WORLD ENERGY ANALYSIS

A project by Priyanshu Bhattacharya on gaining insights about energy usage and consumption across the world using Excel,MySQL & Tableau.

INTRODUCTION

- In an era marked by growing environmental concerns and the need for sustainable energy solutions, my 'World Energy Analysis' project delves into the intricate landscape of global energy consumption trends.
- The World Energy Analysis project seeks to shed light on the dynamics of energy consumption across the globe over many decades. Our aim is to provide a comprehensive overview of how nations have evolved in their energy usage, with a particular focus on the adoption and reliance on renewable energy sources.

- As the world grapples with the challenges posed by climate change, my project delves into the pivotal role of data analysis in understanding the trends and patterns that drive energy decisions. With data as our compass, we explore how nations have shifted towards greener alternatives and the implications of these shifts on their energy landscapes

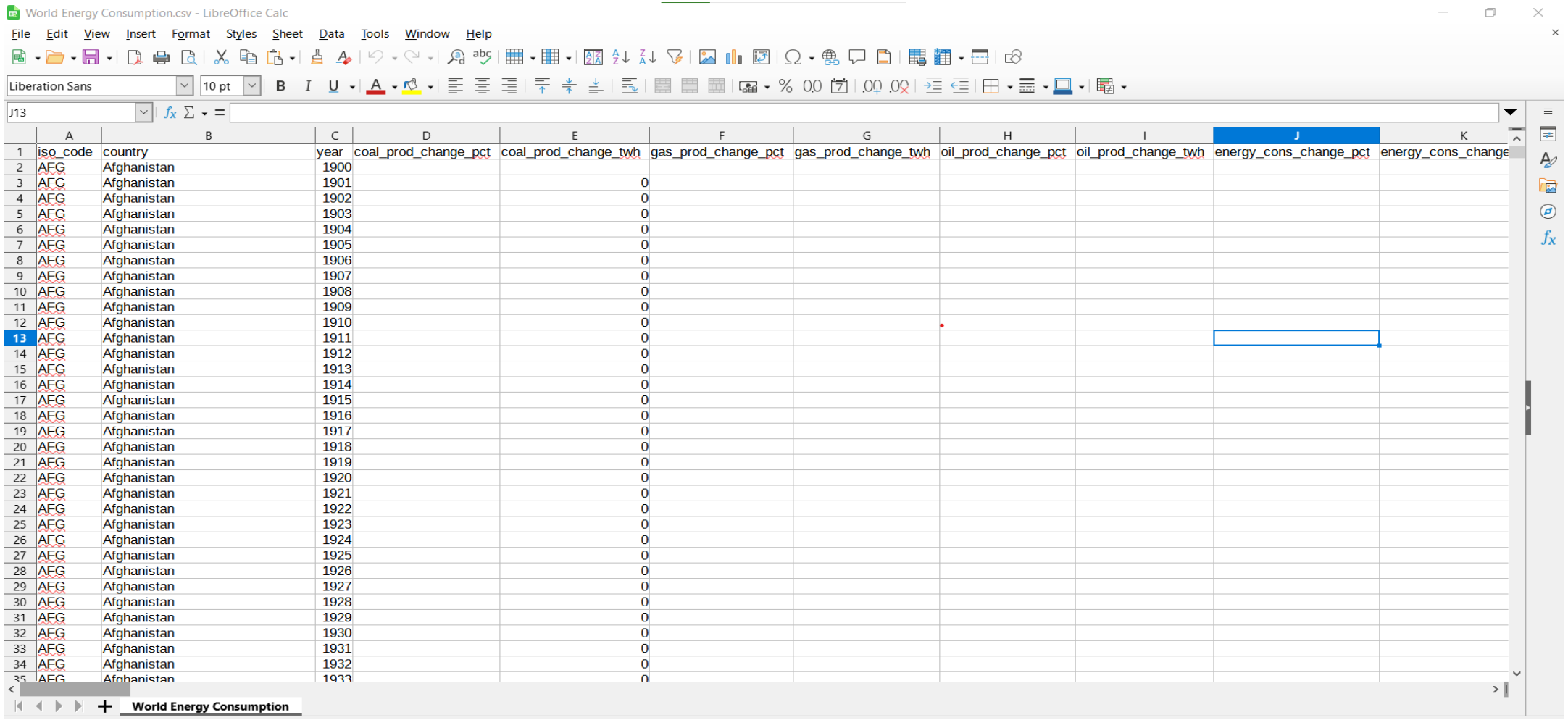
Gathering Data

- I gathered and downloaded the World Energy Consumption dataset from Kaggle.(link : https://www.kaggle.com/datasets/pralabhpoudel/world-energy-consumption). The original dataset contains over a 100 columns and several thousand rows of data, containing data of many countries in columns like '*Annual percentage change in oil production*', '*Annual change in coal production*', '*Electricity generation from renewables (measured in terawatt-hours)*', to name a few. This data is spread across several decades for each country, hence helping us to analyze each country's energy performance with more clarity.

Data Cleaning

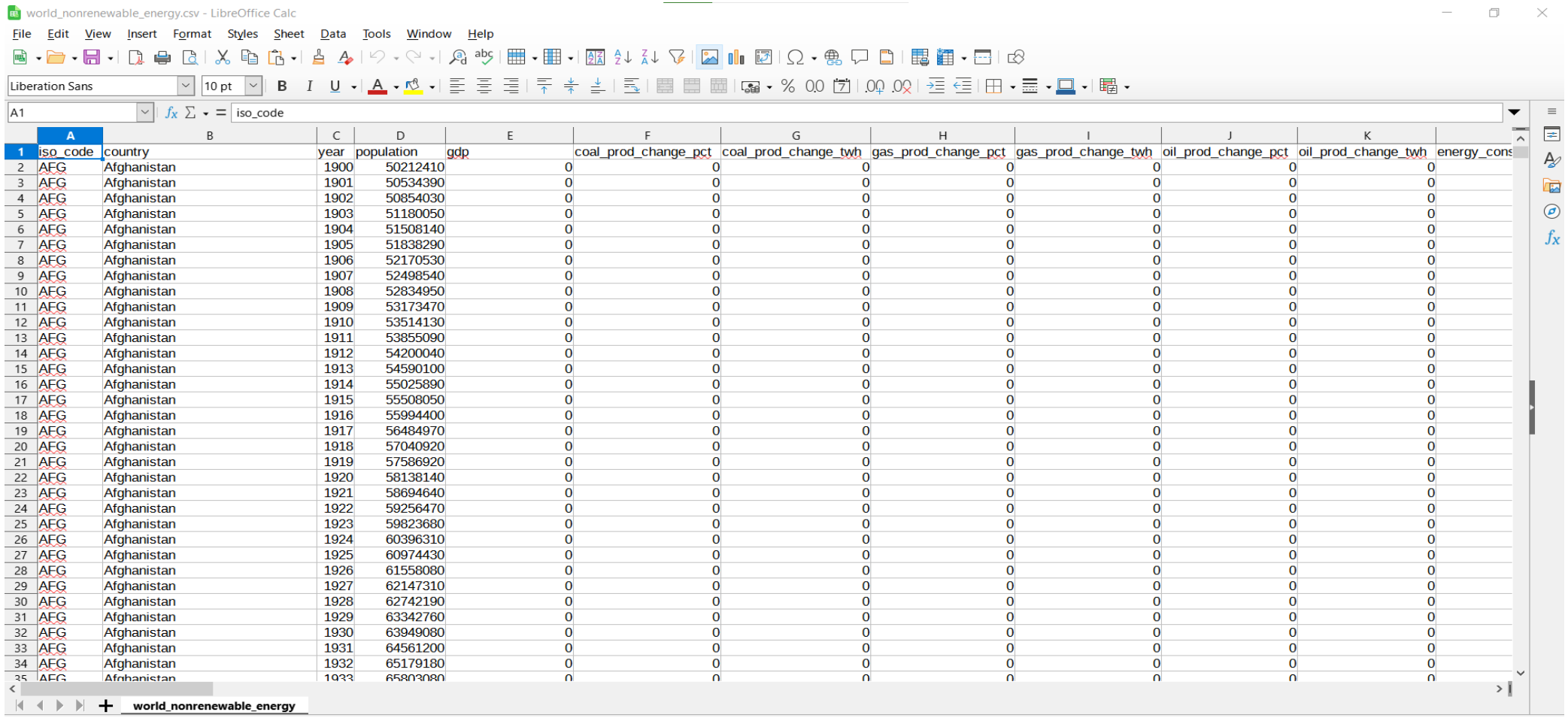
- The data was stored in a .csv format. Although the data was arranged quite beautifully, in many places there were many blank spaces. These blank spaces meant that there was no particular data available for that row and the specific column.
- Now the problem is, since we have to connect this .csv file to our MySQL server, we cannot afford to have blank spaces, or , empty cells. Because in this case, it will read them just as a series of comas and MySQL may not understand that these are actually empty cells.
- But before that, I split the big table into two halves, one table for the renewable energy data, and the other for data related to non-renewable energy sources and their consumption.
- Hence to prevent any errors, I first filled all the blank cells with zeroes. After that, I used the 'load infile' command to upload both the .csv files into the mysql server and then , we had two tables with all the data contained within them.

