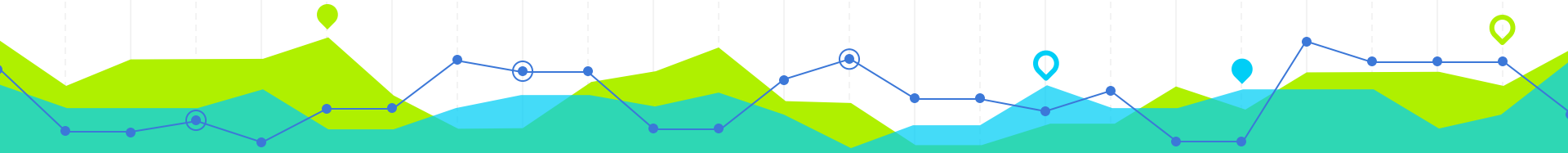
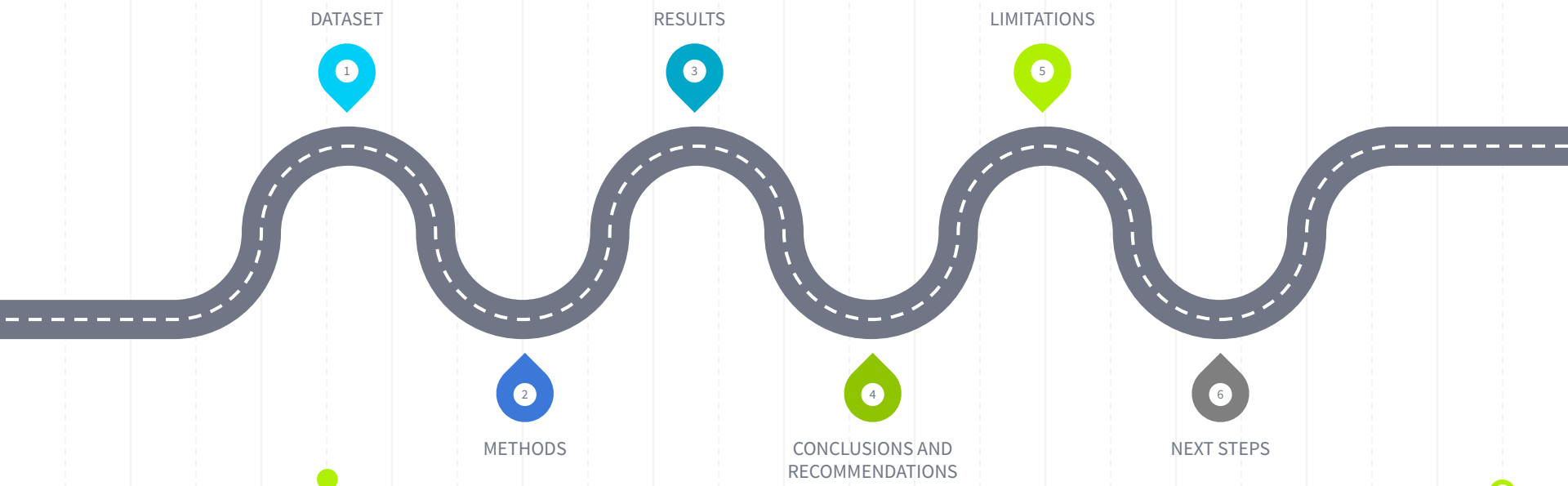


TIME SERIES - ENERGY PRODUCTION IN THE US

Business Problem

- Electricity - more in demand for tech sector growth
- Data Centers, Hospitals, Distribution Centers
- Need for available and reliable sources of power
- Investing in electricity - identify growing sources

ROADMAP


DATASET
1
RESULTS
3
LIMITATIONS
5
2
METHODS
4
CONCLUSIONS AND RECOMMENDATIONS
6
NEXT STEPS

Dataset:

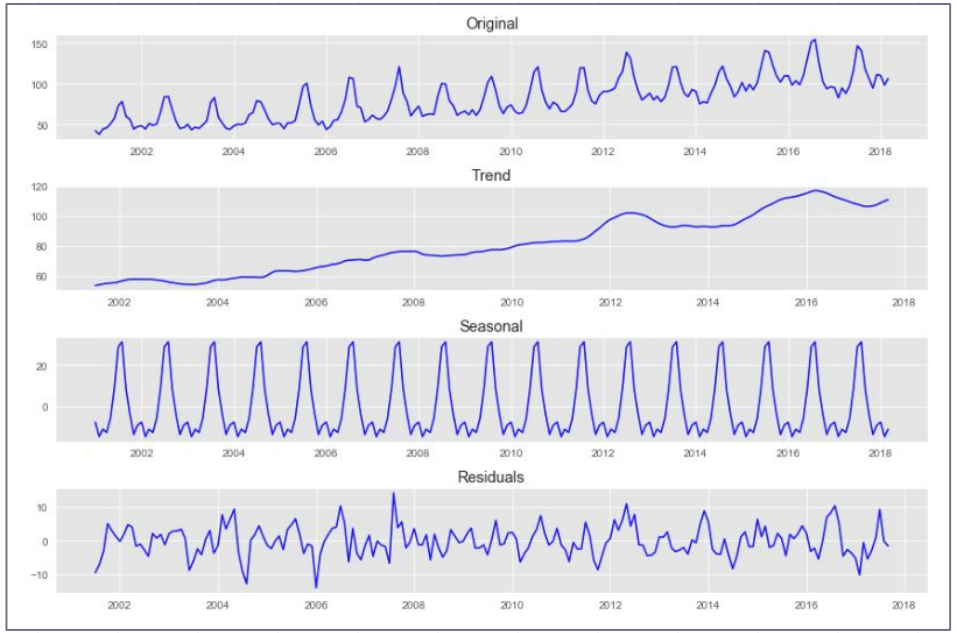
- Dataset from Kaggle, adapted from the US EIA website
- Production of electricity via different sources in all 50 states
- Data spans from January 2001 to May 2022, one record per month

Methods

- Data Preparation
- Naive Baseline Model
- ARMA models
- SARIMAX models
- Predicting on the Test Set
- Forecasting next 3 years
- Study of Seasonality
- Study of production by State

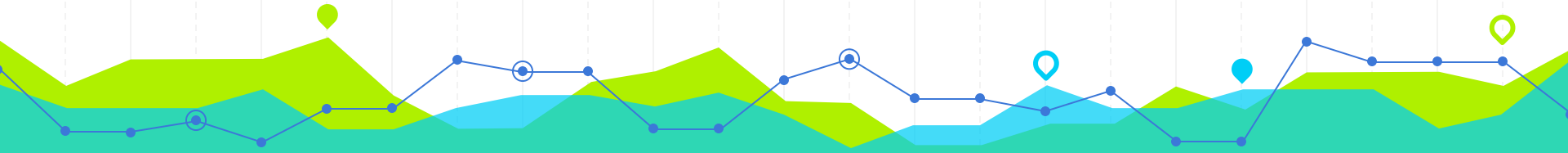
Models

Series Decomposition:



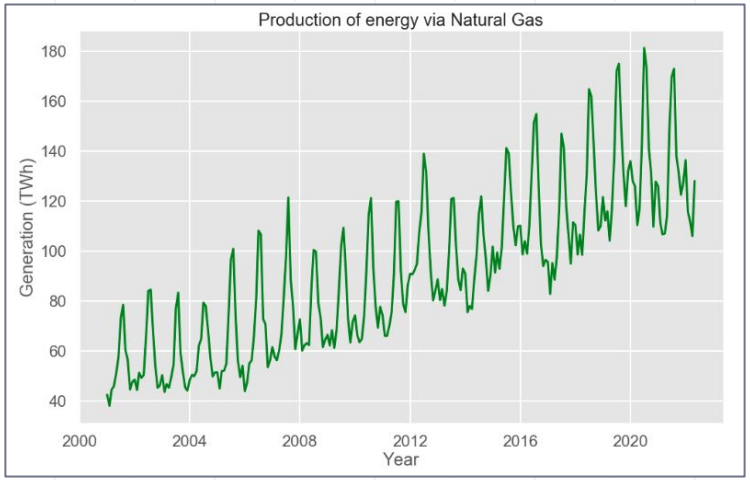
ARMA and SARIMA models:

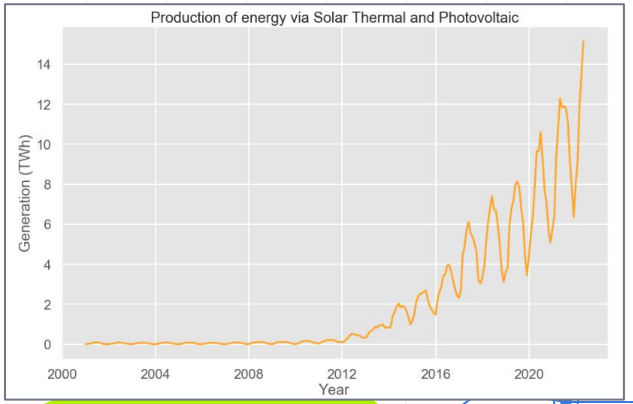
$$y_t = c + \phi_1 y_{t-1} + \theta_1 \epsilon_{t-1} + \epsilon_t$$



Results

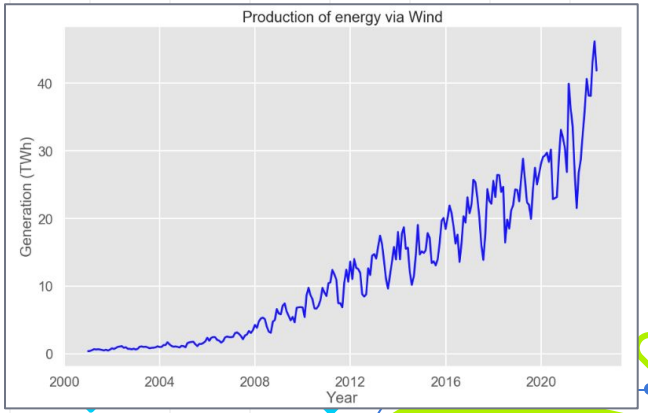
TOP 3 SOURCES





Natural gas, solar and wind all showed upward trends

We decided to focus on natural gas for its greater reliability



PREDICTIONS ON TEST

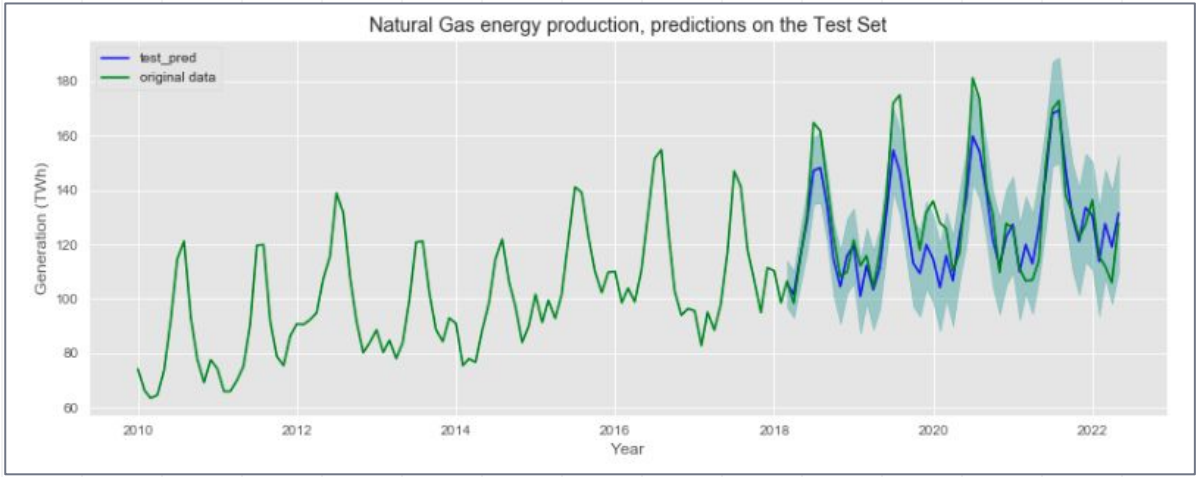
Best model:

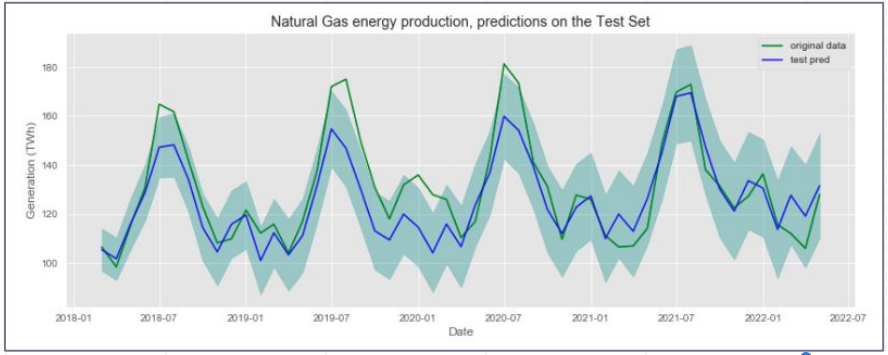
SARIMAX model parameters
(8, 1, 2)(12, 2, 1, 12)

AIC of 173.5

With this model:

predictions on the test set
for 51 months with an error
RMSE = 10.9 TWh





FORECASTING

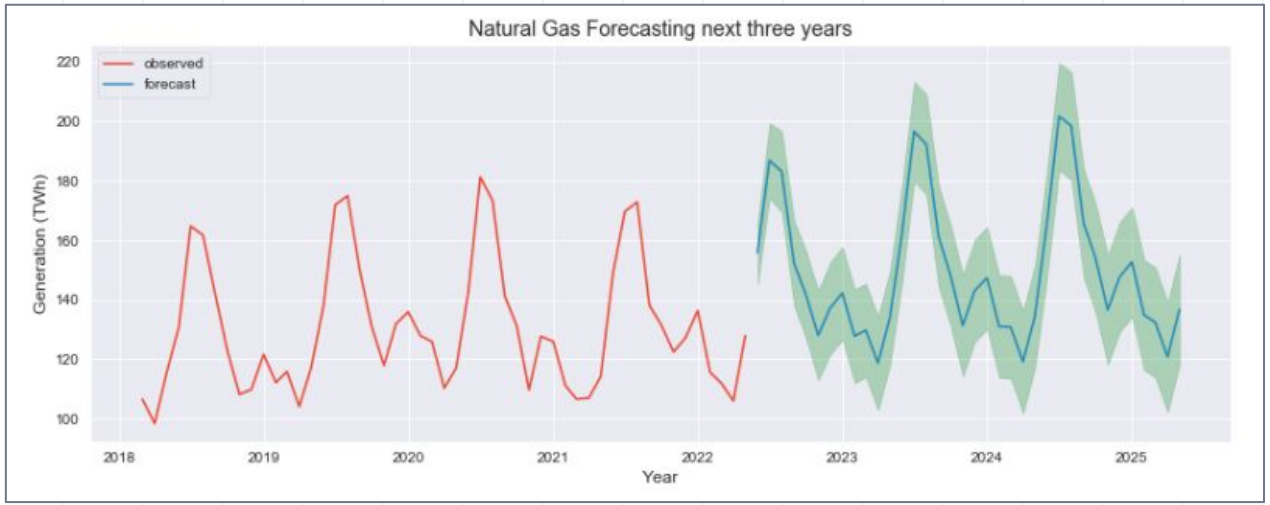
We forecasted our data

for 3 years finding a growth of up to 16.7%

