Marwa Oussaifi May 2019

Final Project

1. Introduction:

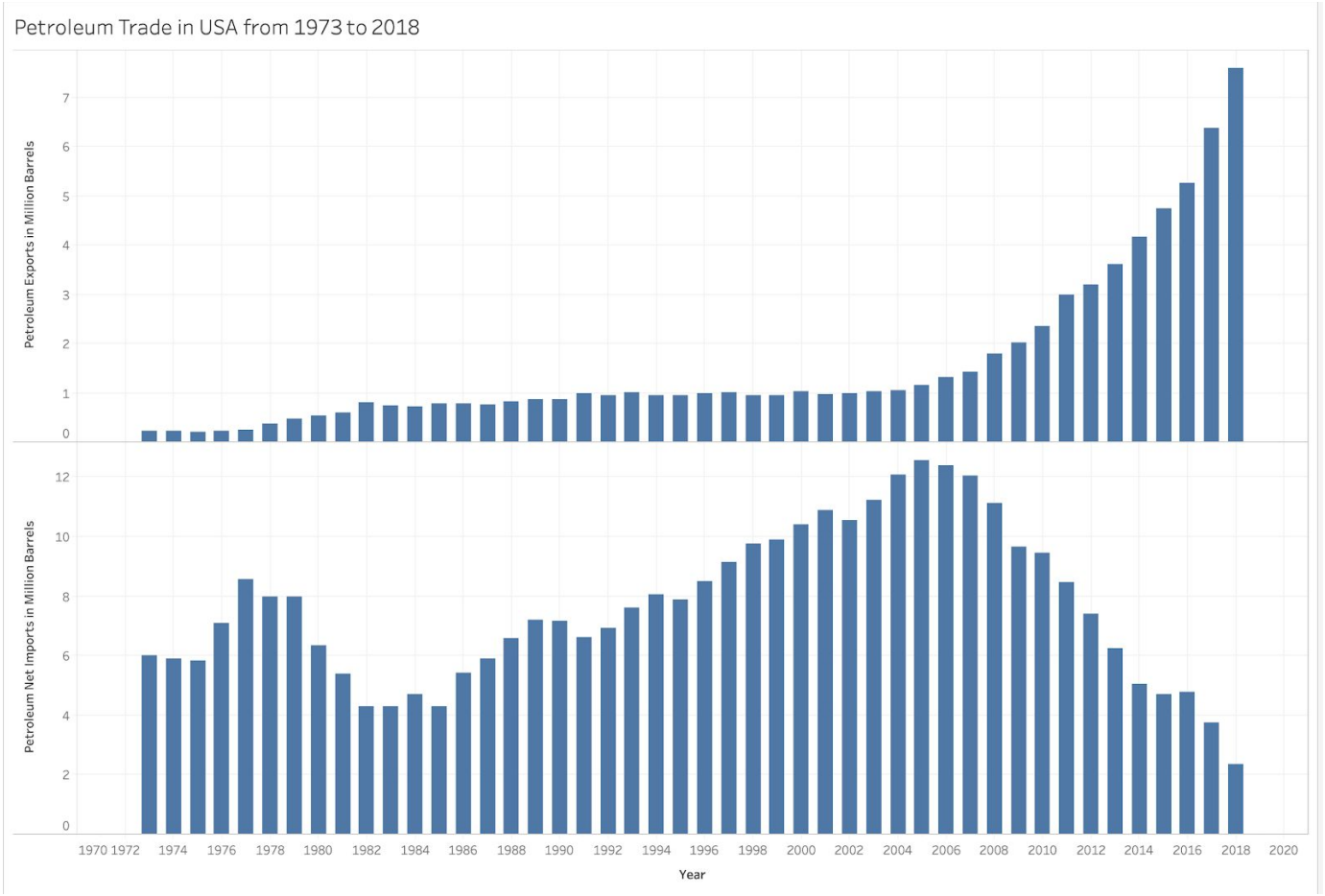
I was looking for a data set in the energy field. And I found the data I'm using currently under this link, here. It is a collection of recent and historical energy statistics. This dataset includes statistics on total energy production, consumption, and trade; energy prices; overviews of petroleum, natural gas, coal, electricity, nuclear energy, renewable energy, and international petroleum; carbon dioxide emissions; and data unit conversion values. I liked this data source because it is rich in content and I can join several tables to get better insights.
In this project, I focused on the datasets related to petroleum, electricity and renewable energy as well as the total energy production. I wanted to investigate the relationship between petroleum trades, prices and the production of renewable energy as well as the usage of electricity vs. petroleum energy in the United States.

2. Summary of Data:

I used different type of plots to summarize my dataset.

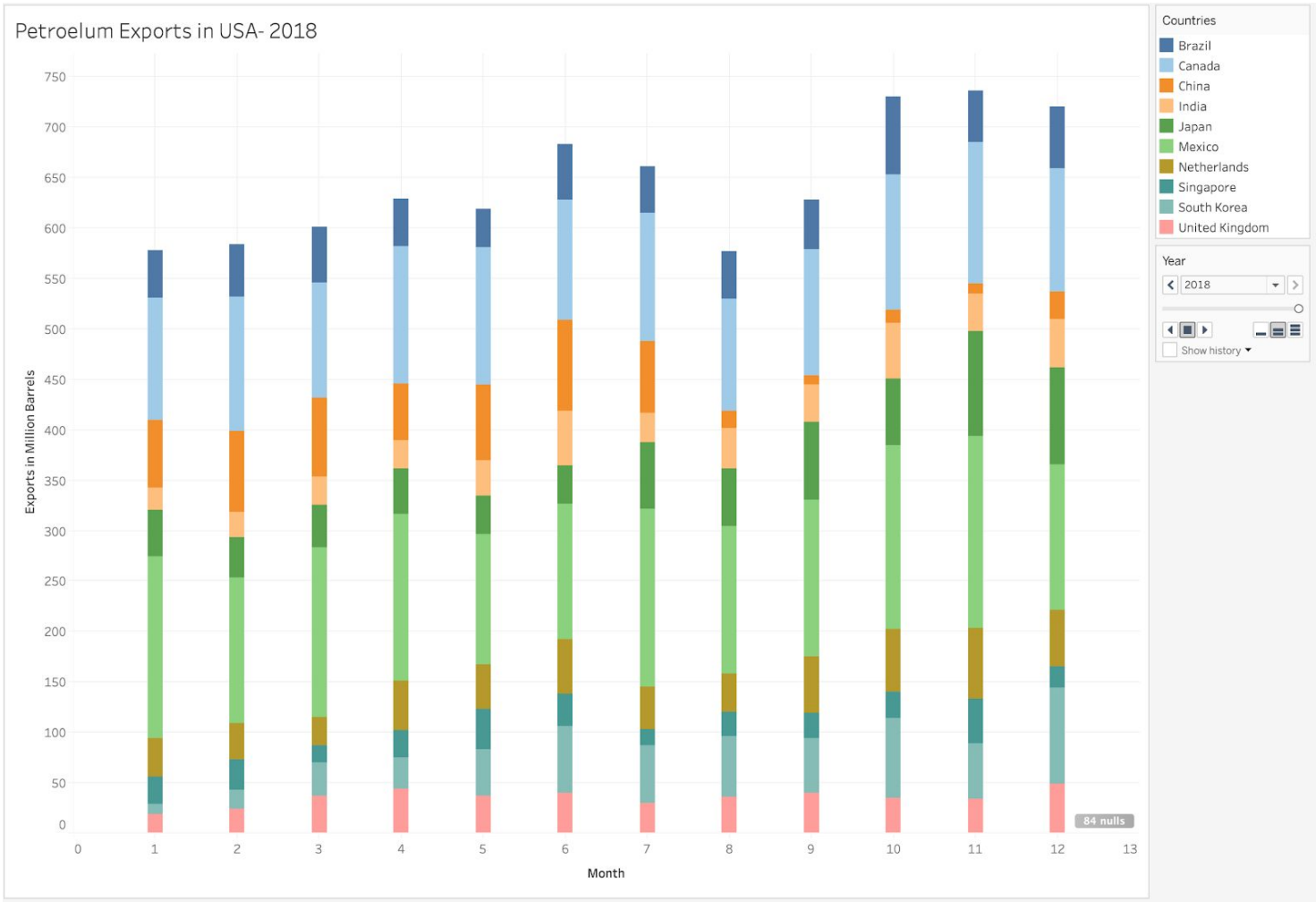
- Histogram:

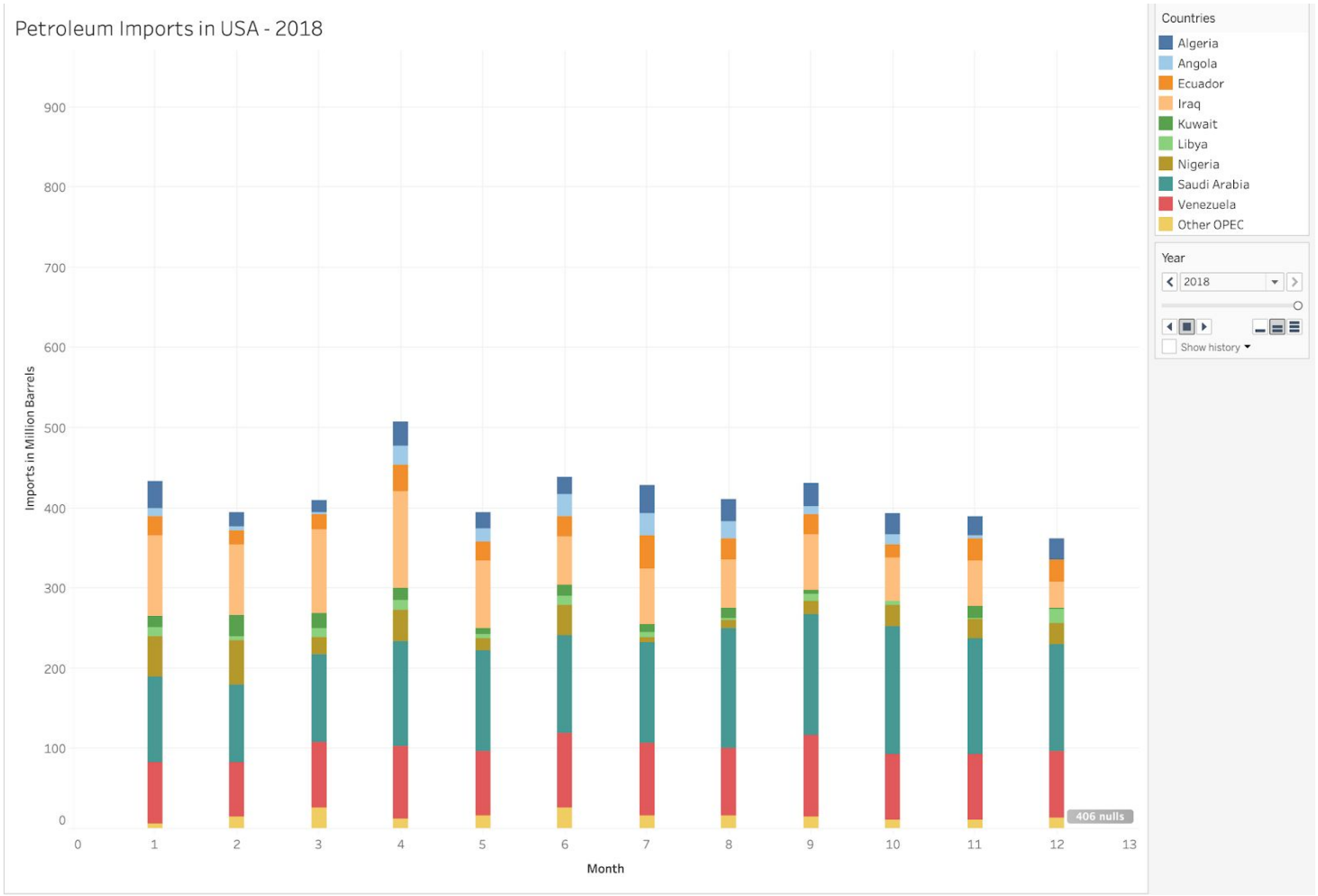
In the plot below, I explored the overall trend of the exports and imports of petroleum in the US in the time period between 1973 and 2018. We can conclude that the petroleum imports increased significantly from the year 2010 to present where the exports increased in the same period.


Petroleum Trade in USA from 1973 to 2018
Petroleum Exports in Million Barrels
0
1
2
3
4
5
6
7
Petroleum Net Imports in Million Barrels
0
2
4
6
8
10
12
1970 1972 1974 1976 1978 1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014 2016 2018 2020
Year

- Barplot:

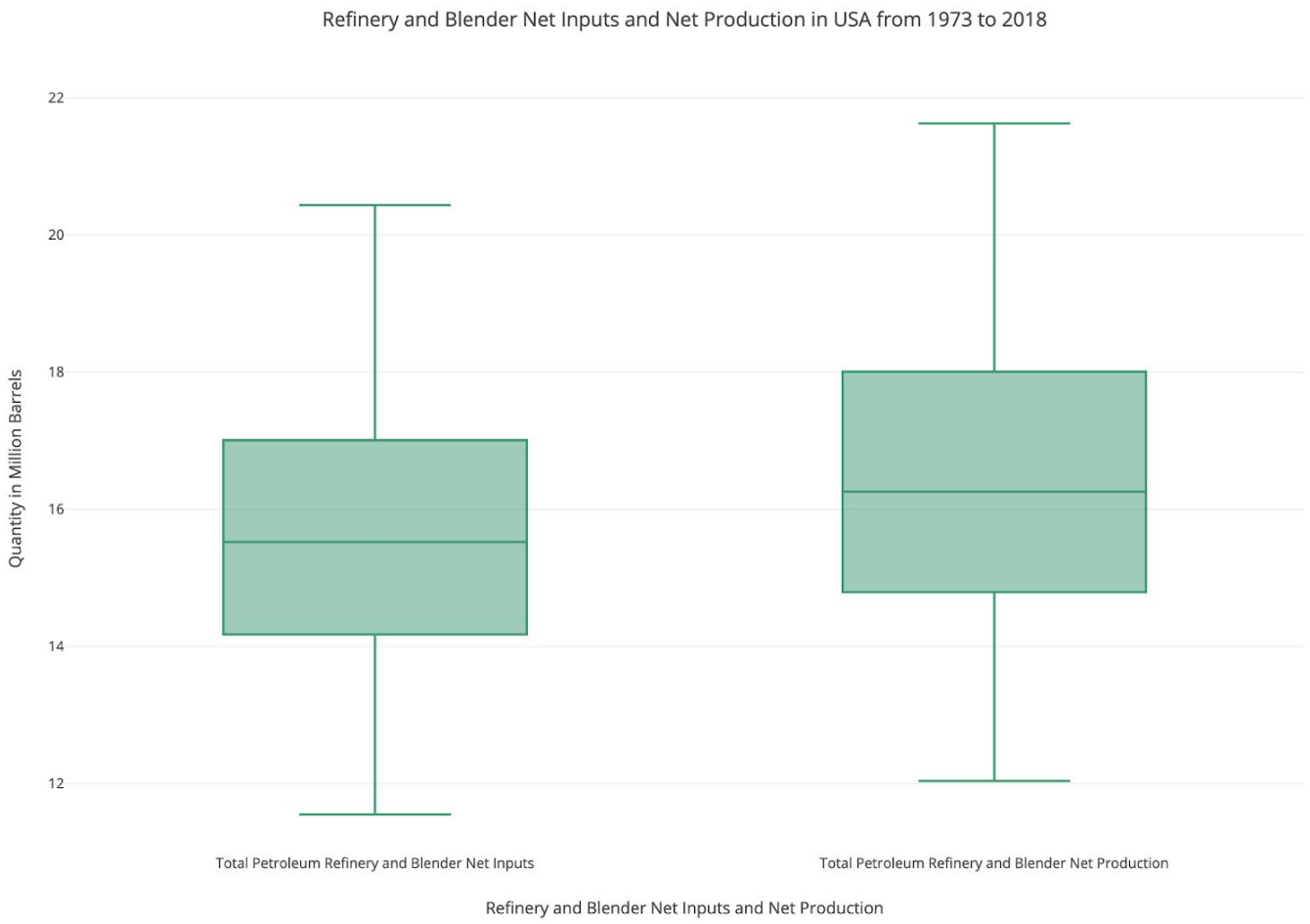
The stacked bar plots below show respectively, the monthly exports and imports of petroleum in USA per countries of destination and origin during the year 2018.
The time range I used for this visualization is from 1973 to 2018 but here I only showed the last year results. We can see that the main countries that USA is exporting to are Mexico and Canada and the main ones that it is importing from are Saudi Arabia, Iraq and Venezuela.




Petroleum Imports in USA - 2018
Imports in Million Barrels
900
800
700
600
500
400
300
200
100
0
0
1
2
3
4
5
6
7
8
9
10
11
12
13
Month
406 nulls
Countries
Algeria
Angola
Ecuador
Iraq
Kuwait
Libya
Nigeria
Saudi Arabia
Venezuela
Other OPEC
Year
2018
Show history

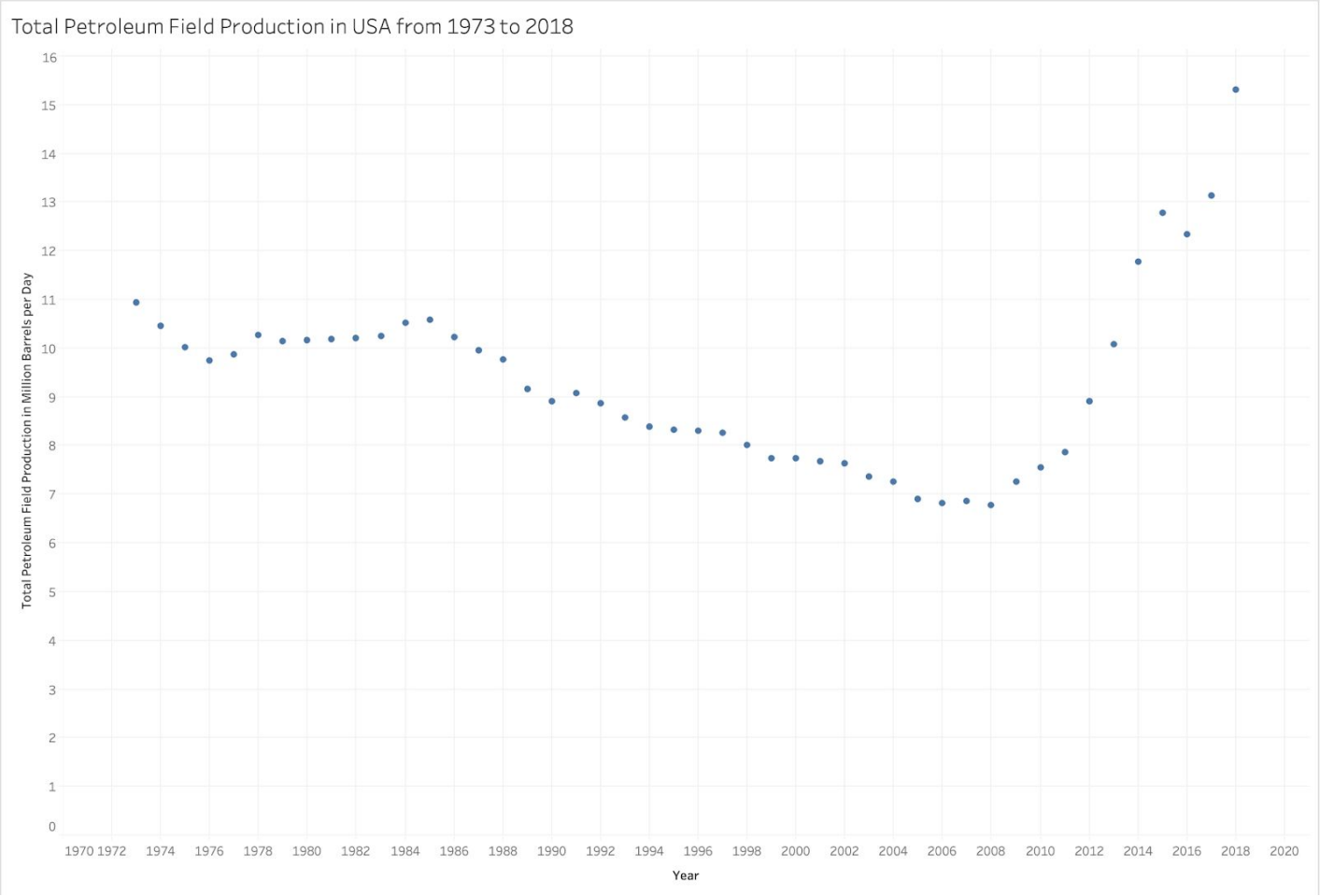
- Boxplot

The box plot below shows the petroleum refinery and blender net inputs and production in USA from 1973 to 2018. We can see that the production is overall slightly higher than the input which makes the petroleum processing profitable.