Before :



	A	B	C	D	E	F	G	H	I	J	K
1	iso_code	country	year	coal_prod_change_pct	coal_prod_change_twh	gas_prod_change_pct	gas_prod_change_twh	oil_prod_change_pct	oil_prod_change_twh	energy_cons_change_pct	energy_cons_change
2	AFG	Afghanistan	1900								
3	AFG	Afghanistan	1901		0						
4	AFG	Afghanistan	1902		0						
5	AFG	Afghanistan	1903		0						
6	AFG	Afghanistan	1904		0						
7	AFG	Afghanistan	1905		0						
8	AFG	Afghanistan	1906		0						
9	AFG	Afghanistan	1907		0						
10	AFG	Afghanistan	1908		0						
11	AFG	Afghanistan	1909		0						
12	AFG	Afghanistan	1910		0						
13	AFG	Afghanistan	1911		0						
14	AFG	Afghanistan	1912		0						
15	AFG	Afghanistan	1913		0						
16	AFG	Afghanistan	1914		0						
17	AFG	Afghanistan	1915		0						
18	AFG	Afghanistan	1916		0						
19	AFG	Afghanistan	1917		0						
20	AFG	Afghanistan	1918		0						
21	AFG	Afghanistan	1919		0						
22	AFG	Afghanistan	1920		0						
23	AFG	Afghanistan	1921		0						
24	AFG	Afghanistan	1922		0						
25	AFG	Afghanistan	1923		0						
26	AFG	Afghanistan	1924		0						
27	AFG	Afghanistan	1925		0						
28	AFG	Afghanistan	1926		0						
29	AFG	Afghanistan	1927		0						
30	AFG	Afghanistan	1928		0						
31	AFG	Afghanistan	1929		0						
32	AFG	Afghanistan	1930		0						
33	AFG	Afghanistan	1931		0						
34	AFG	Afghanistan	1932		0						
35	AFG	Afghanistan	1933		0						

After :



world_nonrenewable_energy.csv - LibreOffice Calc

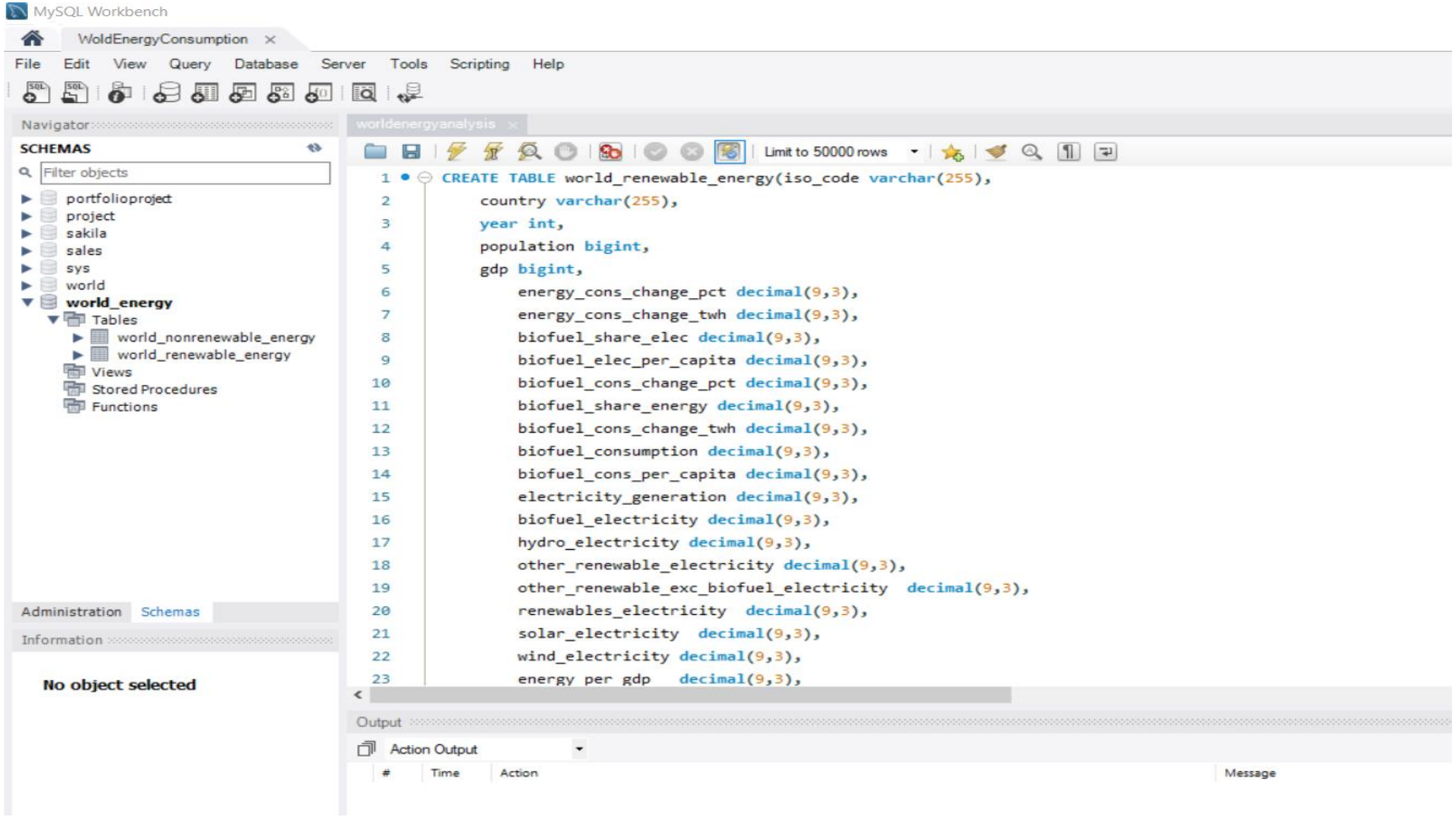
File Edit View Insert Format Styles Sheet Data Tools Window Help

