Understanding GB Power Prices and Renewable Generation Methods

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2024/07/14

Power Price Drivers

- **Commodity Prices Influence Power Prices**: Gas and coal price are the main driver
- **Seasonality**: Power prices exhibit a seasonal pattern, driven by higher heating demands in winter months

Energy Technology Analysis

- **Renewable vs. Non-Renewable Generation**: the generation gap is decreasing
- **Renewable Generation**: Offshore and onshore wind dominate total generation and biomass shows highest load factor

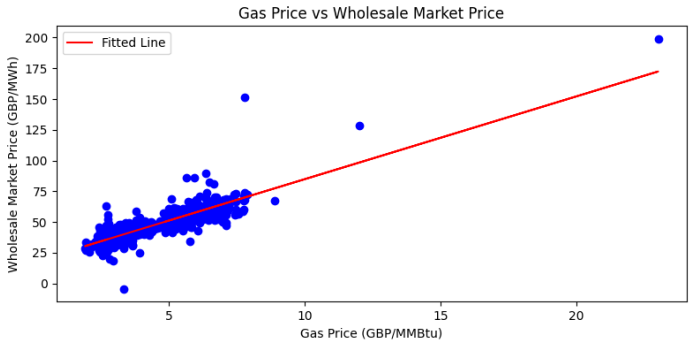
Predicting Power Price for 2020

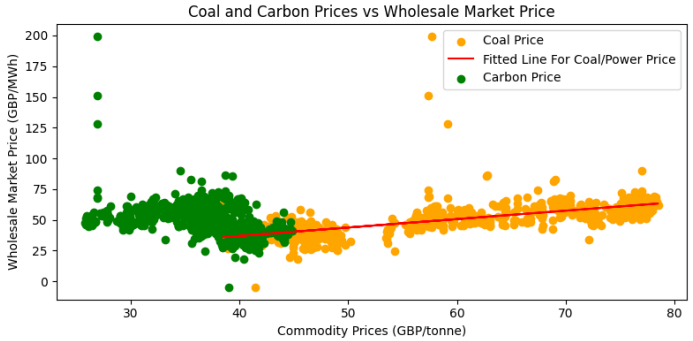
- **Linear Regression Model**: outperforms other models, with gas price being the top feature
- **Predicted Price for 2020**: closely follows the gas price, impacted by significant events

A Power Price Drivers

Wholesale Market Price is Affected by Commodity Price and Underlying Demand; It Mainly Drives by Gas Price and Has Strong Seasonality

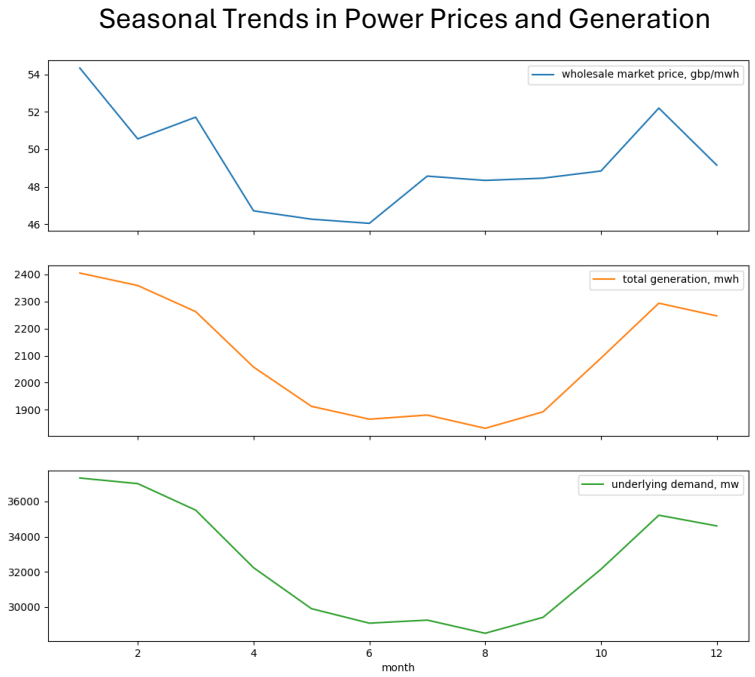
Wholesale Market Price Has Strong Positive Correlations with Gas Price and Coal Price





- A 1 GBP/MMBtu increase in gas prices results in an approximate **6.74** GBP/MWh increase in wholesale market prices
- **Strong relationship** between gas and power price, with the fitted line explains 73.9% of the power price variability
- 1 GBP/tonne increase in coal prices results in an approximate **0.68** GBP/MWh increase in power price, **moderate correlations**

The Power Prices Shows a Seasonal Pattern, Driven by Heating Demands in Winter



Winter months experiences higher power prices and underlying demand

Power generation is adjusted based on seasonal demand, with lower generation during summer and increased generation during winter

The **demand-driven pricing effect** is evident from the correlation between demand and prices

Correlation of Wholesale Market Price vs

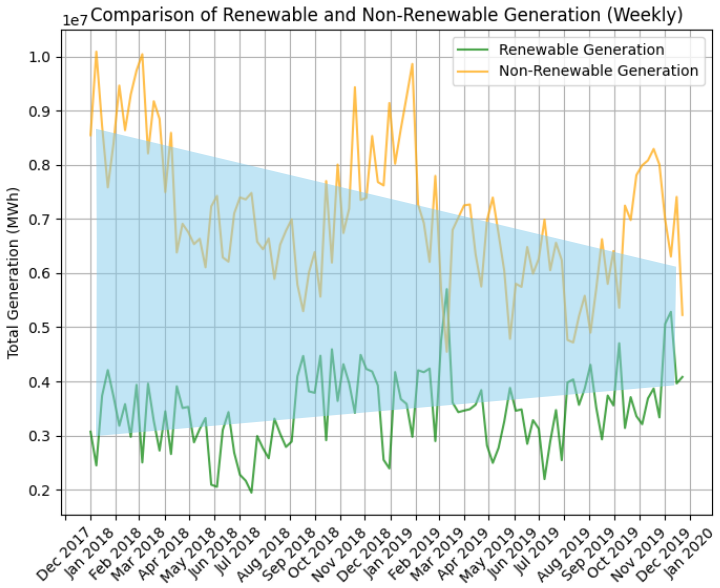
Gas Price	Coal Price	Carbon Price	Tot Generation	Load Factor	Underlying Demand
0.65	0.49	-0.28	0.057	0.083	0.42

High Correlations 1.0 — Low Corr 0.0 — High Corr -0.5

B Energy Technology Analysis

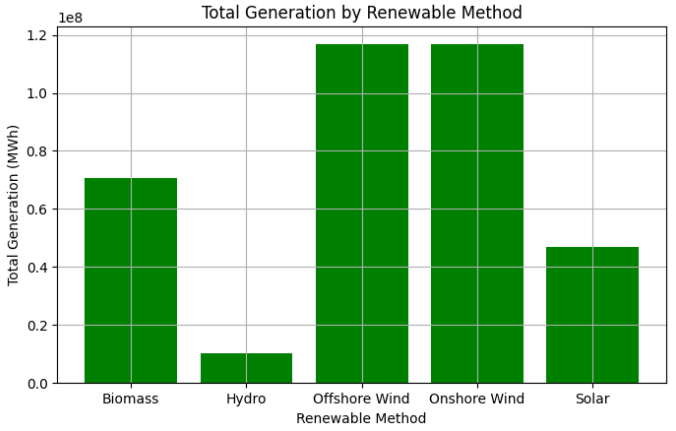
Renewable Generation is Catching Up Non-Renewable Generation; Wind and Biomass Being the Top Renewable Method With High Generation and Load Factor

