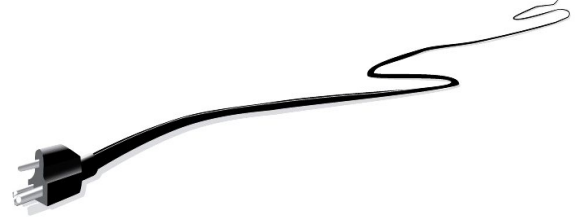# Day-Ahead Electricity Price Prediction

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.
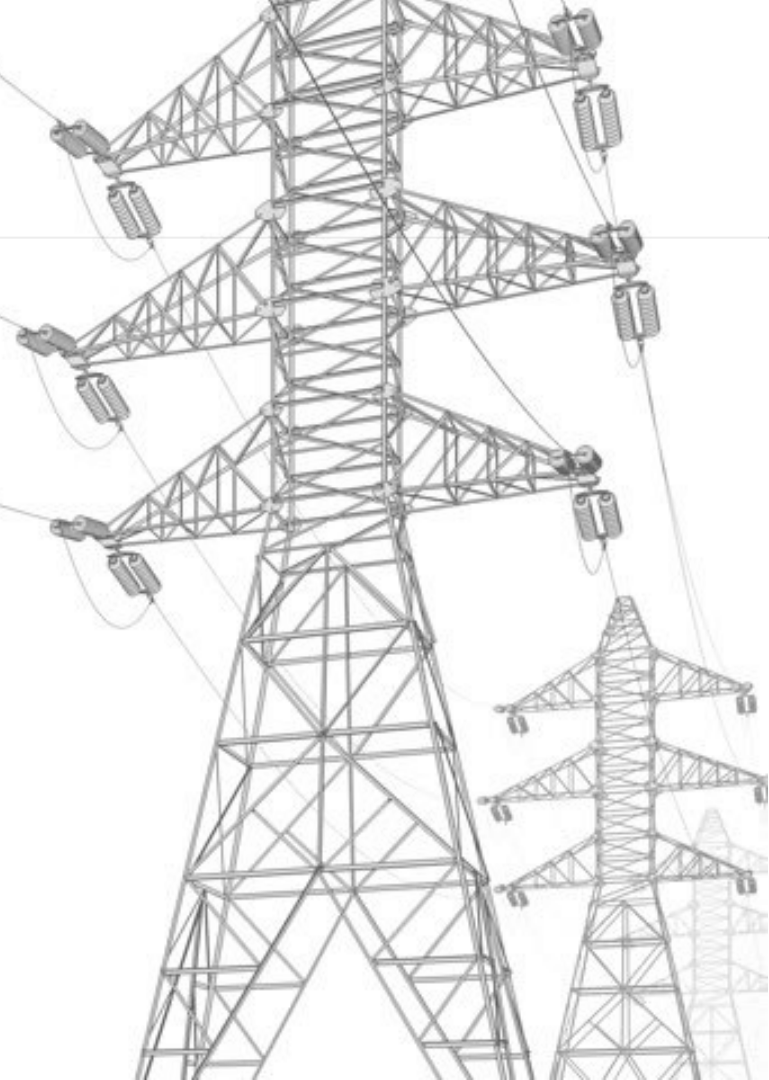
Data Collection

