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## Introduction

This study employed world data bank MENA – Energy Indicators dataset for the analysis. The key variables used for the analysis are access to electricity, energy use, electric power consumption, CO2 emission liquid and gaseous fuel.

Dataset snapshot

Dataset 1

| | country | date | Access_to_electricity(% of population | Electric power consumption (kWh per capita) | Energy use (kg of oil equivalent per capita) | CO2 emissions from gaseous fuel consumption (% of total) | CO2 emissions from liquid fuel consumption (kt) |
|---|---|---|---|---|---|---|---|
| 6 | Argentina | 2014 | 100.000000 | 3074.702071 | 2029.922825 | 53.744348 | 87586.295 |
| 7 | Argentina | 2013 | 99.356224 | 2967.376558 | 1967.021678 | 49.366988 | 90835.257 |
| 8 | Argentina | 2012 | 99.228859 | 3000.603523 | 1936.803540 | 53.469638 | 85657.453 |
| ... | ... | ... | ... | ... | ... | ... | ... |
| 1612 | Venezuela, RB | 1994 | 98.323334 | 2665.759795 | 2324.974122 | 45.391298 | 63494.105 |
| 1613 | Venezuela, RB | 1993 | 98.239532 | 2697.686148 | 2049.504018 | 36.197225 | 69302.633 |
| 1614 | Venezuela, RB | 1992 | 97.820203 | 2689.309414 | 2249.819897 | 18.476779 | 73831.378 |

537 rows × 8 columns

Dataset 2

| | country | date | Access_to_electricity(% of population | Electric power consumption (kWh per capita) | Energy use (kg of oil equivalent per capita) | CO2 emissions from gaseous fuel consumption (% of total) | CO2 emissions from liquid fuel consumption (kt) |
|---|---|---|---|---|---|---|---|
| 1653 | World | 2014 | 85.552847 | 3128.298712 | 1919.991765 | 20.336427 | 1.036714e+07 |
| 1654 | World | 2013 | 85.031065 | 3106.981734 | 1894.112059 | 20.170828 | 1.020665e+07 |
| 1655 | World | 2012 | 84.745819 | 3047.755531 | 1891.700426 | 20.216118 | 1.013381e+07 |
| ... | ... | ... | ... | ... | ... | ... | ... |
| 1667 | World | 2000 | 78.736034 | 2386.825244 | 1637.205968 | 20.662066 | 9.274896e+06 |
| 1668 | World | 1999 | 74.708477 | 2317.327280 | 1623.839599 | 20.716253 | 9.044144e+06 |
| 1669 | World | 1998 | 73.406490 | 2284.670692 | 1611.335079 | 19.885250 | 8.898867e+06 |

## Descriptive Statistics

Power consumption and CO2 emission in world nations

| | date | Access_to_electricity(% of population | Electric power consumption (kWh per capita) | Energy use (kg of oil equivalent per capita) | CO2 emissions from gaseous fuel consumption (% of total) | CO2 emissions from liquid fuel consumption (kt) |
|---|---|---|---|---|---|---|
| count | 537.000000 | 537.000000 | 537.000000 | 537.000000 | 537.000000 | 5.370000e+02 |
| mean | 2003.039106 | 88.330460 | 3201.388654 | 1943.707057 | 14.270363 | 3.015548e+05 |
| std | 6.797741 | 14.929808 | 4566.648445 | 2385.349097 | 16.009996 | 6.743868e+05 |
| ... | ... | ... | ... | ... | ... | ... |
| 50% | 2003.000000 | 94.664978 | 1513.158055 | 1022.160344 | 7.076101 | 2.083589e+04 |
| 75% | 2009.000000 | 98.820000 | 2602.250605 | 1599.516711 | 25.213470 | 2.057297e+05 |
| max | 2014.000000 | 100.000000 | 17264.736744 | 8455.547014 | 67.060262 | 2.699517e+06 |

