Sudeep Kakarla
U84798931

# UNIVERSITY OF SOUTH FLORIDA
## MUMA COLLEGE OF BUSINESS
## TAMPA

**Data Visualization – ISM6419**
By
Dr. Johannes Reichgelt

## FINAL PROJECT REPORT

Title:

## ELECTRICITY GENERATION AND ITS SOURCES AROUND THE WORLD

# INTRODUCTION:

Electricity has become an essential commodity that powers our daily lives. It is used to light our homes, run appliances, and power the industries. The demand for electricity is rapidly and constantly increasing, and as such, it is essential to explore different sources of electricity generation to meet this demand sustainably. In this research project We will examine the different methods of electricity generation used around the world, including fossil fuels, nuclear power, and renewable energy sources such as solar, wind, and hydroelectric power. We would look into the amount of electricity generated by each country around the world, the imports, exports, demands and impacts etc.

**The main motive of this project** is to look into the current scenario of what extent we are dependent on electricity and gain some insights of what and how we can meet the electricity demands in the future keeping in mind the impact on the environment. This can be achieved by looking into the historical data to present years data and analyze to find out a trend and patterns that can provide us solutions for our research questions.

**Research Questions:**

- Is the world meeting the demand of electricity?
- What are the main sources of electricity?
- What range of emissions are being produced in order to generate electricity?
- How is demand is related to population and population growth?
- How many people in the world are not able to access electricity?

# METHODOLOGY:

I have taken steps to obtain information from a variety of different sources., some of which include websites of EMBER.ORG(Which has continent and country wise emissions data), data.world, kaggle, and our world data. Which included data of electricity production, imports, exports, emissions populations etc. Once I was ready with the data required I had made some efforts in cleaning the data and making it meaningful without any noise or bad data. I then linked the data sources with the entities possible and also created few calculated fields to analyse the data in order to get solutions for the research questions. I also converted megawatt hours to terawatt hours in order to make the analysis easy in some cases.

**Data Sources:**

https://data.world/project-data-viz/electricity-production-by-source-1965-to-2021

https://ourworldindata.org/world-population-growth

https://ember-climate.org

https://www.kaggle.com/datasets/pralabhpoudel/world-energy-consumption

https://ourworldindata.org/grapher/per-capita-electricity-generation?tab=chart
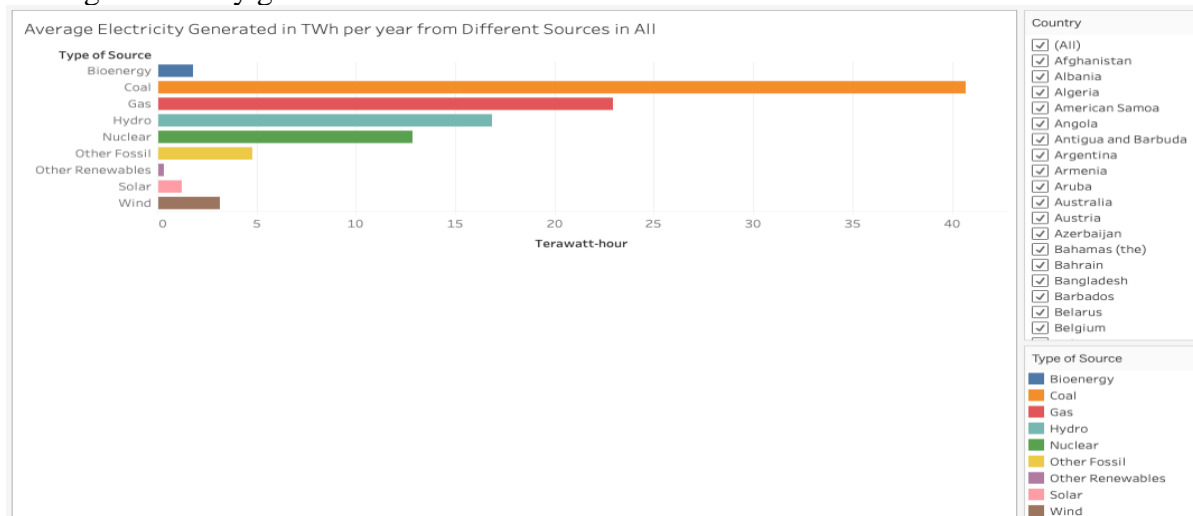
# ANALYSIS:

Average electricity generated in TWh from different sources and countries



Each year, from each country electricity is generated in different amounts from different sources. With help of this visualization I wanted to know how much average electricity was generated from different type of sources by countries over a period of time. Adding country as filter helped me in looking into depth of electricity sources in each country again. I can clearly notice that what are the different sources of electricity and which one among them being the main source. With this visualization I can answer the research question, what are the different types of electricity sources and also, I can notice that Coal to be the highest contributor of electricity around the world.

