

# ELECTRICITY

## PROJECT OVERVIEW

Access to electricity & Energy is particularly crucial to human development as electricity is, in practice, indispensable for certain basic activities, such as lighting, refrigeration, and household appliances, and cannot easily be replaced by other forms of energy.



# KEY QUESTIONS

## Energy Access and Consumption:

- Energy access and consumption patterns are directly linked, allowing for the categorization of regions for infrastructure development based on their energy access and consumption patterns.

## Carbon Emission Forecasting:

- Access to electricity shows a weak to negative relationship with low carbon emissions.

## Energy Equity Analysis:

- GDP per capita has a moderate positive relationship with access to electricity and access to clean fuels for cooking.

## Renewable Energy Potential Assessment and Investment Strategies:

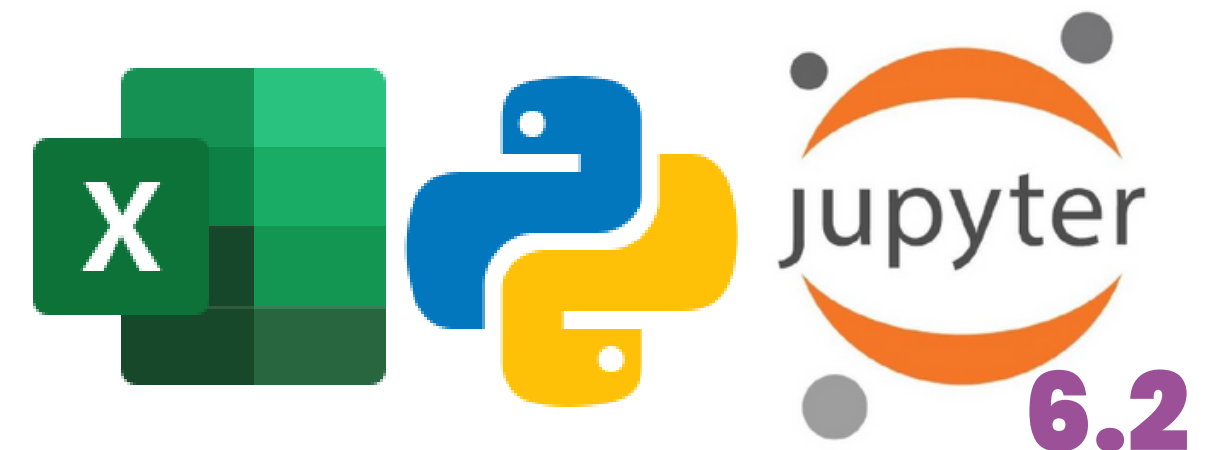
- Renewable energy potential is moderately positively correlated with GDP per capita, and higher usage could reduce overall energy consumption rates.

# TOOLS/SKILL

- Python
- Data wrangling & subsetting
- Data consistency
- Data combining & exporting  
Deriving new variables
- Grouping data
- Aggregating variables
- Data visualization with Python
- Reporting in Excel

# DATA SET

- Electricity dataset provided | via from kaggle.