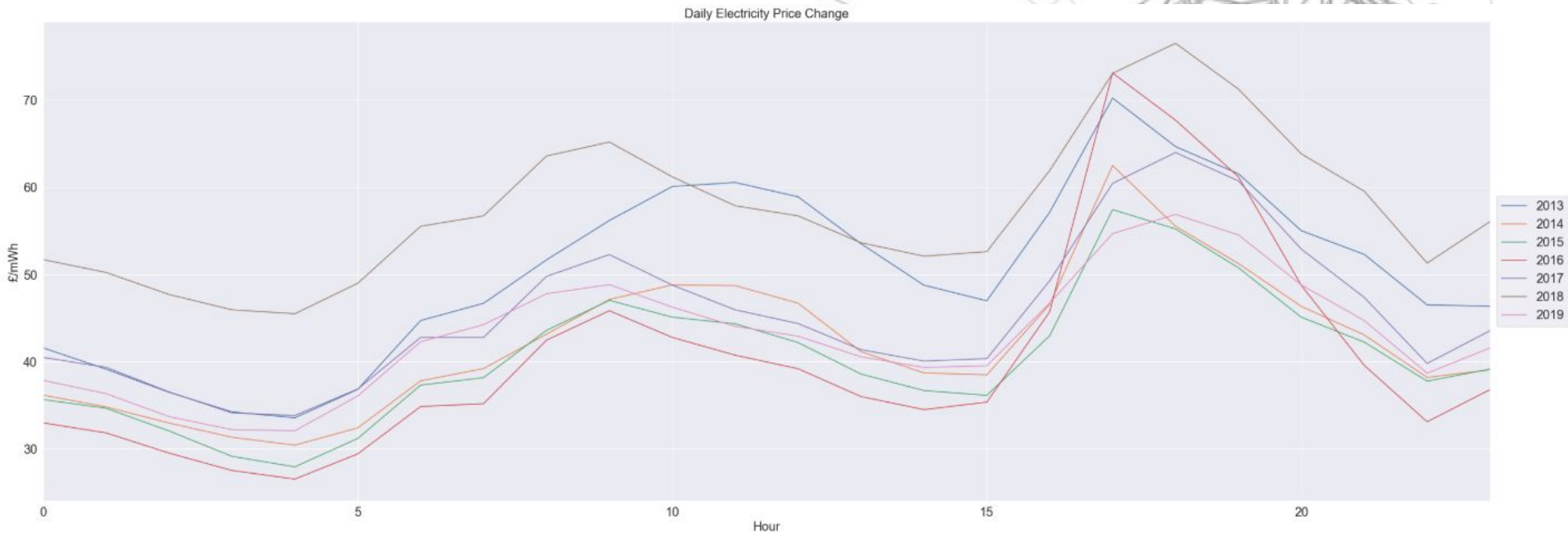## Electricity

- Hourly electricity price data

Commodity

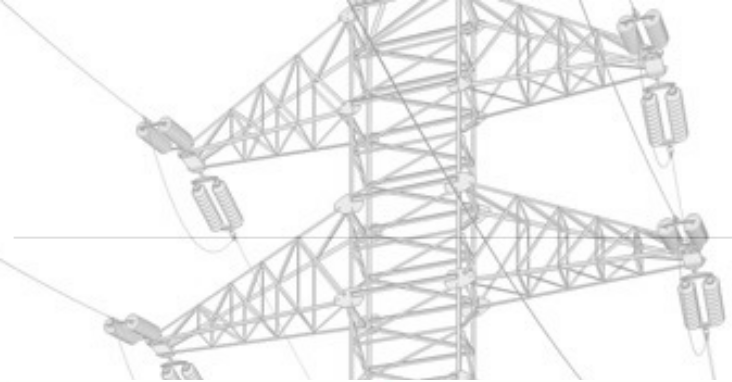- Daily commodity prices

Temperature

- Hourly temperature data

Daily Patterns