The proportion electricity source in total generated electricity
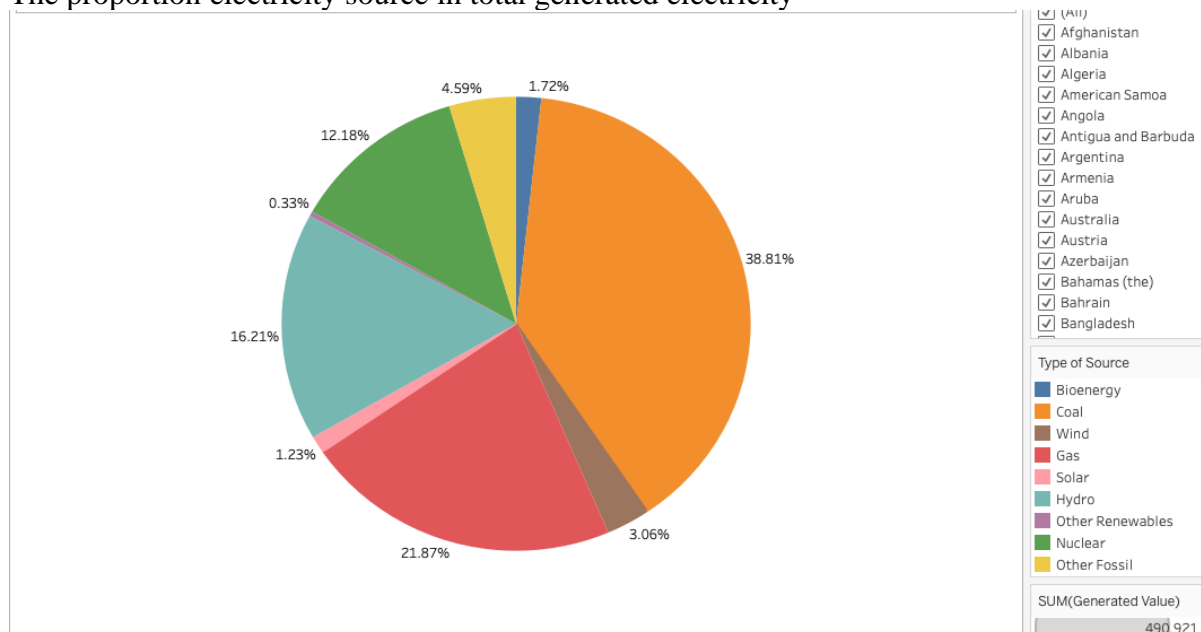


With this, I can analyze the exact proportion of each source in total electricity generation and get insights on what source the world needs to concentrate on if the main source gets extinct.

Comparing Demand with Generation of Electricity-
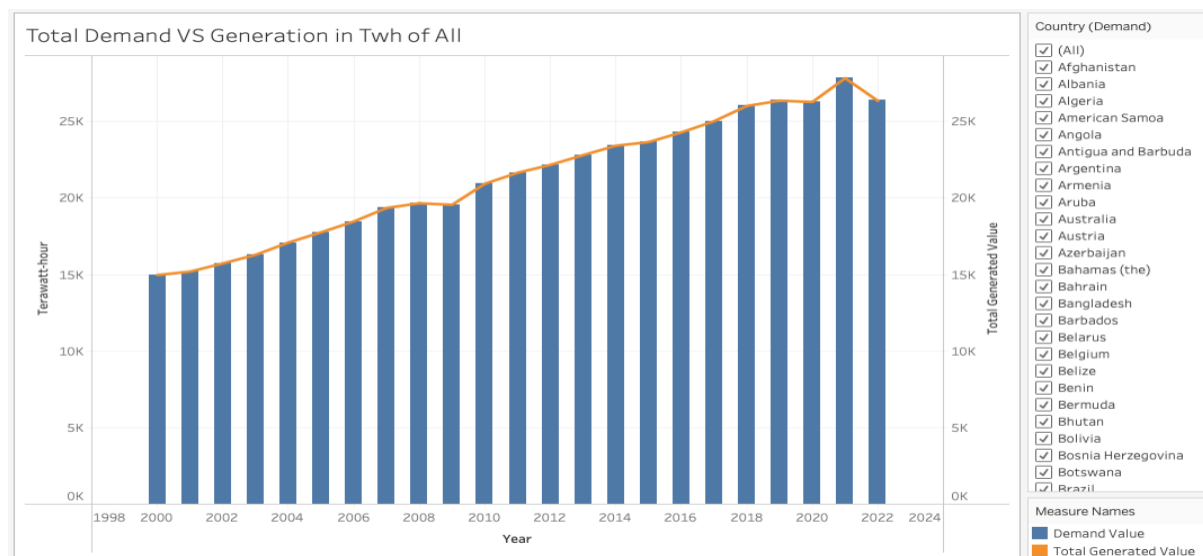


