



**INNOMATICS<sup>®</sup>**  
**RESEARCH LABS**

**INNOVATION. AUTOMATION. ANALYTICS**

**PROJECT ON**

**WORLDWIDE ENERGY  
CONSUMPTION ANALYSIS**

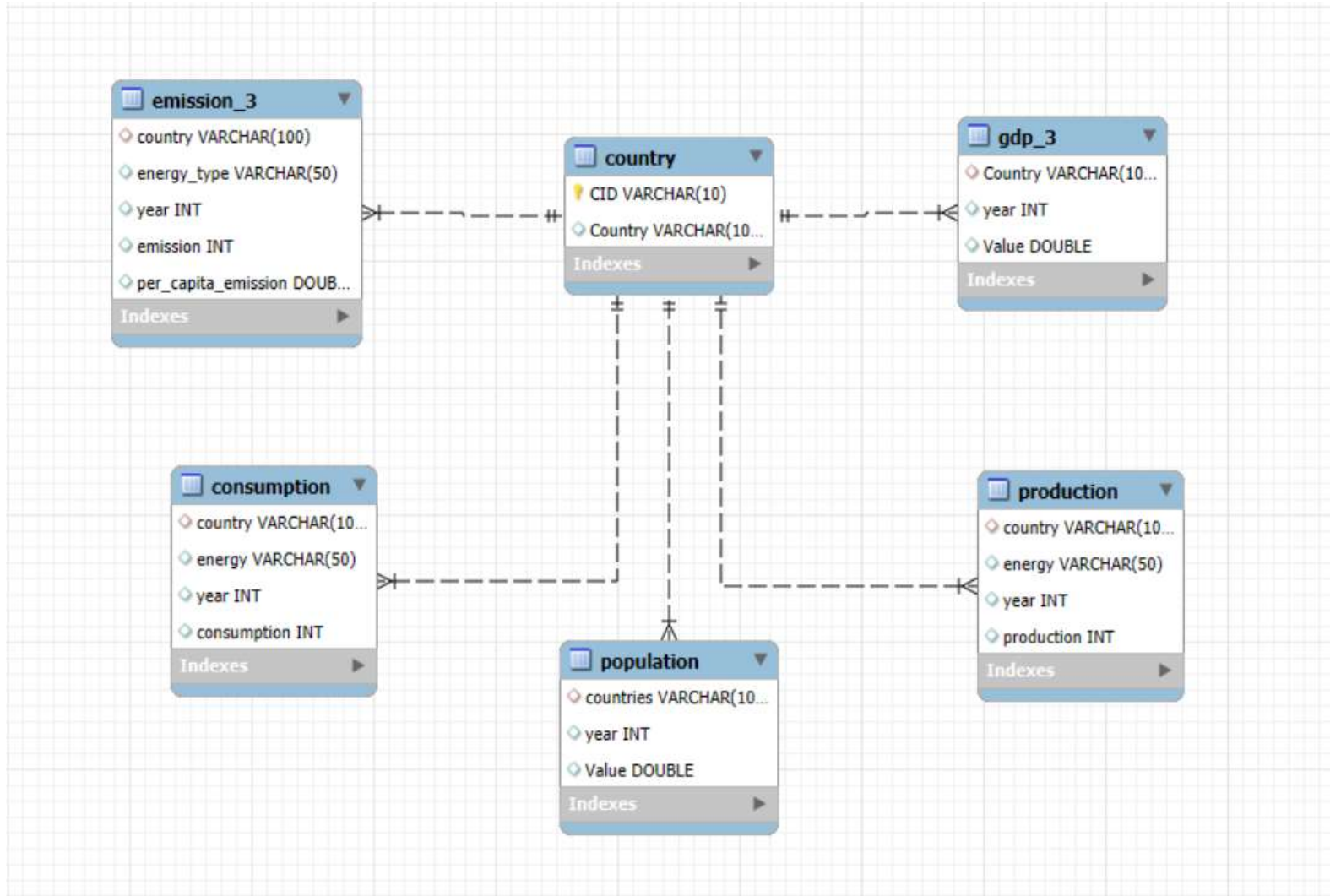
# Agenda

- **Project Overview**
- **ER Diagram and schema explanation**
- **Key analysis questions (USE CASES)**
- **SQL query results with summaries**
- **Final Business Insights**
- **Conclusion**

# PROJECT OVERVIEW

- To analyze energy consumption patterns across different time intervals and identify periods of high and low usage.
- To evaluate which segments - such as appliances, regions, or user groups - contribute most to overall energy consumption.
- To detect anomalies or unusual spikes in usage that may indicate inefficiencies or abnormal behavior.
- To convert raw SQL results into meaningful insights that support decision-making for optimizing energy usage and reducing wastage.