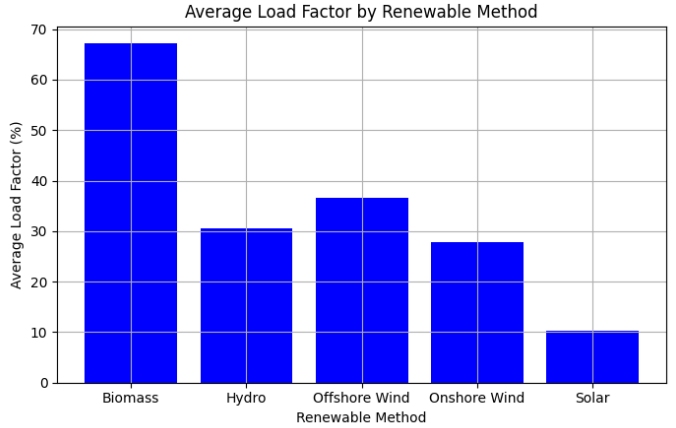
The Generation Gap Between Renewable Method and Non-Renewable Method is Decreasing Between 2018-2019



- Renewable energy generation has steadily increased, while non-renewable energy generation shows a declining trend
- This trend indicates a significant shift towards renewable energy sources, suggesting increased adoption and investment in renewable technologies

Offshore and Onshore Wind Lead the Renewable Generation; Biomass Has the Highest Load Factor



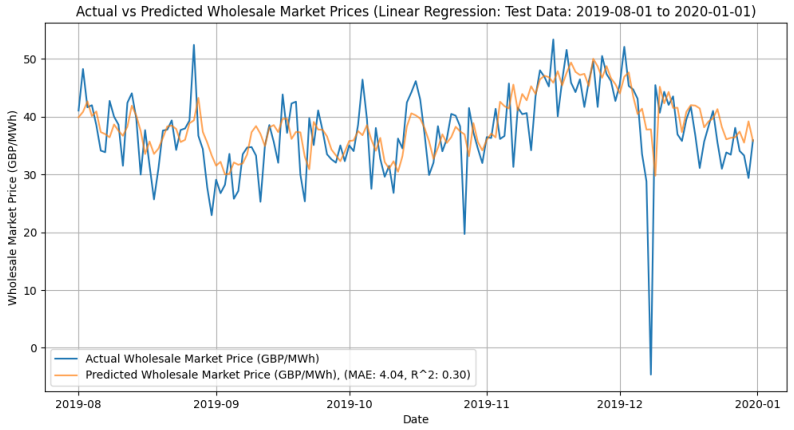


- Offshore wind and onshore wind are the leading renewable energy sources in total generation, followed by biomass
- Biomass is the highest load factor, indicating its consistent and efficient output

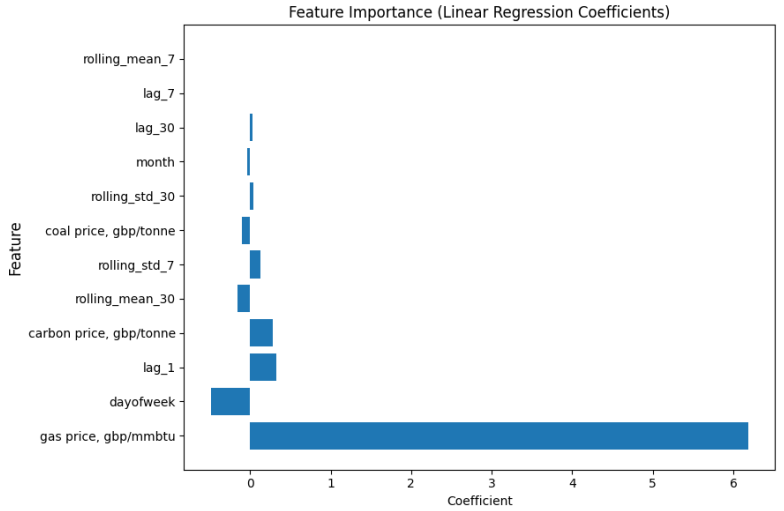
C Models Predicting Power Price for 2020

Linear Regression Model is Built to predict the Power Price in 2020, With Gas Price Being the Most Important Feature; The Price in 2020 Expect to See a Sharp Drop in the First Half and Gradual Recovery in the Second Half

Linear Regression Model Performs the Best, with Gas Price, Day, and the Price Yesterday Being the Top Features

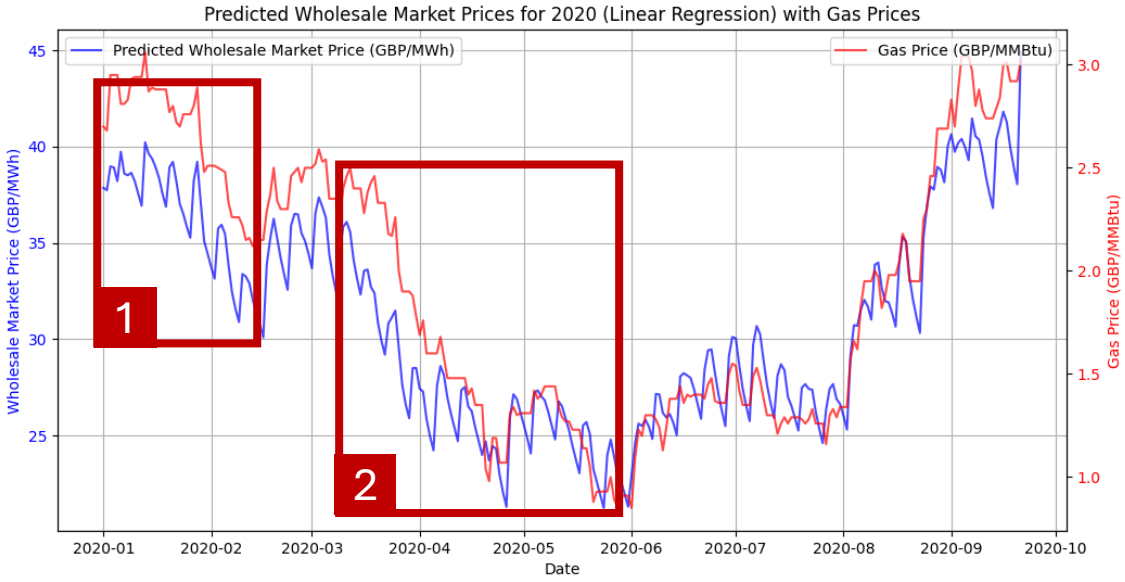


Model	Mean Abs Error	R^2 Score
Linear Regression	4.04	0.30
XGBoost	4.52	0.23
Random Forest	4.51	0.25



- Linear Regression outperforms other models, having mean absolute error of 4.04 and explaining 30.32% of the variability
- Gas price is the most important feature, followed by day of the week and power price of yesterday

Predicted Power Price Follow the Gas Price; There is a Sharp Drop in the H1 and Gradually Recover in the H2



- The predicted power price closely followed the gas prices. Significant events like geopolitical tensions and COVID-19 played a crucial role influencing the power prices

1 Oil Price War

A price war between Saudi Arabia& Russia led to a significant drop in oil and gas prices