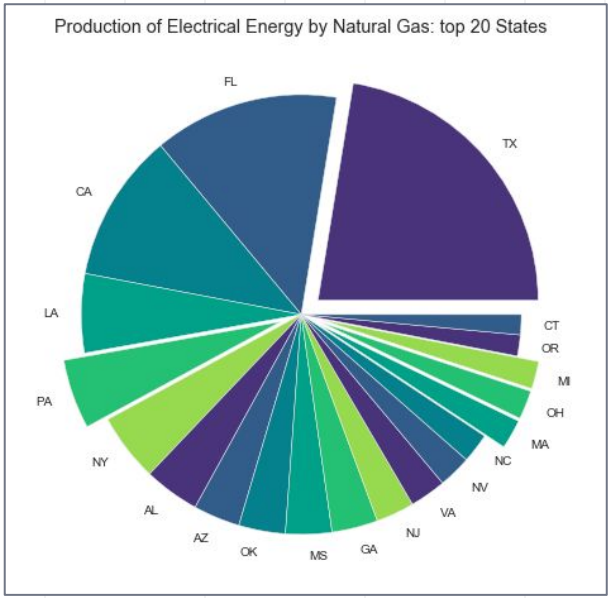
between 2021 and 2024

with an error of 4%

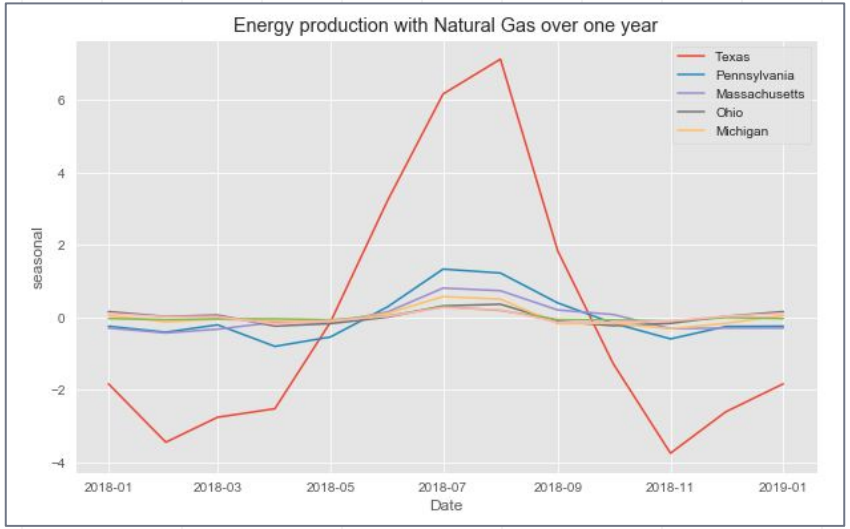
5 - 9 TWh



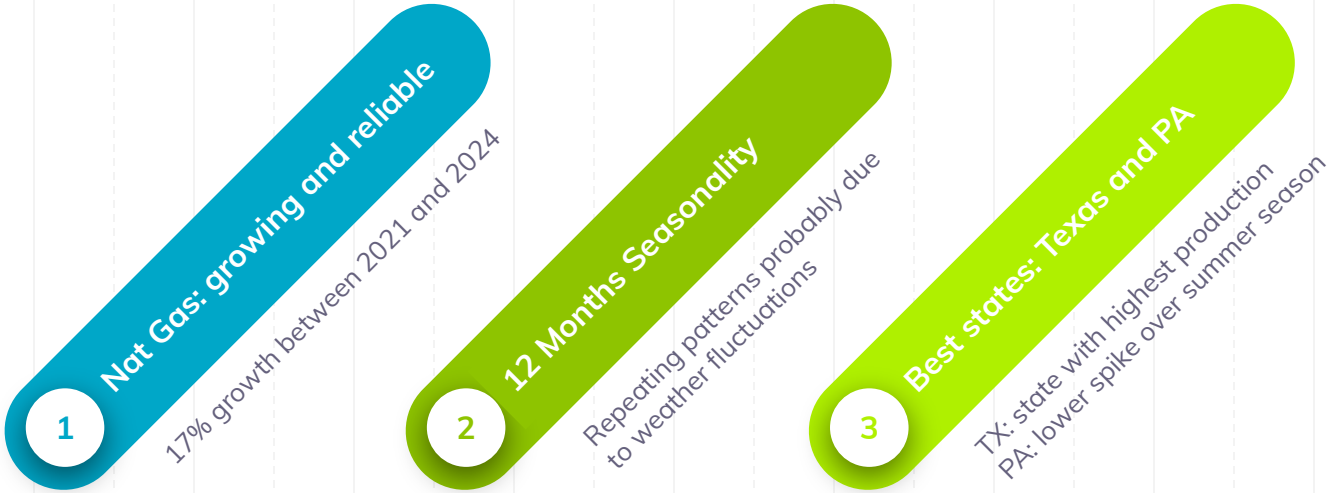
STUDY BY STATE AND SEASON



Study of pattern over a year for Texas, Pennsylvania, Massachusetts, Ohio and Michigan