# ER DIAGRAM



- ❑ One-to-Many from country to emission\_3
- ❑ One-to-Many from country to consumption
- ❑ One-to-Many from country to production
- ❑ One-to-Many from country to gdp\_3
- ❑ One-to-Many from country to population

# TABLES

## 1. COUNTRY

CID	Country
Af0	Afghanistan
Al1	Albania
Al2	Algeria
Am3	American Samoa
An4	Angola
An5	Antarctica
An6	Antigua and Barbuda
Ar7	Argentina
Ar8	Armenia
Ar9	Aruba
Au10	Australia

## 2. EMISSION\_3

country	energy_type	year	emission	per_capita_emission
American Samoa	Consumed natural gas (MMtonnes CO2)	2020	0	0.007126096
Antarctica	Consumed natural gas (MMtonnes CO2)	2020	0	0.007126096
Antigua and Barbuda	Consumed natural gas (MMtonnes CO2)	2020	0	0.007126096
Aruba	Consumed natural gas (MMtonnes CO2)	2020	0	0.007126096
Belize	Consumed natural gas (MMtonnes CO2)	2020	0	0.007126096
Bermuda	Consumed natural gas (MMtonnes CO2)	2020	0	0.007126096
Bhutan	Consumed natural gas (MMtonnes CO2)	2020	0	0.007126096
Botswana	Consumed natural gas (MMtonnes CO2)	2020	0	0.007126096
British Virgin Islands	Consumed natural gas (MMtonnes CO2)	2020	0	0.007126096
Burkina Faso	Consumed natural gas (MMtonnes CO2)	2020	0	0.007126096



### 3. POPULATION

countries	year	Value
Afghanistan	2024	42647.49
Albania	2024	2791.765
Algeria	2024	46814.31
Angola	2024	37885.85
Antigua and Barbuda	2024	93.772
Argentina	2024	45696.16
Armenia	2024	2973.84
Aruba	2024	108.066
Australia	2024	27236.21

### 4. PRODUCTION

country	energy	year	production
Afghanistan	Nuclear (quad Btu)	2020	0
Albania	Nuclear (quad Btu)	2020	0
Algeria	Nuclear (quad Btu)	2020	0
American Samoa	Nuclear (quad Btu)	2020	0
Angola	Nuclear (quad Btu)	2020	0
Antarctica	Nuclear (quad Btu)	2020	0
Antigua and Barbuda	Nuclear (quad Btu)	2020	0
Aruba	Nuclear (quad Btu)	2020	0
Australia	Nuclear (quad Btu)	2020	0
Austria	Nuclear (quad Btu)	2020	0

### 5. GDP\_3

Country	year	Value
Afghanistan	2020	83.21645
Albania	2020	36.78752
Algeria	2020	531.9749
Angola	2020	215.9016
Antigua and Barbuda	2020	1.772876
Argentina	2020	866.9691
Armenia	2020	33.00228
Aruba	2020	2.584789
Australia	2020	1219.307
Austria	2020	453.2275

### 6. CONSUMPTION

country	energy	year	consumption
Afghanistan	Nuclear (quad Btu)	2020	0
Albania	Nuclear (quad Btu)	2020	0
Algeria	Nuclear (quad Btu)	2020	0
American Samoa	Nuclear (quad Btu)	2020	0
Angola	Nuclear (quad Btu)	2020	0
Antarctica	Nuclear (quad Btu)	2020	0
Antigua and Barbuda	Nuclear (quad Btu)	2020	0
Aruba	Nuclear (quad Btu)	2020	0
Australia	Nuclear (quad Btu)	2020	0
Austria	Nuclear (quad Btu)	2020	0

# USE CASES

- ❑ What are the top 5 countries by GDP in the most recent year?

## QUERY

```
SELECT country, Value AS GDP
FROM gdp_3
WHERE year = (SELECT MAX(year) FROM gdp_3)
ORDER BY GDP DESC
LIMIT 5;
```

## OUTPUT

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

- ❑ Which energy types contribute most to emissions across all countries ?

### QUERY

```
SELECT energy_type, SUM(emission) AS total_emission  
FROM emission_3  
GROUP BY energy_type  
ORDER BY total_emission DESC;
```

### OUTPUT

energy_type	total_emission
CO2 emissions (MMtonnes CO2)	285446
Coal and coke (MMtonnes CO2)	127890
Petroleum and other liquids (MMtonnes CO2)	94594
Consumed natural gas (MMtonnes CO2)	62938



- ❑ How has population growth affected total emissions in each country ?