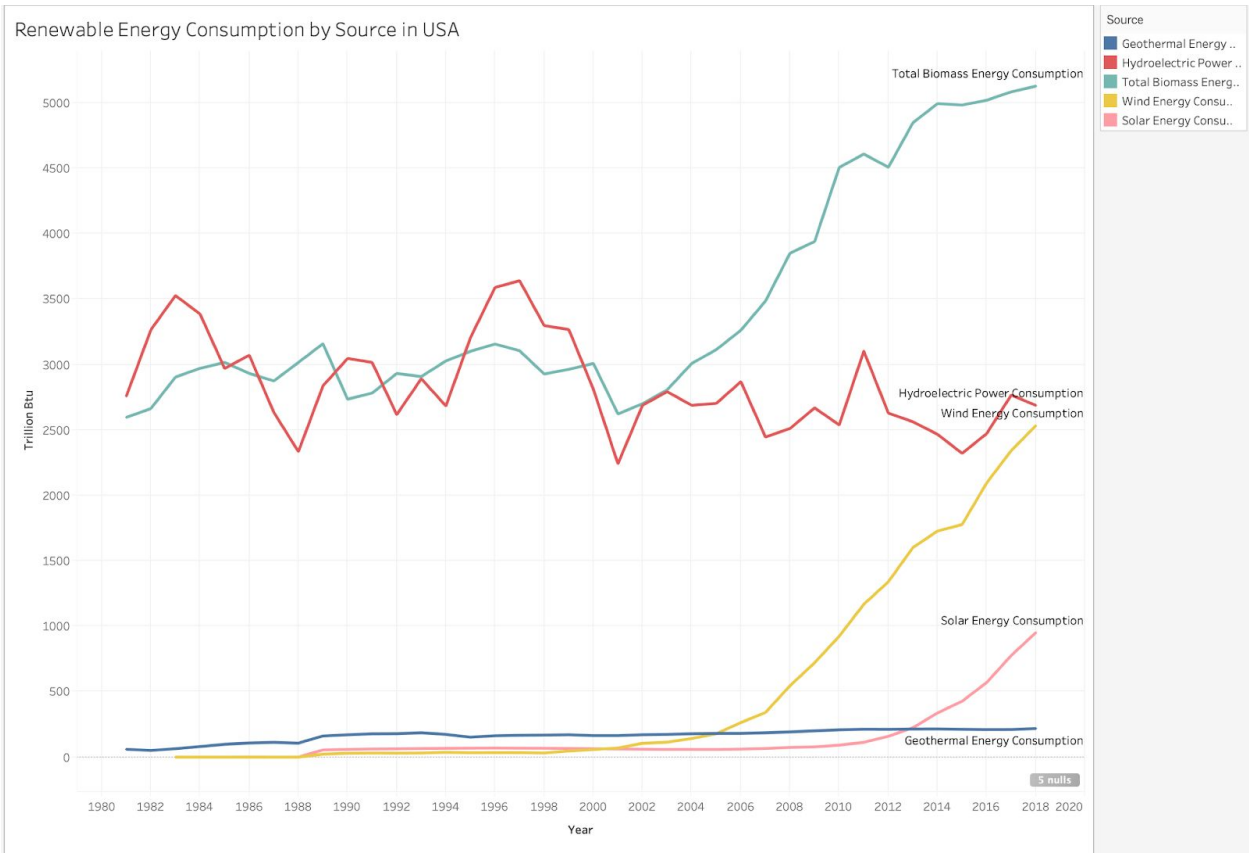


- Scatterplot

The scatter plot below shows the total petroleum field production in USA from 1973 to 2018. I t shows that the total production started decreasing since 1988 but then increased again starting from 2008.

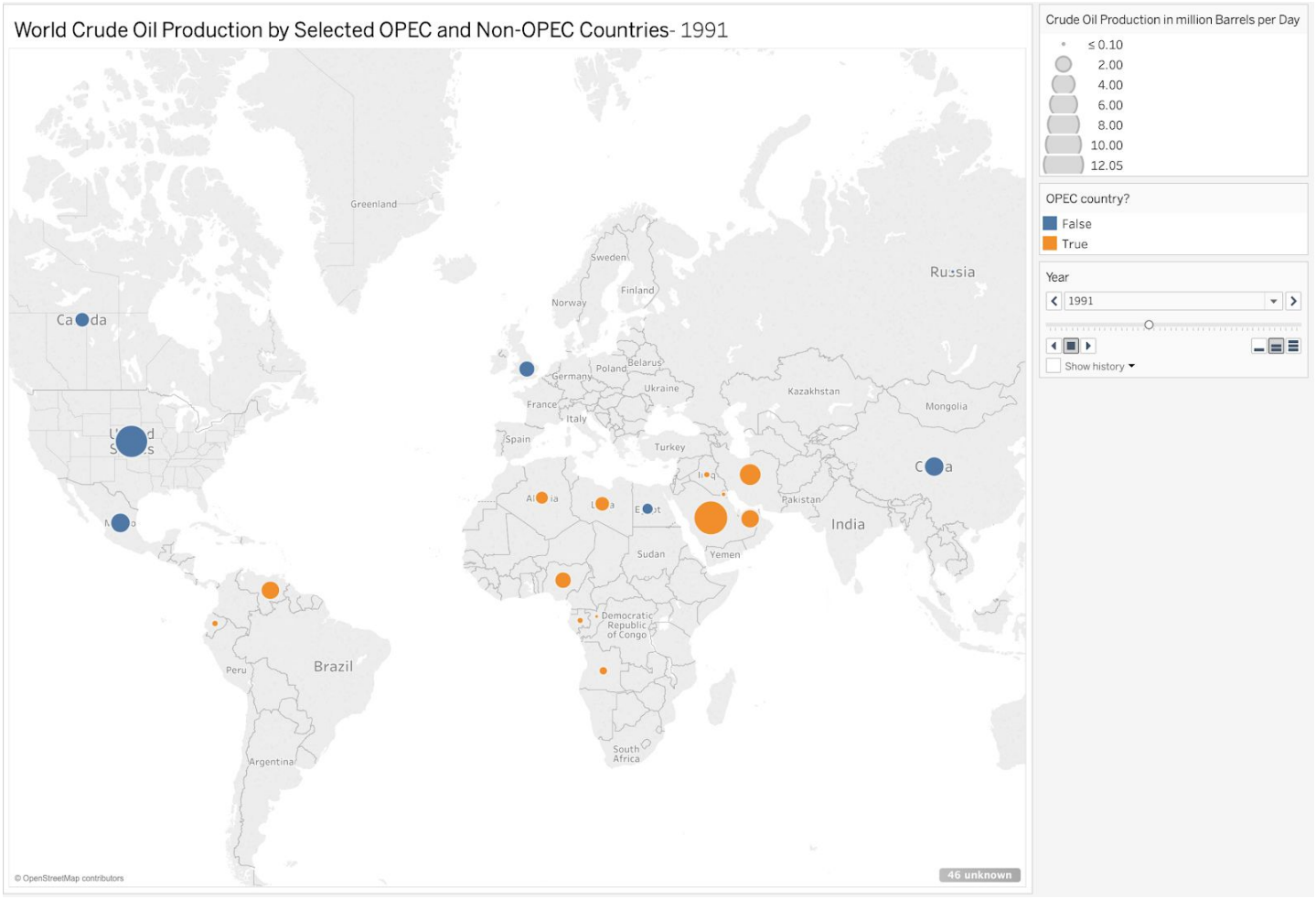


The below scatter plot (line) shows the renewable energy consumption segmented by source. The biomass energy including wood, waste, and biofuels have the lion share for consumption in the USA.



