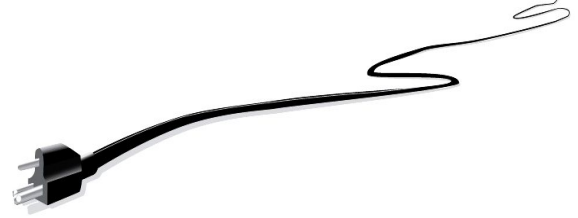


# Day-Ahead Electricity Price Prediction



Carter Bouley





## Project Goals

Wholesale Electricity prices change over the course of the day

This provides opportunity to optimize consumption according to prices

### Price Prediction

- Electricity prices follow patterns over *daily*, *weekly* and *seasonal* timeframes.
- Machine learning techniques can be utilized to *predict* these patterns effectively



***Few electricity providers give their customers access to wholesale prices.***

*Octopus energy has designed an 'Agile Tariff' which does exactly that.*



## Data Collection

### Electricity

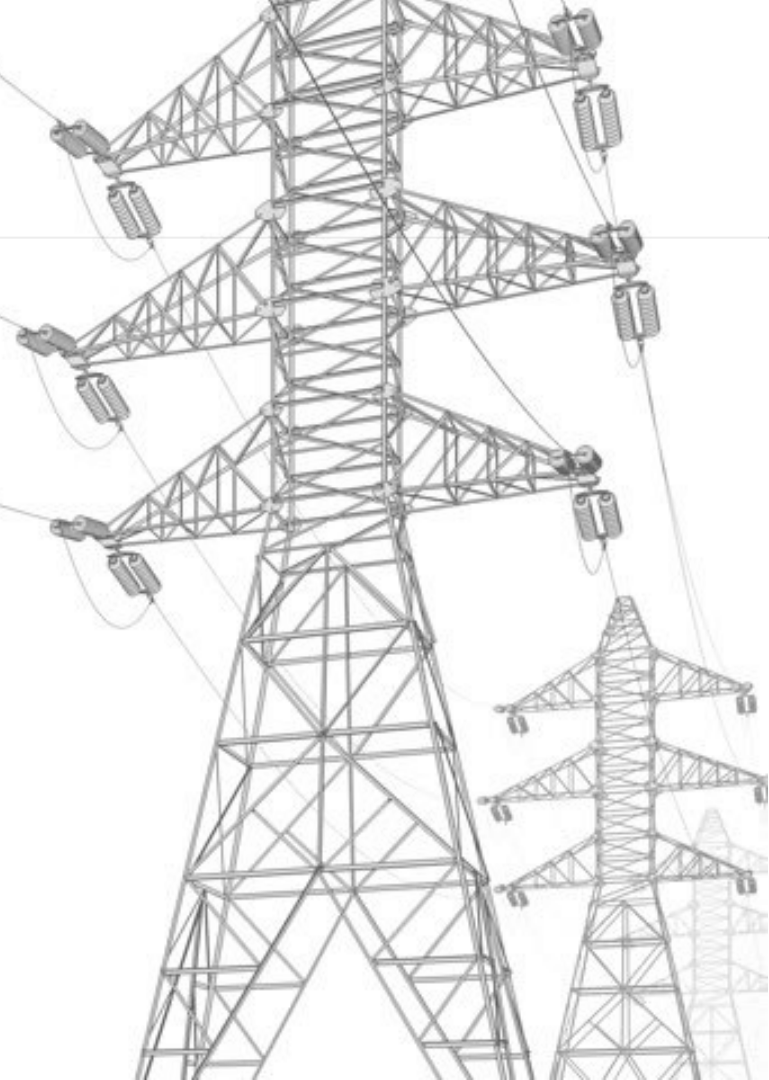
- Hourly electricity price data

### Commodity

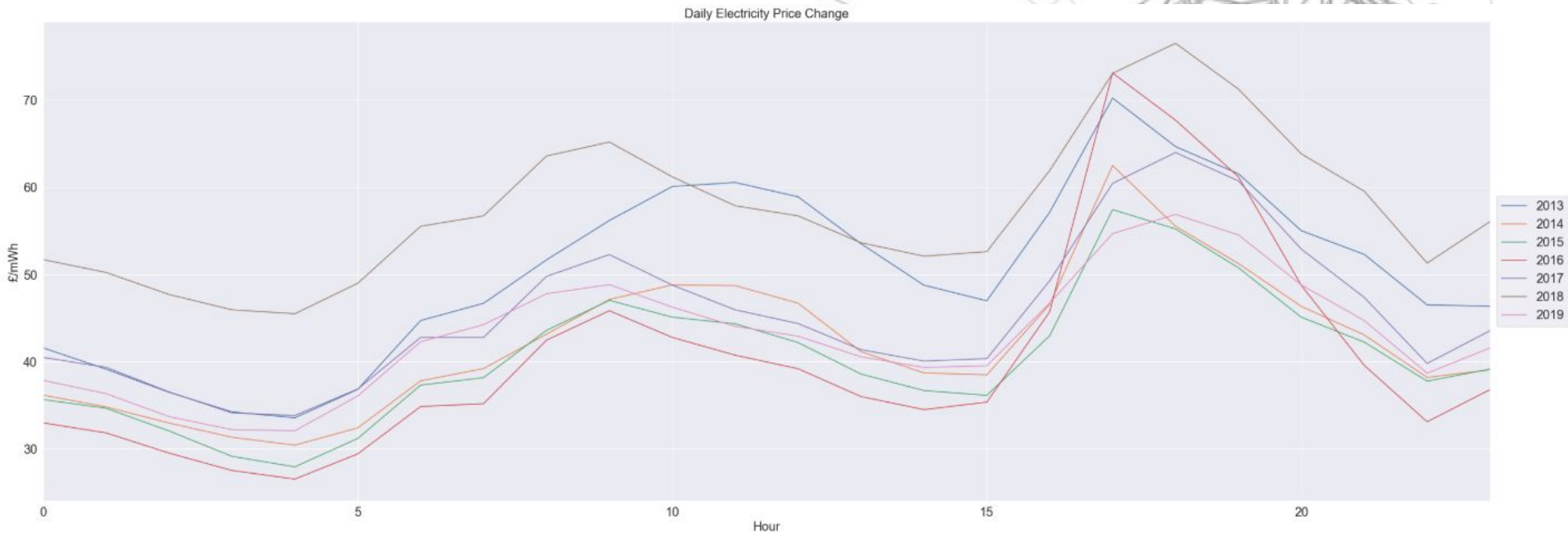
- Daily commodity prices

### Temperature

- Hourly temperature data

