50),
    year INT,
    consumption INT,
    FOREIGN KEY (country) REFERENCES country(Country)
);
DESC consumption;
```

Field	Type	Null	Key	Default	Extra
country	varchar(100)	YES	MUL	NULL	
energy	varchar(50)	YES		NULL	
year	int	YES		NULL	
consumption	int	YES		NULL	

Population Table

```
CREATE TABLE population (
    countries VARCHAR(100),
    year INT,
    Value DOUBLE,
    FOREIGN KEY (countries) REFERENCES country(Country)
);
DESC population;
```

Field	Type	Null	Key	Default	Extra
countries	varchar(100)	YES	MUL	NULL	
year	int	YES		NULL	
Value	double	YES		NULL	

Emission Table

```
CREATE TABLE emission_3 (
    country VARCHAR(100),
    energy_type VARCHAR(50),
    year INT,
    emission INT,
    per_capita_emission DOUBLE,
    FOREIGN KEY (country) REFERENCES country(Country)
);
DESC emission_3;
```

Field	Type	Null	Key	Default	Extra
country	varchar(100)	YES	MUL	NULL	
energy_type	varchar(50)	YES		NULL	
year	int	YES		NULL	
emission	int	YES		NULL	
per_capita_emission	double	YES		NULL	

ER DIAGRAM
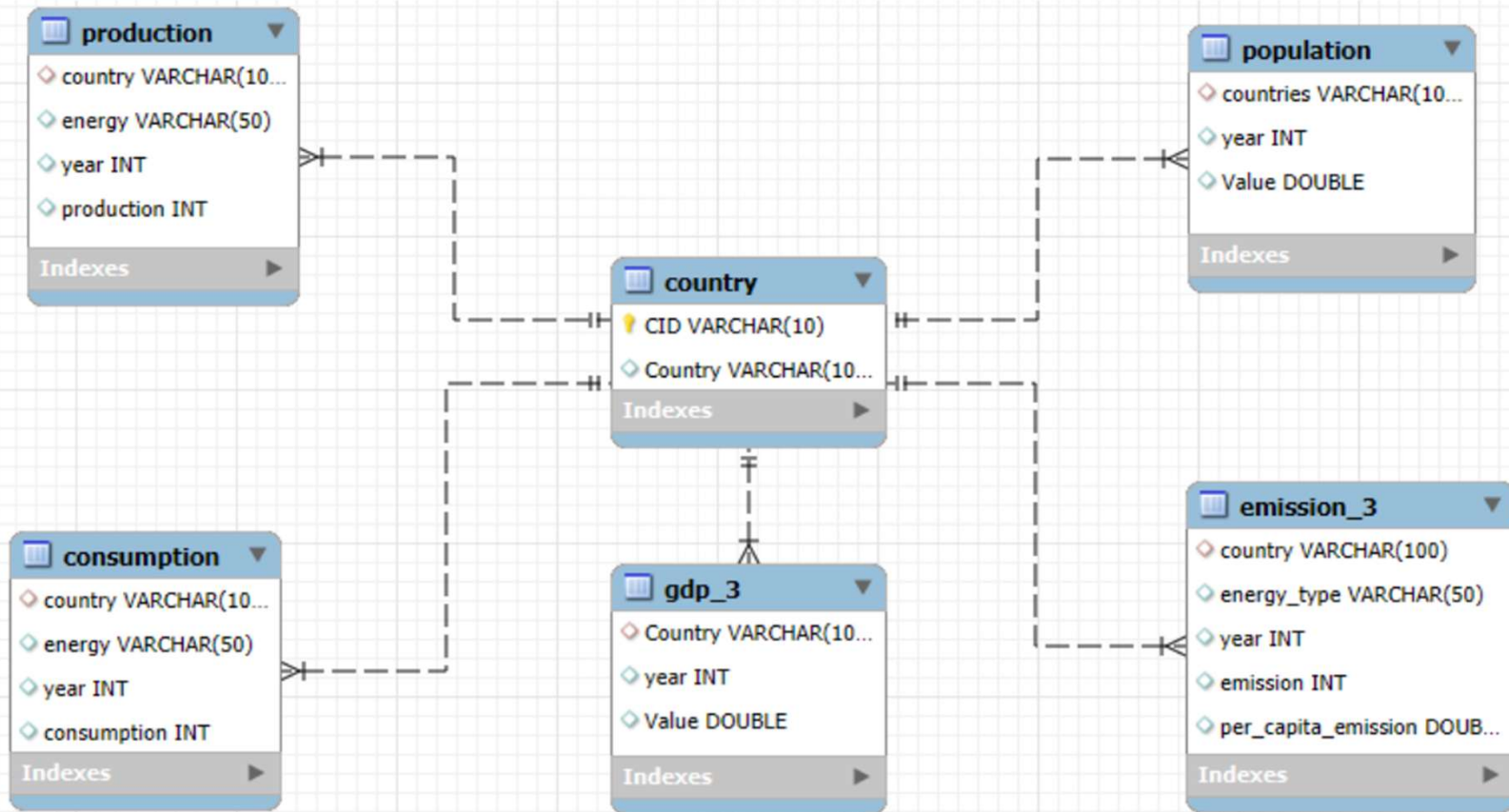
1. What is the total emission per country for the most recent year available?