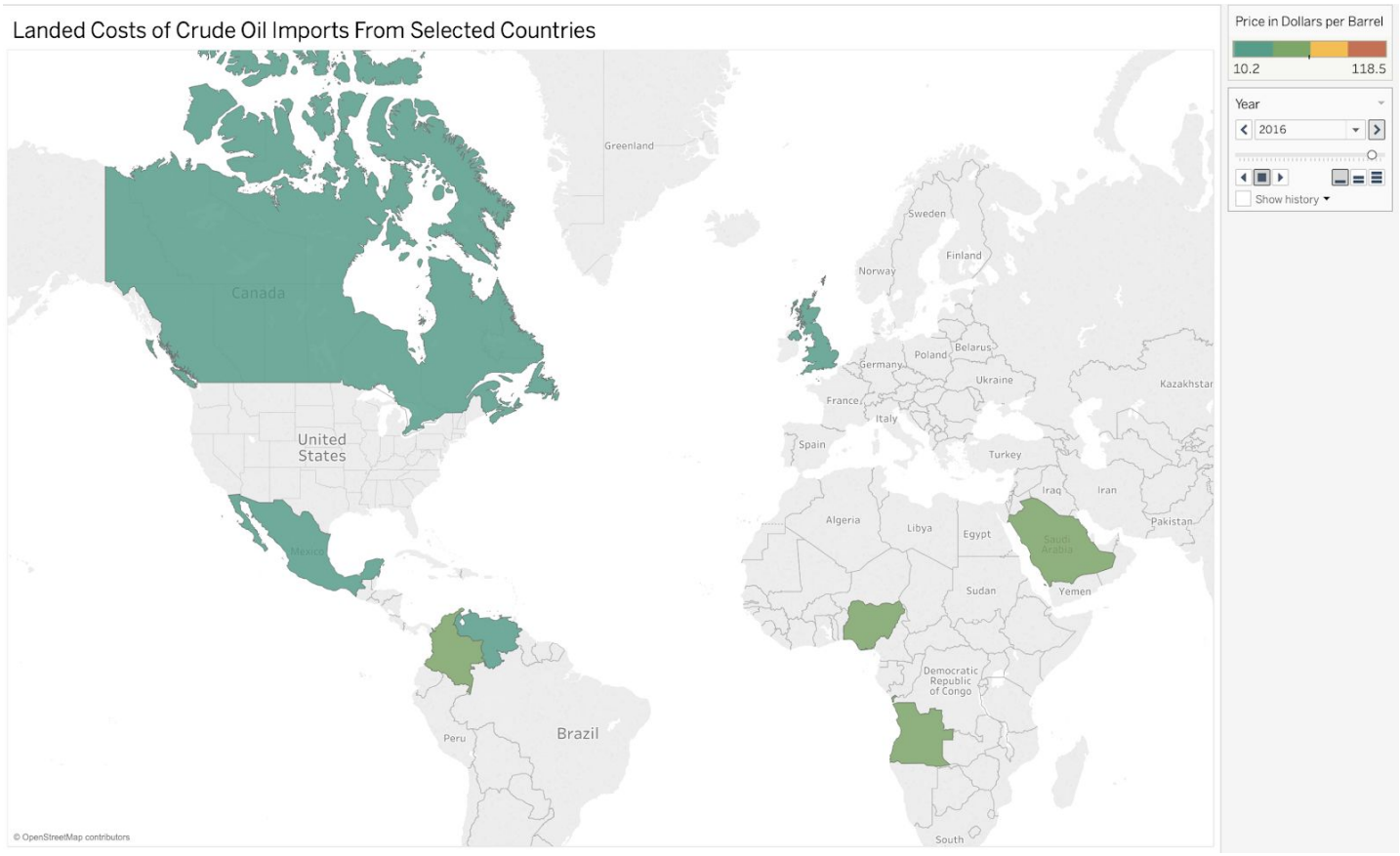
- Bubble Map

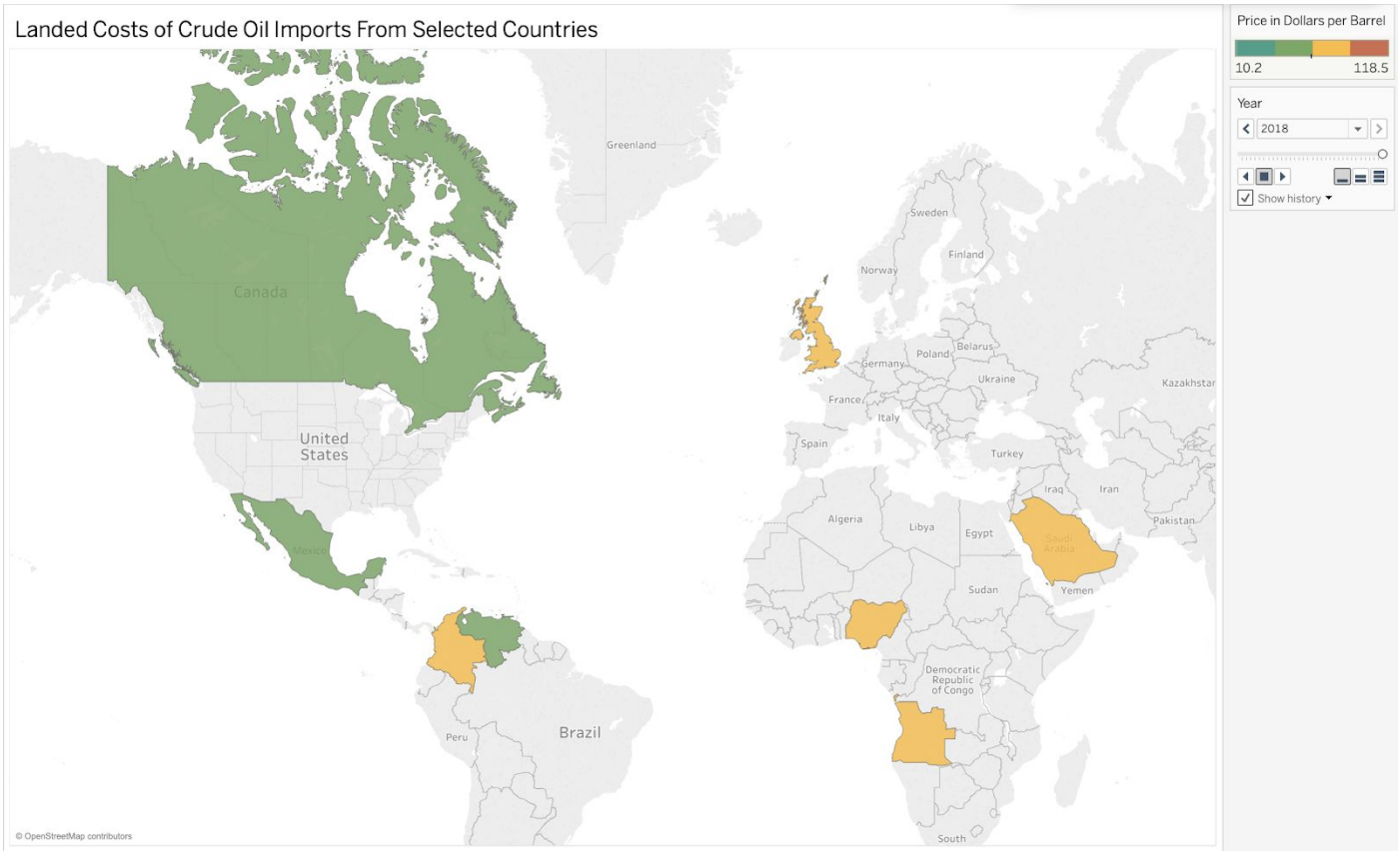
I used bubble map to explore the crude oil produced by both OPEC and non-OPEC countries in the world. In order to do so, I used an interactive map to get these values over the years from 1973 to 2018.