Liberation Sans 10 pt

A1 iso_code

	A	B	C	D	E	F	G	H	I	J	K	
1	iso_code	country	year	population	gdp	coal_prod_change_pct	coal_prod_change_twh	gas_prod_change_pct	gas_prod_change_twh	oil_prod_change_pct	oil_prod_change_twh	energy_cons
2	AFG	Afghanistan	1900	50212410	0	0	0	0	0	0	0	
3	AFG	Afghanistan	1901	50534390	0	0	0	0	0	0	0	
4	AFG	Afghanistan	1902	50854030	0	0	0	0	0	0	0	
5	AFG	Afghanistan	1903	51180050	0	0	0	0	0	0	0	
6	AFG	Afghanistan	1904	51508140	0	0	0	0	0	0	0	
7	AFG	Afghanistan	1905	51838290	0	0	0	0	0	0	0	
8	AFG	Afghanistan	1906	52170530	0	0	0	0	0	0	0	
9	AFG	Afghanistan	1907	52498540	0	0	0	0	0	0	0	
10	AFG	Afghanistan	1908	52834950	0	0	0	0	0	0	0	
11	AFG	Afghanistan	1909	53173470	0	0	0	0	0	0	0	
12	AFG	Afghanistan	1910	53514130	0	0	0	0	0	0	0	
13	AFG	Afghanistan	1911	53855090	0	0	0	0	0	0	0	
14	AFG	Afghanistan	1912	54200040	0	0	0	0	0	0	0	
15	AFG	Afghanistan	1913	54590100	0	0	0	0	0	0	0	
16	AFG	Afghanistan	1914	55025890	0	0	0	0	0	0	0	
17	AFG	Afghanistan	1915	55508050	0	0	0	0	0	0	0	
18	AFG	Afghanistan	1916	55994400	0	0	0	0	0	0	0	
19	AFG	Afghanistan	1917	56484970	0	0	0	0	0	0	0	
20	AFG	Afghanistan	1918	57040920	0	0	0	0	0	0	0	
21	AFG	Afghanistan	1919	57586920	0	0	0	0	0	0	0	
22	AFG	Afghanistan	1920	58138140	0	0	0	0	0	0	0	
23	AFG	Afghanistan	1921	58694640	0	0	0	0	0	0	0	
24	AFG	Afghanistan	1922	59256470	0	0	0	0	0	0	0	
25	AFG	Afghanistan	1923	59823680	0	0	0	0	0	0	0	
26	AFG	Afghanistan	1924	60396310	0	0	0	0	0	0	0	
27	AFG	Afghanistan	1925	60974430	0	0	0	0	0	0	0	
28	AFG	Afghanistan	1926	61558080	0	0	0	0	0	0	0	
29	AFG	Afghanistan	1927	62147310	0	0	0	0	0	0	0	
30	AFG	Afghanistan	1928	62742190	0	0	0	0	0	0	0	
31	AFG	Afghanistan	1929	63342760	0	0	0	0	0	0	0	
32	AFG	Afghanistan	1930	63949080	0	0	0	0	0	0	0	
33	AFG	Afghanistan	1931	64561200	0	0	0	0	0	0	0	
34	AFG	Afghanistan	1932	65179180	0	0	0	0	0	0	0	
35	AFG	Afghanistan	1933	65803080	0	0	0	0	0	0	0	

world_nonrenewable_energy


MySQL Workbench
WoldEnergyConsumption
File Edit View Query Database Server Tools Scripting Help
Navigator
SCHEMAS
Filter objects
portfolioproject
project
sakila
sales
sys
world
world_energy
Tables
world_nonrenewable_energy
world_renewable_energy
Views
Stored Procedures
Functions
Administration Schemas
Information
No object selected
worldenergyanalysis
Limit to 50000 rows
1 CREATE TABLE world_renewable_energy(iso_code varchar(255),
2 country varchar(255),
3 year int,
4 population bigint,
5 gdp bigint,
6 energy_cons_change_pct decimal(9,3),
7 energy_cons_change_twh decimal(9,3),
8 biofuel_share_elec decimal(9,3),
9 biofuel_elec_per_capita decimal(9,3),
10 biofuel_cons_change_pct decimal(9,3),
11 biofuel_share_energy decimal(9,3),
12 biofuel_cons_change_twh decimal(9,3),
13 biofuel_consumption decimal(9,3),
14 biofuel_cons_per_capita decimal(9,3),
15 electricity_generation decimal(9,3),
16 biofuel_electricity decimal(9,3),
17 hydro_electricity decimal(9,3),
18 other_renewable_electricity decimal(9,3),
19 other_renewable_exc_biofuel_electricity decimal(9,3),
20 renewables_electricity decimal(9,3),
21 solar_electricity decimal(9,3),
22 wind_electricity decimal(9,3),
23 energy_per_gdp decimal(9,3),
Output
Action Output
Time Action Message