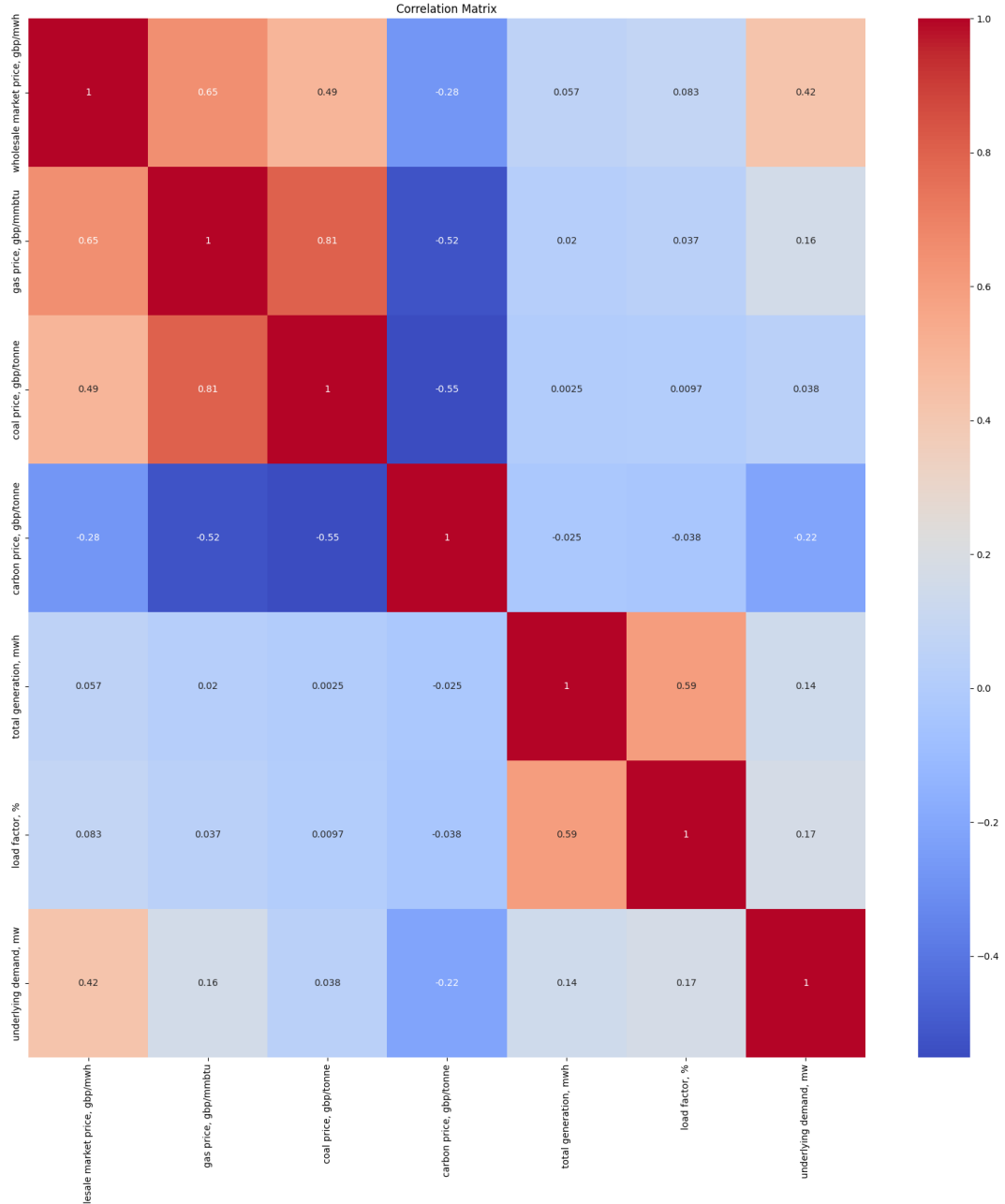
2 COVID-19

It caused reduction in economic activity and energy demand, resulting drop in gas and power price

* If don't have historical power prices, model would inference based on previous predicted price

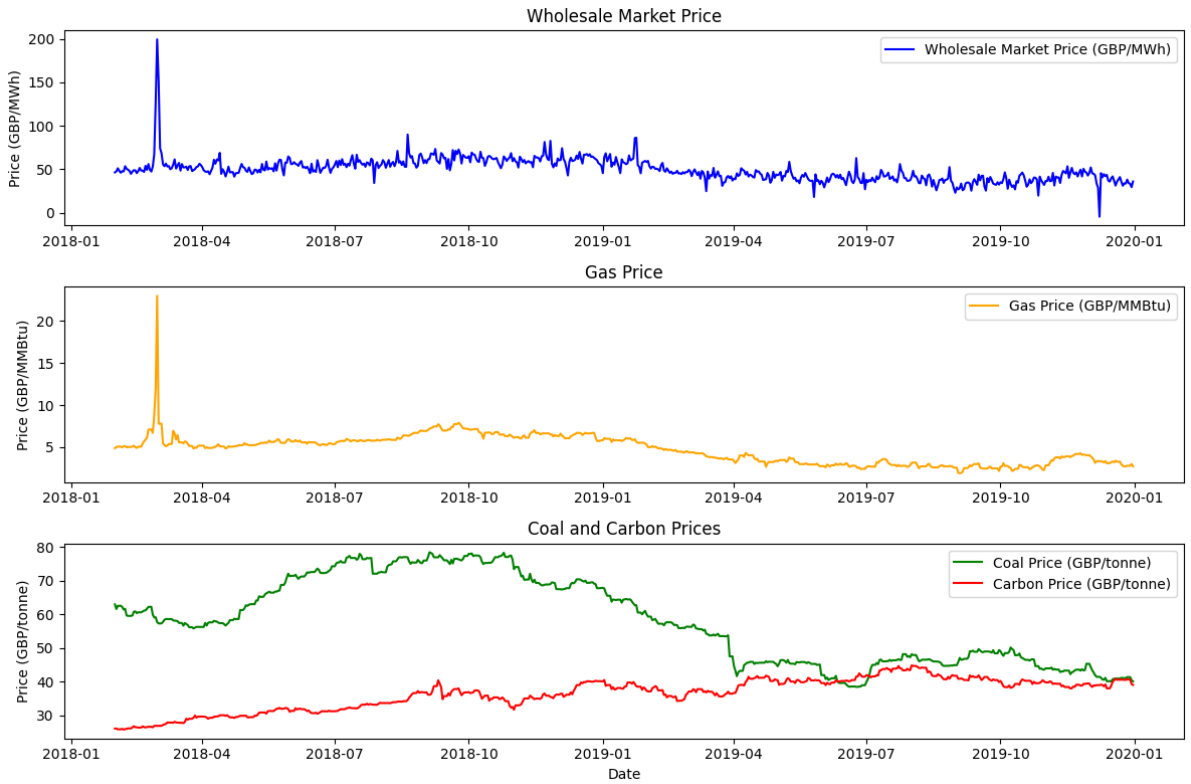
D Appendix

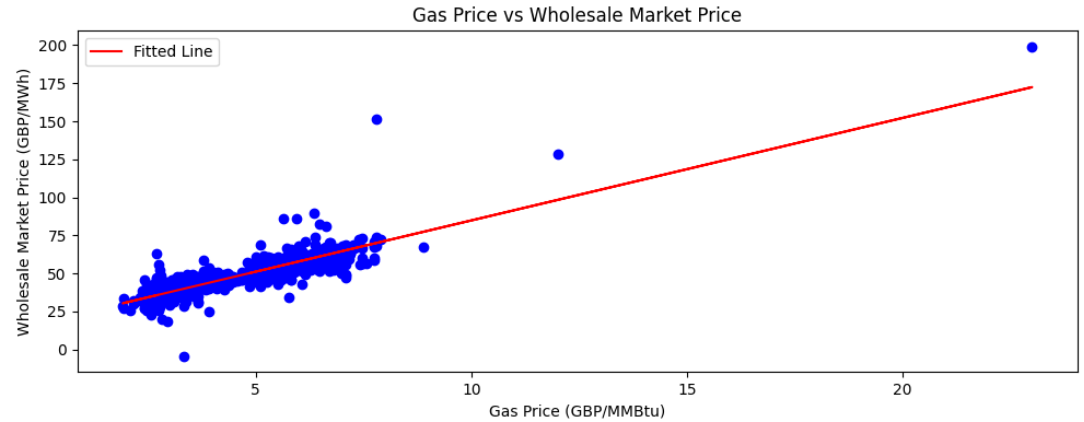
Data Exploration: Correlation Matrix for Slide 1

