ANALYZING GLOBAL ELECTRICITY STATISTICS

TEAM-8:

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AGENDA

Introduction

Summary

Data cleaning & Preprocessing

Exploratory Data Analysis

Data Modelling

Impact

Conclusion

INTRODUCTION

- Electricity is a critical component of modern life, and reliable access to electricity is essential for economic growth and human development.

- Electricity production and consumption have been steadily increasing worldwide, with a growing population and expanding economies leading to greater demand for energy.

- To ensure that electricity is produced efficiently and sustainably, it is crucial to monitor and analyze the trends and patterns of electricity production.

- By gaining insights into global electricity production, we can make informed decisions to promote a reliable and sustainable energy future.

- Analyzing the relationship between electricity production and economic growth is crucial for making informed decisions and policies that promote both economic development and environmental sustainability.

SUMMARY

- **Data:**
  - Monthly Electricity Statistics dataset from the International Energy Agency (IEA).
 - GDP dataset obtained from World Bank.

- **Goal:**
  - To analyze the electricity production over the years based on fuel type.
  - Gain insights into the relationship between electricity production and economic activity.
  - Develop an algorithm that can forecast future events or outcomes based on historical data.

- **Methods:**
  - Collecting and Tidying Data (impute NAs, transformation)
  - EDA (scatter, bar, line plots)
  - Modeling (Linear Regression, Arima model)

DATA CLEANING & PREPROCESSING

- Handling missing values

- Remove outliers

- Data Transformation
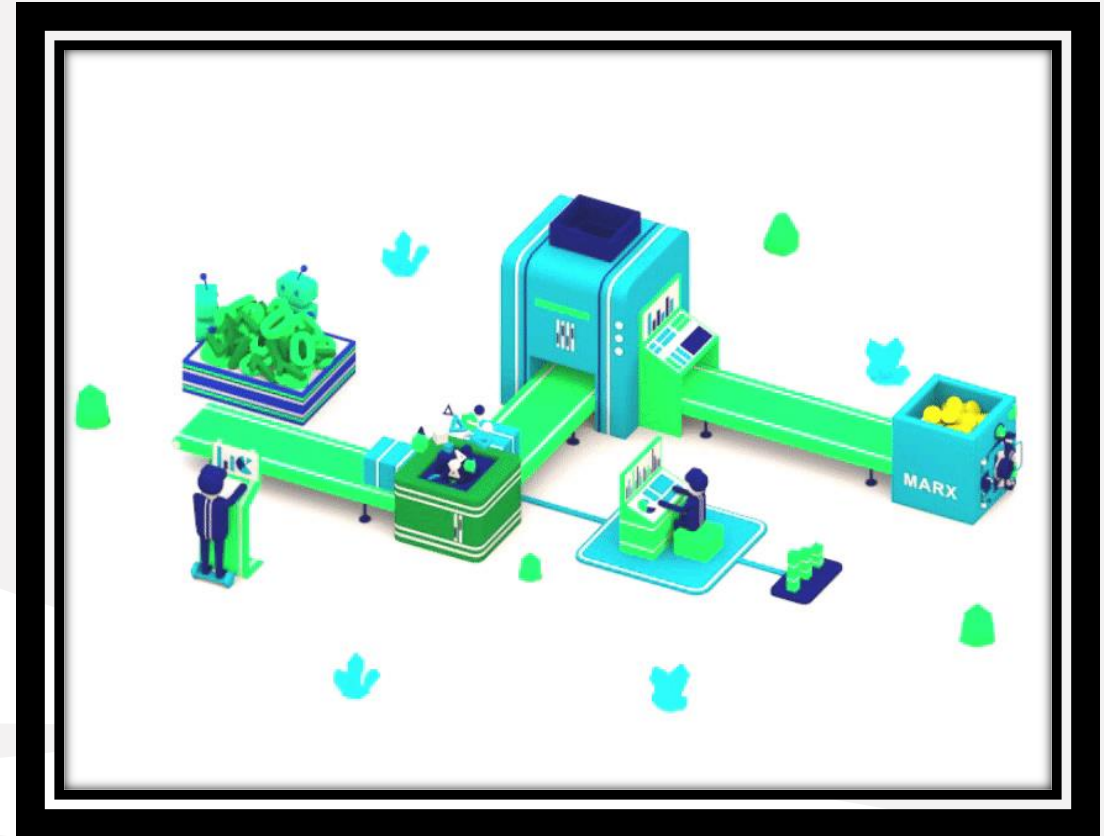
BEFORE AND AFTER – ELECTRICITY

Country	Time	Balance	Product	Value	Unit
Australia	22-Nov	Net Electricity Production	Electricity	20511.9374	GWh
Australia	22-Nov	Net Electricity Production	Total Combustible Fuels	12054.8703	GWh
Australia	22-Nov	Net Electricity Production	Coal, Peat and Manufactured Gases	8507.7583	GWh
Australia	22-Nov	Net Electricity Production	Oil and Petroleum Products	284.9962	GWh
Australia	22-Nov	Net Electricity Production	Natural Gas	3043.3903	GWh
Australia	22-Nov	Net Electricity Production	Combustible Renewables	218.7255	GWh

Country	Balance	Product	Jan-10	Feb-10	Mar-10	Apr-10	May-10
Argentina	Net Electricity Production	Coal, Peat and Manufactured Gases	35747.0472	31617.534	30641.11	26477.5368	28396.5812
Argentina	Net Electricity Production	Combustible Renewables	1870.68797	1716.8344	1814.8085	1694.76008	1687.70433
Argentina	Net Electricity Production	Electricity	35351.2476	31560.206	32151.016	28862.5301	30230.2799
Argentina	Net Electricity Production	Geothermal	621.261286	552.06081	627.81233	605.886476	630.618524
Argentina	Net Electricity Production	Hydro	13045.3187	11678.985	12278.040	11061.955	12259.0941

BEFORE AND AFTER - GDP

API	GDP at purchasing power parities	1980	1981	1982	1983
INTL.4701-34-WORL-BDOLPPP.A	World	27852.3325	28742.7821	28878.1409	29692.8496
INTL.4701-34-AFG-BDOLPPP.A	Afghanistan	0.000001	0.000001	0.000001	0.000001
INTL.4701-34-ALB-BDOLPPP.A	Albania	0.000001	0.000001	0.000001	0.000001
INTL.4701-34-DZA-BDOLPPP.A	Algeria	0.000001	0.000001	0.000001	0.000001
INTL.4701-34-ASM-BDOLPPP.A	American Samoa	NA	NA	NA	NA
INTL.4701-34-AGO-BDOLPPP.A	Angola	0.000001	0.000001	0.000001	0.000001
INTL.4701-34-ATA-BDOLPPP.A	Antarctica	NA	NA	NA	NA
INTL.4701-34-ATG-BDOLPPP.A	Antigua and Barbuda	0.000001	0.000001	0.000001	0.000001