# EXPLORING RELATIONSHIPS

## Exploring relationships using heatmap

### Variables Analyzed:

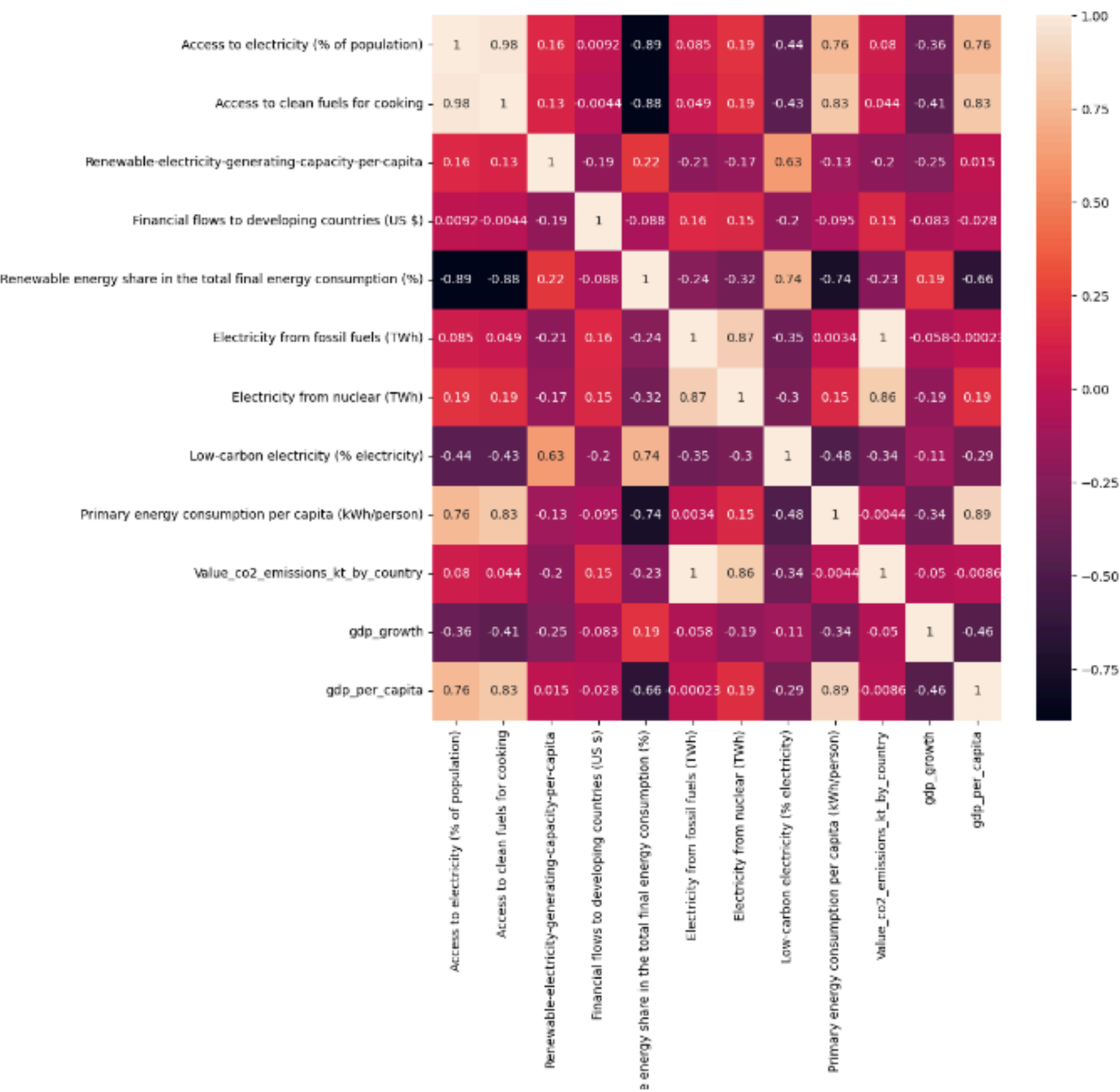
- The analysis considers variables such as **electricity access, clean cooking fuel access, GDP per capita, renewable energy consumption, and carbon emissions.**

### Correlation Analysis:

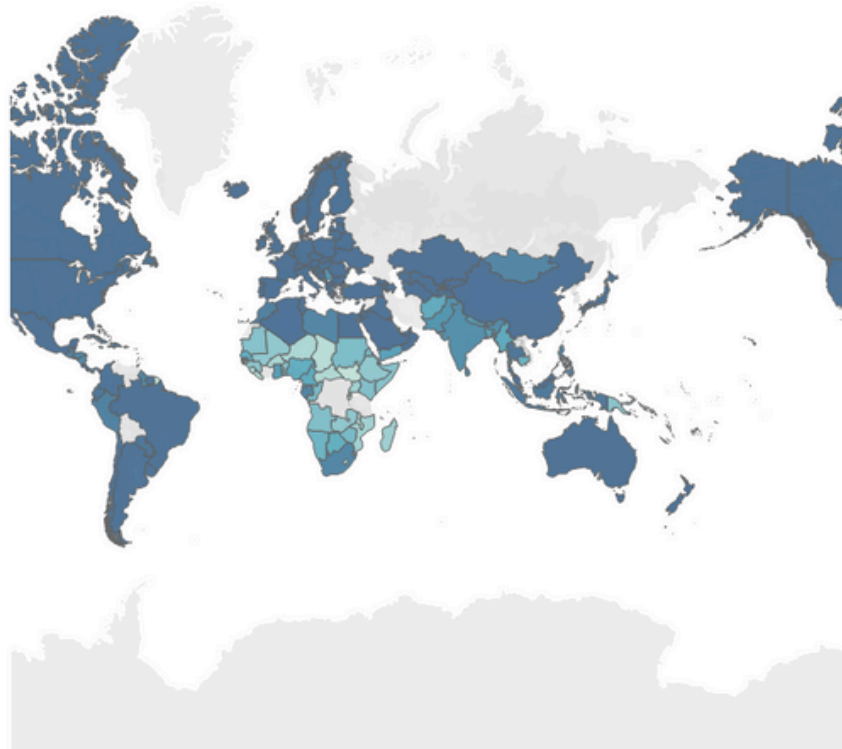
- High GDP per capita correlates with better access to electricity and clean cooking fuels, suggesting wealthier regions have better energy access. However, a negative correlation may exist between electricity access and carbon emissions, suggesting other factors influence these relationships.