```sql
select country,
max(year) max_year,
sum(per_capita_emission) as tot
from emission_3
group by country
order by max_year desc;
```

country	max_year	tot
Afghanistan	2023	0.092639248
Albania	2023	0.11401753599999999
Algeria	2023	0.11401753599999999
American Samoa	2023	0.11401753599999999
Angola	2023	0.11401753599999999
Antarctica	2023	0.11401753599999999
Antigua and Barbuda	2023	0.11401753599999999
Argentina	2023	0.11401753599999999
Armenia	2023	0.11401753599999999
Aruba	2023	0.11401753599999999
Australia	2023	0.11401753599999999
Austria	2023	0.11401753599999999
Azerbaijan	2023	0.11401753599999999
Bahrain	2023	0.11401753599999999

2. What are the top 5 countries by GDP in the most recent year?

```sql
select country,
value as gdp from gdp_3
where year =(select max(year) from gdp_3)
order by gdp desc limit 5;
```

country	gdp
China	28673.24
United States	22679.47
India	11660.21
Japan	5179.704
Germany	4463.949

3. Compare energy production and consumption by country and year.

```sql
select a.country, a.year, a.production, b.consumption

from production as a

inner join consumption as b

on a.country=b.country and a.year= b.year;
```

country	year	production	consumption
Afghanistan	2020	0	0
Afghanistan	2020	0	0
Afghanistan	2020	0	0
Afghanistan	2020	0	0
Afghanistan	2020	0	0
Afghanistan	2020	0	0
Albania	2020	0	0
Albania	2020	0	0
Albania	2020	0	0
Albania	2020	0	0
Albania	2020	0	0
Albania	2020	0	0
Algeria	2020	0	0

4. Which energy types contribute most to emissions across all countries?

```sql
select energy_type,

sum(per_capita_emission) as tot_emission

from emission_3

group by energy_type

order by tot_emission desc;
```

energy_type	tot_emission
Coal and coke (MMtonnes CO2)	6.349351536000086
CO2 emissions (MMtonnes CO2)	6.349351536000086
Consumed natural gas (MMtonnes CO2)	6.192577424000078
Petroleum and other liquids (MMtonnes CO2)	6.156946944000076

5. How have global emissions changed year over year?

```sql
select year,
sum(per_capita_emission) as tot_emission
from emission_3
group by year
order by tot_emission;
```

year	tot_emission
2023	6.249586192000081
2021	6.263838384000081
2022	6.263838384000081
2020	6.270964480000082

6. What is the trend in GDP for each country over the given years?

```sql
select country, year,
sum(value) as tot_gdp
from gdp_3
group by country, year
order by country, year;
```

country	year	tot_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
Albania	2023	43.63172
Albania	2024	45.2091
Algeria	2020	531.9749
Algeria	2021	552.5308
Algeria	2022	572.6695
Algeria	2023	596.0418
Algeria	2024	615.7547

7. How has population growth affected total emissions in each country?

```sql
select a.countries, a.year, a.value, b.per_capita_emission,

(a.value * b.per_capita_emission) as tot_emission

from population as a

inner join emission_3 as b

on a.countries=b.country and a.year= b.year

order by a.countries, a.year;
```

countries	year	value	per_capita_emission	tot_emission
Afghanistan	2020	39068.98	0.007126096	278.40930210208
Afghanistan	2020	39068.98	0.007126096	278.40930210208
Afghanistan	2020	39068.98	0.007126096	278.40930210208
Afghanistan	2020	39068.98	0.007126096	278.40930210208
Afghanistan	2021	40000.41	0.007126096	285.04676169936005
Afghanistan	2021	40000.41	0.007126096	285.04676169936005
Afghanistan	2021	40000.41	0.007126096	285.04676169936005
Afghanistan	2022	40578.84	0.007126096	289.16870940864
Afghanistan	2022	40578.84	0.007126096	289.16870940864
Afghanistan	2022	40578.84	0.007126096	289.16870940864
Afghanistan	2023	41454.76	0.007126096	295.41059941696
Afghanistan	2023	41454.76	0.007126096	295.41059941696
Afghanistan	2023	41454.76	0.007126096	295.41059941696
Albania	2020	2871.954	0.007126096	20.465819911584003
Albania	2020	2871.954	0.007126096	20.465819911584003

8. Has energy consumption increased or decreased over the years for major economies?