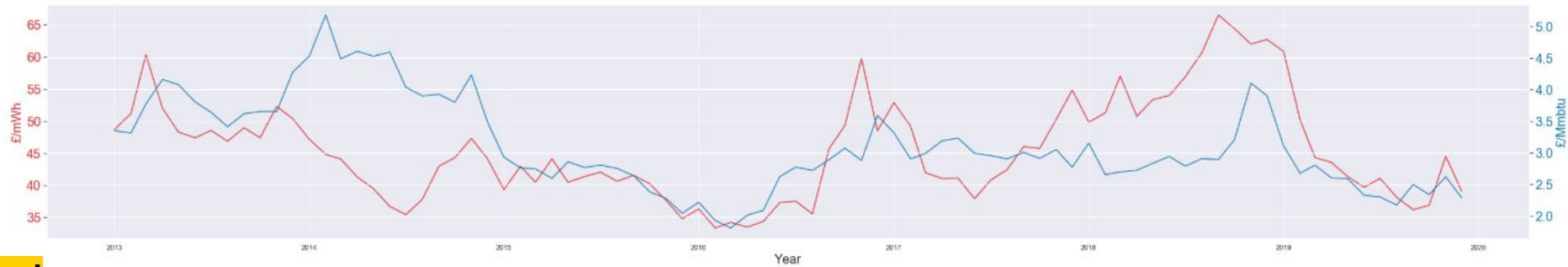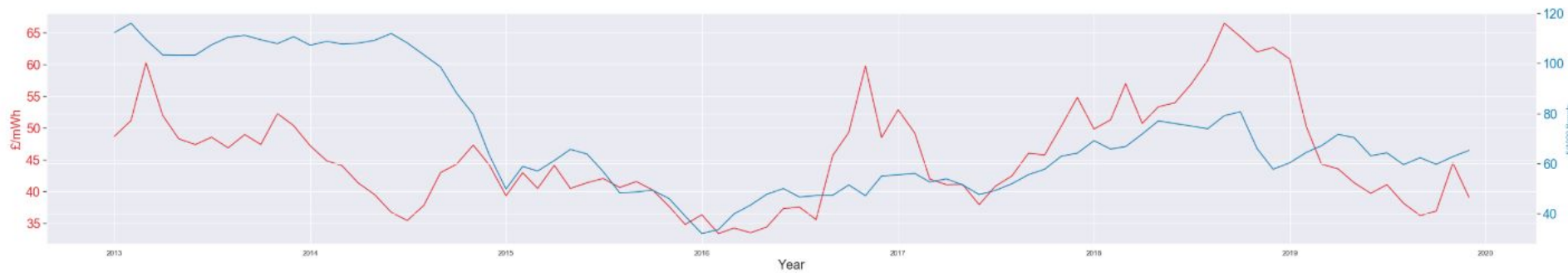Daily Electricity Price Change
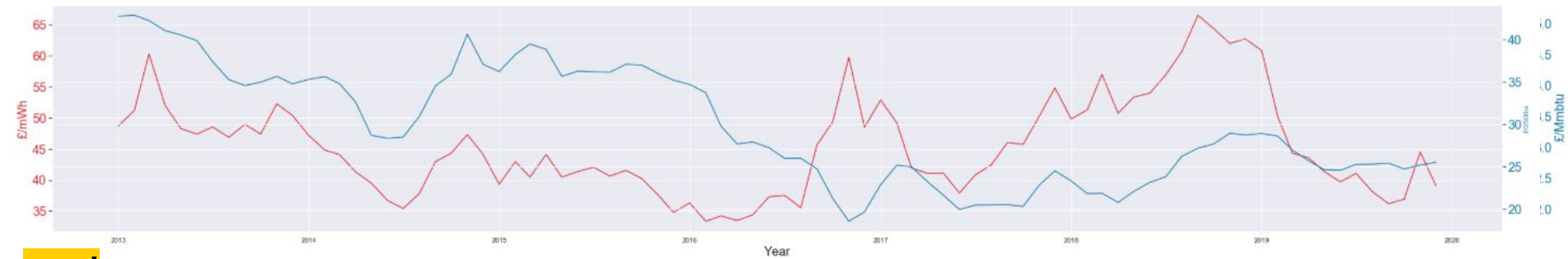
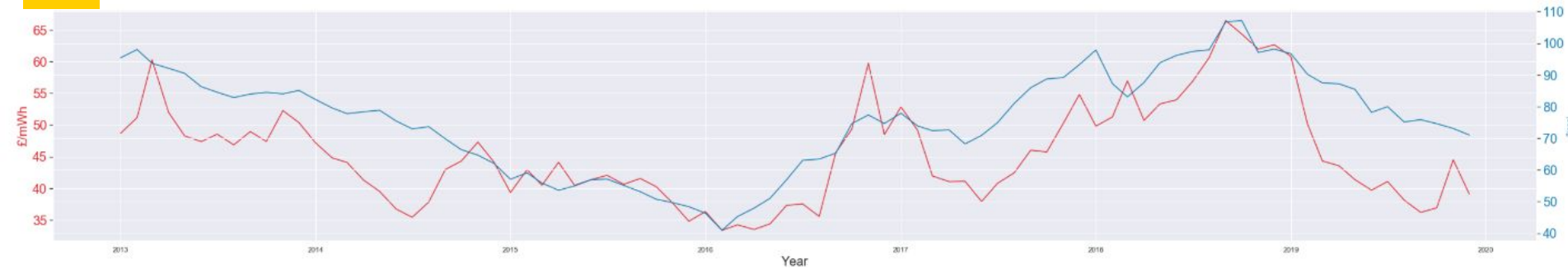# Adding Multiple Variables