### QUERY

```
SELECT p.countries AS country, p.year, p.Value AS population,  
       SUM(e.emission) AS total_emission  
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.countries, p.year;
```

### OUTPUT

country	year	population	total_emission
Afghanistan	2020	39068.98	36
Afghanistan	2021	40000.41	40
Afghanistan	2022	40578.84	36
Afghanistan	2023	41454.76	32
Albania	2020	2871.954	12
Albania	2021	2849.635	16
Albania	2022	2827.608	18
Albania	2023	2811.655	14
Algeria	2020	44042.09	568
Algeria	2021	44761.1	608
Algeria	2022	45477.38	634
Algeria	2023	46164.22	656

- ❑ What is the global share (%) of emissions by country?

### QUERY

```
SELECT country,  
       SUM(emission) AS total_emission,  
       (SUM(emission) * 100.0 / (SELECT SUM(emission) FROM emission_3))  
       AS global_share_percent  
FROM emission_3  
GROUP BY country  
ORDER BY global_share_percent DESC;
```

### OUTPUT

country	total_emission	global_share_percent
China	184676	32.35004
United States	76906	13.47177
India	40446	7.08500
Russia	28962	5.07333
Japan	16274	2.85075
Iran	11932	2.09015
Indonesia	10626	1.86138
Germany	10318	1.80742
South Korea	10130	1.77449
Saudi Arabia	10000	1.75172
Canada	9034	1.58250

## ❑ Global average GDP, emission, and population by year

### QUERY

```
SELECT g.year,  
       AVG(g.Value) AS avg_gdp,  
       AVG(e.emission) AS avg_emission,  
       AVG(p.Value) AS avg_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  
GROUP BY g.year  
ORDER BY g.year;
```

### OUTPUT

year	avg_gdp	avg_emission	avg_population
2020	629.0274965879119	85.3955	39656.20231536519
2021	671.0425053881461	89.4439	39986.56866078178
2022	694.6001345356871	91.2926	40345.80627994969
2023	717.9255333412382	93.4552	40711.65565397223

## ❑ Countries with highest energy consumption relative to GDP

### QUERY

```
SELECT c.country, c.year,  
       SUM(c.consumption) / g.Value AS consumption_to_gdp  
FROM consumption c  
JOIN gdp_3 g  
  ON c.country = g.Country AND c.year = g.year  
GROUP BY c.country, c.year, g.Value  
ORDER BY consumption_to_gdp DESC  
LIMIT 10;
```

### OUTPUT

country	year	consumption_to_gdp
Trinidad and Tobago	2021	0.031130662550778003
Trinidad and Tobago	2020	0.030807716716883243
Trinidad and Tobago	2022	0.030675985212948086
Trinidad and Tobago	2023	0.029815403889896484
North Korea	2022	0.027212009857278452
North Korea	2021	0.027170679141993424
North Korea	2020	0.02715563464483281
North Korea	2023	0.02640516400511415
Turkmenistan	2020	0.02131666881432105
Turkmenistan	2021	0.020375400453026656

## ❑ Emission-to-GDP ratio per country by year

### QUERY

```
SELECT g.Country, g.year,  
       SUM(e.emission) / g.Value AS emission_gdp_ratio  
FROM   gdp_3 g  
JOIN   emission_3 e  
       ON g.Country = e.country AND g.year = e.year  
GROUP BY g.Country, g.year, g.Value  
ORDER BY g.Country, g.year;
```

### OUTPUT

China	2020	1.9098603651244317
China	2021	1.821737377339813
China	2022	1.772865159432819
China	2023	1.786049018229533

# FINAL BUSINESS INSIGHTS

## 1. Economic Growth Drives Energy Demand

Countries with higher GDP consistently show higher energy consumption and emissions, indicating that economic expansion is closely tied to energy dependence.

## 2. Global Emissions Continue to Rise

Year-over-year trends reveal a steady increase in global emissions, highlighting the growing environmental burden across major economies.

## 3. Fossil Fuels Dominate Emission Contribution

Coal and oil-based energy types contribute the highest share of emissions, making them the major drivers of global carbon output.

## 4. Population Growth Directly Influences Emissions

Countries with rapidly increasing populations show corresponding rises in total emissions, reinforcing the link between demographic expansion and environmental impact.



# CONCLUSION

- Economic growth, population growth, and energy use are causing emissions to rise, so countries need to plan sustainably.
- Big economies have a major role in moving to cleaner energy.
- Energy demand is increasing everywhere, so efficient use and balanced production are important.
- Different countries emit differently because of lifestyles and resources.
- To ensure long-term environmental and economic stability, reducing emissions and using more renewable energy is essential.

THANK  
YOU