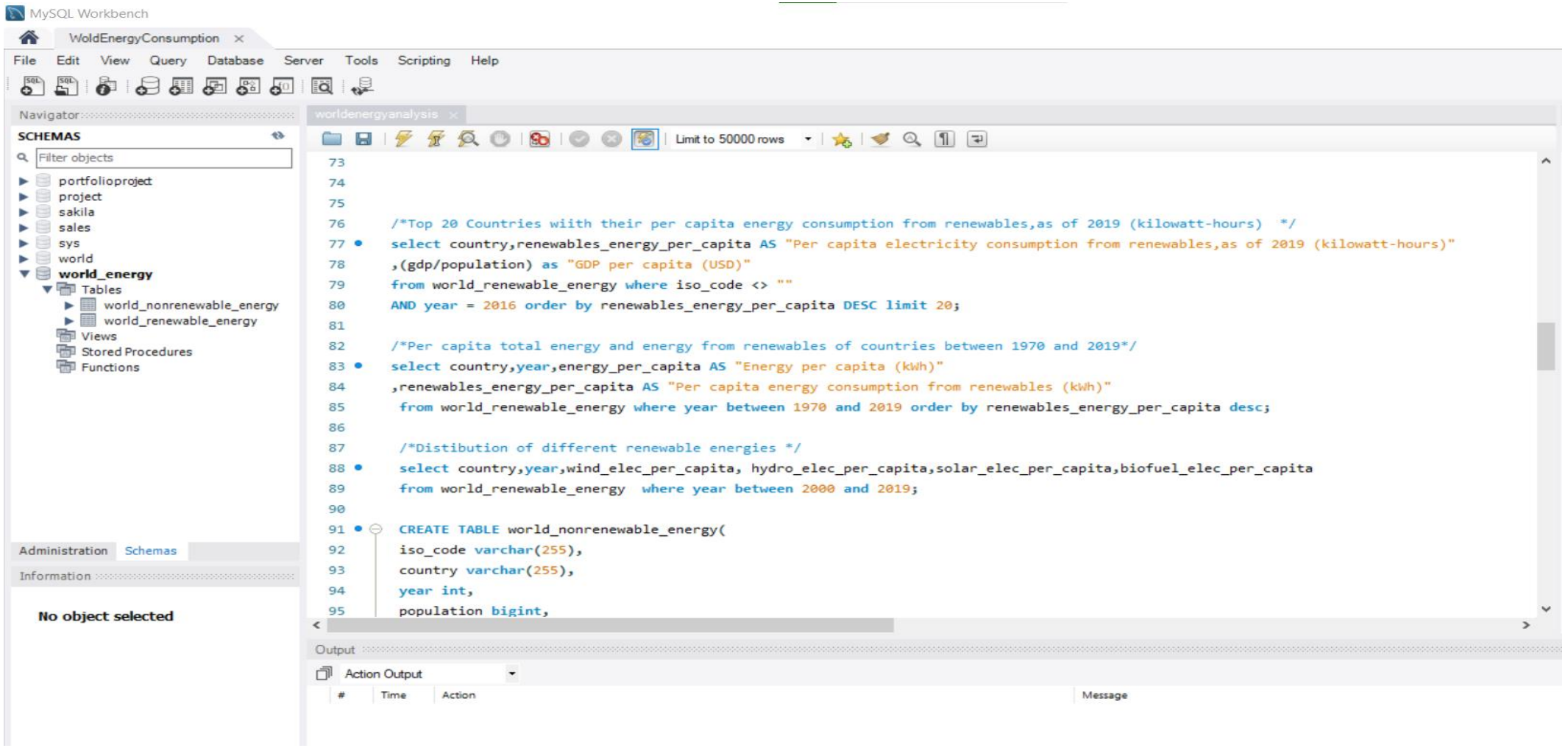
Writing queries

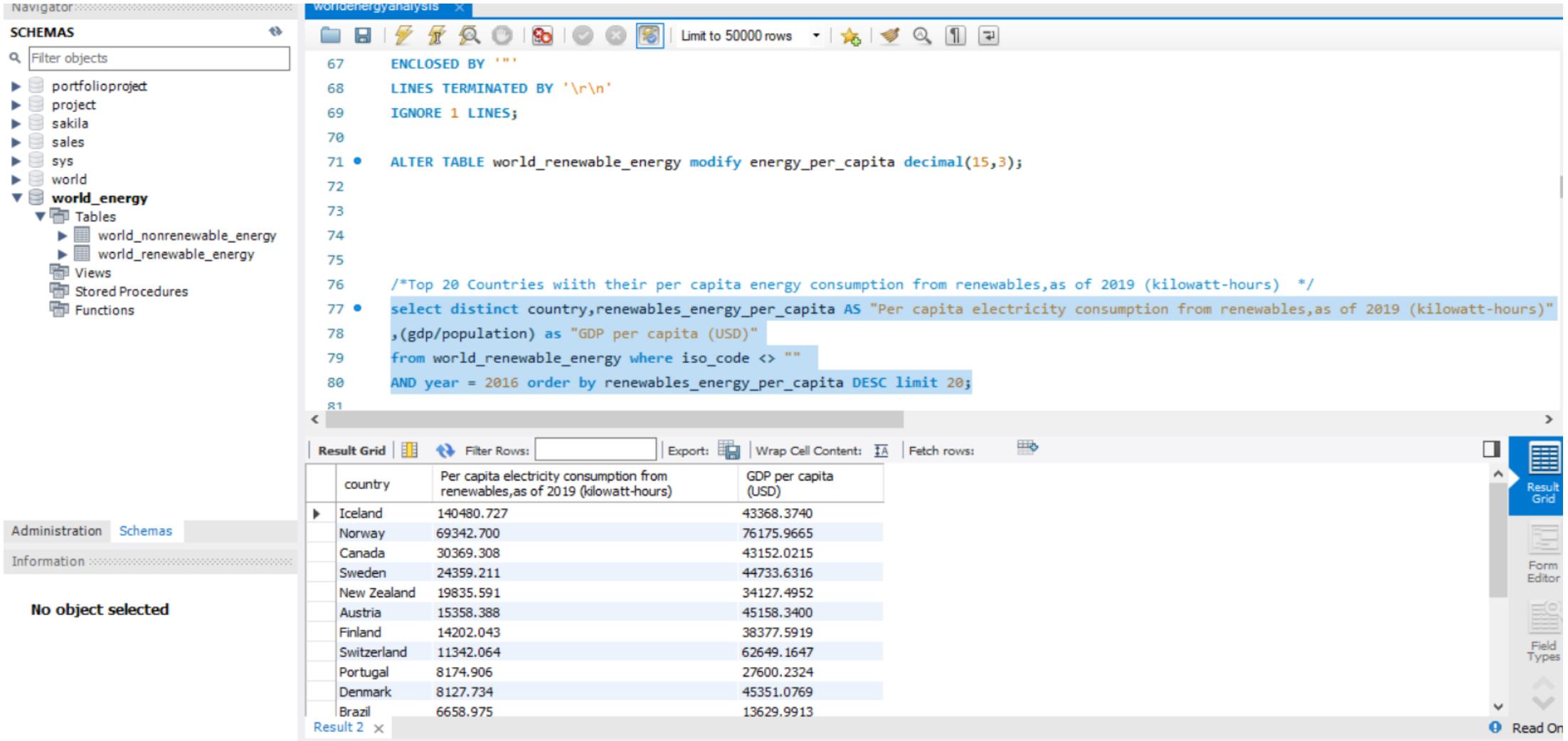
- So after successfully loading our .csv files into MySQL , it's time to gain some insights on our data and answer some questions related to energy distribution and energy usage of nations.
- We answer some questions and looked into things like :

1) What is the trend of total energy consumptions for some nations across the past 6 decades?
2) What is the amount of renewable energy consumption per capita and non-renewable energy consumption per capita amongst the G20 countries?
3) Which are the top 20 countries with the highest energy per capita from renewables?

- 4) Which are the top 15 oil-based energy producers in the world?
- To answer these questions we first wrote relevant queries in MySQL and extracted the information. After extracting the relevant information, we put them onto excel files which were then in turn connected to Tableau, a BI tool which helps us to visualize and present our data in a more beautiful way so that we can explain it better to relevant stakeholders.