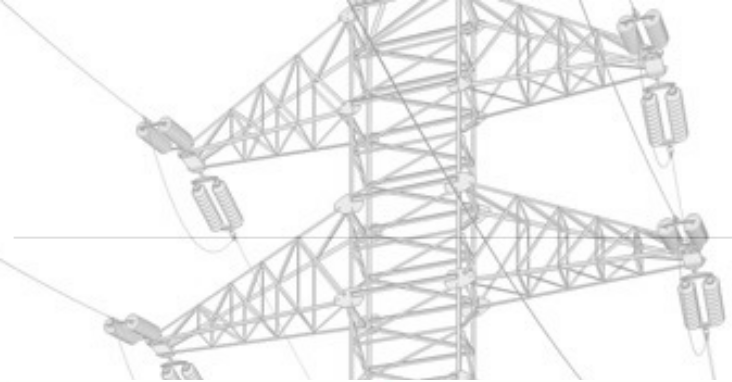


# Daily Patterns

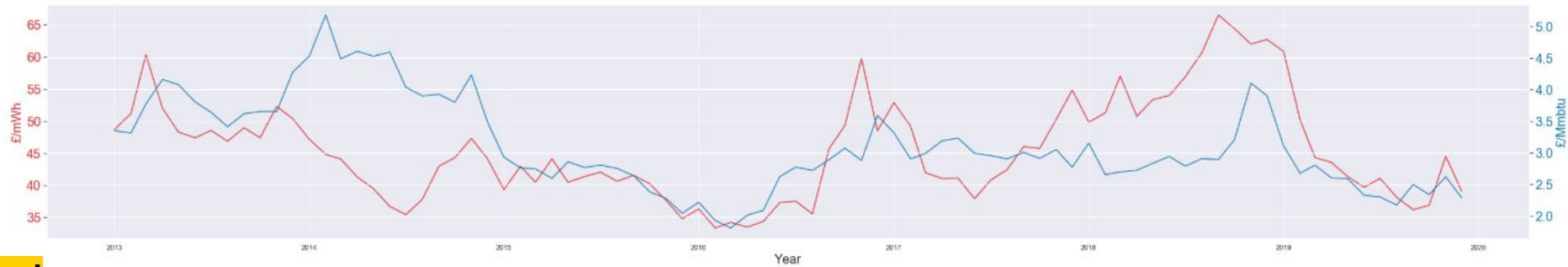




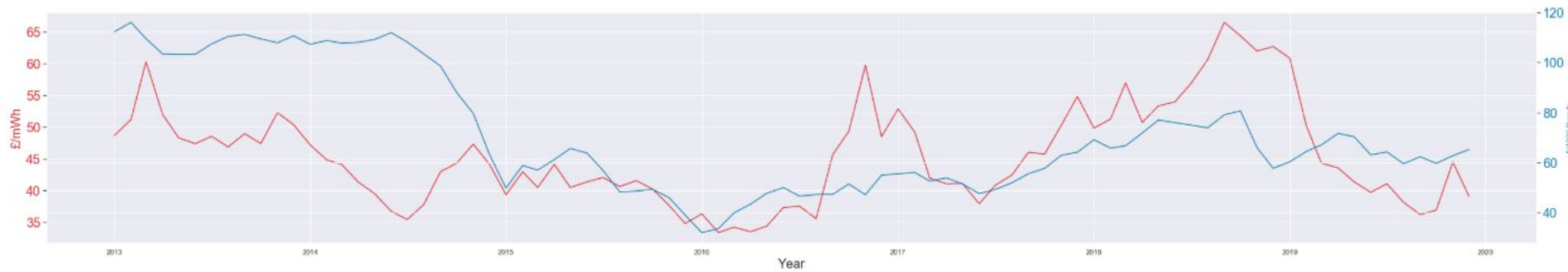
# Adding Multiple Variables



## Natural Gas



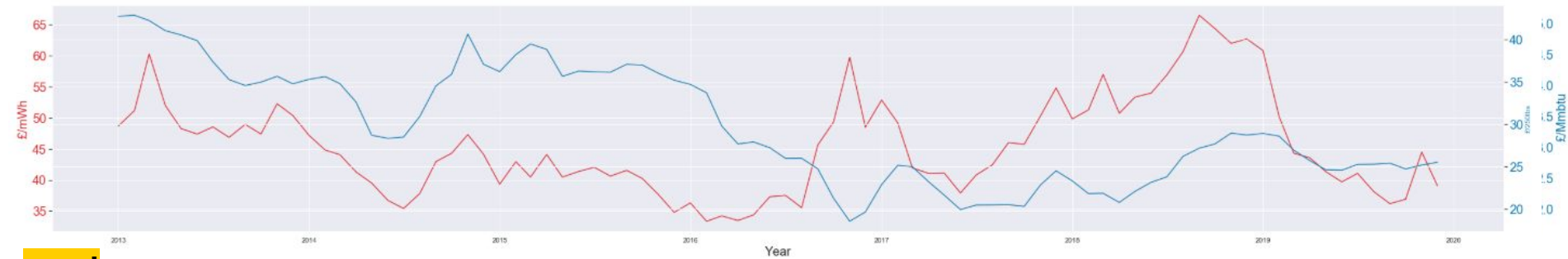
## Oil



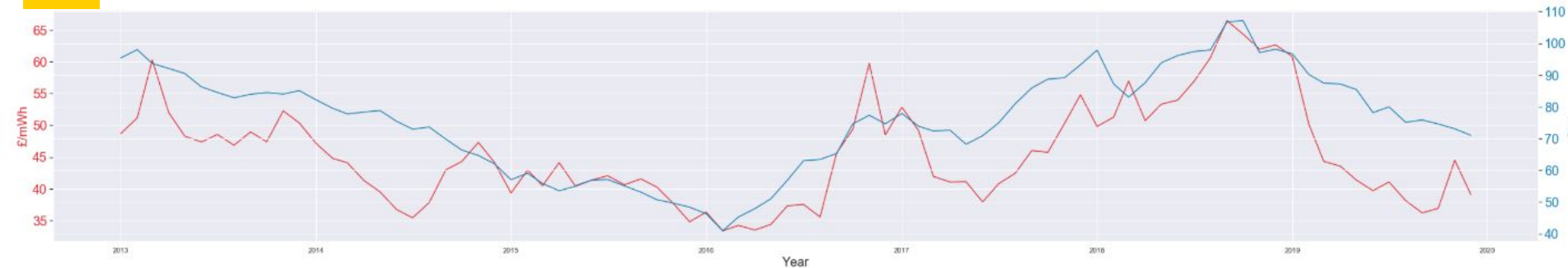


# Adding Multiple Variables

## Uranium



## Coal





## Selecting a **Baseline Model**

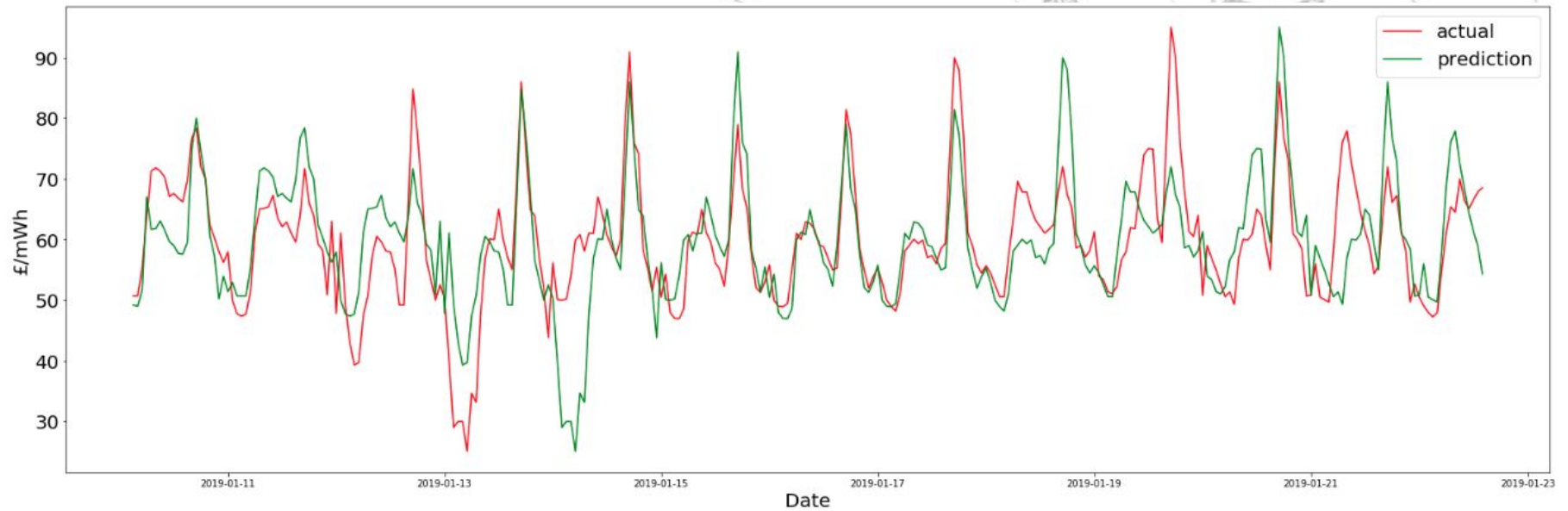