8 rows × 6 columns

There are total 537 records in the electricity consumption indicator dataset fetched from the world data bank. The mean access to electricity for % of population is 88%. The mean electric power consumption (kWh per capita) is 3201.38. The mean total energy use (kg of oil equivalent per capita) is 1943.70. The mean CO2 emission from gaseous fuel consumption (%) is 14% and the mean CO2 emission from liquid fuel consumption (kt) is 3.01. The median access to electricity % of population is 94.66%. This indicates that most of the world population has strong access to electricity. The median energy usage is higher than mean which shows that the total energy usage is increasing among world nations. The statistics also showed that median and maximum CO2 emission from gaseous fuel is higher than liquid fuels.

```
dataworld.describe()
```

| | Access_to_electricity(% of population | Electric power consumption (kWh per capita) | Energy use (kg of oil equivalent per capita) | CO2 emissions from gaseous fuel consumption (% of total) | CO2 emissions from liquid fuel consumption (kt) |
|---|---|---|---|---|---|
| count | 22.000000 | 44.000000 | 44.000000 | 57.000000 | 5.700000e+01 |
| mean | 82.568451 | 2113.836790 | 1592.362530 | 16.866023 | 8.066238e+06 |
| std | 4.434985 | 569.236850 | 175.566341 | 3.420611 | 2.024479e+06 |
| ... | ... | ... | ... | ... | ... |
| 50% | 82.244456 | 2146.845032 | 1614.595963 | 16.341340 | 8.534485e+06 |
| 75% | 85.422401 | 2520.089374 | 1701.316018 | 20.170828 | 9.337218e+06 |
| max | 90.097011 | 3128.298712 | 1919.991765 | 21.124034 | 1.048250e+07 |

8 rows × 5 columns

The mean electricity access in the world is 82%, the mean electricity consumption is 2113.83 which is lesser than nations. The mean and SD total energy use is 1592.36 ± 175.56, the mean and SD CO2 emission from gaseous fuel is 16% ± 3.42% and liquid fuel is 8% ± 2.02%. While comparing the summary statistics from both datasets, it is evident total electricity consumption is higher among major nations than whole world. The total energy use is also higher among major world nations than the whole world. It is evident that few Latin American nations such as Argentina, Brazil and Mexico etc and North American nations such as US, Canada consume more electricity and energy as well as emit more carbon di oxide that the whole world.

Correlation analysis

| | date | Access_to_electricity(% of population | Electric power consumption (kWh per capita) | Energy use (kg of oil equivalent per capita) | CO2 emissions from gaseous fuel consumption (% of total) | CO2 emissions from liquid fuel consumption (kt) |
|---|---|---|---|---|---|---|
| date | 1.000000 | 0.190893 | -0.012217 | -0.047629 | 0.012696 | -0.032603 |
| Access_to_electricity(% of population | 0.190893 | 1.000000 | 0.428142 | 0.426809 | 0.365172 | 0.307581 |
| Electric power consumption (kWh per capita) | -0.012217 | 0.428142 | 1.000000 | 0.989543 | 0.366663 | 0.712610 |
| Energy use (kg of oil equivalent per capita) | -0.047629 | 0.426809 | 0.989543 | 1.000000 | 0.397099 | 0.771272 |
| CO2 emissions from gaseous fuel consumption (% of total) | 0.012696 | 0.365172 | 0.366663 | 0.397099 | 1.000000 | 0.247726 |
| CO2 emissions from liquid fuel consumption (kt) | -0.032603 | 0.307581 | 0.712610 | 0.771272 | 0.247726 | 1.000000 |

The above correlation matrix shows positive correlation between electric power consumption to total energy use, CO2 emission from gaseous and liquid fuels among Latin American, North American nations.