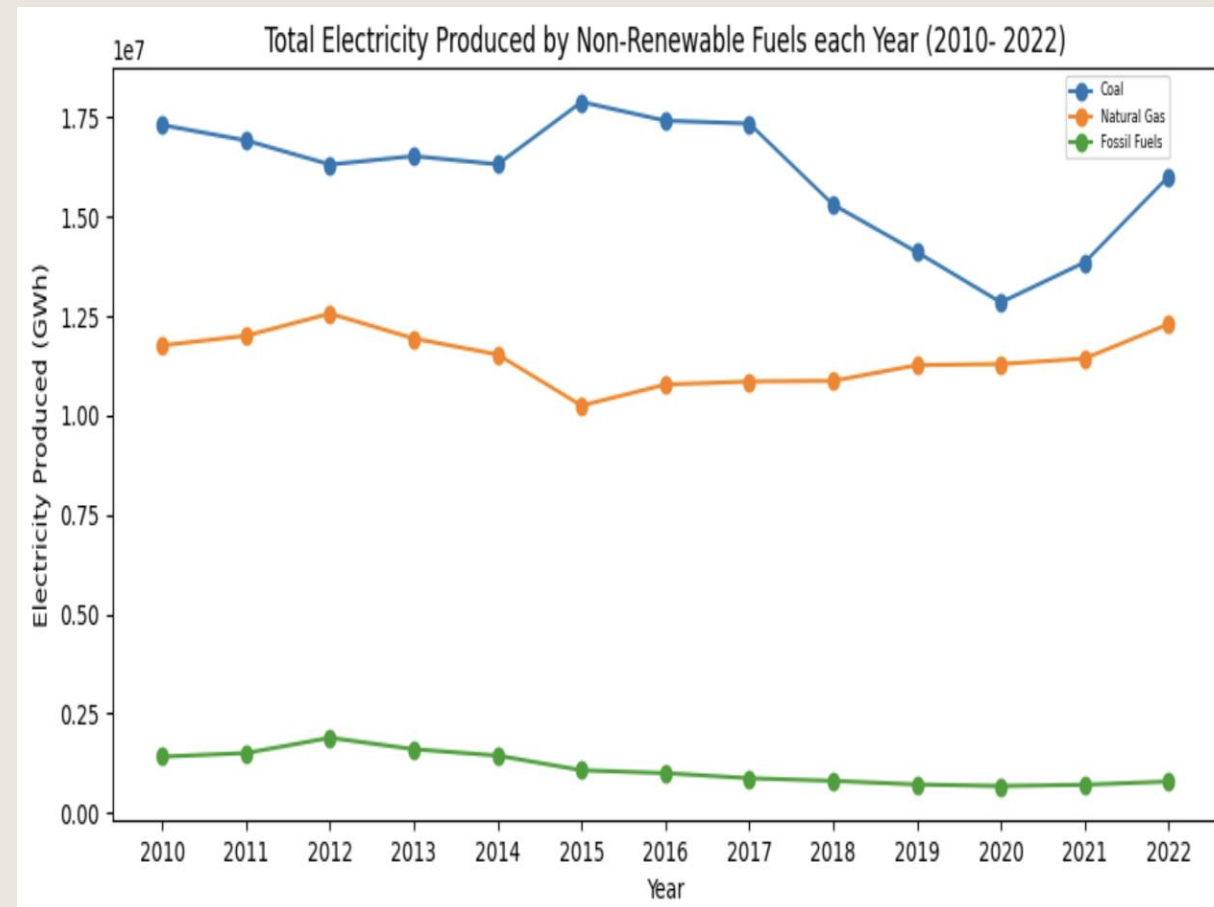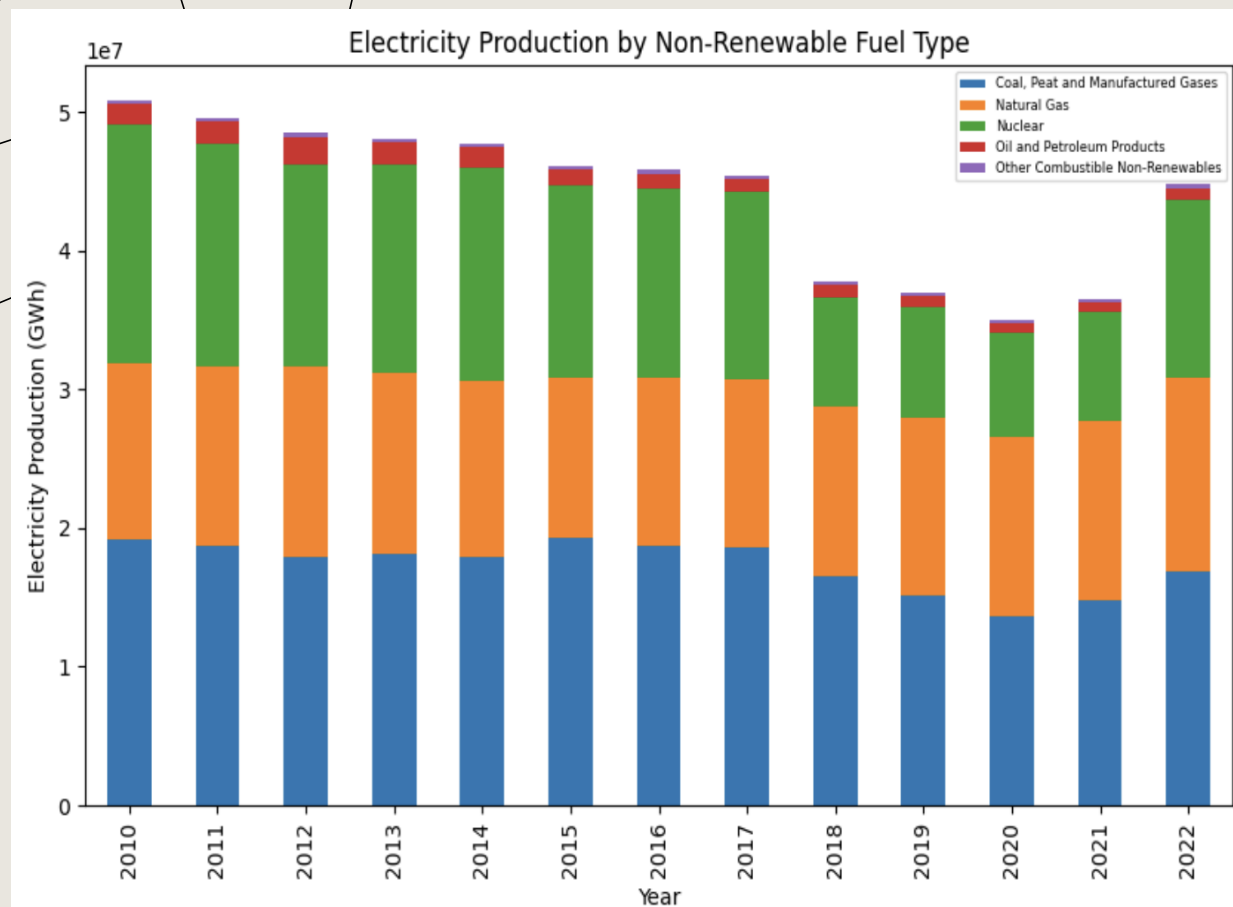| Country	2010	2011	2012	2013
Argentina	806.414	854.8308	846.0566	866.407
Australia	972.1682	999.0316	1036.675	1059.516
Austria	408.1216	420.5186	423.5815	423.5195
Belgium	488.3986	496.6756	500.3465	502.6446
Brazil	2846.833	2963.238	3010.962	3107.761
Bulgaria	123.5594	126.4718	127.0963	126.3435
Canada	1433.923	1479.035	1505.08	1540.136