- Target is to predict price in **24** hours
- Baseline model uses the price ***now*** as the prediction for the price at ***this time tomorrow***
- This provides a ***target*** to beat

The Mean Absolute Percentage Error of this method is **17.33%**





## Selecting a **Baseline Model**







## Data Shape

### Input

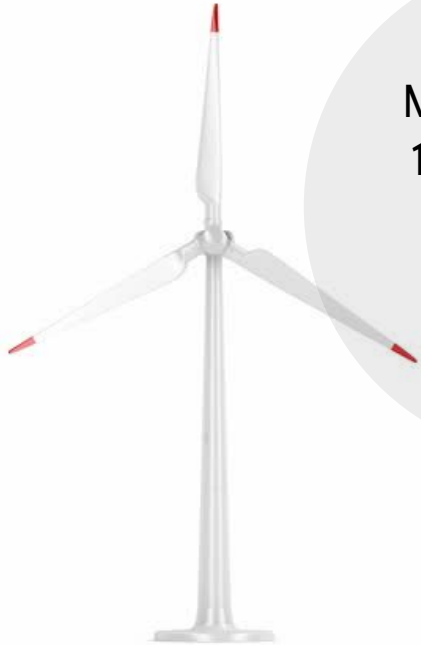
Model can 'see'  
168 hours into  
the past # of  
each of the  
variables