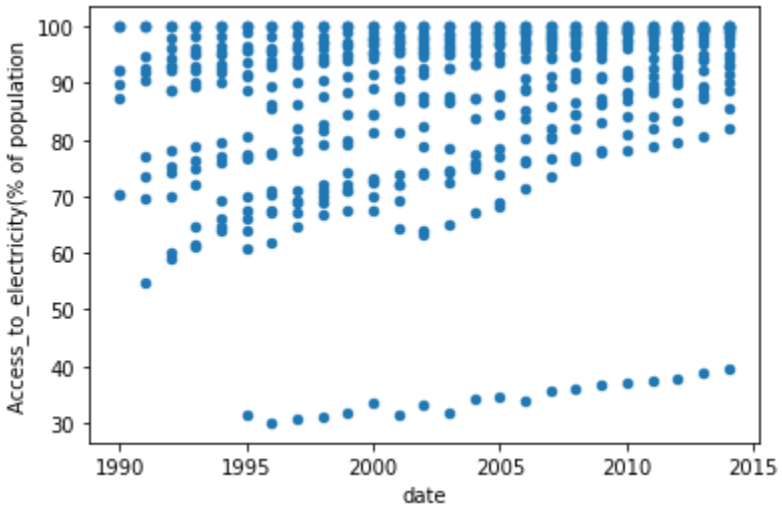
```
dataworld.corr()
```

| | Access_to_electricity(% of population | Electric power consumption (kWh per capita) | Energy use (kg of oil equivalent per capita) | CO2 emissions from gaseous fuel consumption (% of total) | CO2 emissions from liquid fuel consumption (kt) |
|---|---|---|---|---|---|
| Access_to_electricity(% of population | 1.000000 | 0.927149 | 0.913741 | 0.165100 | 0.966685 |
| Electric power consumption (kWh per capita) | 0.927149 | 1.000000 | 0.977280 | 0.889359 | 0.906268 |
| Energy use (kg of oil equivalent per capita) | 0.913741 | 0.977280 | 1.000000 | 0.850782 | 0.900792 |
| CO2 emissions from gaseous fuel consumption (% of total) | 0.165100 | 0.889359 | 0.850782 | 1.000000 | 0.816340 |
| CO2 emissions from liquid fuel consumption (kt) | 0.966685 | 0.906268 | 0.900792 | 0.816340 | 1.000000 |

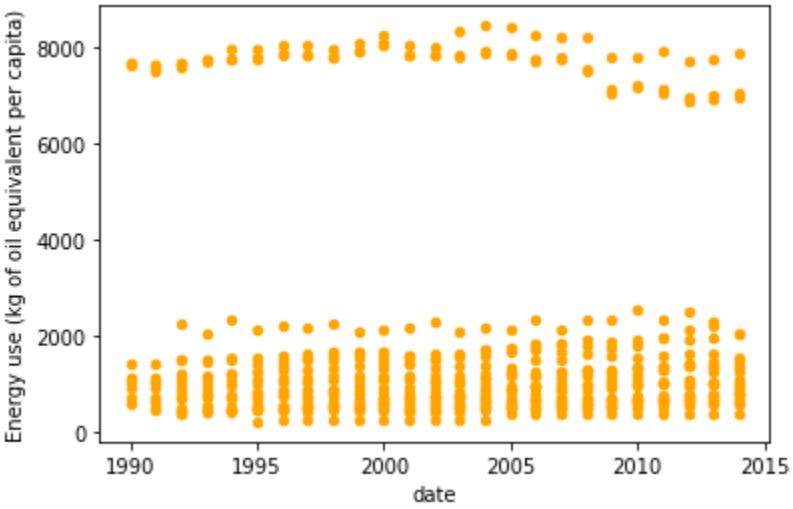
The correlation matrix from whole world dataset infers that there is a strong positive correlation between access to electricity and electric power consumption, total energy use and Co2 emission from liquid fuel since the Pearson's r is positive and close to 1 and CO2 emission from gaseous fuel shows weak positive correlation.