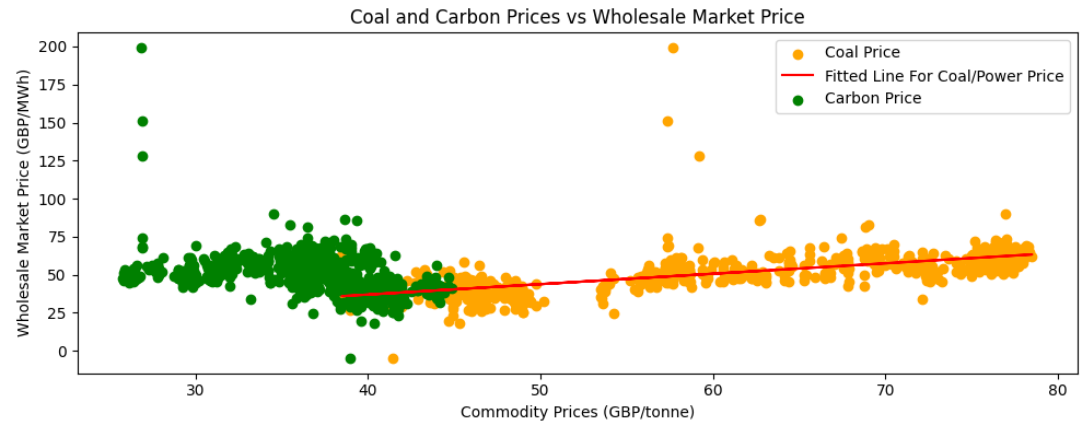


D Appendix

Slide 1: Wholesale Power Price vs Commodity Price







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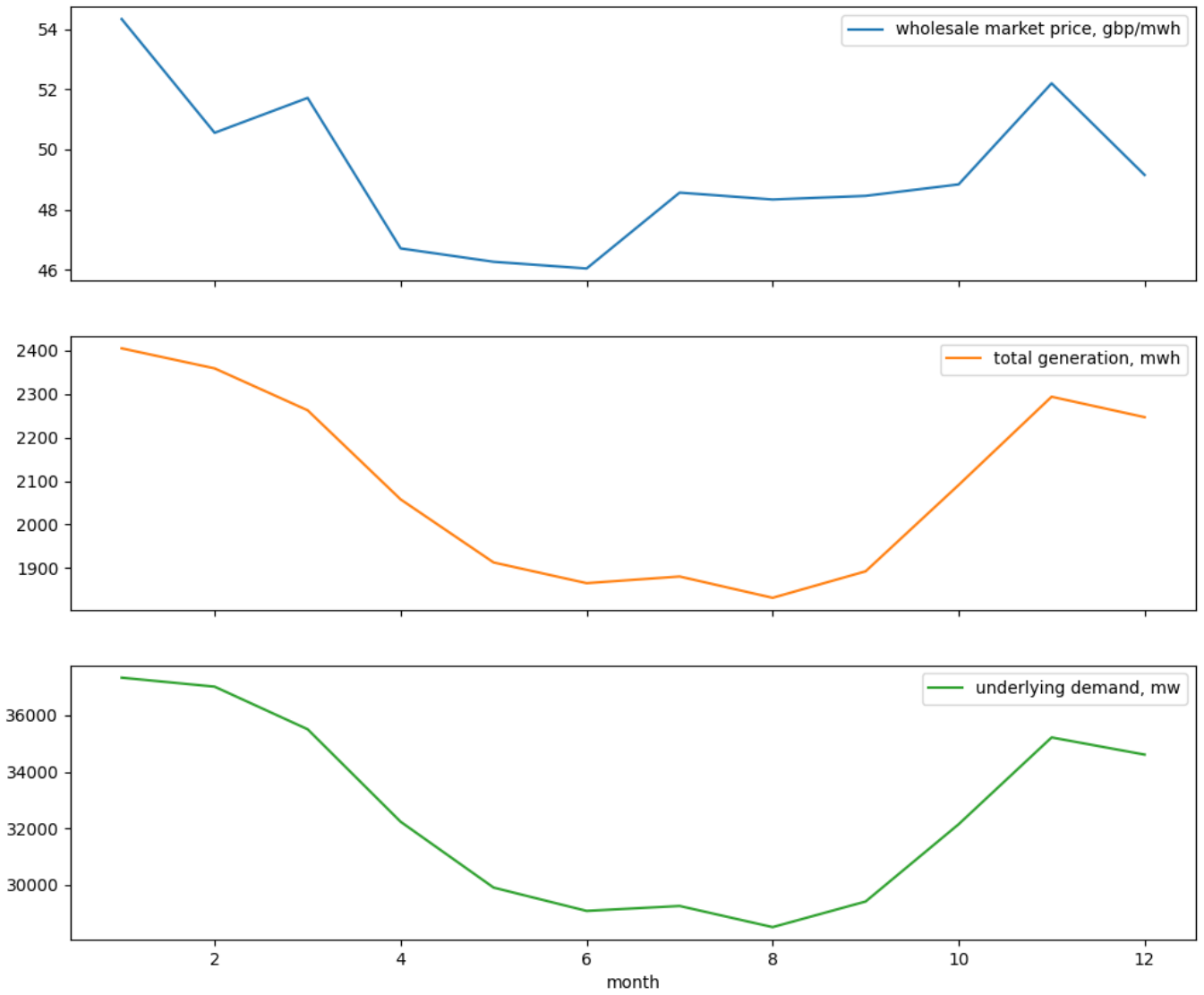
Slide 1: Wholesale Power Price vs Total Generation and Underlying Demand