```sql
select a.country, a.year,
sum(a.consumption) as tot_consumption
from consumption as a
inner join
gdp_3 as b
on a.country= b.country and a.year = b.year
group by a.country, a.year
order by tot_consumption desc;
```

country	year	tot_consumption
China	2023	177
China	2022	168
China	2021	165
China	2020	156
United States	2021	112
United States	2022	112
United States	2023	111
United States	2020	106
India	2023	38
Russia	2021	36
India	2022	36
Russia	2022	36
Russia	2023	35
Russia	2020	33

9. What is the emission-to-GDP ratio for each country by year?

```sql
select a.country, a.year, (a.per_capita_emission/ b.value ) as gdp_ratio

from emission_3 as a

inner join gdp_3 as b

on a.country = b.country and a.year = b.year

order by a.country, b.country;
```

country	year	gdp_ratio
Afghanistan	2020	0.00008563332612121 7621
Afghanistan	2020	0.00008563332612121 7621
Afghanistan	2020	0.00008563332612121 7621
Afghanistan	2020	0.00008563332612121 7621
Afghanistan	2021	0.000108039461920393 01
Afghanistan	2021	0.000108039461920393 01
Afghanistan	2023	0.000120973102266390 19
Afghanistan	2021	0.000108039461920393 01
Afghanistan	2023	0.000120973102266390 19
Afghanistan	2023	0.000120973102266390 19
Afghanistan	2022	0.000115230013861049 29
Afghanistan	2022	0.000115230013861049 29
Afghanistan	2022	0.000115230013861049 29
Albania	2020	0.000193709605866337 27
Albania	2020	0.000193709605866337 27
Albania	2020	0.000193709605866337 27
Albania	2020	0.000193709605866337 27

10. What is the energy consumption per capita for each country over the last decade?

```sql
select a.country, a.year,

(a.consumption/b.value) as consump_pp

from consumption as a

inner join population as b

on a.country=b.countries and a.year=b.year

where a.year >=(select max(year) from consumption) -9

order by consump_pp desc;
```

country	year	consump_pp
Qatar	2020	0.000713425781424 1762
Qatar	2021	0.000710484116772 3275
Qatar	2022	0.000691454145354 0332
Bahrain	2020	0.000679253690385 2999
Trinidad and Tobago	2020	0.000675208504386 1545
Trinidad and Tobago	2021	0.000672170849697 8928
Qatar	2023	0.000671347750750 0633
Trinidad and Tobago	2022	0.000668484498847 1985
Trinidad and Tobago	2023	0.000665366097734 2954
Bahrain	2021	0.000664732295686 2198
Bahrain	2022	0.000642185691845 9114
Bahrain	2023	0.000627372644921 5125
Singapore	2021	0.000545208804976 8114
Singapore	2020	0.000531597066434 7485
Singapore	2022	0.000528338863867 1517
Singapore	2023	0.000506546180717 7793
Qatar	2023	0.000335673875375 03167

11. How does energy production per capita vary across countries?

```sql
select a.country, a.year,
(a.production/b.value) as prod_pc
from production as a
inner join
gdp_3 as b
on a.country=b.country and a.year=b.year
order by prod_pc desc ;
```

country	year	prod_pc
Congo-Brazzaville	2020	0.055598366297604715
Congo-Brazzaville	2021	0.05477489162787691
Congo-Brazzaville	2022	0.053832844710546175
Congo-Brazzaville	2023	0.05275522052473508
Mongolia	2023	0.04711173277659828
Libya	2023	0.042731043547633379
Libya	2021	0.041375195652595644
Turkmenistan	2020	0.03197500322148158
Kuwait	2020	0.031865248238250085
Libya	2022	0.0313805036696361
Kuwait	2021	0.03116076983720575
Trinidad and Tob...	2021	0.031130662550778003
Trinidad and Tob...	2020	0.0308077716716883243
Trinidad and Tob...	2022	0.03067598521294808
Turkmenistan	2021	0.030563100679539983
Kuwait	2023	0.030548171666468952
Turkmenistan	2022	0.030074666374207245

12. Which countries have the highest energy consumption relative to GDP?