Demand of electricity is a term which explains how much minimum electricity need to be in place to meet minimum requirements of the country. I have created a DUAL AXIS visualization which explains demand and generation, The line here indicated electricity generation in the whole world and blue bars indicate the demand each year. Upon looking into the visualization, I can answer the research question that demand is being met in most of years, but, a little lower electricity was generated than demand in 2021.

Net imports of electricity by continent in TWh each given year-
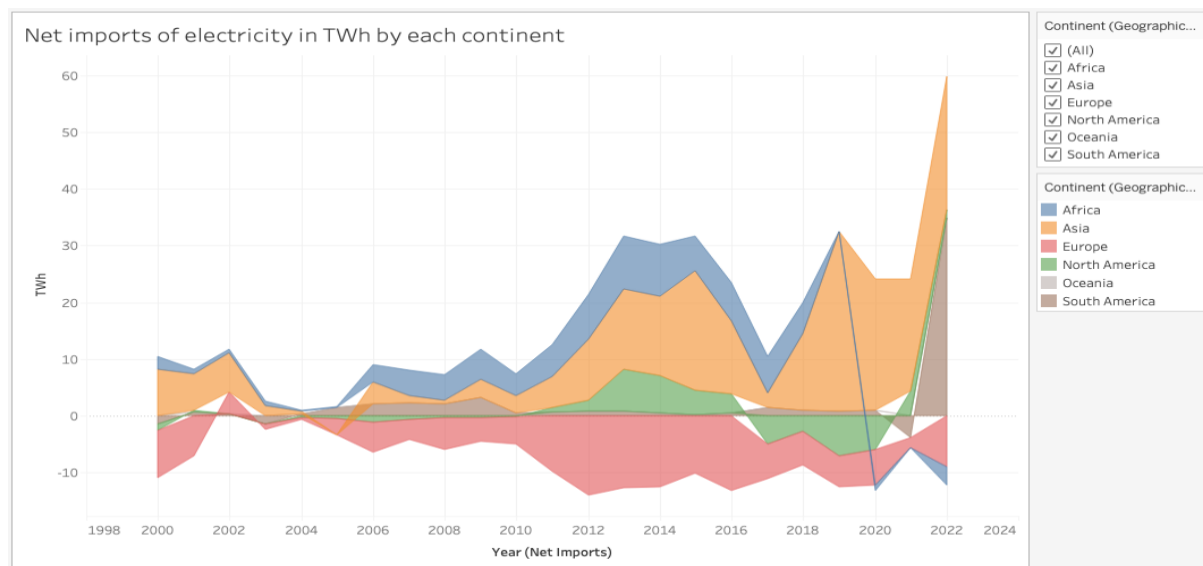


Although, we have net imports here, the values below the zero line can be treated as exports. After analysis of the above area graph filtered by continent, there were highest imports in 2022 by Asia, which answers the question if a continent is not able to meet the electricity requirements by generating on its own.