Natural Gas

Oil

Adding Multiple Variables
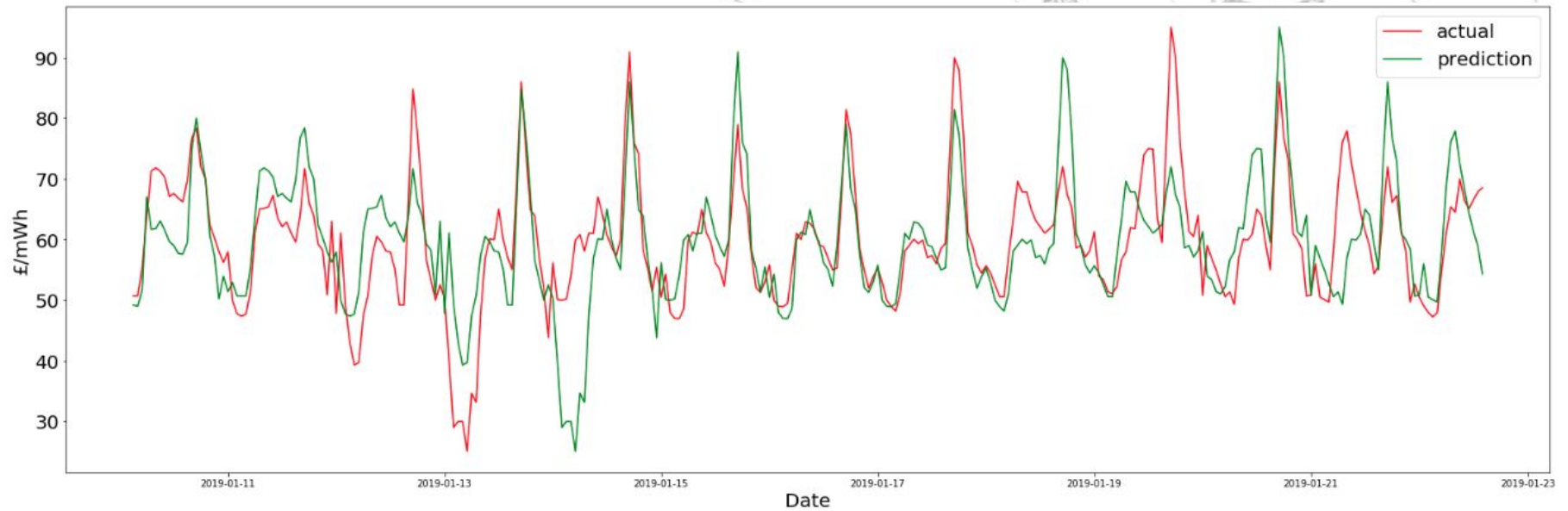
Uranium

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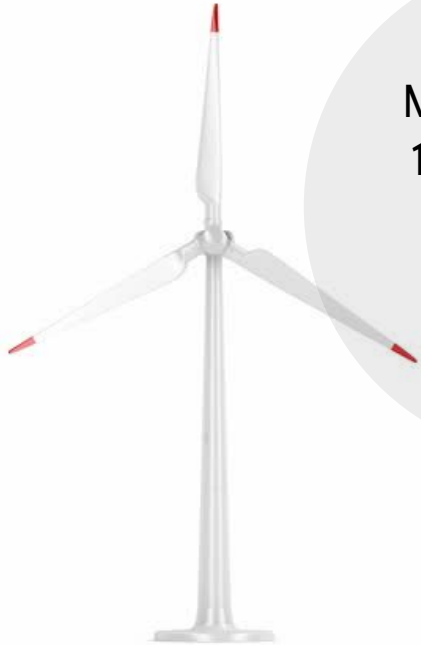Model can 'see' 168 hours into the past # of each of the variables