### Interpreting the Heatmap:

- The heatmap is interpreted using color coding, with warm colors indicating strong positive correlations, cool colors indicating strong negative correlations, and neutral colors indicating weak or no correlation.



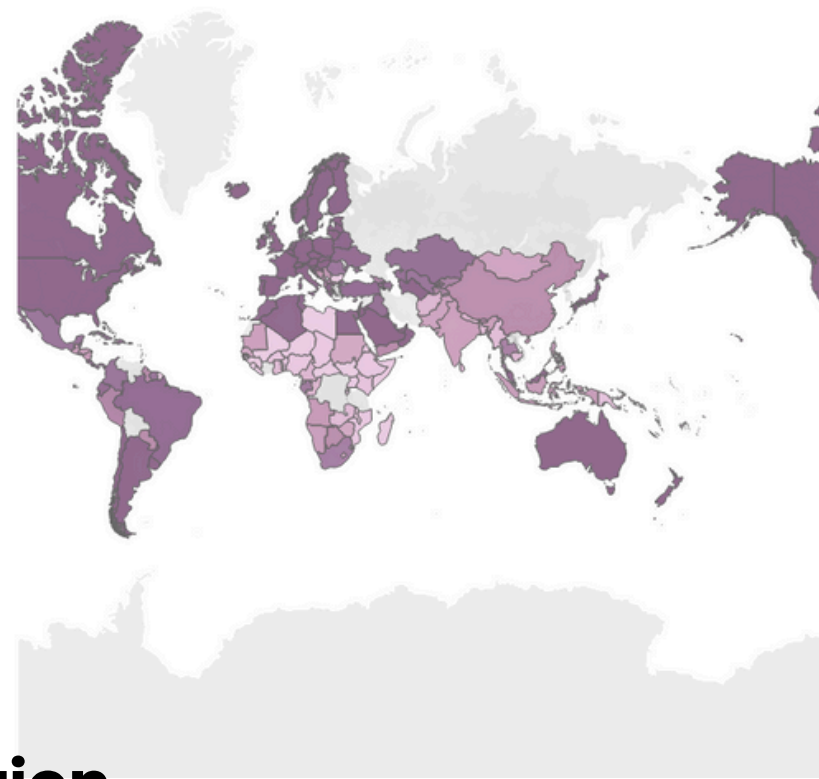
Geospatial analysis of Access to electricity by population across Global



## Access to electricity % of the population

- The choropleth map reveals that countries like Gabon, Ghana, and Algeria have a significant percentage of their population accessing electricity, while all South American countries and a good percentage of Asia have access.

Geospatial analysis of Access to clean fuels for cooking by population across Global



## Access to clean fuels for cooking

- The choropleth map reveals that only a few African countries, such as South Africa, Algeria, and Gabon, have access to clean cooking fuels, while all South America, Asia, and Australia do.