- Chloropleth Map

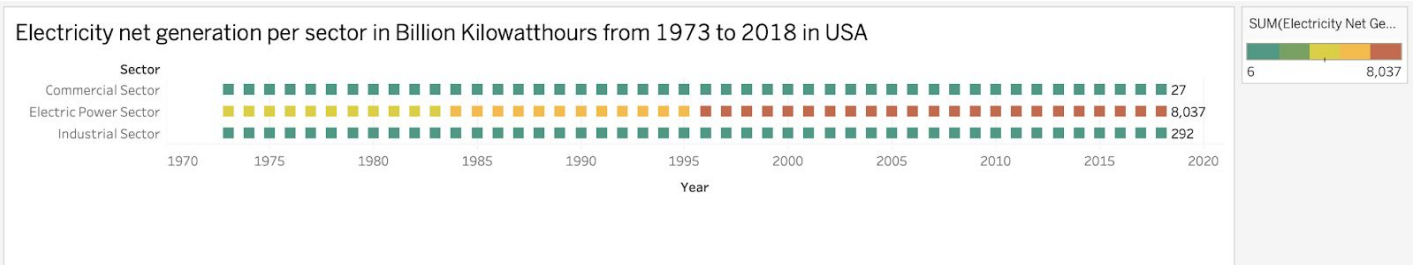
I used Chloropleth map to visualize the change in the costs of crude oil imports from selected countries to USA. The cheapest ones in 2016 were Canada, Mexico, United Kingdom and Venezuela. But in the second map, we can see that United Kingdom is no longer considered cheap source for importing crude oil. Also, all the three other countries mentioned above have higher corresponding costs.





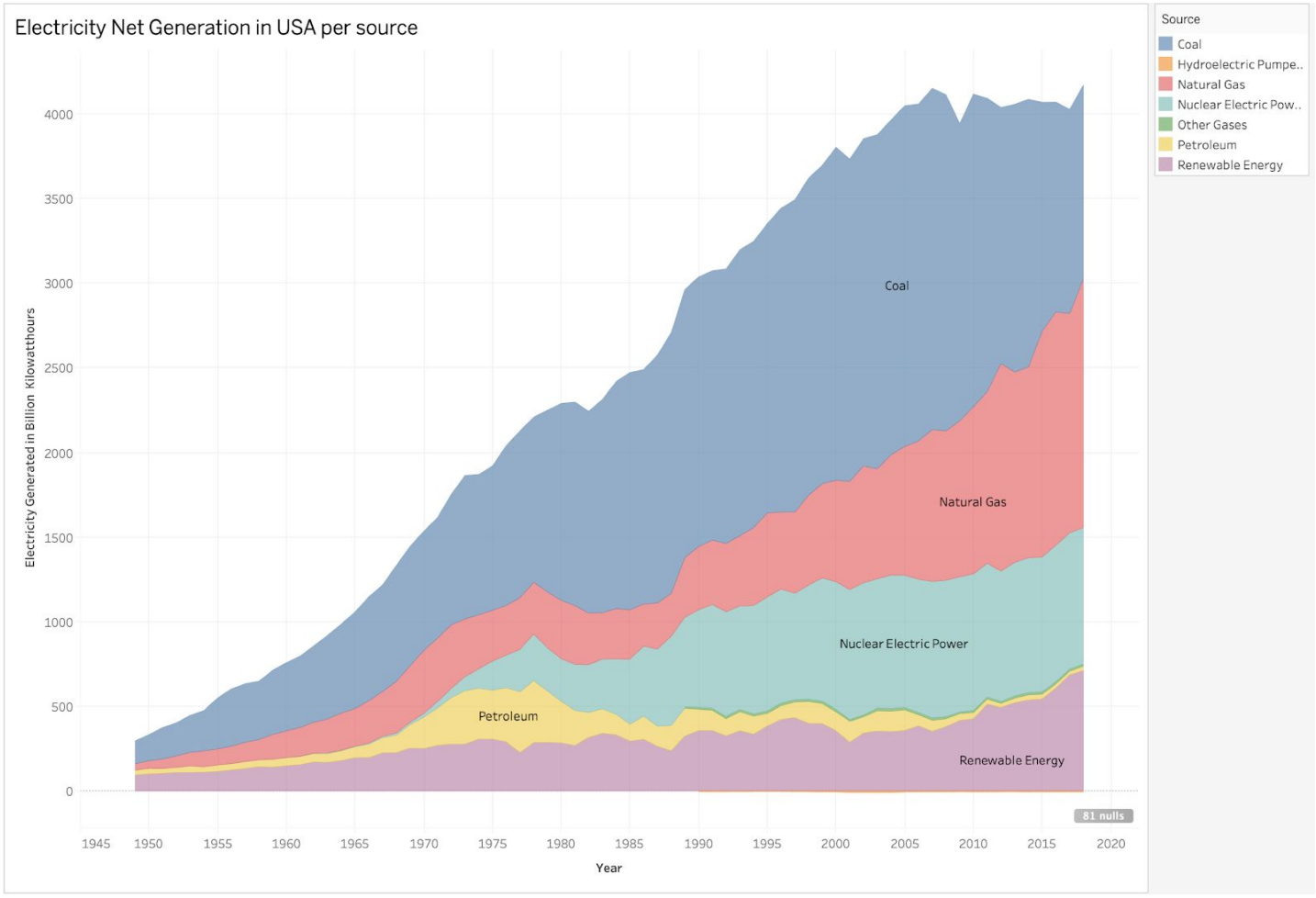
- Heat map

In the heat map below, I visualized the electricity generation per sector. In fact, the electric power sector is the main sector generating electricity in USA in total from 1973 to 2018. Also, the electricity generated increased significantly starting from 1996.