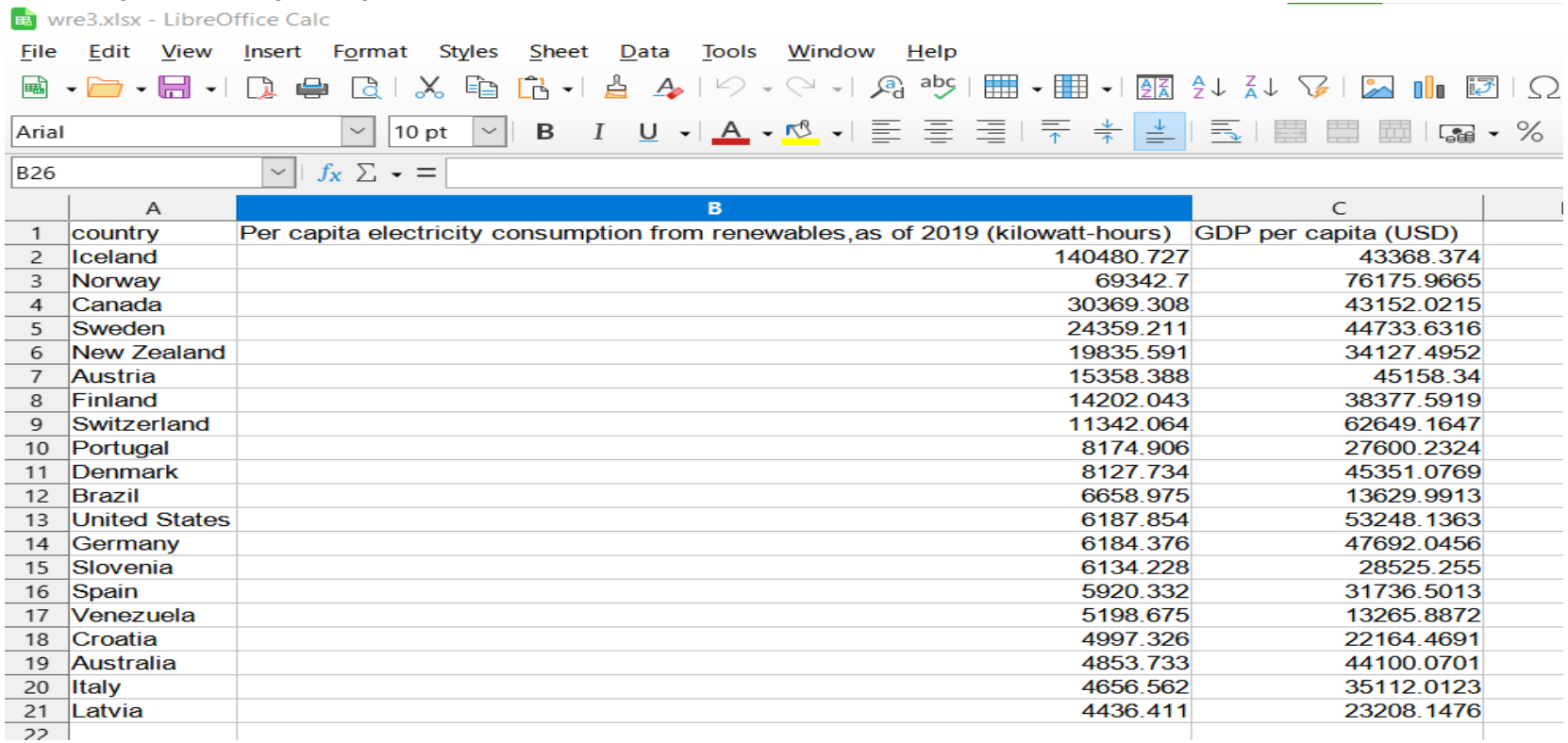
Some queries :




Navigator
SCHEMAS
Filter objects
portfolioproject
project
sakila
sales
sys
world
world_energy
Tables
world_nonrenewable_energy
world_renewable_energy
Views
Stored Procedures
Functions
Administration
Schemas
Information
No object selected
worldenergyanalysis
Limit to 50000 rows
67 ENCLOSED BY '"'
68 LINES TERMINATED BY '\r\n'
69 IGNORE 1 LINES;
70
71 ALTER TABLE world_renewable_energy modify energy_per_capita decimal(15,3);
72
73
74
75
76 /*Top 20 Countries wiith their per capita energy consumption from renewables,as of 2019 (kilowatt-hours) */
77 select distinct country,renewables_energy_per_capita AS "Per capita electricity consumption from renewables,as of 2019 (kilowatt-hours)"
78 ,(gdp/population) as "GDP per capita (USD)"
79 from world_renewable_energy where iso_code <> ""
80 AND year = 2016 order by renewables_energy_per_capita DESC limit 20;
81
Result Grid
Filter Rows:
Export:
Wrap Cell Content:
Fetch rows:
country
Per capita electricity consumption from renewables,as of 2019 (kilowatt-hours)
GDP per capita (USD)
Iceland 140480.727 43368.3740
Norway 69342.700 76175.9665
Canada 30369.308 43152.0215
Sweden 24359.211 44733.6316
New Zealand 19835.591 34127.4952
Austria 15358.388 45158.3400
Finland 14202.043 38377.5919
Switzerland 11342.064 62649.1647
Portugal 8174.906 27600.2324
Denmark 8127.734 45351.0769
Brazil 6658.975 13629.9913
Result 2
Result Grid
Form Editor
Field Types
Read On

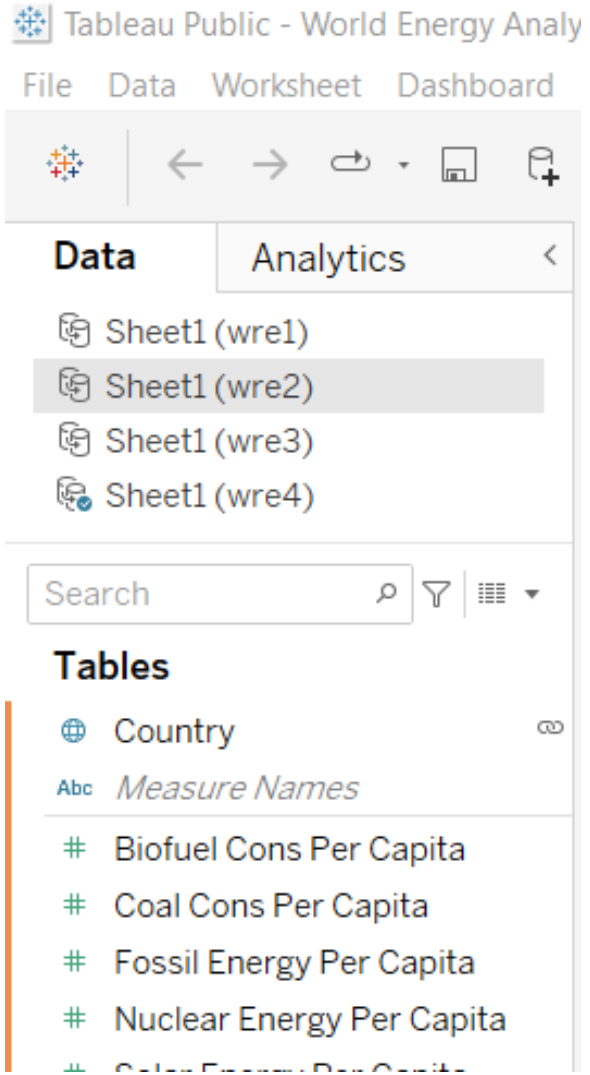
Connecting data source to Tableau

- After getting all the desried results and outputs from MySQL, we copy the output from MySql and paste them on excel files. This is done because Tableau public does not support importing data diirectly from sql files.
- Hence we paste query results on .xlsx files, like this :