EXPLORATORY DATA ANALYSIS

ELECTRICITY PRODUCTION BY RENEWABLE FUEL
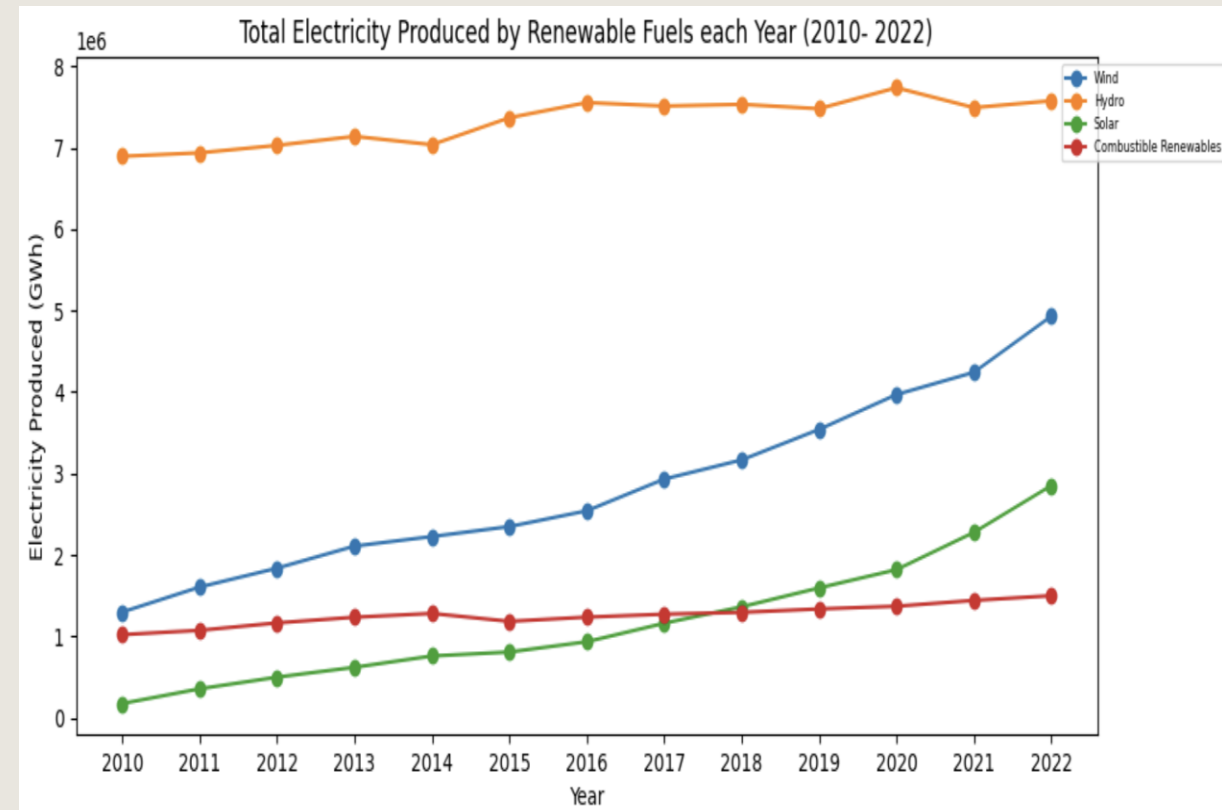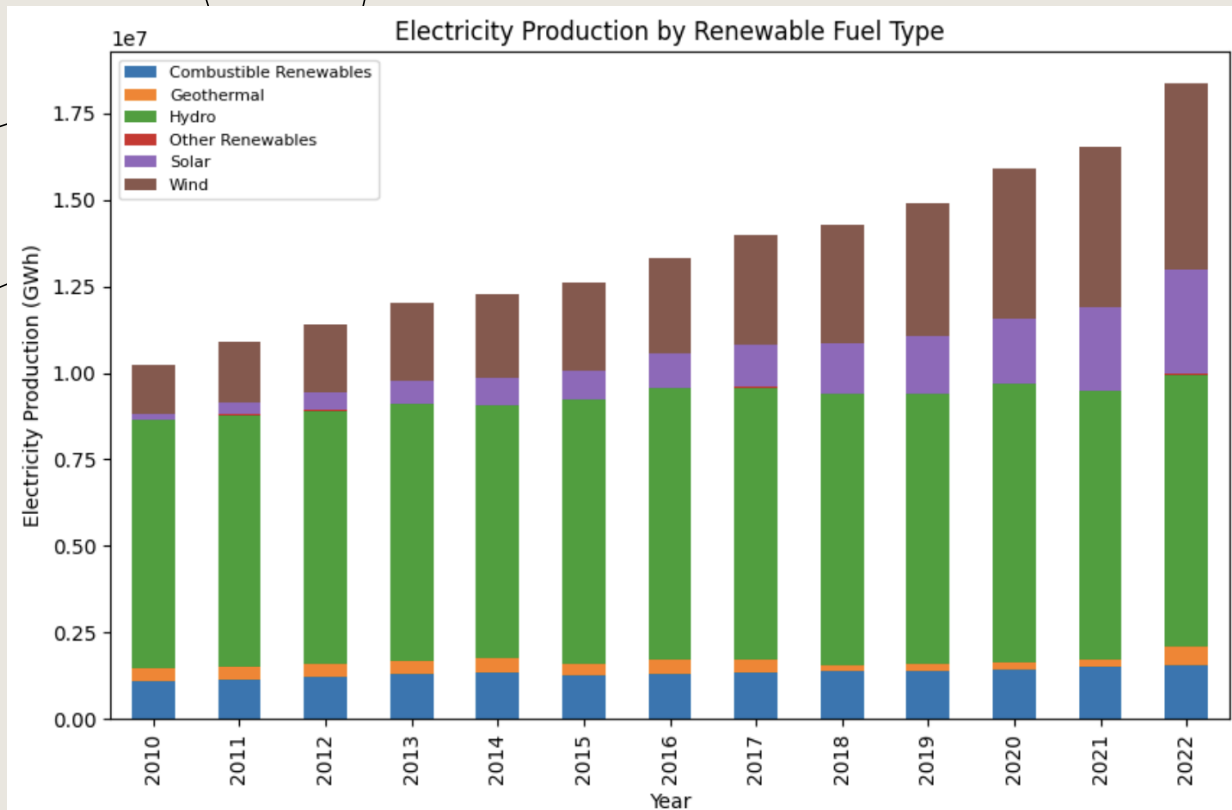
ELECTRICITY PRODUCTION BY NON-RENEWABLE FUEL

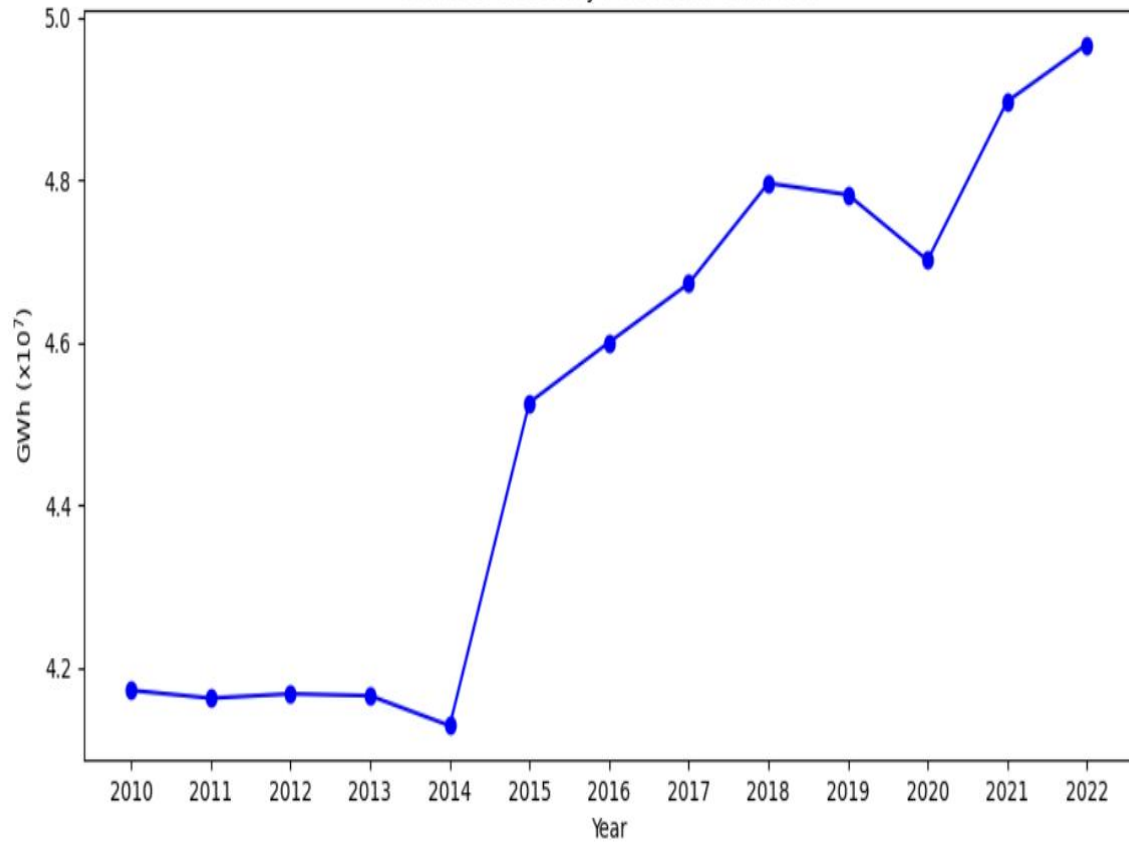Net Electricity Production for each APAC country over the years
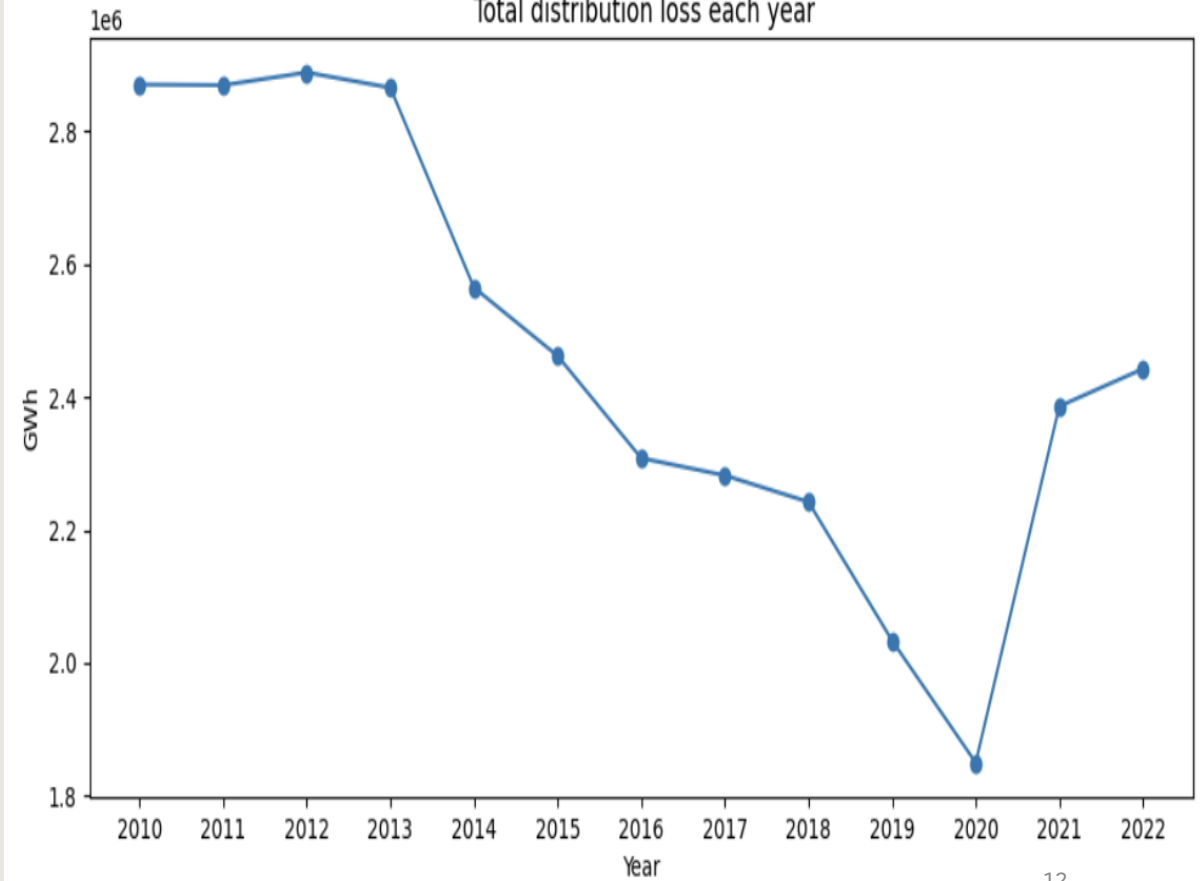