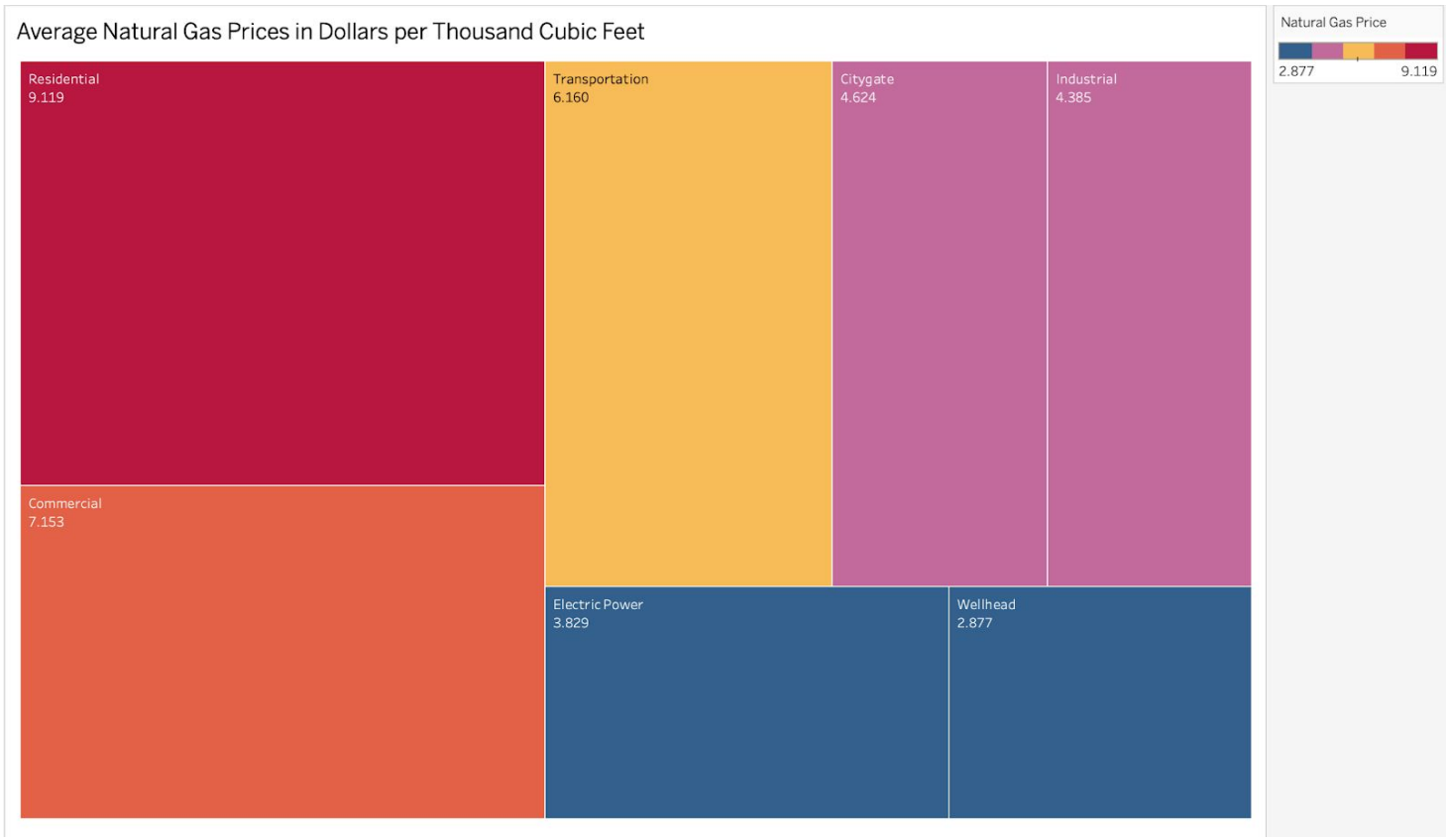
- Stacked area or stream graph

The stacked area graph below shows the electricity generation in USA per source from 1949 to 2018. We can see a significant increase in quantity generated over years and we can see also that coal has been always the main source for generating electricity in the USA.

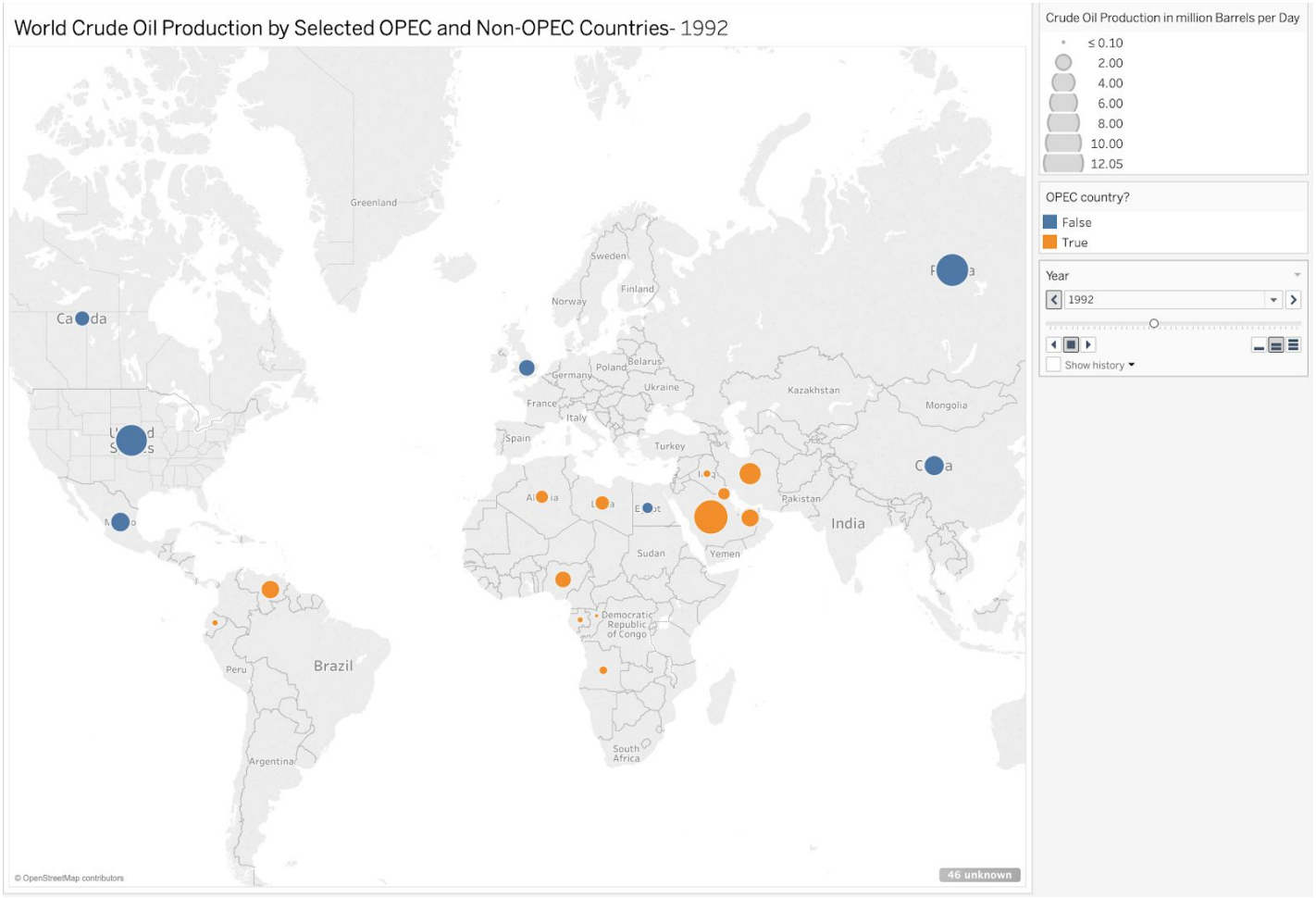


- Treemapping

The tree mapping graph shows the average natural gas prices segmented per sector. The residential sector has the highest prices were electric power and wellhead have the cheapest ones.