CONCLUSIONS and RECOMMENDATIONS:



LIMITATIONS

Data Preparation:

Different dataset could require formatting and filling missing data

Parameters and Models:

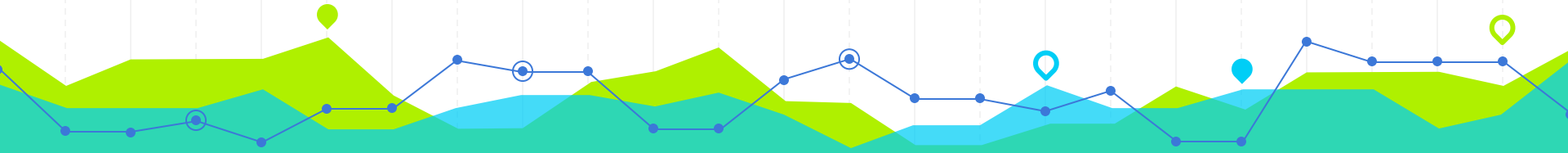
Different parameters and models might not perform as well

Running Time:

Searches for best parameters take a long time to run

Next Steps and Future Improvements:

- Studying solar and wind generated energy trends
- More data: farther in the past or records by day
- Deeper study trend and seasonality and influential factors
- More powerful tools: Prophet, AWS SageMaker’s DEEPAR



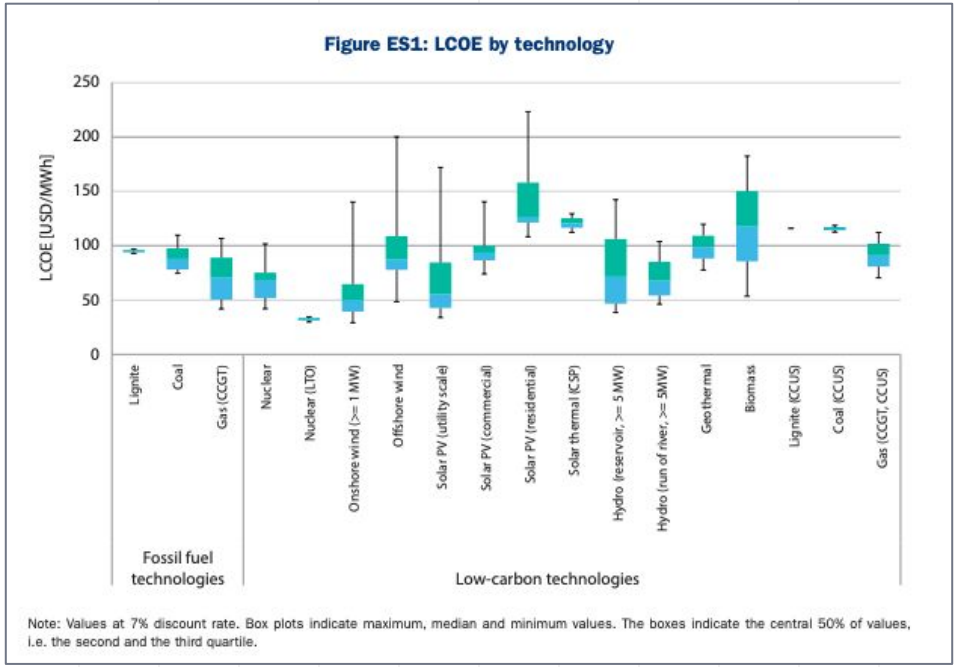
THANKS!

Any questions?

You can find me at

marianlkuzmin@gmail.com

Production Cost by source:



Source: from the full report found on https://www.iea.org/reports/projected-costs-of-generating-electricity-2020