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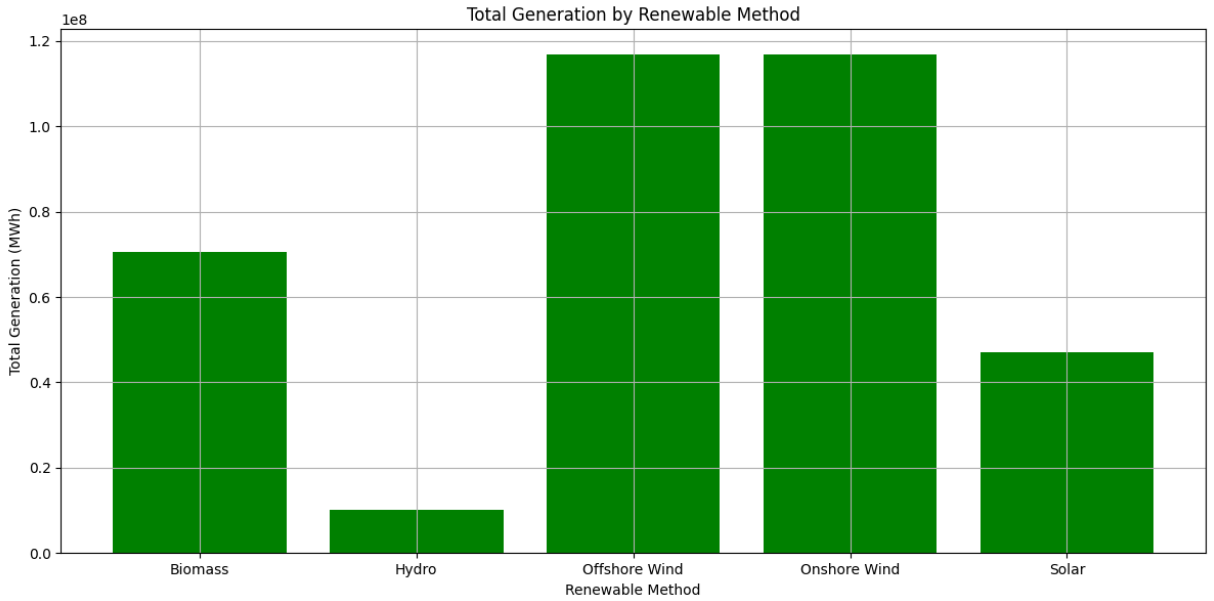
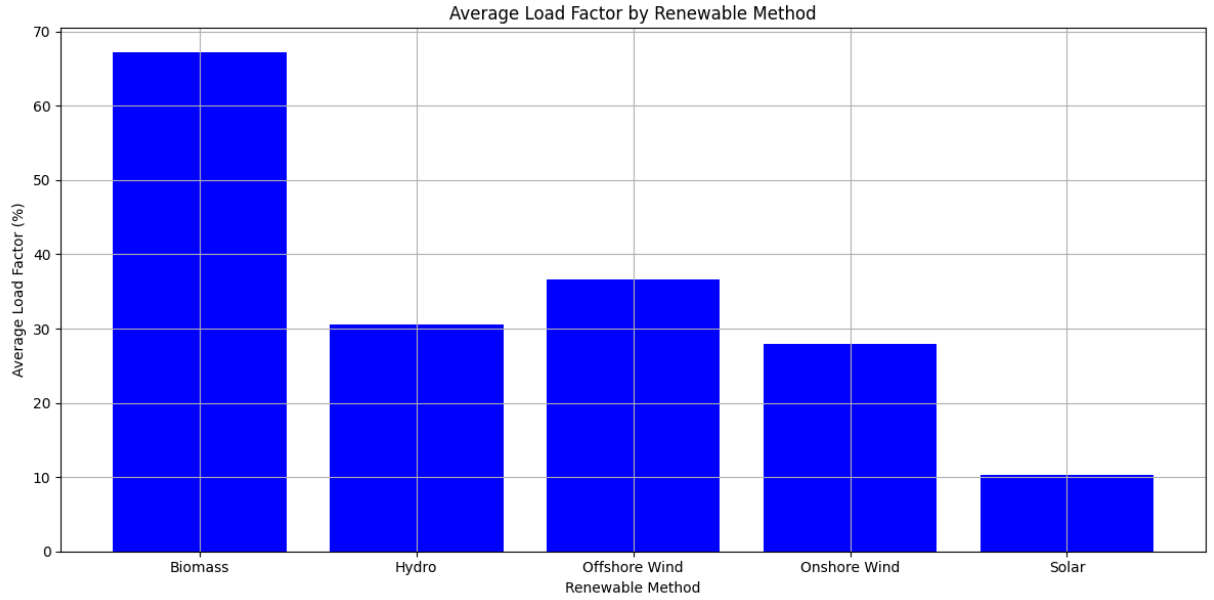
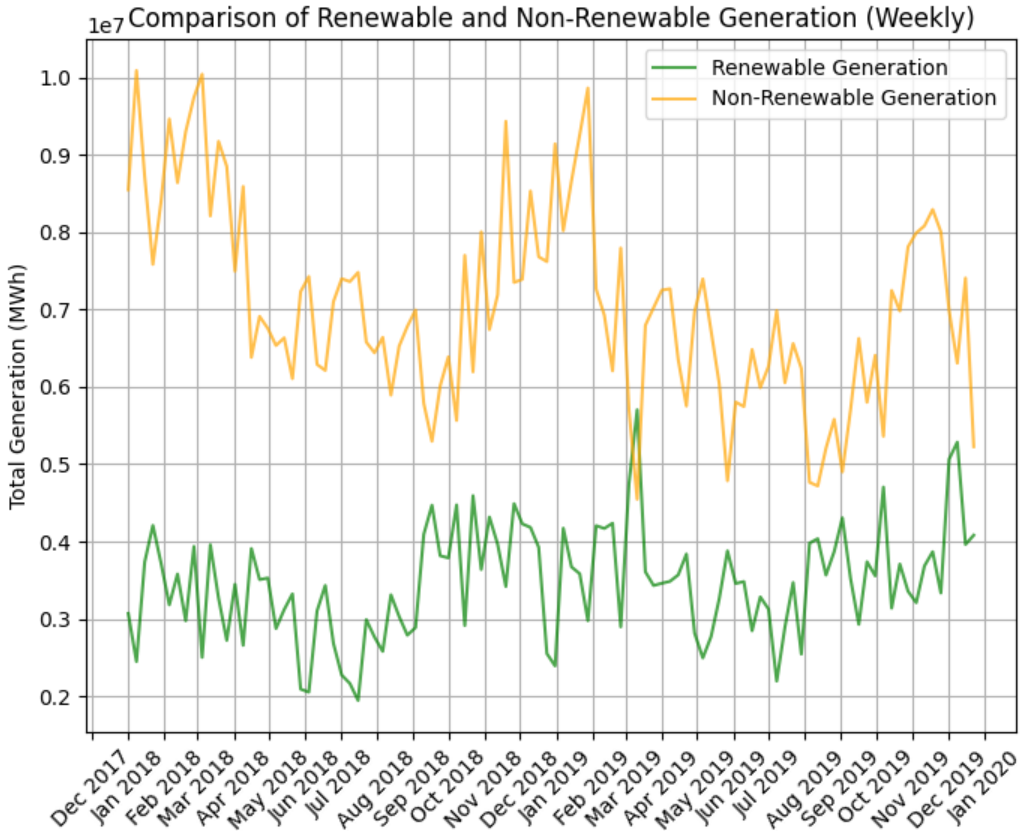
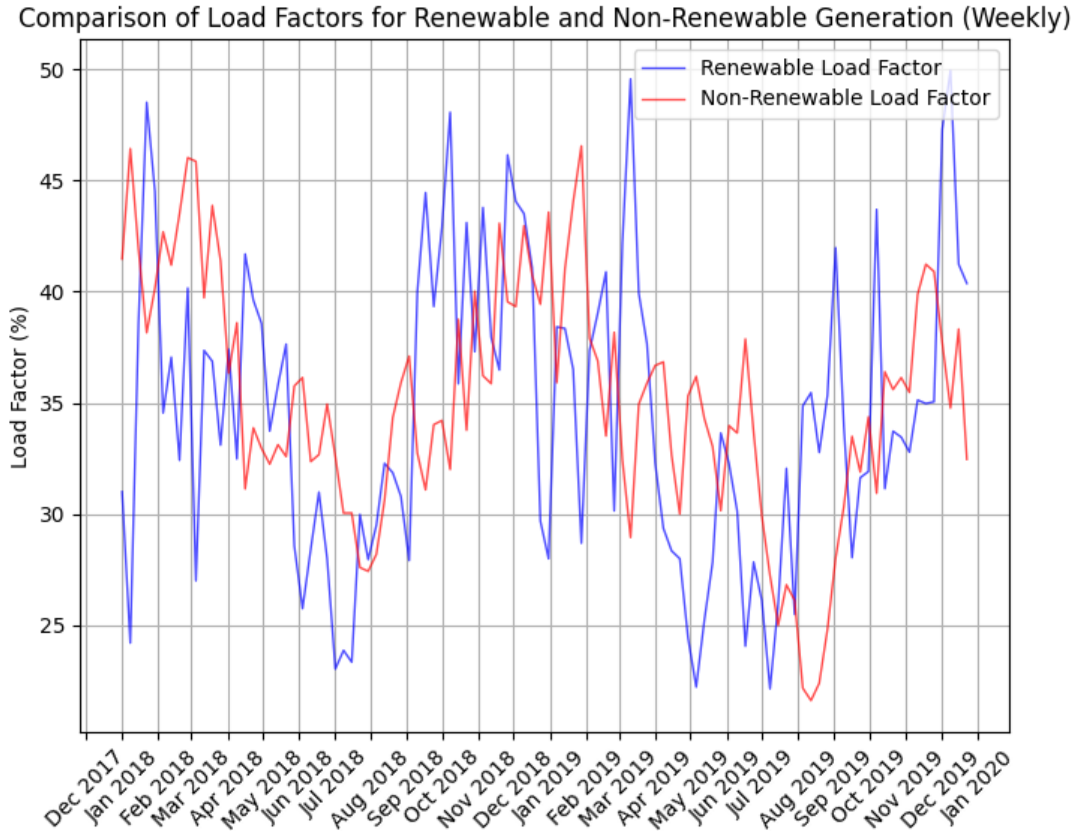
Slide 2: Total Generation and Average Load Factor by Renewable Method