**Visualization**

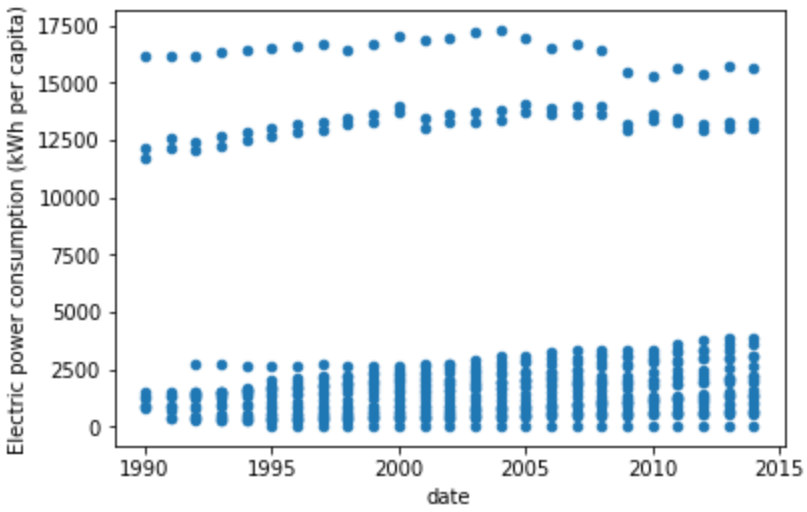
Scatter Plot



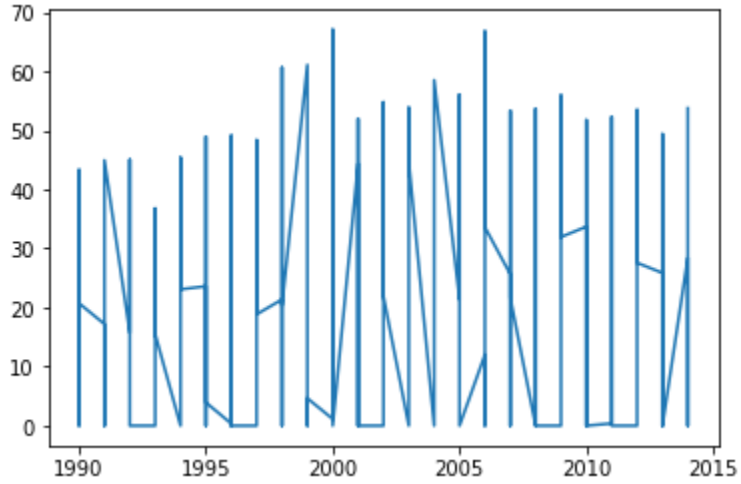

The scatter plot showed that access to electricity increased during 1990 to 2015 timeline. This is due to the growing population demand among Latin and North American nations.



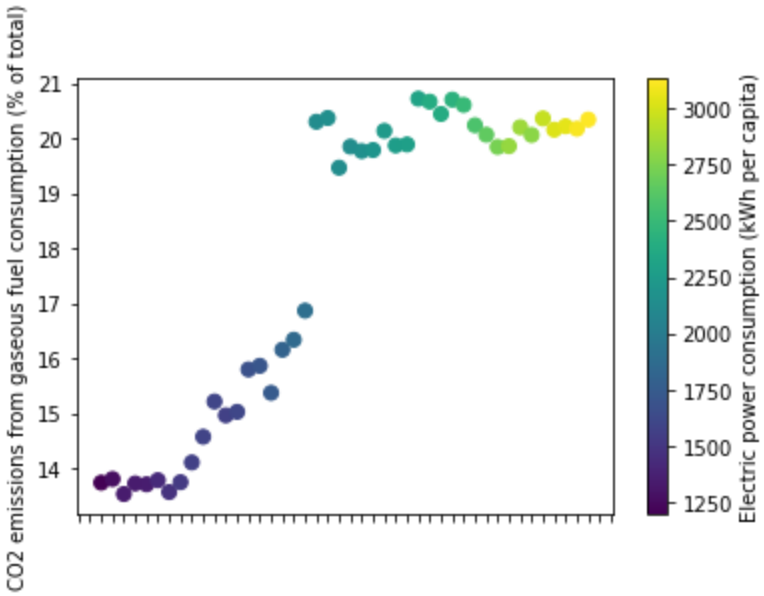

The energy use per kg of oil equivalent per capita among Latin and North American nations were observed to rise during 1990 to 2010. The peak energy use was observed during 2005 – 2010. However, it continued to decline during 2011 – 2015 slightly.




The total electric power consumption among Latin and North American nations exhibited increasing trend during 1990 to 2005. However, it remarkably declined during 2006 to 2015.




The CO2 emission from gaseous fuels continue to increase in Latin and North American countries during 1990 to 2015. The peak emission were observed during 2000 and 2005.




The CO2 emission from gaseous fuel is observed to increase with the electric power consumption in the whole world. The peak emission perfectly correlates with the peak electric power consumption in the whole world dataset

**Conclusion**

This study has performed the analysis using python program using world data bank on access to electricity, power consumption, total energy use and CO2 emission. The study concludes that North and Latin American nations consume electricity and energy higher than whole world and responsible for the increased CO2 emission in gaseous and liquid fuel.