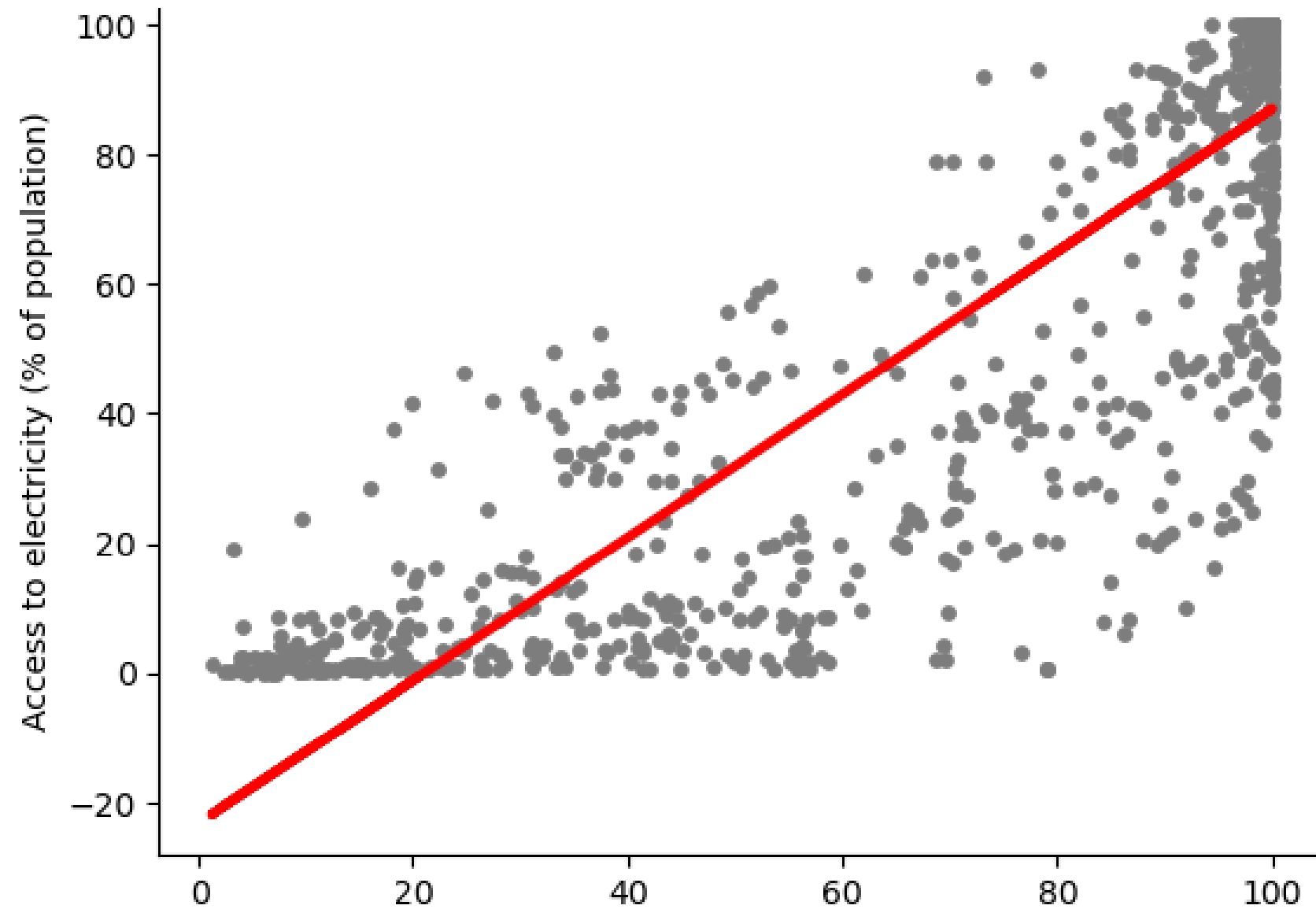
Geospatial analysis of Renewable-electricity-generating-capacity-per-capita by population across Global



## Renewable-electricity-generating-capacity-per-capita

- The choropleth map reveals that few South American and Asian countries have low renewable-electricity-generating capacity-per-capita.

# LINEAR REGRESSION ANALYSIS



## Model Building

Reshape Variable: Defined the independent variable ( $X$  = Access to electricity (% of the population)) and the dependent variable ( $Y$  = Access to clean fuels for cooking)

## Run Linear Regression:

Initialized and trained a linear regression model on the training data, then made predictions on the test data.

Regression Line: Generate a plot showing the regression line on the test set demonstrating a positive relationship between Access to electricity (% of the population) vs Access to clean fuels for cooking