Slide 2: Renewable and Non-Renewable Generation and Load Factor Comparison





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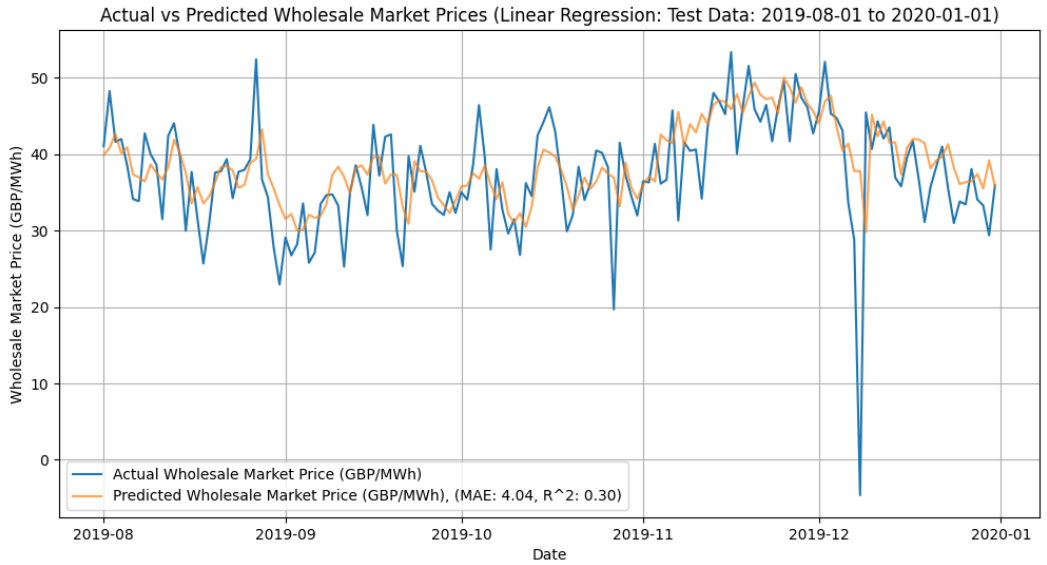
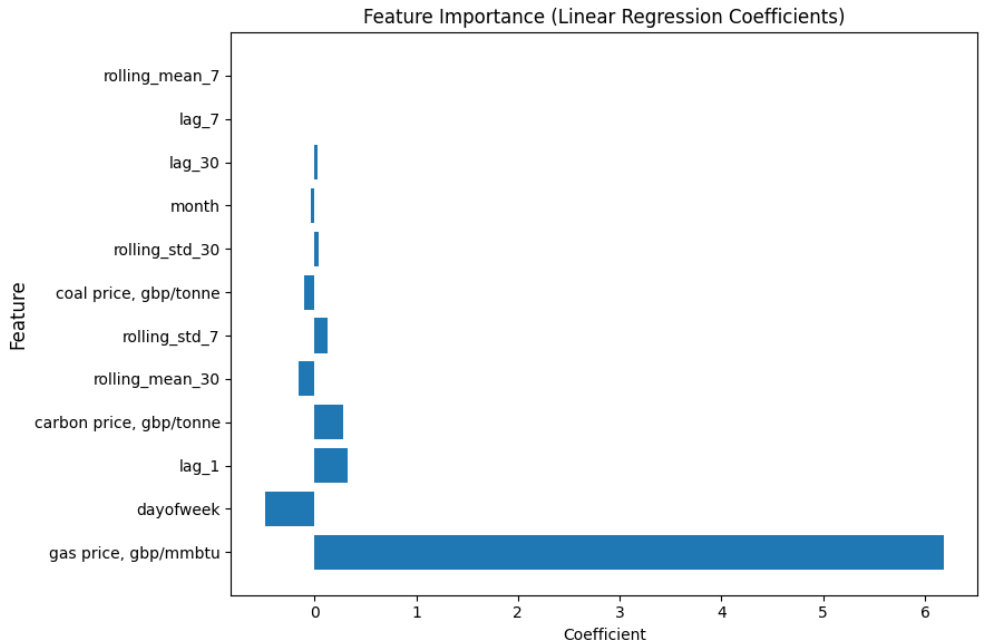
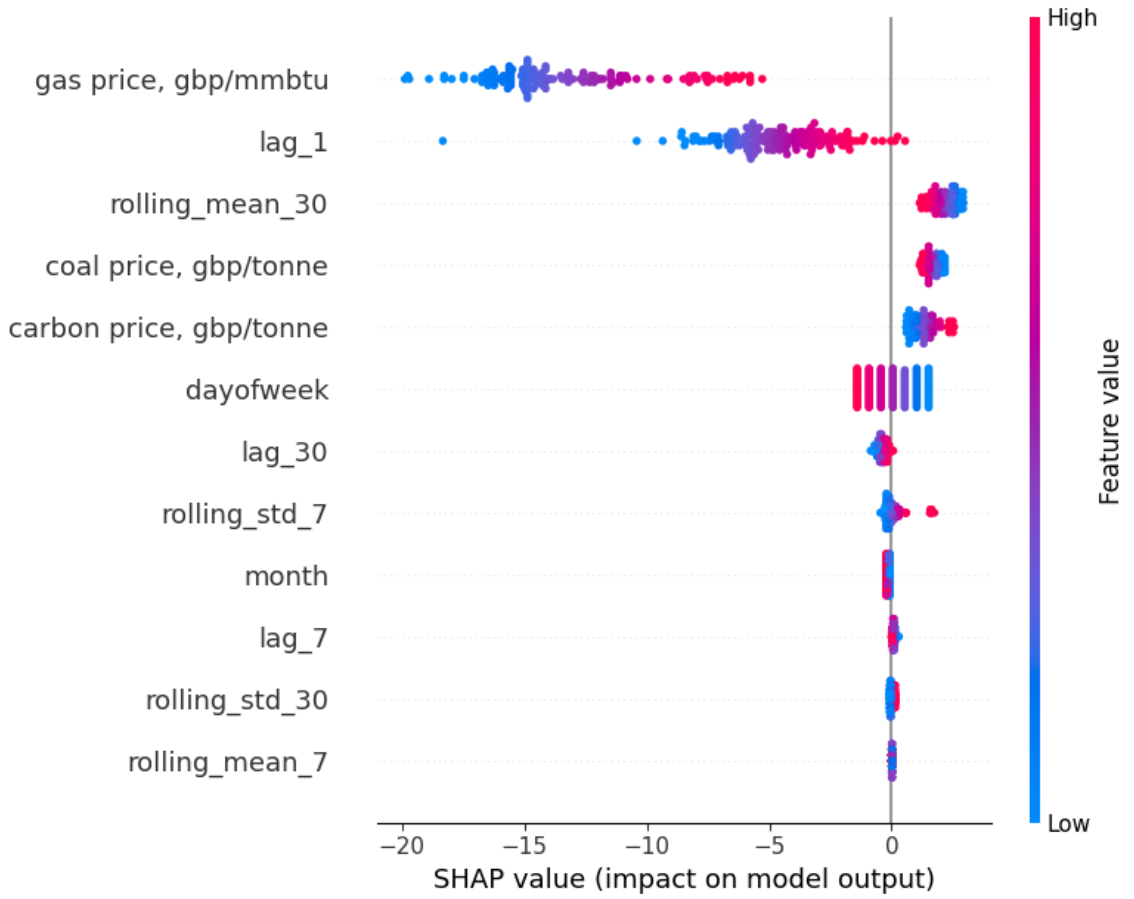
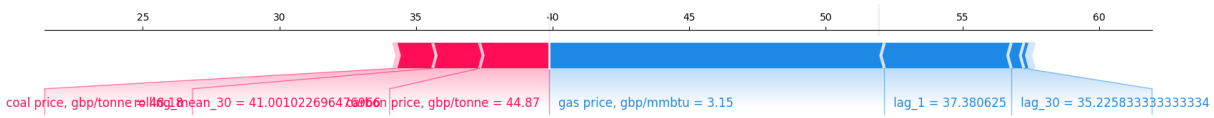
Slide 3: Linear Regression Model Test Result and Feature Explanation