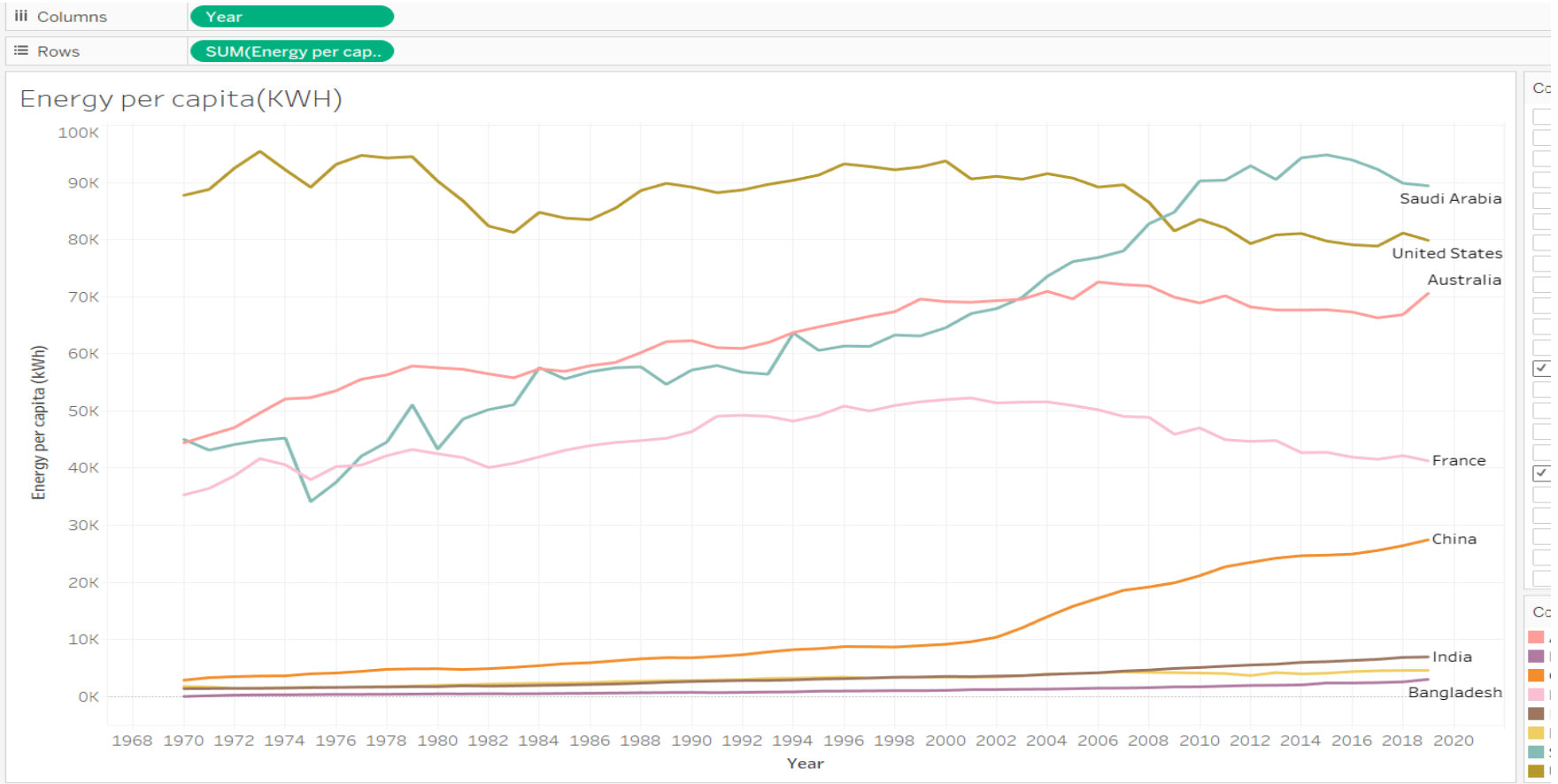


	A	B	C
1	country	Per capita electricity consumption from renewables,as of 2019 (kilowatt-hours)	GDP per capita (USD)
2	Iceland	140480.727	43368.374
3	Norway	69342.7	76175.9665
4	Canada	30369.308	43152.0215
5	Sweden	24359.211	44733.6316
6	New Zealand	19835.591	34127.4952
7	Austria	15358.388	45158.34
8	Finland	14202.043	38377.5919
9	Switzerland	11342.064	62649.1647
10	Portugal	8174.906	27600.2324
11	Denmark	8127.734	45351.0769
12	Brazil	6658.975	13629.9913
13	United States	6187.854	53248.1363
14	Germany	6184.376	47692.0456
15	Slovenia	6134.228	28525.255
16	Spain	5920.332	31736.5013
17	Venezuela	5198.675	13265.8872
18	Croatia	4997.326	22164.4691
19	Australia	4853.733	44100.0701
20	Italy	4656.562	35112.0123
21	Latvia	4436.411	23208.1476
22			

- After that, we connect the excel files to Tableau, so that we can draw visualizations from the data there.
- We can use different data sets in one single Tableau project itself. Just like here we have used wre1,wre2,etc.



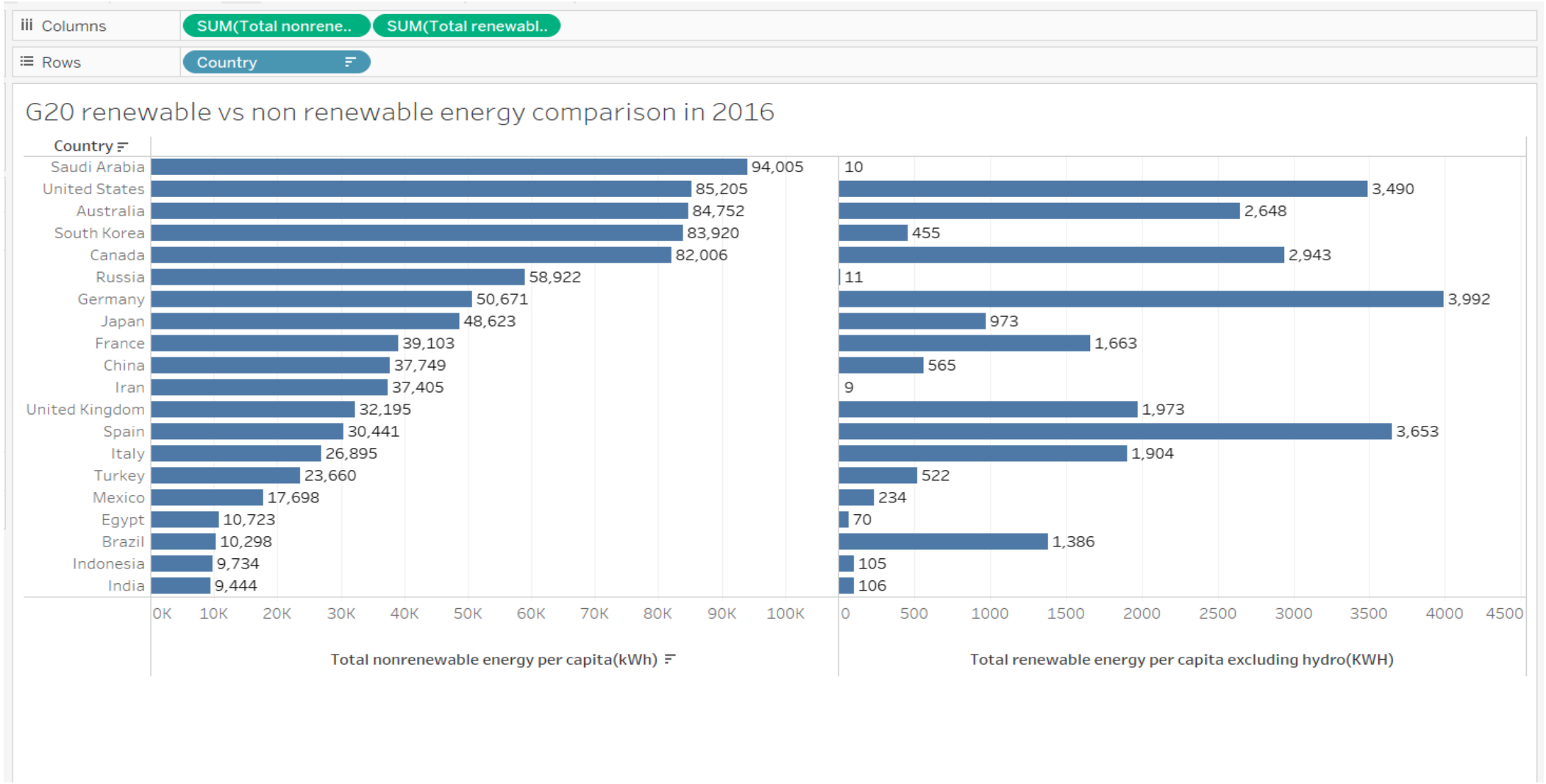
- Now with the data connected, we can start creating our visualizations! Let us visualize the query results of our first question : "What is the trend of total energy consumptions for some nations across the past 6 decades? "