Net Electricity Production for each EMEA country over the years
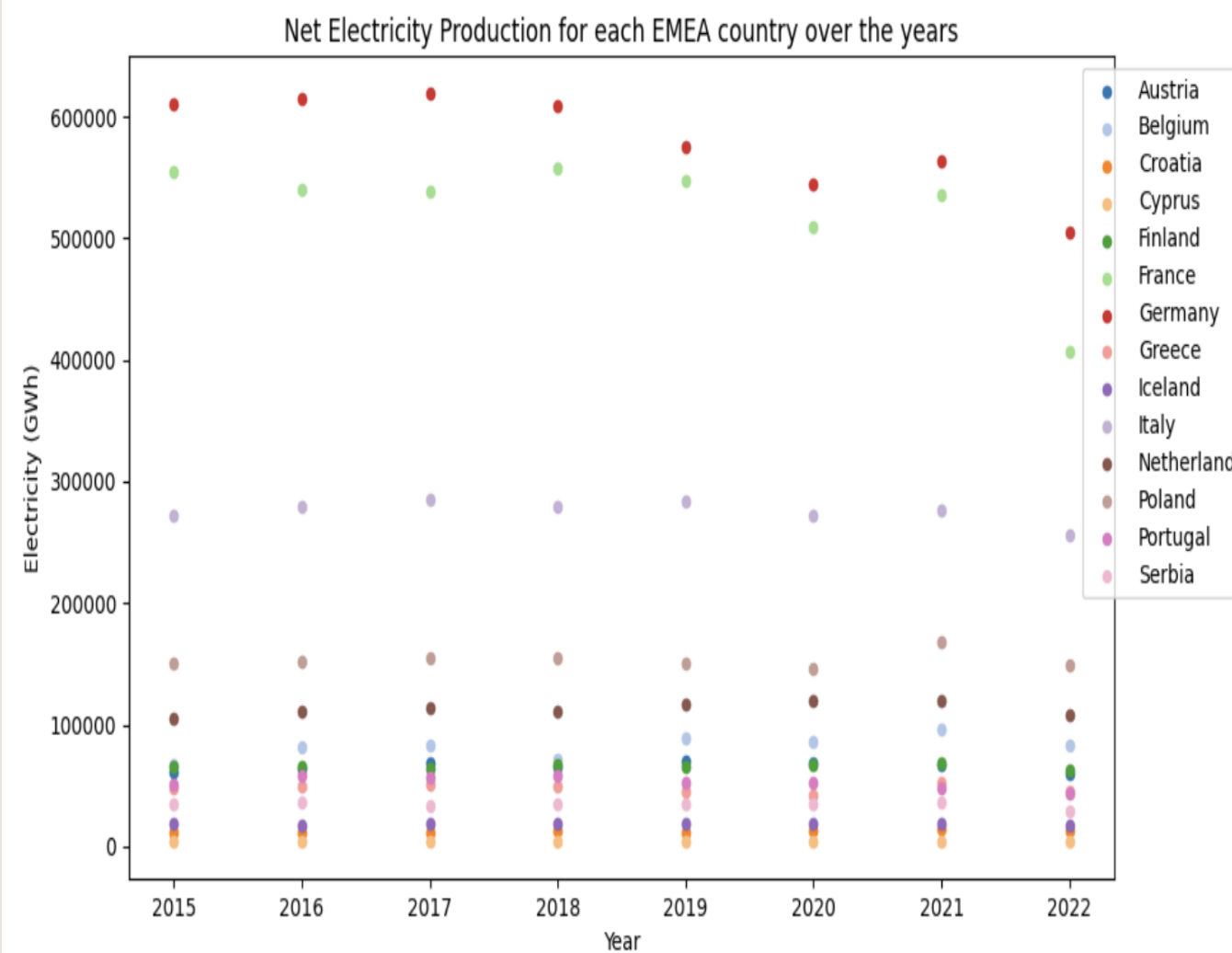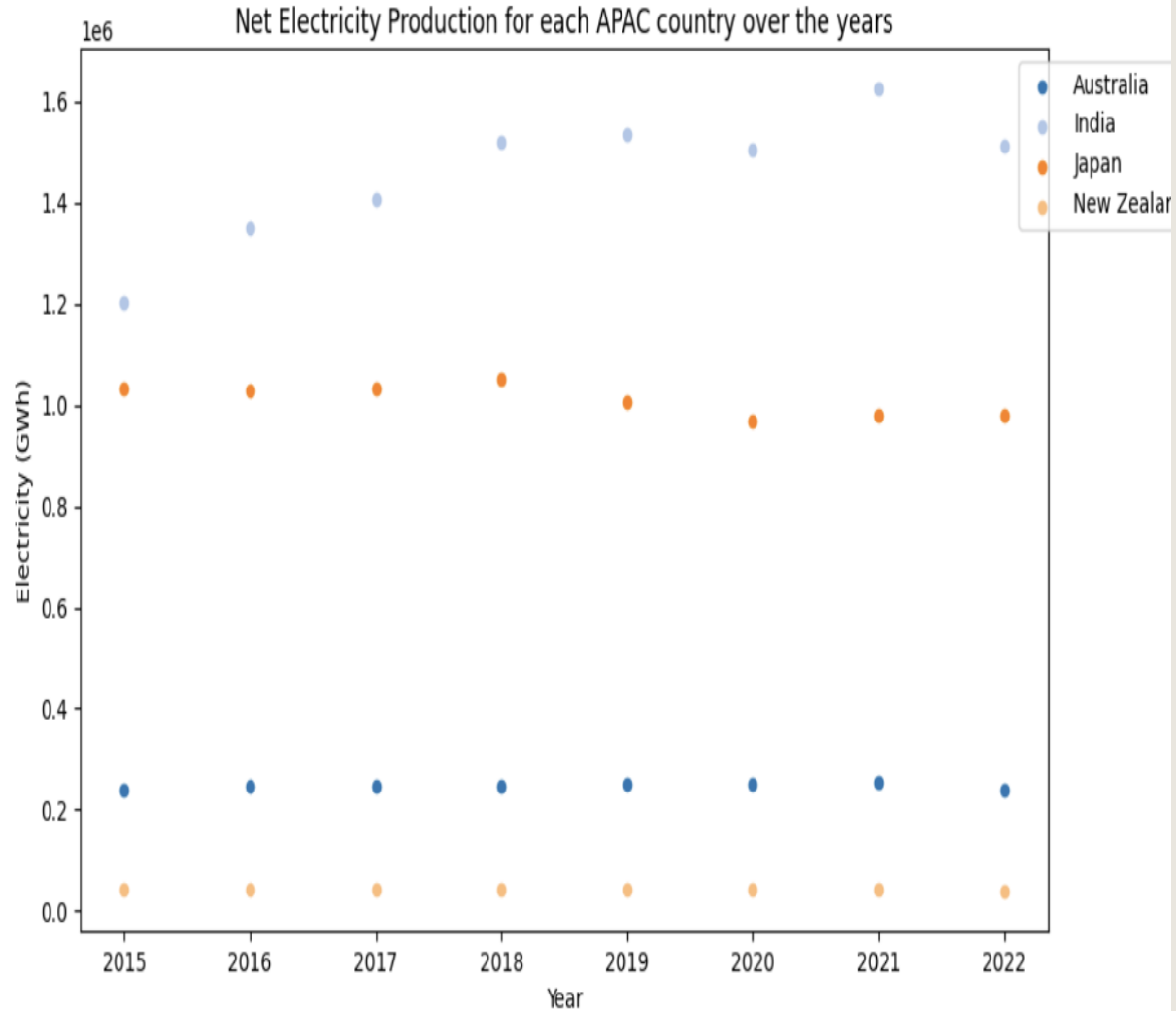
NET ELECTRICITY PRODUCTION VS DISTRIBUTION LOSS
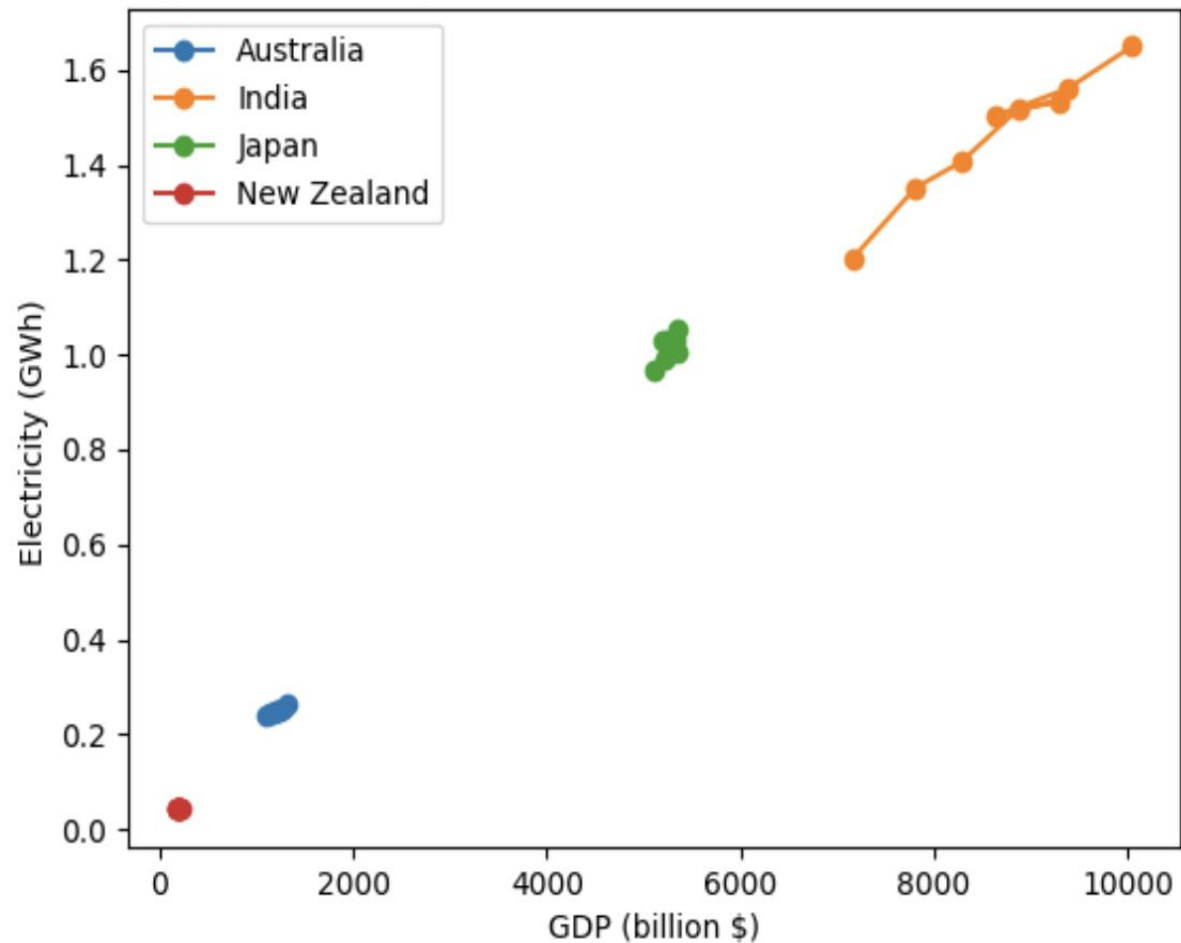
NET ELECTRICITY PRODUCTION V/S GDP