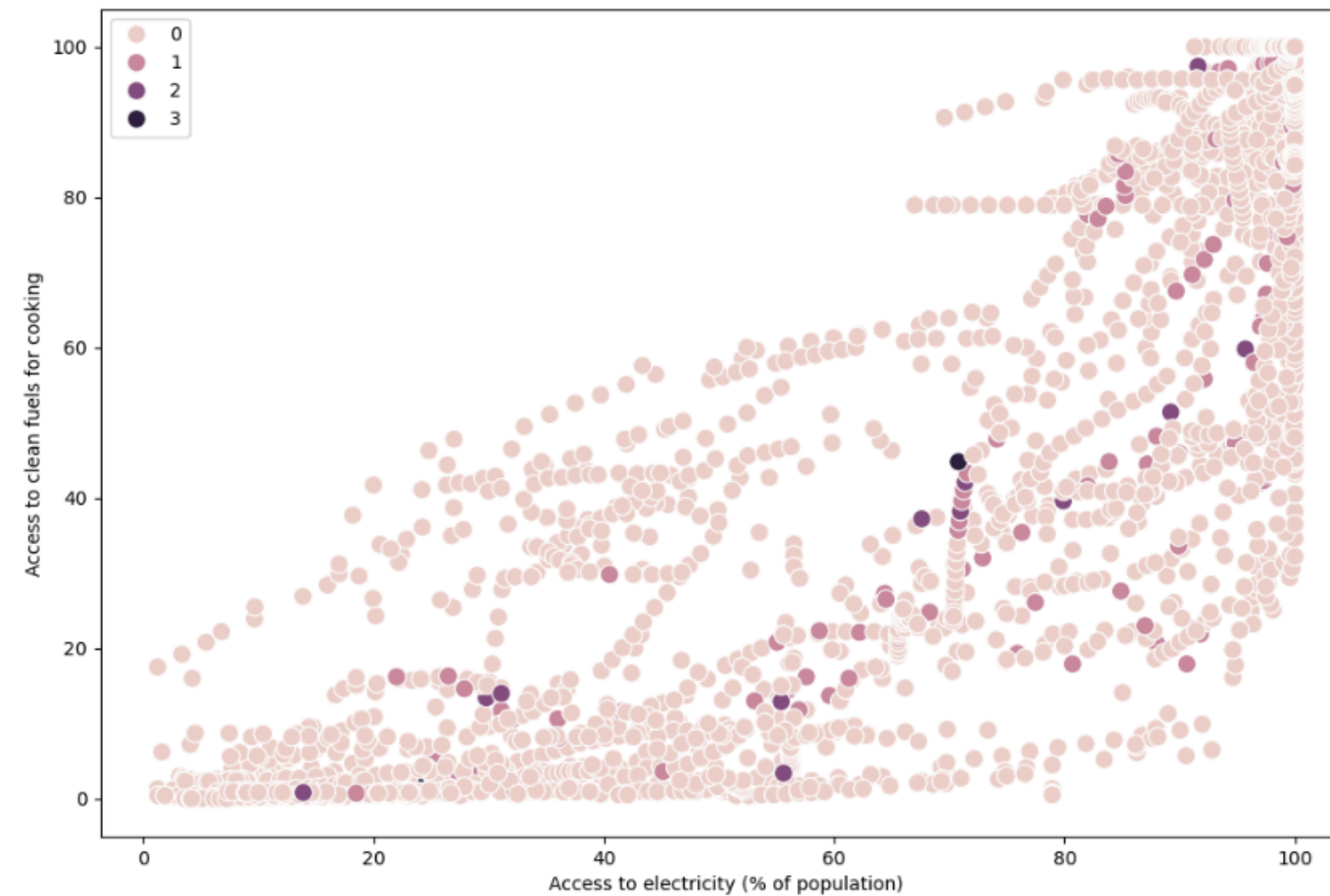
## Run Linear Regression with Machine Learning

The Training dataset using machine plotted against the prediction line shows the model is certainly not given a different prediction from the model result

Another set of the population with extremely/100% both access to electricity and access to clean fuels for cooking

The primary indication/meaning is that access to electricity varies directly to access to clean fuels for cooking





## Cluster Analysis

Cluster analysis applies K-means clustering to the dataset containing access to electricity and other forms of energy and contributing conditions to identify meaningful groups with the dataset.

### The Elbow Technique:

Applied the elbow technique to determine the optimal number of clusters. Converted the scores to positive values for plotting.

Plotted the elbow curve, which suggested that the optimal number of clusters is 4 as the curve starts to flatten

### Cluster Interpretation:

The clusters can be interpreted meaningfully in the context of access to electricity:

Cluster 0 represents High access to electricity & similar other energy-related amenities