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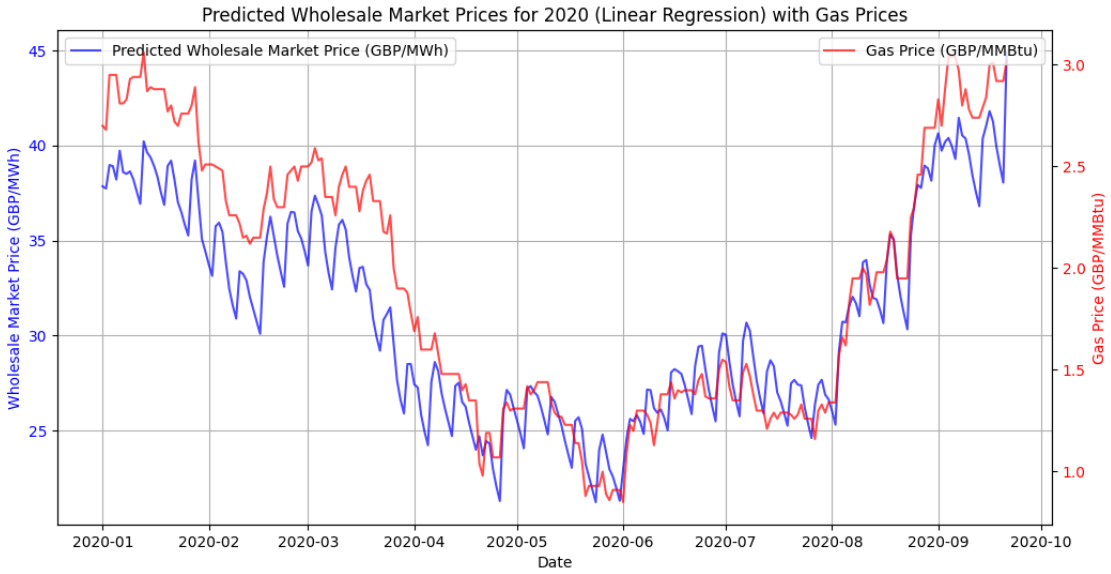
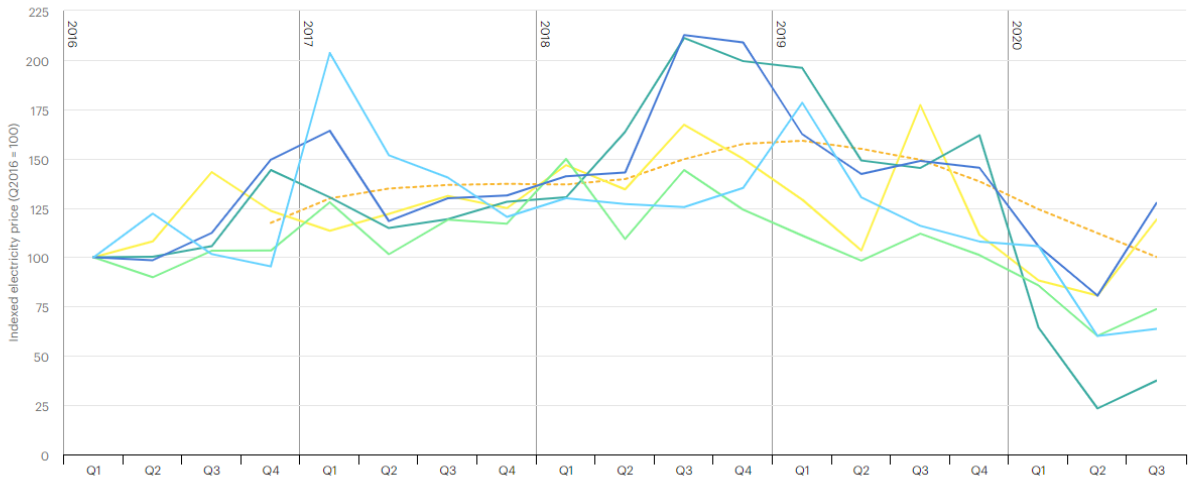
Slide 3: Linear Regression Model Power Price Inference and Actual Price Globally