Net Electricity Production vs. GDP for APAC Countries

Net Electricity Production vs. GDP for EMEA Countries
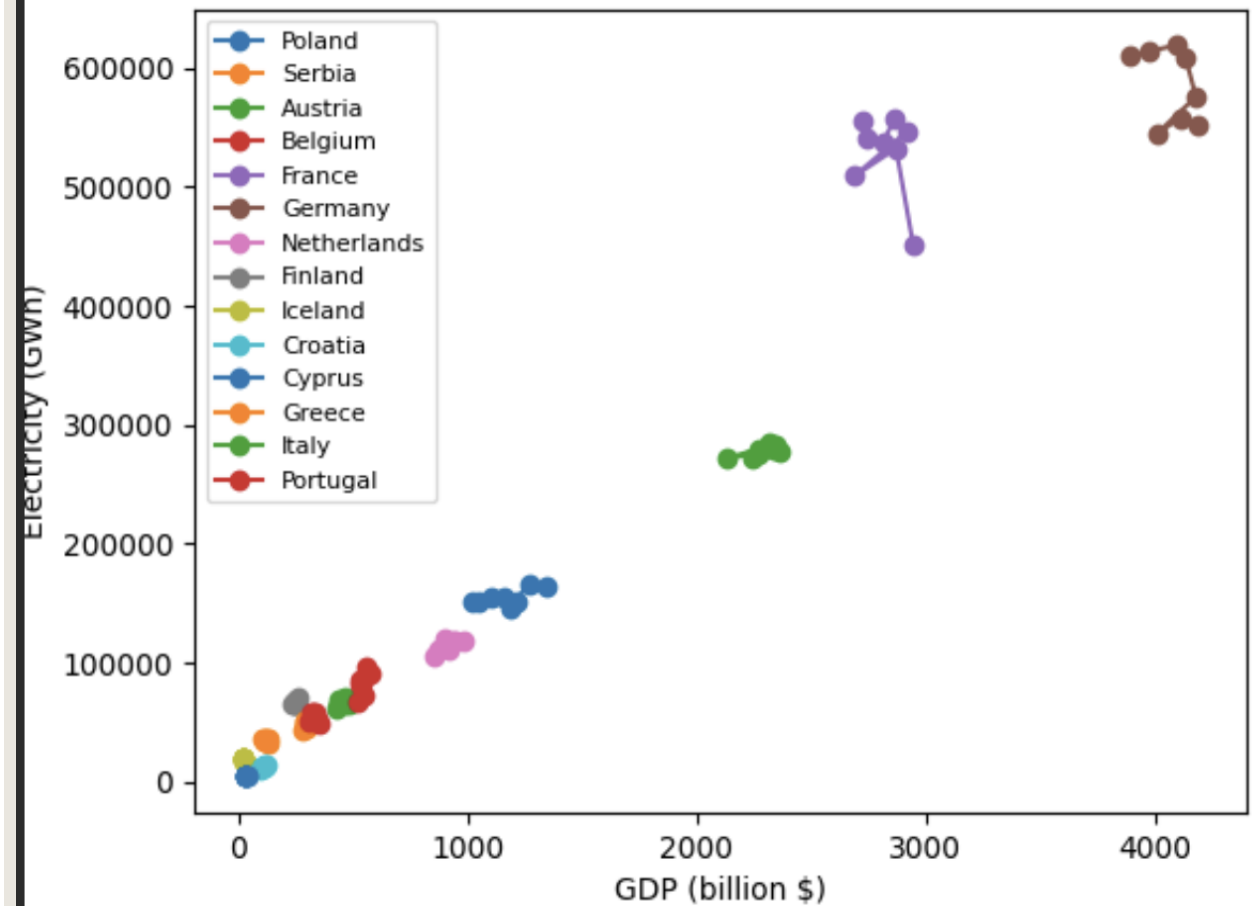
GROWTH RATE ANALYSIS FOR GDP VS RENEWABLE ENERGY