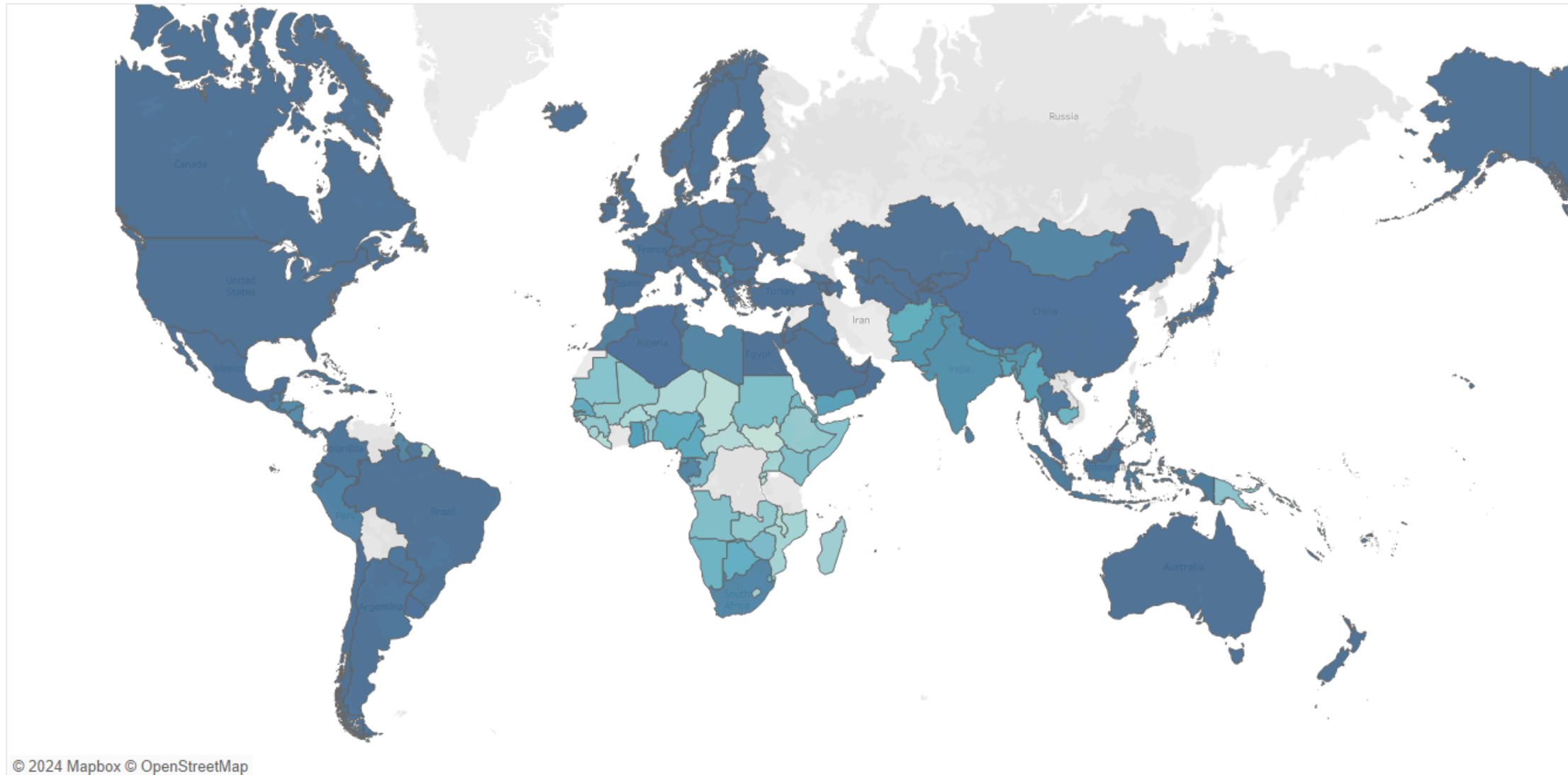
Cluster 1 & 2 represents low access to electricity & similar other energy-related amenities

Cluster 3 represents shallow access to electricity & similar other energy-related amenities

### Descriptive Statistics:

The mean values of Access to electricity and similar other energy-related amenities increase progressively from Cluster 0 to Cluster 2, highlighting the gradient of the cluster across different clusters.

## Global access to electricity, clean cooking, and Renewable energy



## Key Insights

### Correlations Analysis:

There is a strong positive correlation between Access to electricity and other forms of energy like Access to clean fuels for cooking, Renewable-electricity-generating-capacity-per-capita, and electricity from renewables (TWh) all of these show a significant correlation with Access to electricity

### Global/Geographical Analysis:

Access to electricity is very high in population countries like the United States, Canada, Brazil, China, and Australia. A very good percentage of the countries in sub-Saharan Africa have shallow access to electricity.

### Cluster Analysis:

K-means Clustering identified 4 clusters representing varying levels of Access to electricity and other forms of energy ranging from very high to very shallow access.