Top countries producing electricity-
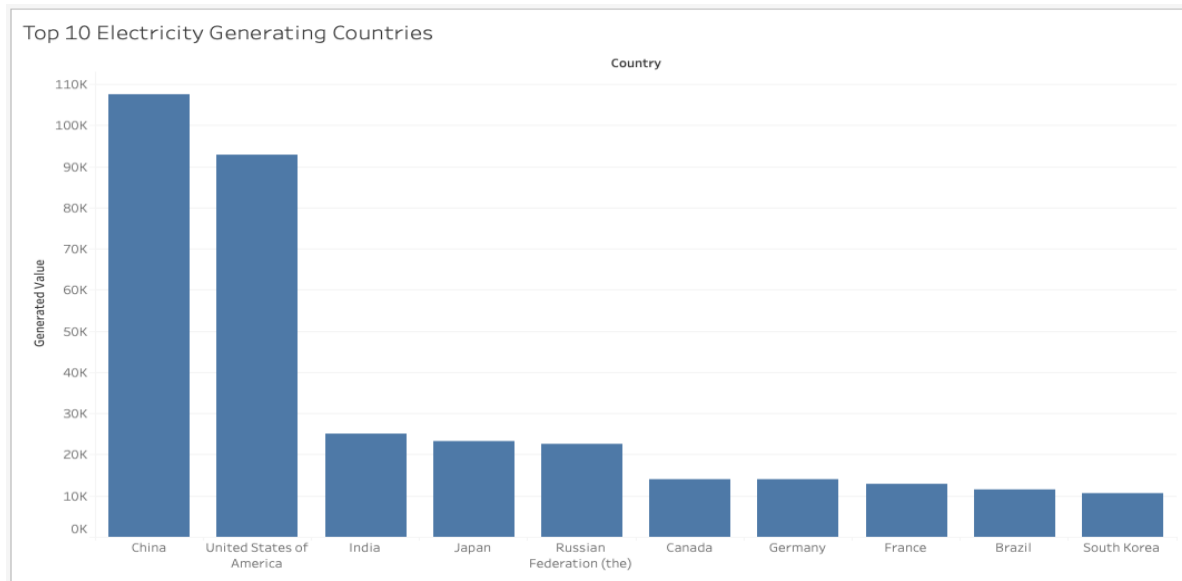


In this visualization I wanted to know what are the top countries producing electricity so that I can know what range of emissions are being produced from that particular country.

Countries producing high emissions from their power sectors-
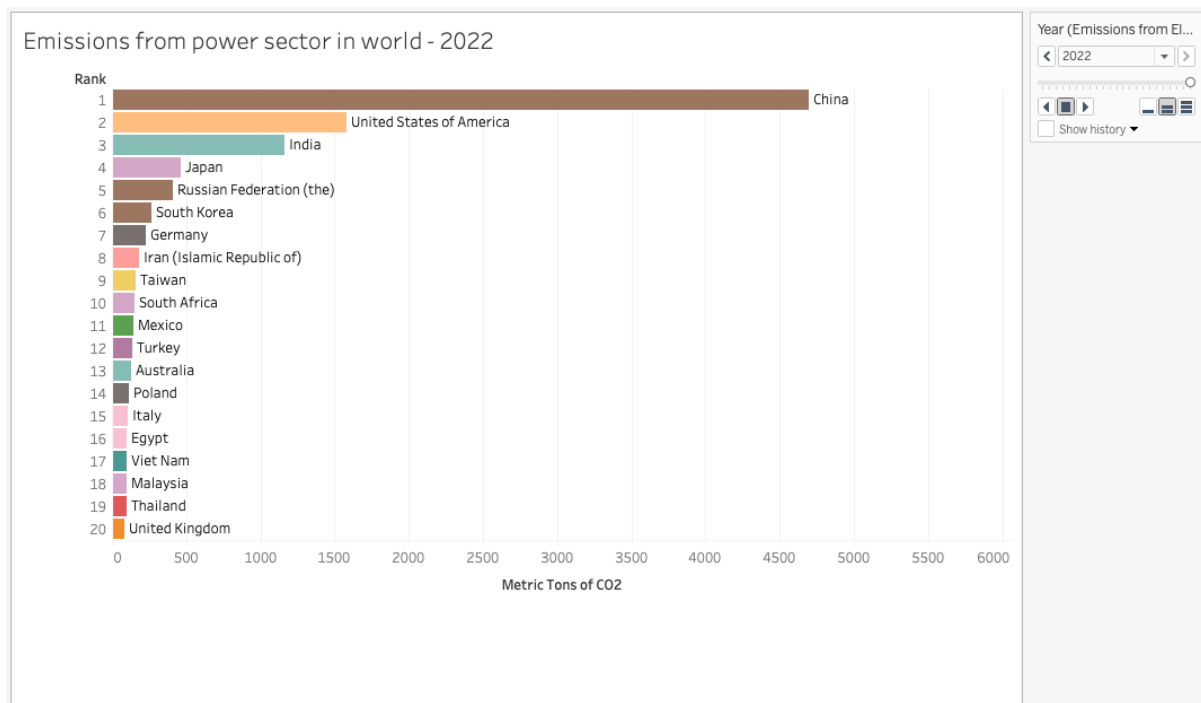


This is an animated visualization I created, to look at the countries trend in producing emissions from their respective power sectors. While China being in the top and USA, followed by India. There is a relation between the top electricity generators to emissions, the more electricity generated the more emissions seen because the main source being COAL.