### Process

Predicts hourly electricity  
price for 24 hours into the  
future

### Output

Hour 24

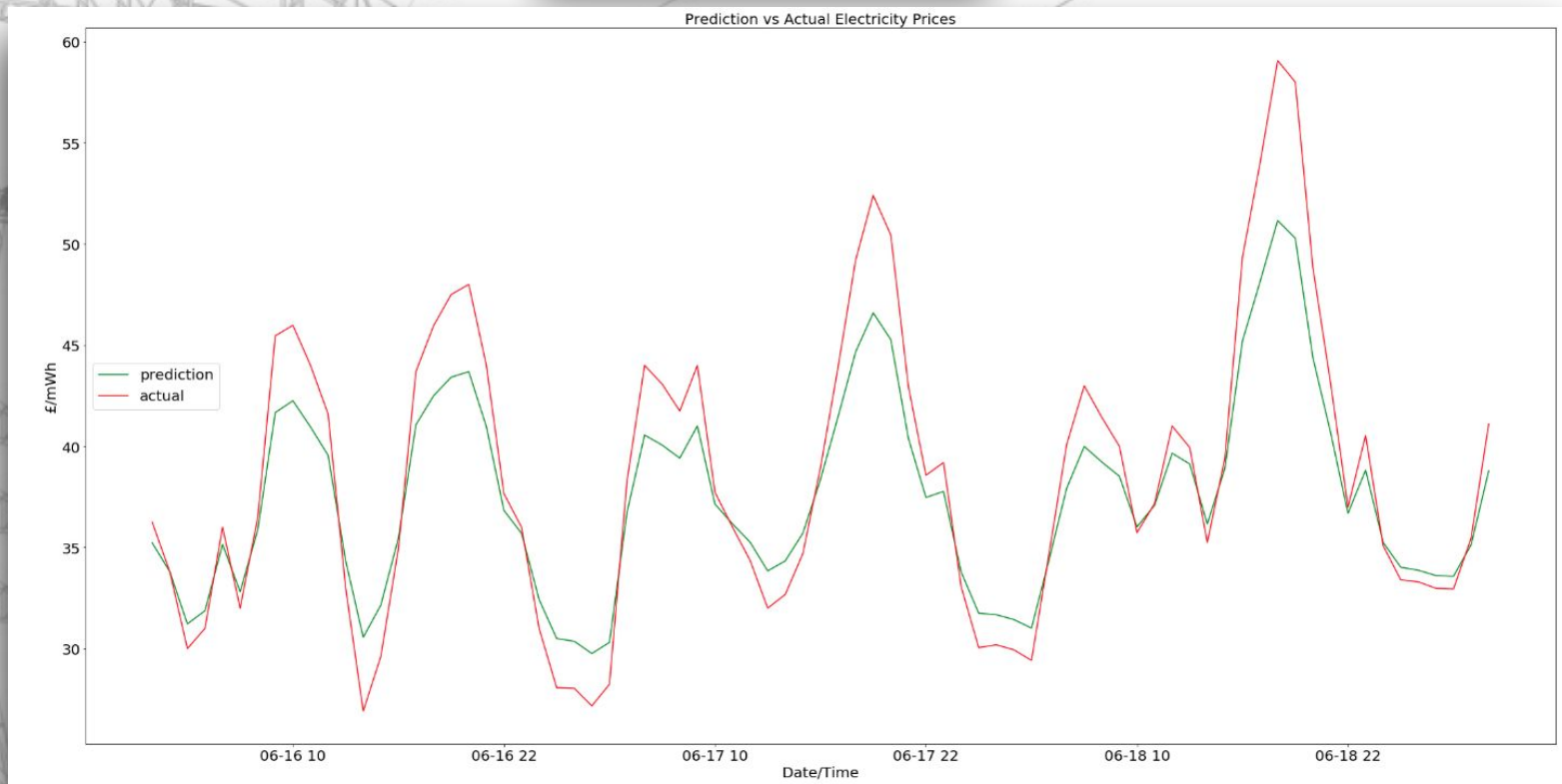




## Classical Machine Learning

	MAPE	Comparison Vs 'Dumb'
Arima	14.43%	+20.09%
Pure Time Series Simple Neural Network	18.85%	-8.77%
Multivariate Recurrent Neural Network	8.13%	+46.91%