Yearly growth rate of GDP vs Electricity produced using Renewable Energy Resouces
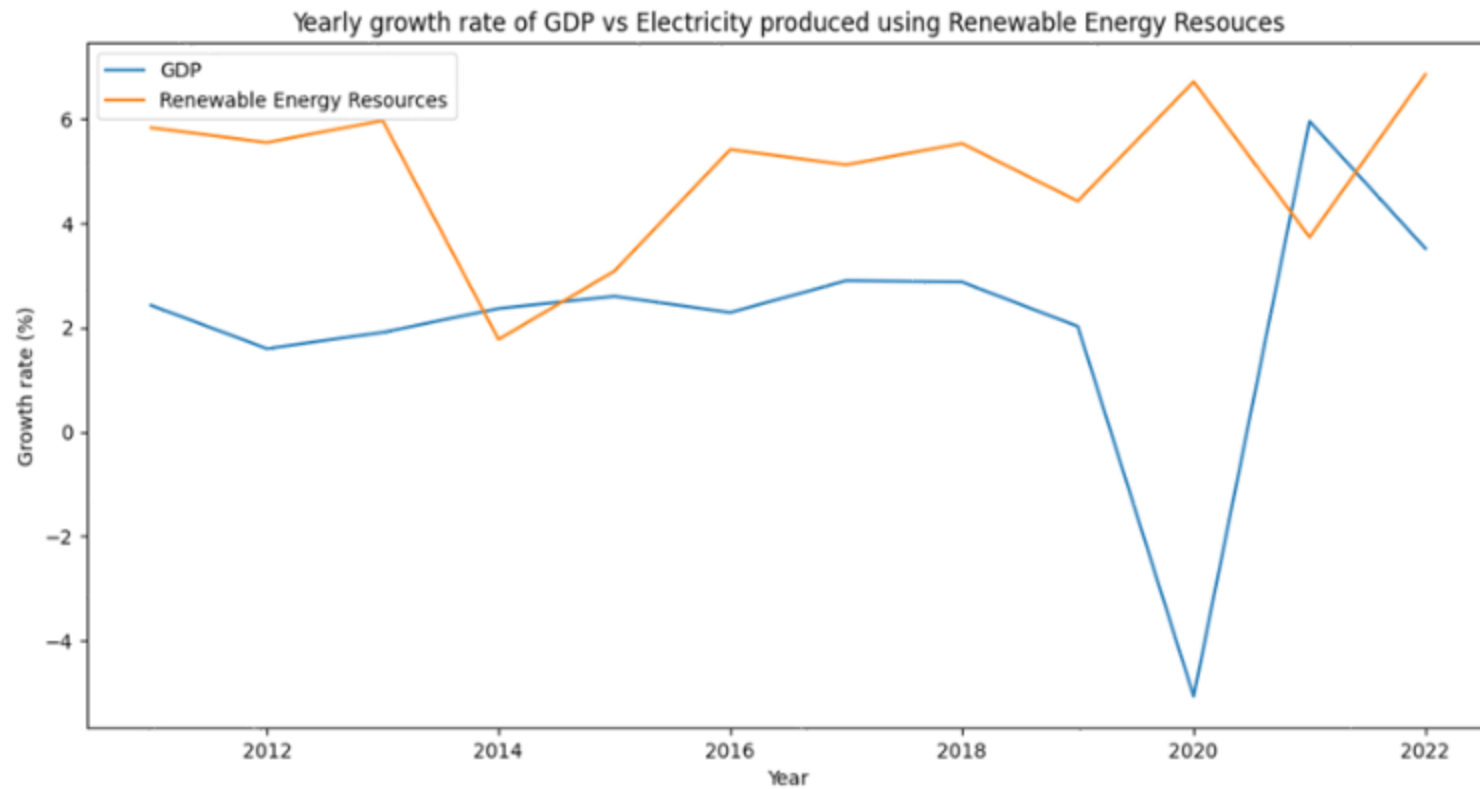
GROWTH RATE ANALYSIS FOR GDP VS NONRENEWABLE ENERGY

Yearly growth rate of GDP vs Electricity produced using Non-Renewable Energy Resouces