Population trend over years
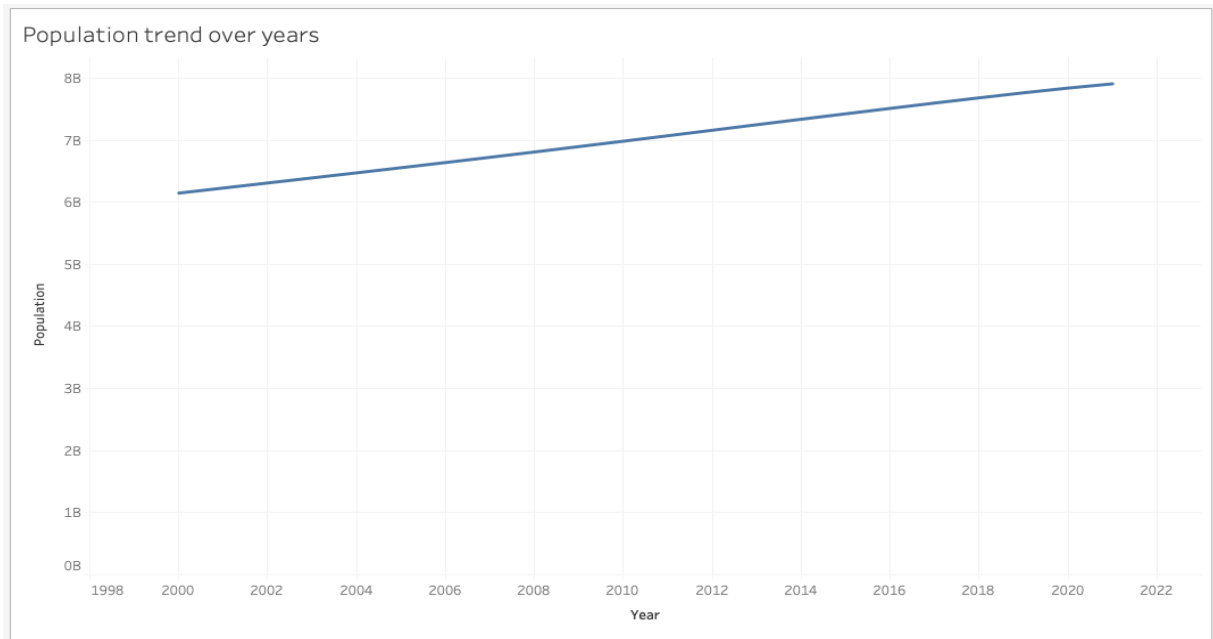
Here, I am comparing both trends of population change and demand change over years. I wanted to analyse if there was any relation between the population and electricity demand trends. While I created two of the visualizations, I noticed a clear increasing trend for both, If we can observe the population is constantly increasing over years and the same is with the demand. Hence this answers our research question of any relation between population growth to electricity demand.