```sql
select a.country, a.year,
 (a.consumption/ b.value) as energy_consump
from consumption as a
inner join
gdp_3 as b
on a.country=b.country and a.year = b.year
order by energy_consump desc limit 10;
```

country	year	energy_consump
Trinidad and Tobago	2021	0.031130662550778003
Trinidad and Tobago	2020	0.0308077716716883243
Trinidad and Tobago	2022	0.030675985212948086
Trinidad and Tobago	2023	0.029815403889896484
North Korea	2022	0.0272120009857278452
North Korea	2021	0.0271706791411993424
North Korea	2020	0.0271556346448332281
North Korea	2023	0.0264051640051141415
Turkmenistan	2020	0.0213166688143214105
Turkmenistan	2021	0.0203754004453026656

13. What is the correlation between GDP growth and energy production growth?

```sql
with gdp_growth AS (

    select country, year, value AS gdp,

    (value - lag(value, 1) over (partition BY country order by year)) /

    lag(value, 1) over (partition BY country order by year) as gdp_growth_rate

    from gdp_3

Production_Growth as (

    select country, year, production,

    (production - lag(production, 1) over (partition by country order by year)) /

    lag(production, 1) over (partition by country order by year) as production_growth_rate

    from production

)
```

```sql
select g.country, g.year, g.gdp_growth_rate, p.production_growth_rate

from gdp_growth as g

inner join

Production_Growth as p on g.country = p.country and g.year = p.year

where

g.gdp_growth_rate is not null and p.production_growth_rate is not null

order by g.country, g.year;
```

country	year	gdp_growth_rate	production_growth_rate
Algeria	2021	0.038640732861644315	0.0000
Algeria	2021	0.038640732861644315	-1.0000
Algeria	2021	0.038640732861644315	-1.0000
Algeria	2022	0.03644810388850716	-1.0000
Algeria	2023	0.04081289469755242	0.0000
Algeria	2023	0.04081289469755242	-1.0000
Algeria	2023	0.04081289469755242	-1.0000
Angola	2021	0.0110615206618652256	-1.0000
Angola	2021	0.0110615206618652256	-1.0000
Angola	2022	0.03313439290337877	-1.0000
Angola	2023	0.009065606256044415	-1.0000
Argent...	2021	0.10441836969737435	0.0000
Argent...	2021	0.10441836969737435	-1.0000
Argent...	2022	0.05269929940221205	-1.0000
Argent...	2022	0.05269929940221205	-1.0000
Argent...	2023	-0.016110425455079406	-1.0000
Australia	2021	0.054115165417733146	10.0000

14. What is the global share (%) of emissions by country?

```sql
with CountryEmissions AS (

    select country,

    sum(per_capita_emission) AS country_total_emissions

    from emission_3

    group by country

),

GlobalEmissions as (

    select

    sum(country_total_emissions) AS global_total

    from CountryEmissions

)
```

```sql
select c.country,

(c.country_total_emissions / g.global_total) * 100 as global_share_percentage

from CountryEmissions as c

cross JOIN

GlobalEmissions as g

order by global_share_percentage desc;
```

country	global_share_percentage
Albania	0.4551920341394036
Algeria	0.4551920341394036
American Samoa	0.4551920341394036
Angola	0.4551920341394036
Antarctica	0.4551920341394036
Antigua and Barbuda	0.4551920341394036
Argentina	0.4551920341394036
Armenia	0.4551920341394036
Aruba	0.4551920341394036
Australia	0.4551920341394036
Austria	0.4551920341394036
Azerbaijan	0.4551920341394036
Bahrain	0.4551920341394036

15. What is the global average GDP, emission, and population by year?

```sql
select p.year,
avg(p.value) as avg_population,
avg(e.per_capita_emission) as avg_emissions,
avg(g.value) as avg_gdp
from population AS p
inner join
emission_3 AS e ON p.year = e.year
inner join
gdp_3 AS g ON p.year = g.year
group by p.year
order by p.year;
```

year	avg_population	avg_emissions	avg_gdp
2020	39362.84443532973	0.007126095997222052	624.4008417825881
2021	39690.73796844026	0.007126095997223701	665.3489843333841
2022	40047.518264728205	0.007126095997223701	688.6989718061757
2023	40411.240621449775	0.00712609599722701	711.8175613685221

INSIGHTS

➢ **Here we have executed and compared the data as per the client requirements as shown in the slides.**

CONCLUSION

➢ **Our project shows that energy use, economy, and environment are deeply connected.**

➢ **This highlights the need for sustainable energy solutions for a balanced future.**

THANK YOU

Presented by

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