# Results





## Why is this useful?

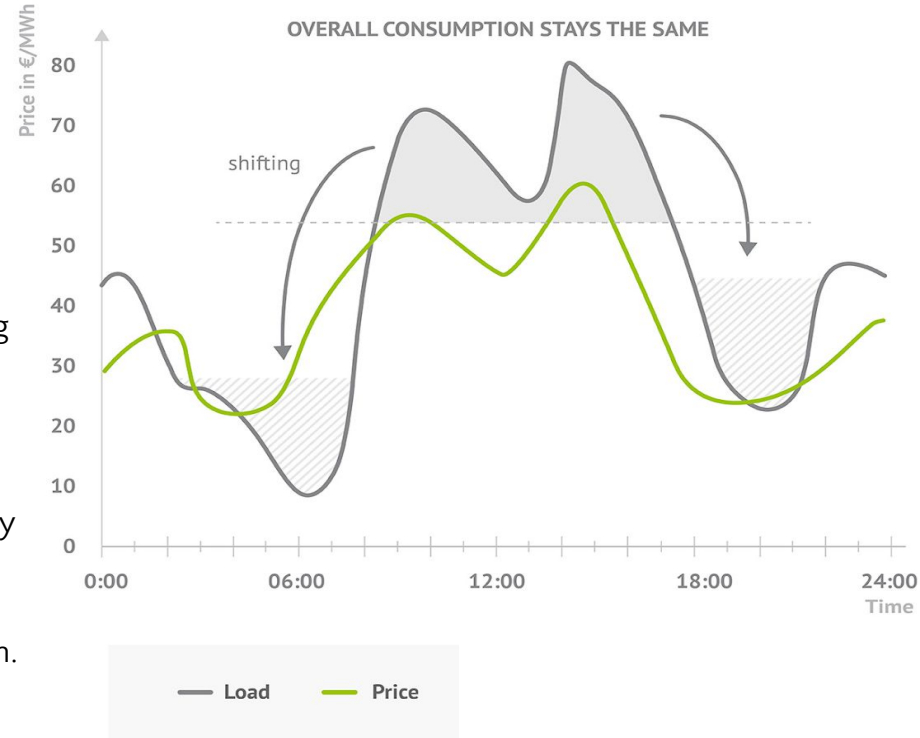
### Load Shifting

Optimizing building electricity **demand** can lead to both monetary and carbon emission savings without sacrificing overall consumption.

### Battery Simulation

For ease I have chosen to model **storage** through a battery simulation.

Using the a popular home battery's parameters (*Tesla Powerwall 2*) I can attribute a value to the price prediction.





# Battery Modelling

## Battery Capacity

The Tesla Powerwall 2 has a Capacity of 14 kWh

## Battery Power

The battery has power of 5kW.

This leads to the full Capacity in just under 3 hours.

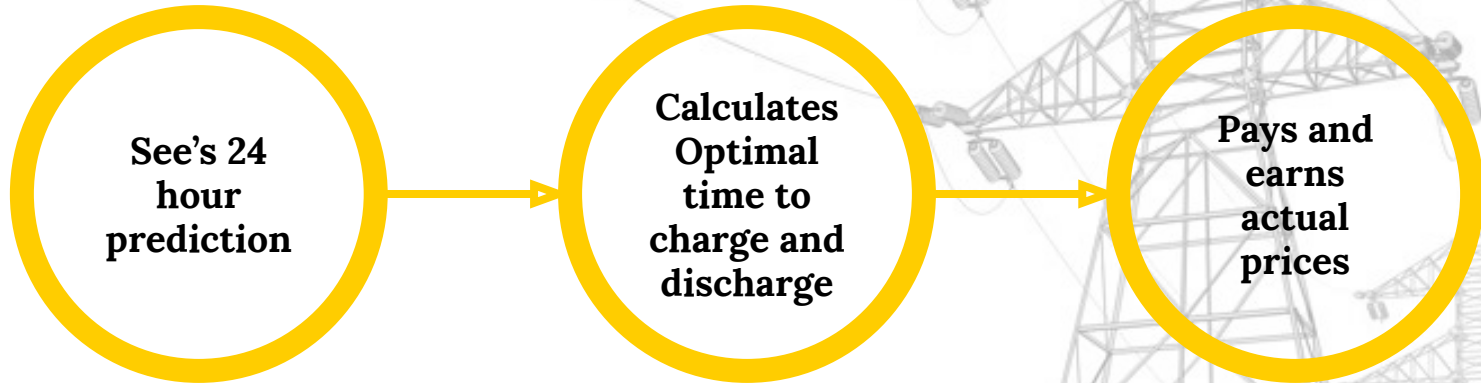
## Target

The battery target is to charge at the cheapest times, and discharge at the most expensive times, maximizing profit.





## Battery Decision Process



# One-Year Returns

**£151.02**

Spend on Charging

**£280.23**

Earned from 'selling' to the Grid

**85.55%\***

ROI



**\*4.4% including cost of battery**





# Thank You

Any **questions** ?