Demand Trend over years

Average Demand Per Capita vs Generation Per Capita in KWh
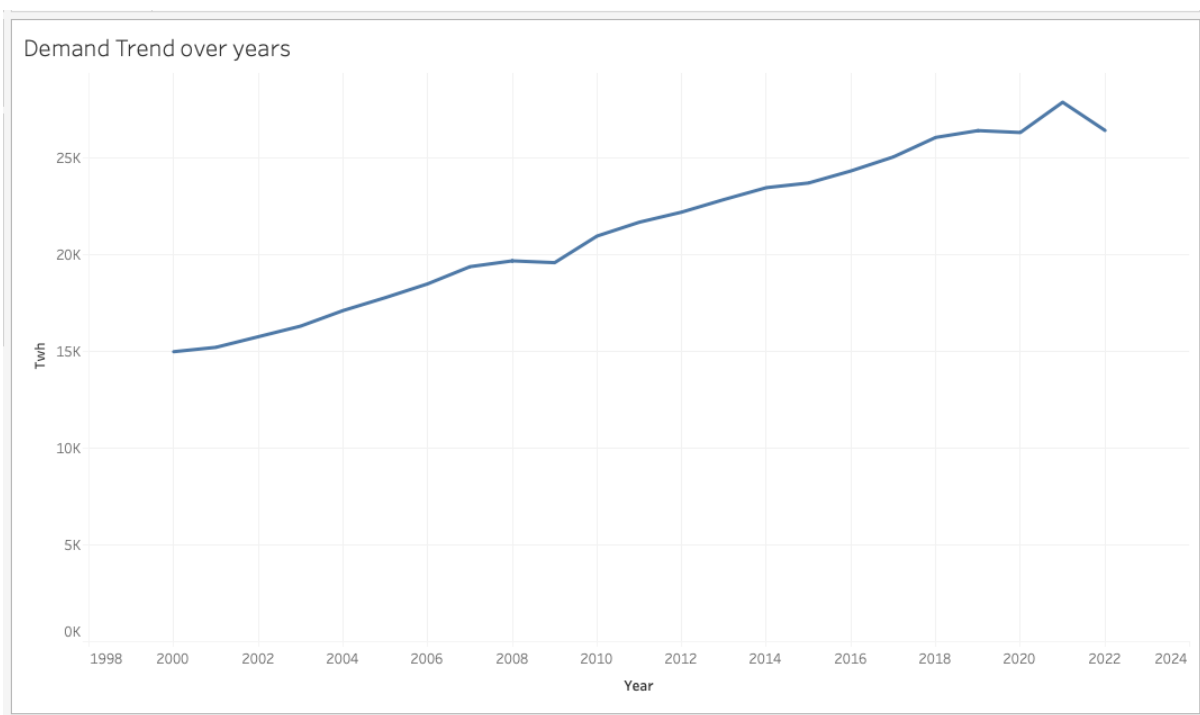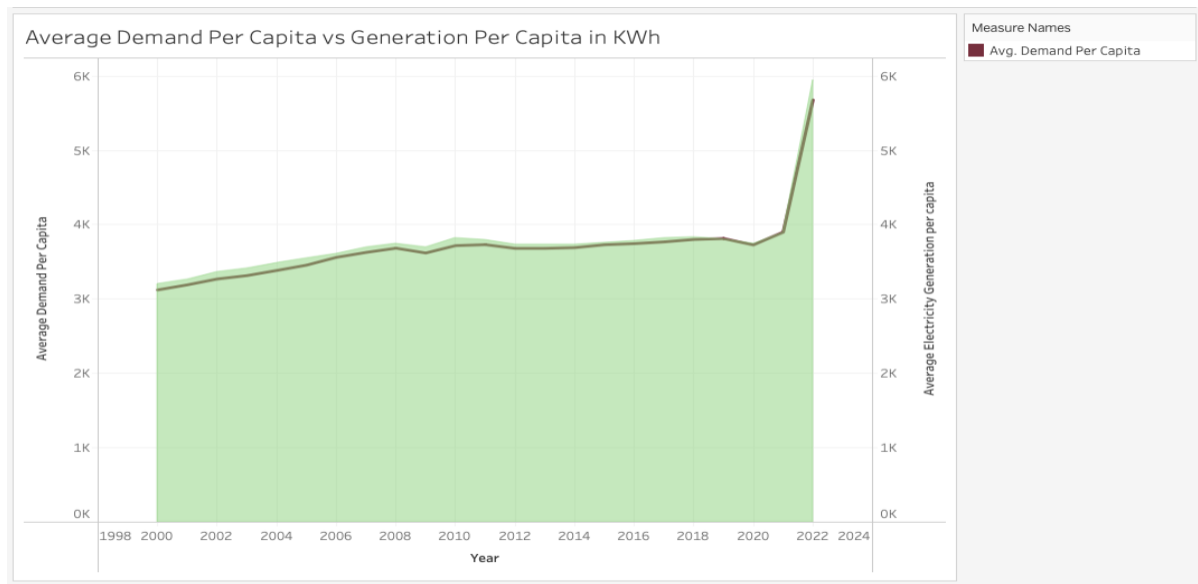
In this visualization I am comparing average per capita demand and average per capita electricity generation. I made a transformation from MWh to KWh in order to make it easy to compare. This is a Dual Axis visualization where I used line for demand per capita and area graph for generation per capita and the demand was always met by the generation ratios, except in the year 2022 where generation was more than the demand, this answers us the question if per capita demand is being met every year.