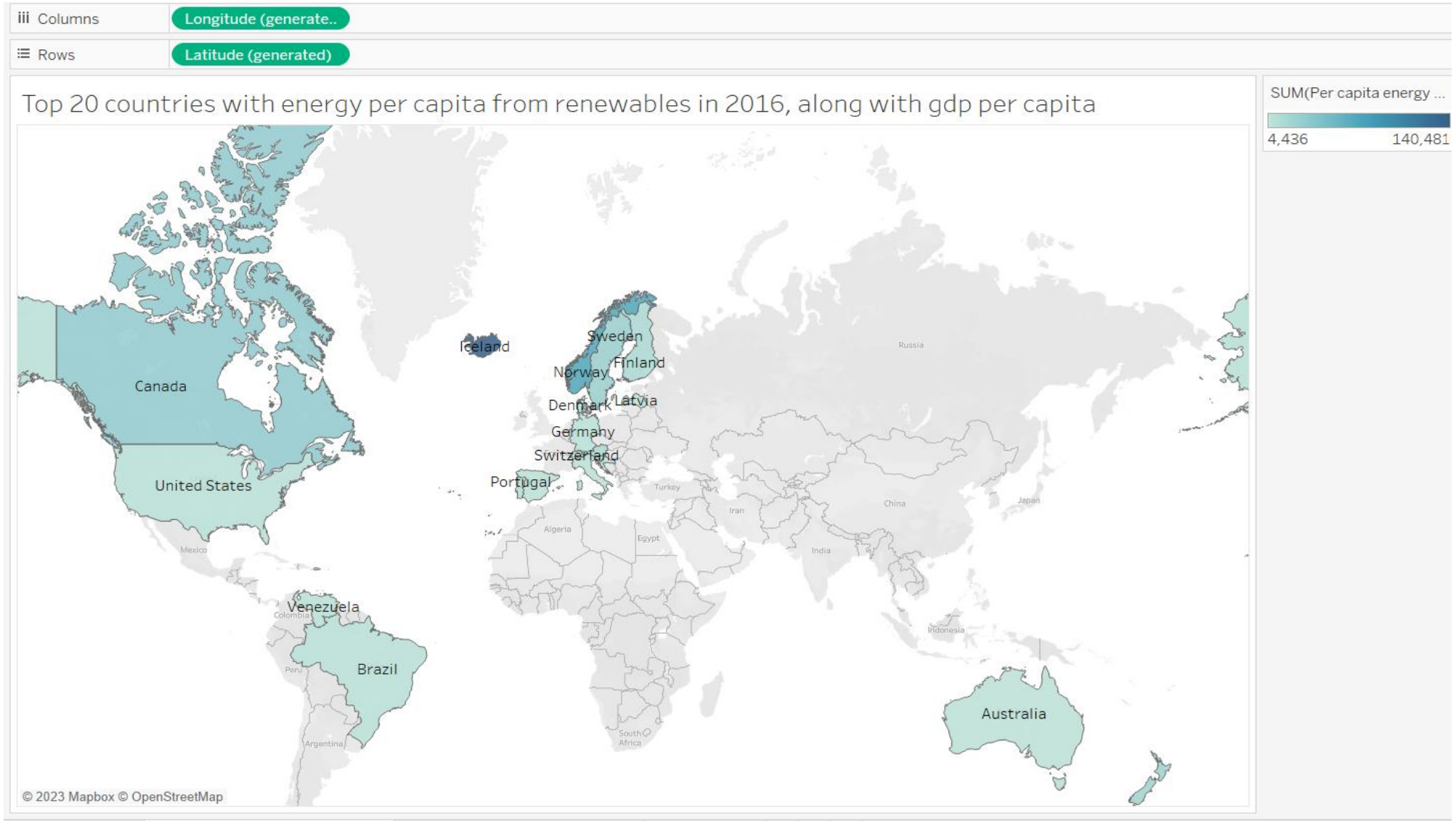


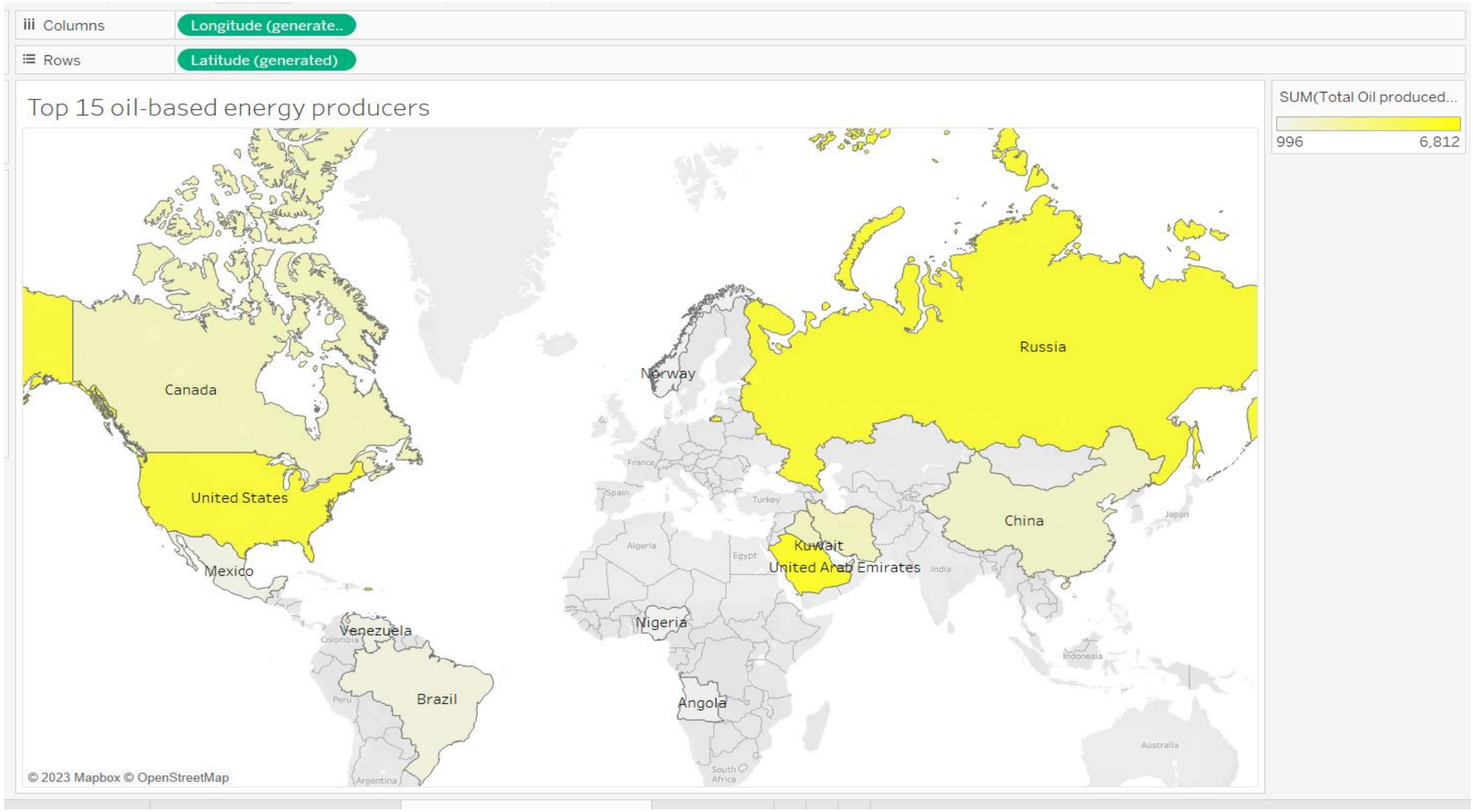
- As we can see, we can infer from the previous graph that :