3. Storyline


World Crude Oil Production by Selected OPEC and Non-OPEC Countries- 1992
Crude Oil Production in million Barrels per Day
≤ 0.10
2.00
4.00
6.00
8.00
10.00
12.05
OPEC country?
False
True
Year
1992
Show history
Greenland
Sweden
Finland
Norway
Poland
Belarus
Germany
Ukraine
France
Italy
Spain
Turkey
Kazakhstan
Mongolia
Pakistan
India
Sudan
Yemen
Democratic Republic of Congo
Brazil
Peru
Argentina
South Africa
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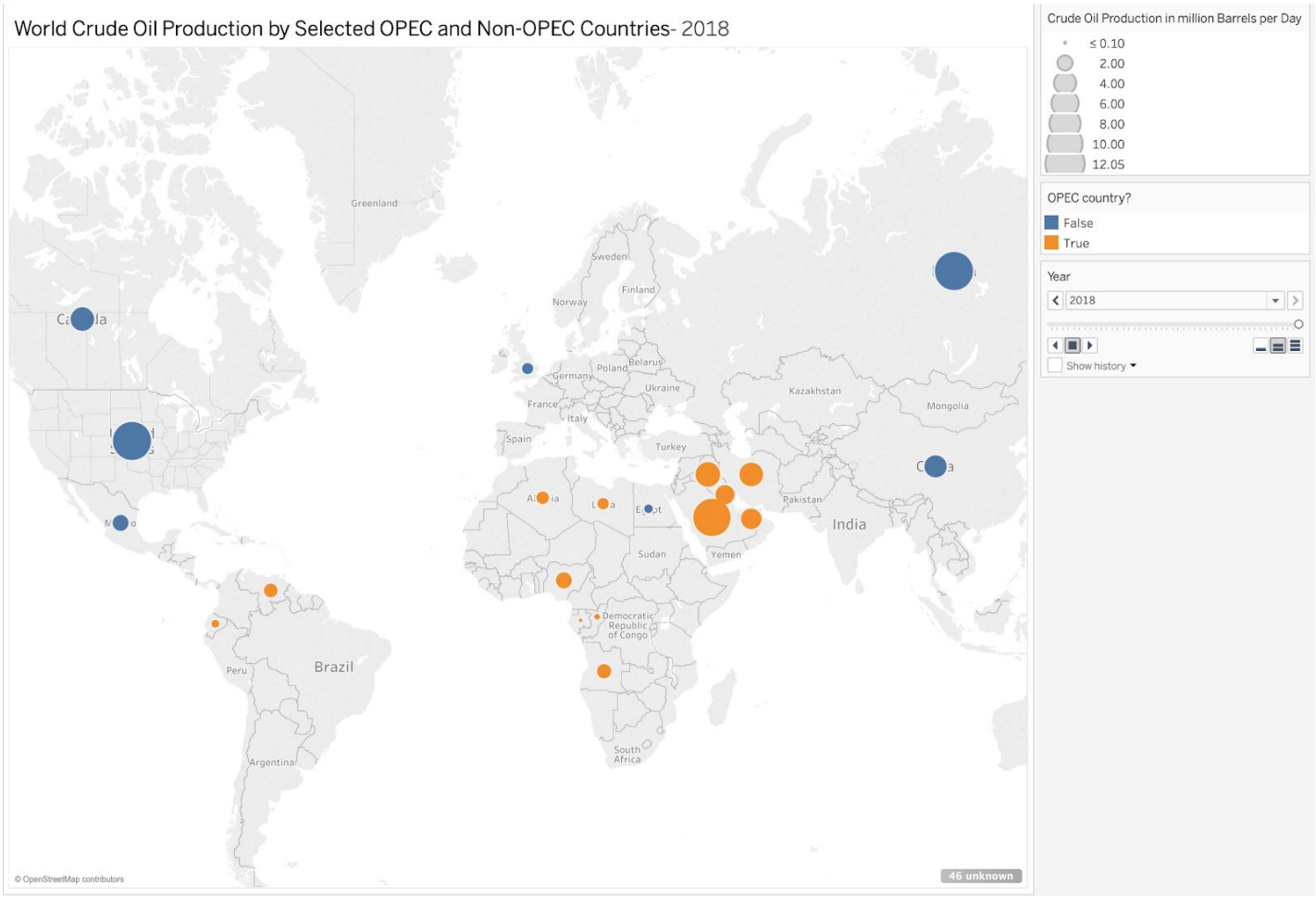
46 unknown



We can see from the first bubble map above that Russia increased significantly its production in crude oil from 1991(please see map in summary section for the year 1991) to 1992. Also, US increased its oil production starting from the year 2010 while Mexico decreased its production. Moreover, for the OPEC countries, Saudi Arabia has been always dominating the oil production but also Iraq started to be an important producer in the year 2014 along with Iran, Kuwait and United Arab Emirates.

Besides, according to my findings in the homework 7, between the years 1984 and 2004, the exports were significantly less than the imports from the OPEC countries. Which means that the US was trying to store the petroleum from these countries.

Starting in 2014, the total annual exports started to get over the total annual imports from OPEC countries. That shows that US is importing crude oil and exporting processed and expensive petroleum products and making profit from that. Also, the “cloropleth maps” show that the closest countries to US have actually the lowest cost for importing crude oil which can be explained by the expensive shipping of huge quantities of oil from fairest countries.

Also, we can conclude that US is trying to produce and use more environment friendly source of energy such as the renewable energies which took over the petroleum in producing electricity over the past decades.

4. Conclusion

In conclusion , we can say that the petroleum is very important energy source in US and all the world and there are few countries dominating the production of the black gold such as US and Saudi Arabia. But, Us is trying to make more profit from exporting expensive processed petroleum products using sophisticated technologies and refineries instead of just exporting crude oil.
In the other hand, we can not denied the strategy of US for greener sources of energy such us the renewable energies that represented an important sources since 2002 when the biomass energy consumption started to increase significantly. Also the wind and solar energies showed a great increase in consumption more recently.

5. Github link

Please see the link below for the github repository where you can find all the code I used to generate the above plots.
https://github.com/moussaifi/data_viz_final