Number of people in world without access to electricity over years
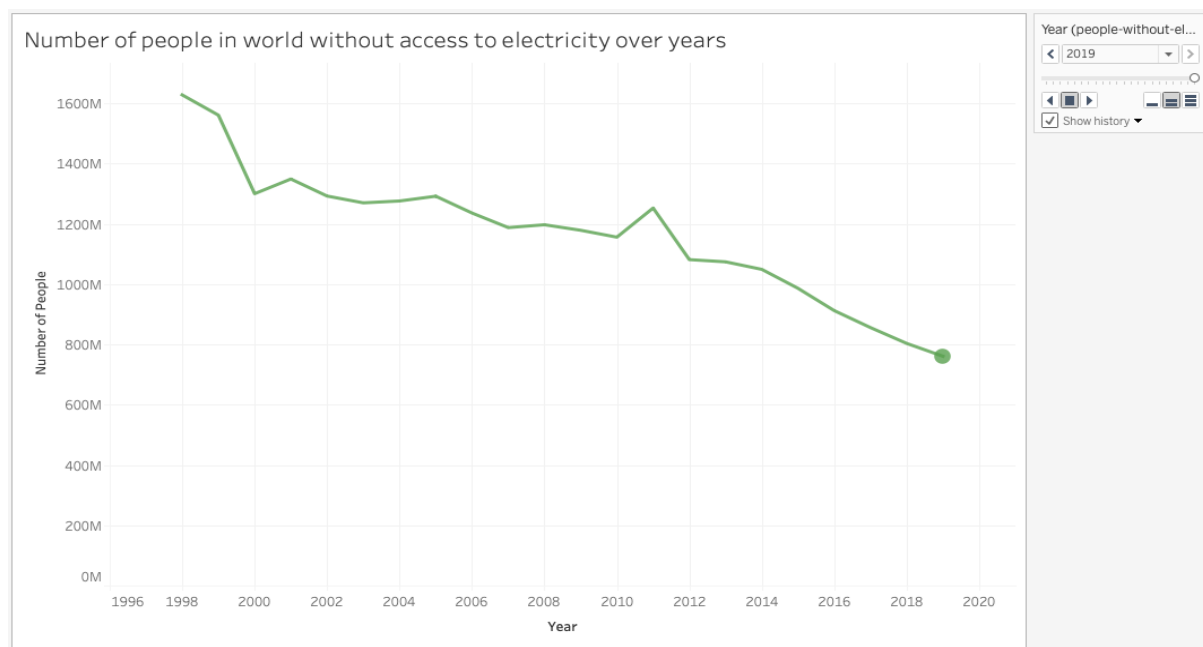
This is an animated visualization, which shows the trend of people without electricity access, there is a constant fall in number of people without electricity access over years which is a good sign. This can answer the research question how many people in the world don't have electricity access and how this trend is going over the years.

## Electricity Generation(Sources) and Demand Dashboard

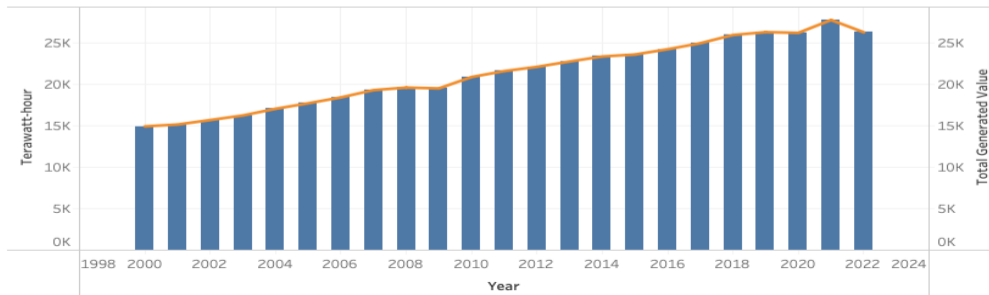### Average Electricity Generated in TWh per year from Different Sources in All
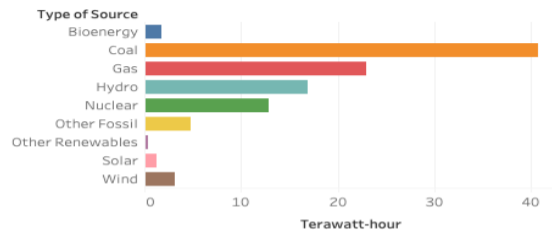


### Proportion of Electricity Source from which electricity is generated.
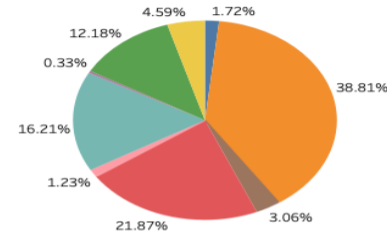


**Country**
- ☑ (All)
- ☑ Afghanistan
- ☑ Albania
- ☑ Algeria
- ☑ American Samoa
- ☑ Angola
- ☑ Antigua and Barbuda
- ☑ Argentina
- ☑ Armenia
- ☑ Aruba
- ☑ Australia
- ☑ Austria
- ☑ Azerbaijan
- ☑ Bahamas (the)
- ☑ Bahrain
- ☑ Bangladesh
- ☑ Barbados
- ☑ Belarus
- ☑ Belgium
- ☑ Belize
- ☑ Benin
- ☑ Bermuda
- ☑ Bhutan