1) Nations like Saudi Arabia, India, China have gradually increased their total energy consumption per capita over the past 60 years.
2) On the other hand countries like United States, France have somewhat declined their per capita energy consumptions since the last few decades.
3) From this list, as of 2020, Saudi Arabia has the highest per capita energy consumption with per capita consumption of over 90 kilowatt-hours per year.

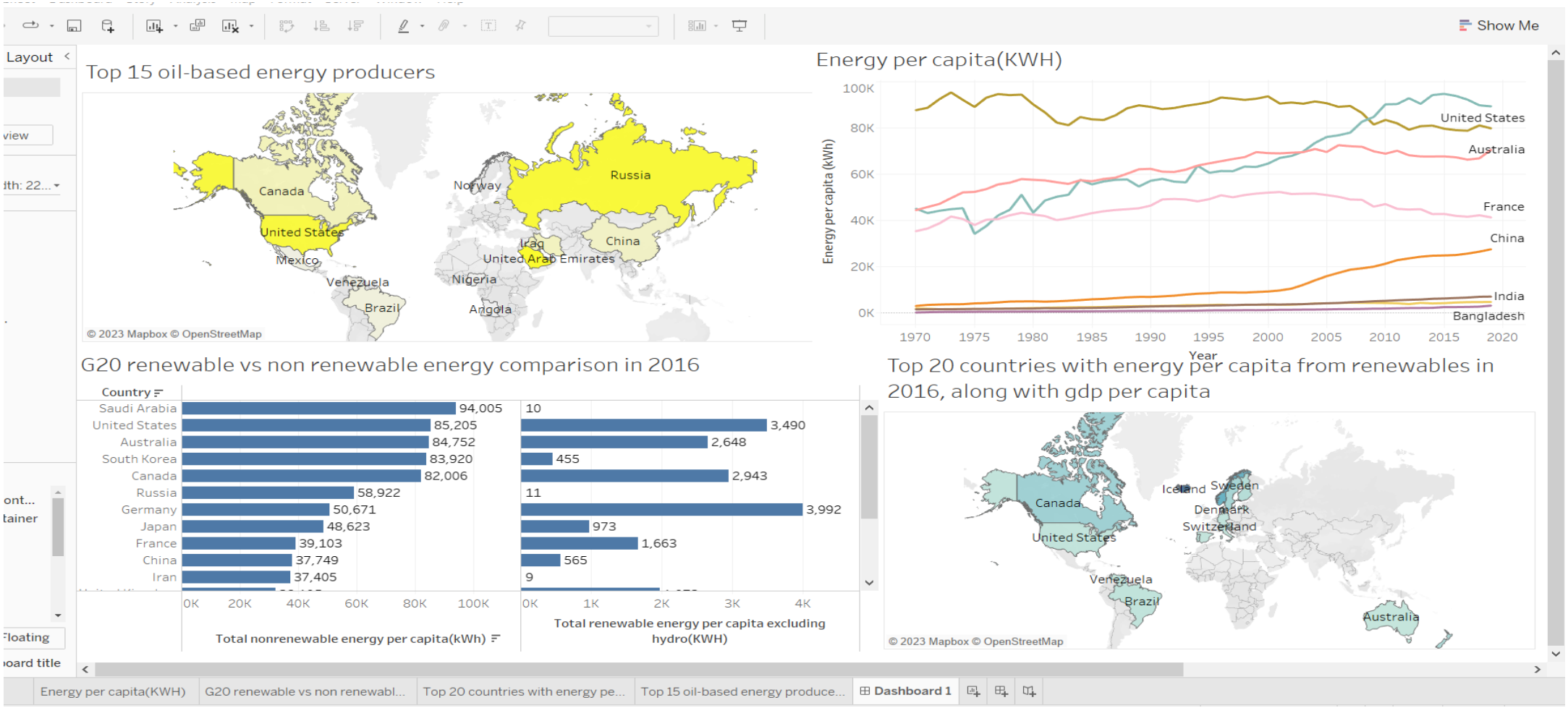
As we can see, we can use these visualizations to understand our data much more effectively rather than just seeing plain numbers and tables. Some other visualizations to our other questions are :


Columns
SUM(Total nonrene..
SUM(Total renewabl..
Rows
Country
G20 renewable vs non renewable energy comparison in 2016
Country
Saudi Arabia 94,005
United States 85,205
Australia 84,752
South Korea 83,920
Canada 82,006
Russia 58,922
Germany 50,671
Japan 48,623
France 39,103
China 37,749
Iran 37,405
United Kingdom 32,195
Spain 30,441
Italy 26,895
Turkey 23,660
Mexico 17,698
Egypt 10,723
Brazil 10,298
Indonesia 9,734
India 9,444
0K 10K 20K 30K 40K 50K 60K 70K 80K 90K 100K
Total nonrenewable energy per capita(kWh)
10
3,490
2,648
455
2,943
11
3,992
973
1,663
565
9
1,973
3,653
1,904
522
234
70
1,386
105
106
0 500 1000 1500 2000 2500 3000 3500 4000 4500
Total renewable energy per capita excluding hydro(KWH)


Columns
Longitude (generate..
Rows
Latitude (generated)
Top 20 countries with energy per capita from renewables in 2016, along with gdp per capita
SUM(Per capita energy ...
4,436
140,481
Canada
United States
Iceland
Sweden
Finland
Norway
Denmark
Latvia
Germany
Switzerland
Portugal
Venezuela
Brazil
Australia
Russia
Turkey
Iran
China
Japan
India
Indonesia
Algeria
Egypt
South Africa
Mexico
Colombia
Peru
Argentina
© 2023 Mapbox © OpenStreetMap


Columns
Longitude (generate..
Rows
Latitude (generated)
Top 15 oil-based energy producers
SUM(Total Oil produced...
996
6,812
Canada
United States
Mexico
Venezuela
Brazil
Norway
Russia
China
Kuwait
United Arab Emirates
Nigeria
Angola
© 2023 Mapbox © OpenStreetMap

Finally, we create a dashboard, wherein we present all our visualizations together :



Conclusions

- Hence, we saw how using Excel,SQL and Tableau can be extremely helpful in cleaning data,organising data, retreiving specific information and finally presenting them in a visually appealing manner to the stakeholders.
- We got energy insights of different countries and how several countries have changed the way