Quarterly average electricity prices in selected markets, 2016-2020



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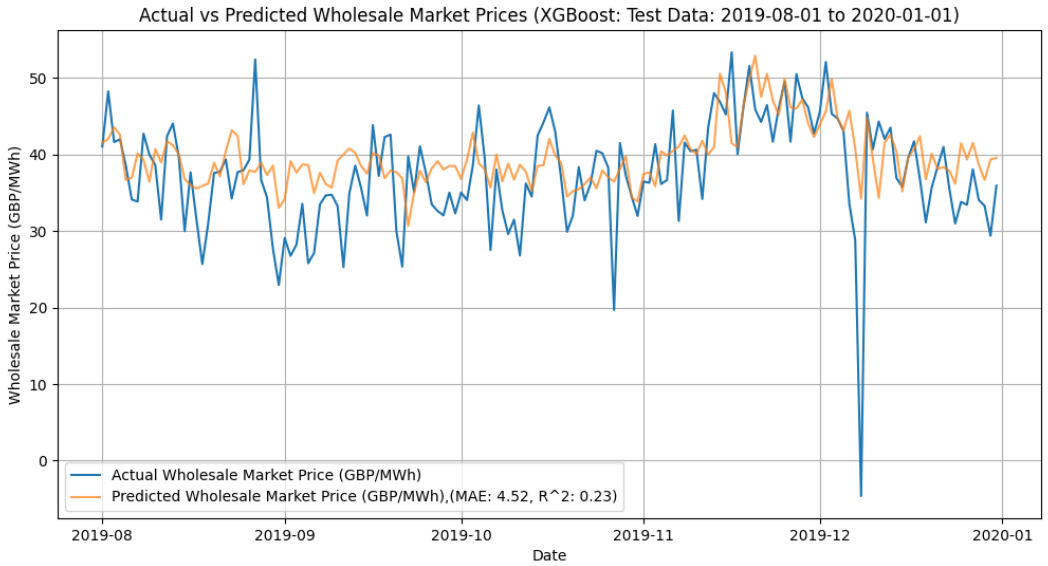
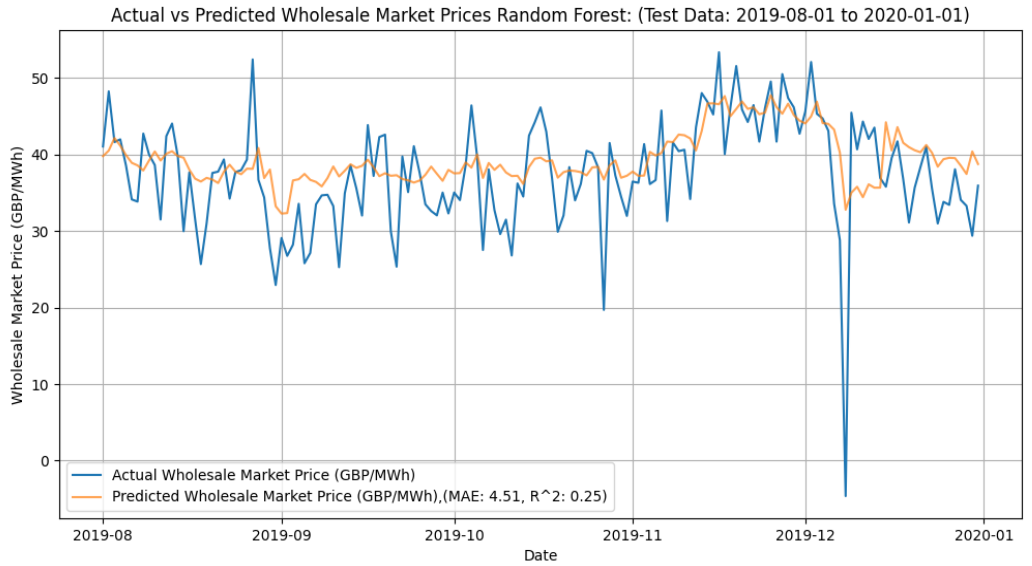
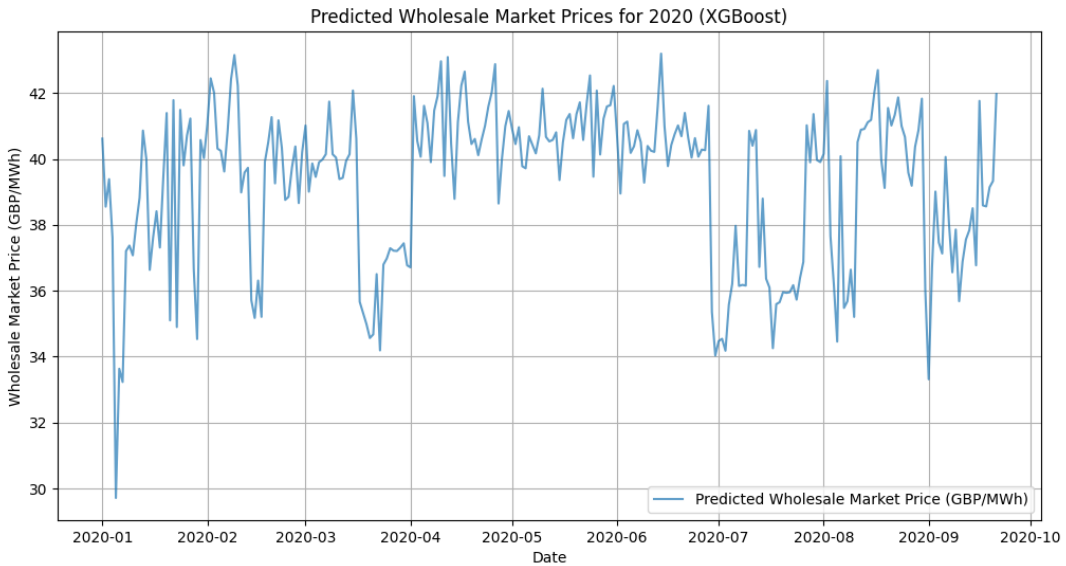
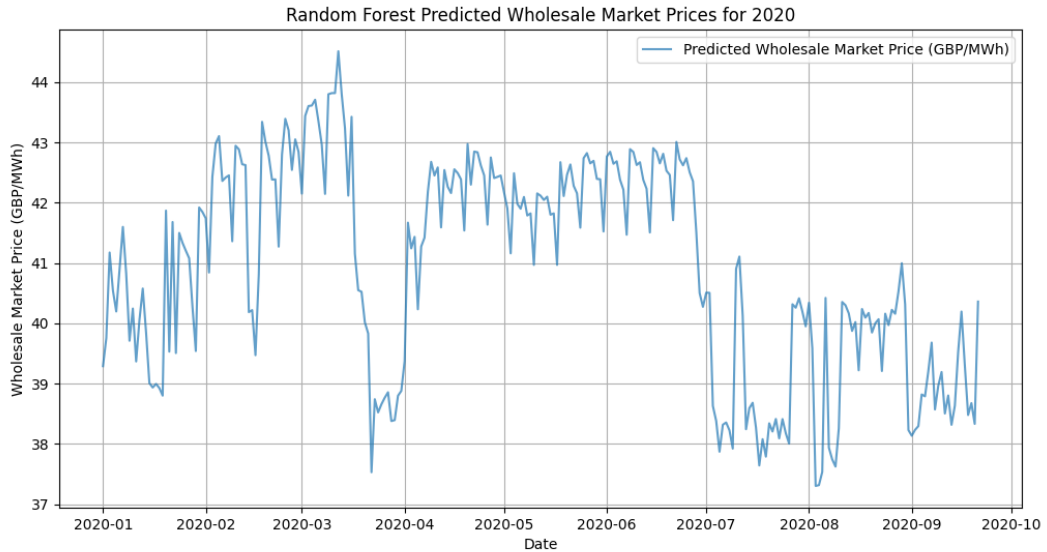
Slide 3: Other Models Test and Inference Result









D Appendix

Slide 3: Random Forest Feature Explanation