DATA MODELLING
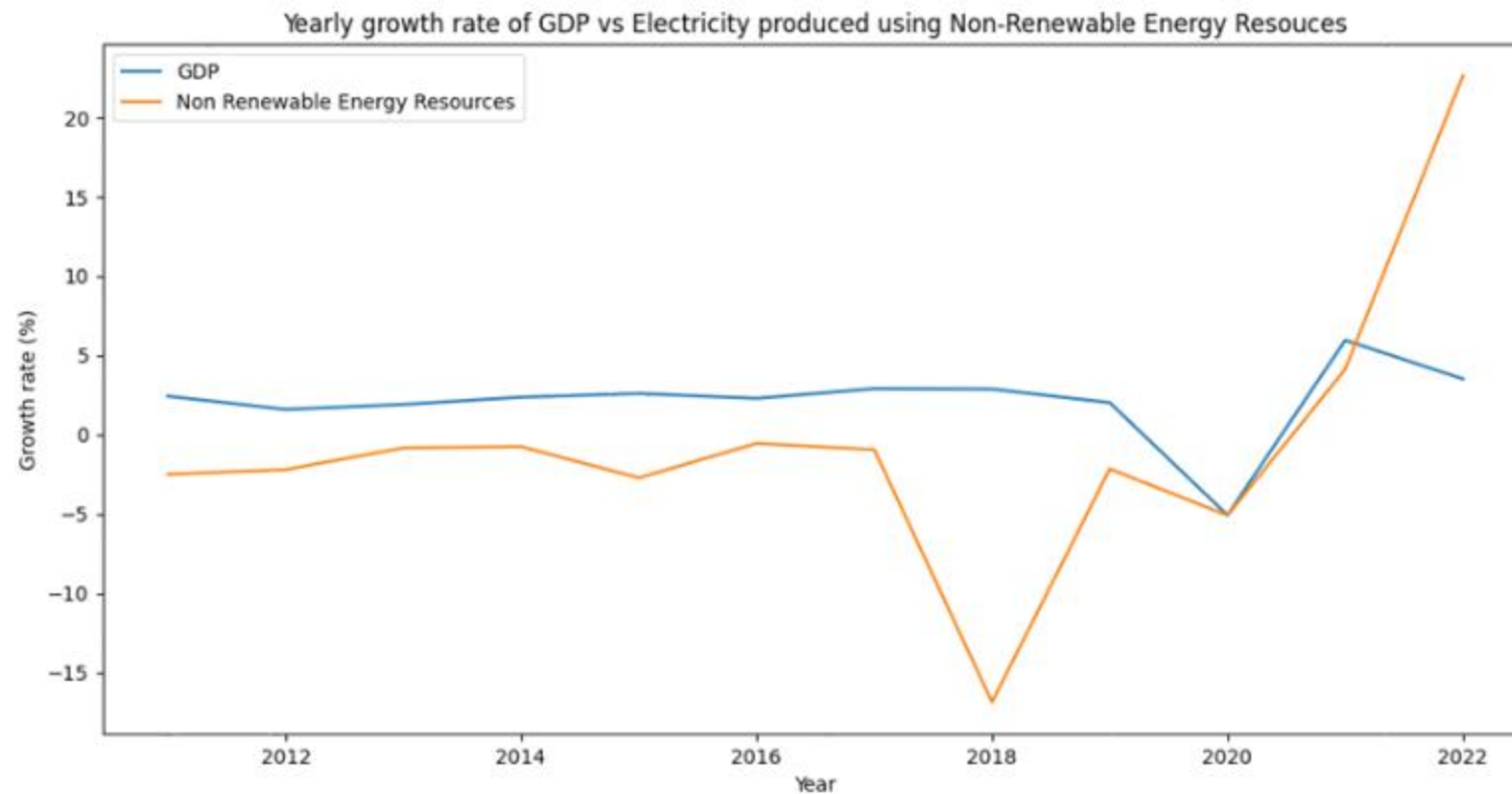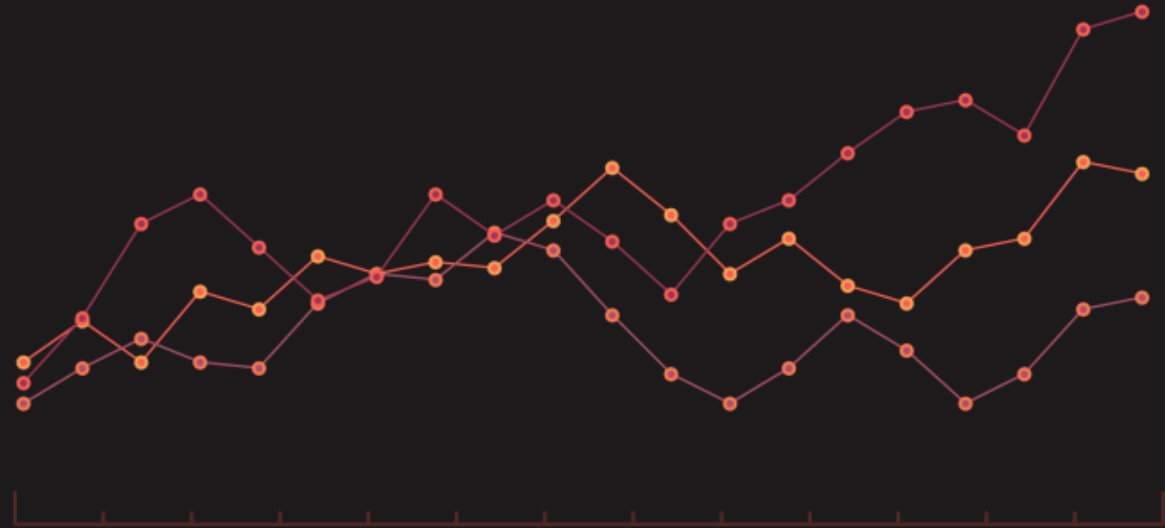
Electricity Production Forecast using Linear Regression
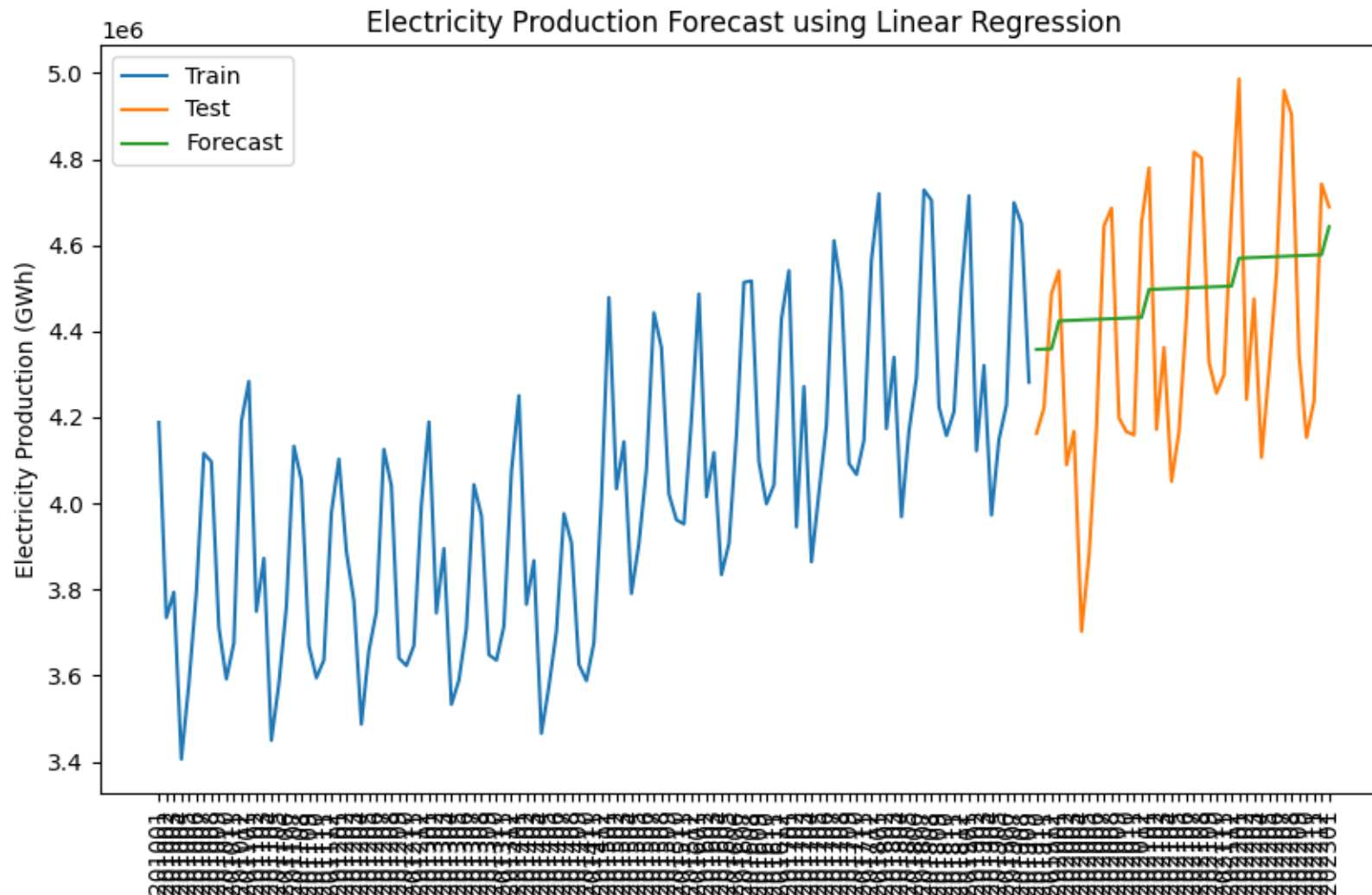
- RMSE: 299896.536
- MAE: 267129.097
- MAPE: 0.062 => 6.2%

ARIMA

Electricity Production Forecast using ARIMA
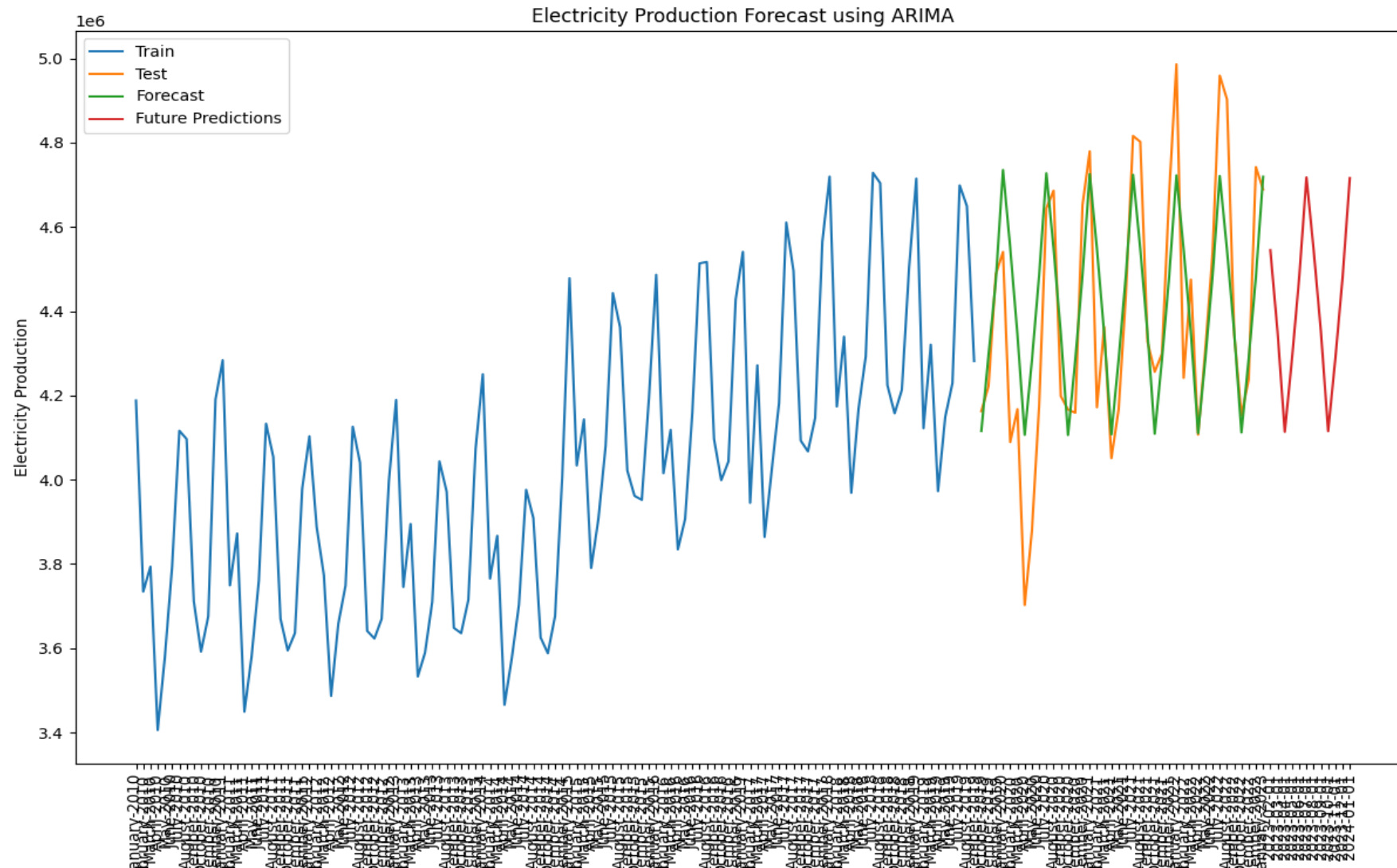
ARIMA MODEL SUMMARY