**Type of Source**
- Bioenergy
- Coal
- Gas
- Hydro
- Nuclear
- Other Fossil
- Other Renewables
- Solar
- Wind

**Measure Names**
- Demand Value
- Total Generated Val..

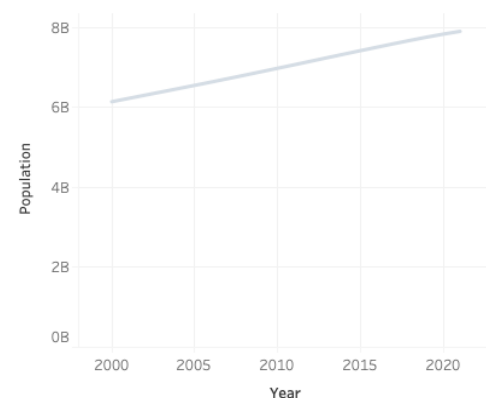### Total Demand VS Generation in Twh of All



These two dashboards have been created with the sheets that I have created to make it easy for the users to understand set of analysis. Like the sources/demand and trends.

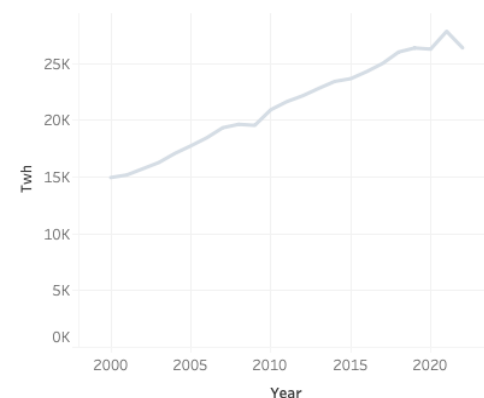### Average Demand Per Capita vs Generation Per Capita in KWh
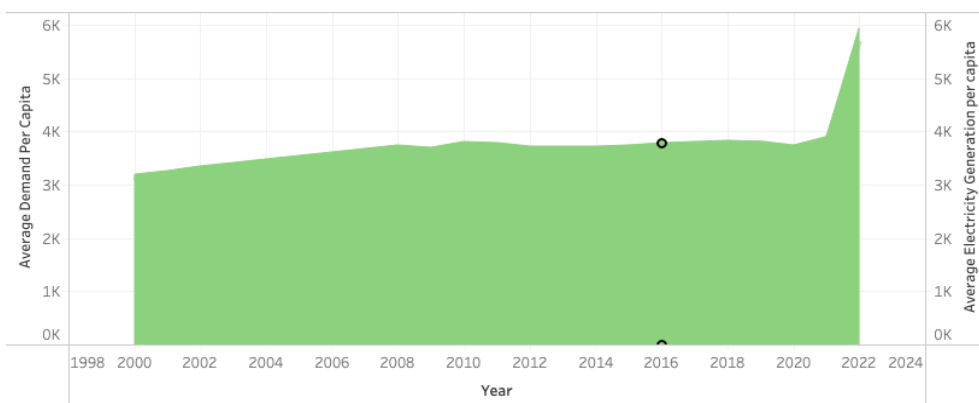


**Measure Names**
- Avg. Demand Per Ca..

### Population trend over years



### Demand Trend over years

## CONCLUSION:

Upon thorough analysis using good amount of visualizations in order to find some key points, trends and patterns, on the data that I used, I can answer the research questions below,

- Is the world meeting the demand of electricity?
  Looking at the comparison visualization of demand to generation, overall the world is currently meeting the demand of electricity.

- What are the main sources of electricity?
  There are numerous sources of electricity from which world draws the power from, such as Coal, Hydro power, Winds, Solar, Gas, Bio-energy, Other fossils, Other renewable sources, nuclear power. Among these Coal is the main source for electricity in the world

- What range of emissions are being produced in order to generate electricity?
  As previously answered Coal is being used as main source of electricity, as a result there are huge number of emissions generated from all the power sectors. China being on the top with 4700 metric tons of $CO_2$, followed by India and USA.

- How is demand is related to population and population growth?
  Using the data for years on demand and population, I have created a line charts which shows the trends of the both upon clearly looking into the trends, I can conclude that with growth of population the demand for electricity will also increase.

- How many people in the world are not able to access electricity?
  Although the trend for number of people without electricity access in the world is showing a downwards graph which is a good sign, there are still around 800 million people in the world without electricity.

## Additional Research Questions that I Identified:

- What are the sources of electricity that are going to be being extinct soon?
- Cost of imports and exports of electricity between countries?
- What sources of electricity can reduce the emissions of $CO_2$?
- Relation between fluctuation in GDP to fluctuation in consumption of electricity?

Thank You.