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                               SARIMAX Results
==============================================================================
Dep. Variable:       Electricity Production   No. Observations:          117
Model:                       ARIMA(6, 0, 3)   Log Likelihood        -1568.452
Date:                     Thu, 20 Apr 2023    AIC                    3158.904
Time:                             13:47:26    BIC                    3189.288
Sample:                         01-01-2010    HQIC                   3171.240
                              - 09-01-2019
Covariance Type:                       opg
==============================================================================
                 coef    std err          z      P>|z|      [0.025      0.975]
------------------------------------------------------------------------------
const        4.019e+06        nan        nan        nan         nan         nan
ar.L1           0.2373      0.191      1.241      0.215      -0.137       0.612
ar.L2           0.3973      0.190      2.094      0.036       0.025       0.769
ar.L3          -0.6320      0.169     -3.749      0.000      -0.962      -0.302
ar.L4           0.2371      0.185      1.281      0.200      -0.126       0.600
ar.L5           0.3950      0.177      2.237      0.025       0.049       0.741
ar.L6           0.3653      0.168      2.171      0.030       0.036       0.695
ma.L1          -0.0103      0.240     -0.043      0.966      -0.481       0.460
ma.L2          -0.0941      0.220     -0.427      0.669      -0.525       0.337
ma.L3           0.9044      0.178      5.082      0.000       0.556       1.253
sigma2       2.819e+10   1.92e-11   1.47e+21      0.000    2.82e+10    2.82e+10
===================================================================================
Ljung-Box (L1) (Q):                   0.11   Jarque-Bera (JB):            13.42
Prob(Q):                              0.74   Prob(JB):                     0.00
Heteroskedasticity (H):               1.59   Skew:                        -0.64
Prob(H) (two-sided):                  0.15   Kurtosis:                     4.06
===================================================================================
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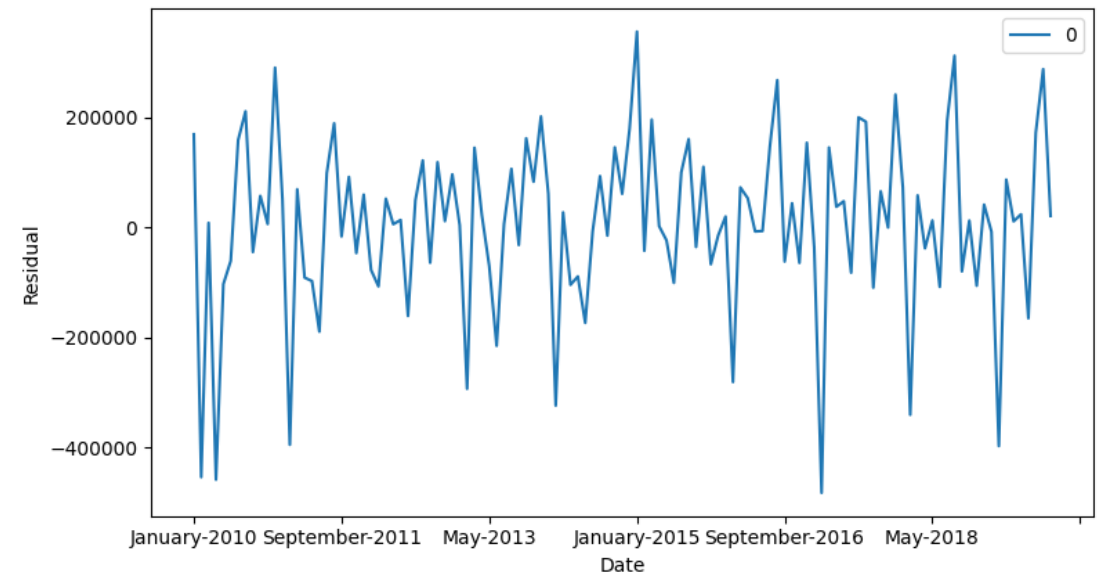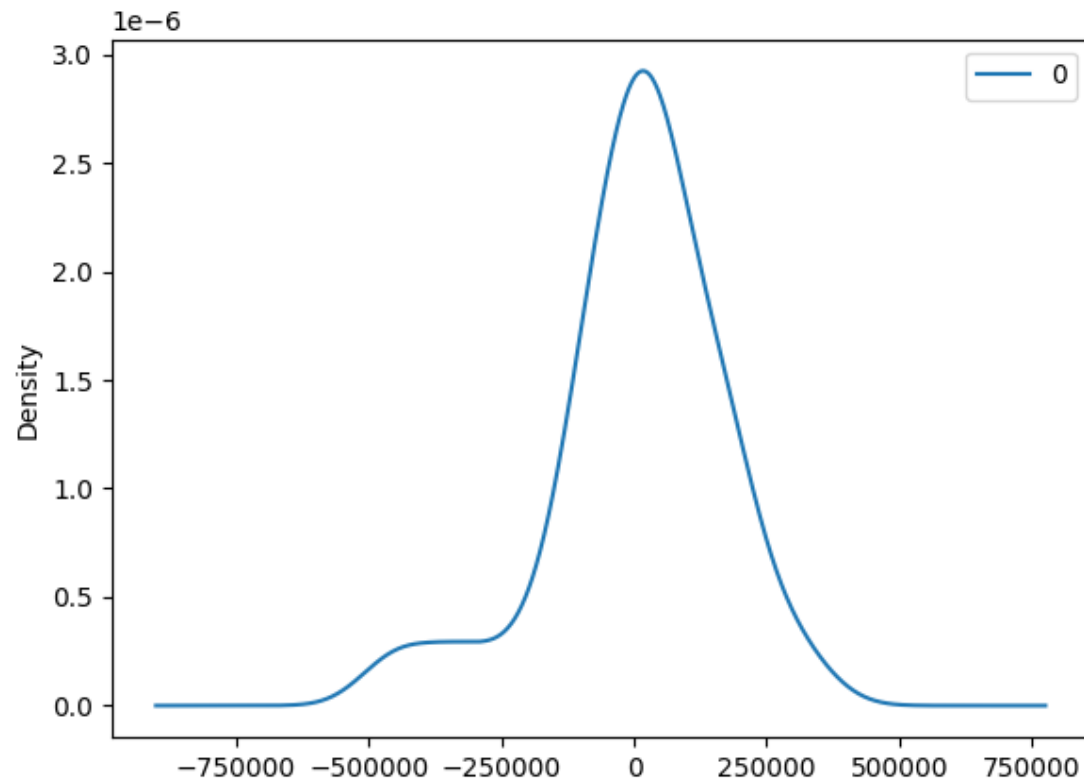
ARIMA MODEL RESIDUALS

- RMSE: 196476.987
- MAE: 148896.888
- MAPE: 0.034 => 3.4%

IMPACT & BENEFITS

- Forecasting future energy scenarios
- Investments in new power plants or fuel sources
- Visualizing data on electricity production by fuel type can be an effective tool for decision-makers in identifying the most efficient and sustainable energy sources for a particular region or country. This can inform policy decisions related to energy production and lead to a more reliable and sustainable energy future.

- Time series forecasting can help energy producers plan and allocate resources more effectively, leading to reduced greenhouse gas emissions and a smaller carbon footprint.

CONCLUSION

- The data on electricity production and GDP highlights the need for targeted investment in developing countries to improve access to electricity and promote economic growth.

THANK YOU !!