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

Prediction vs Actual Electricity Prices
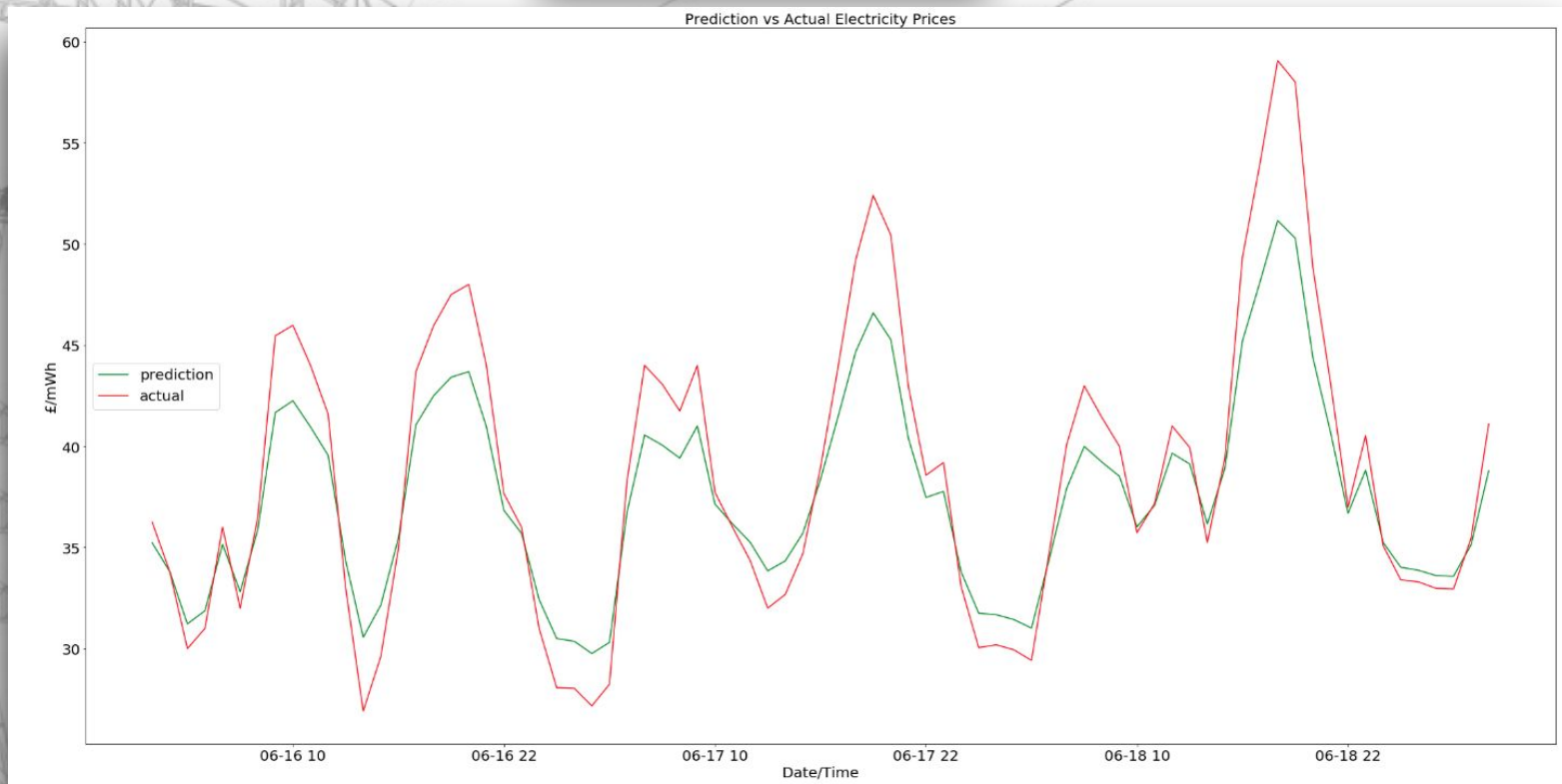
Why is this useful?

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.
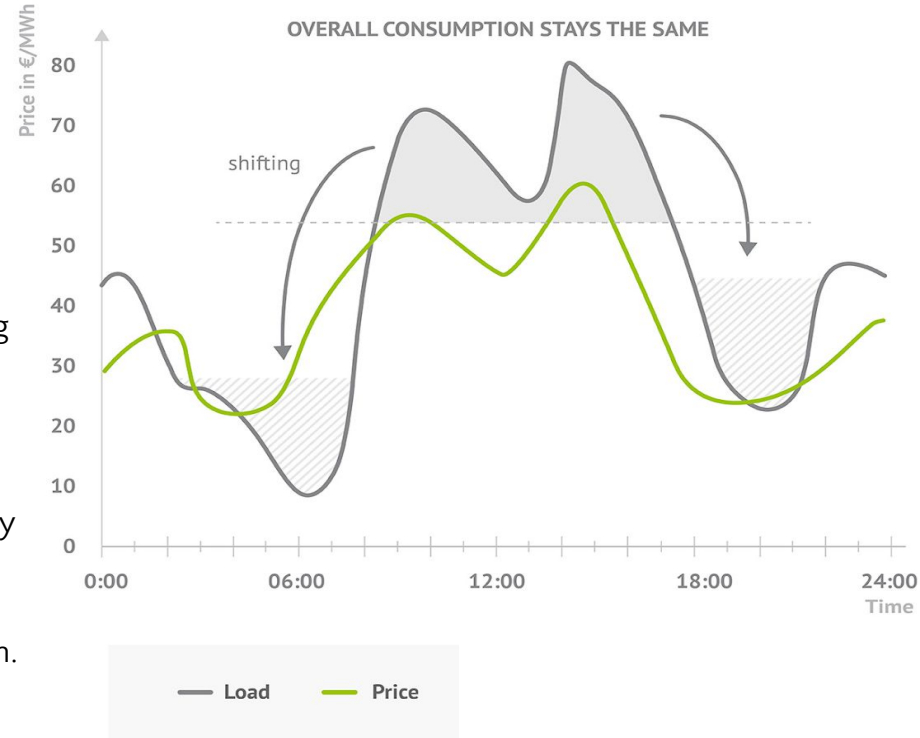
Battery Modelling

Battery Capacity

The Tesla Powerwall 2 has a Capacity of 14 kWh

Battery Power

The battery has power of 5kW.
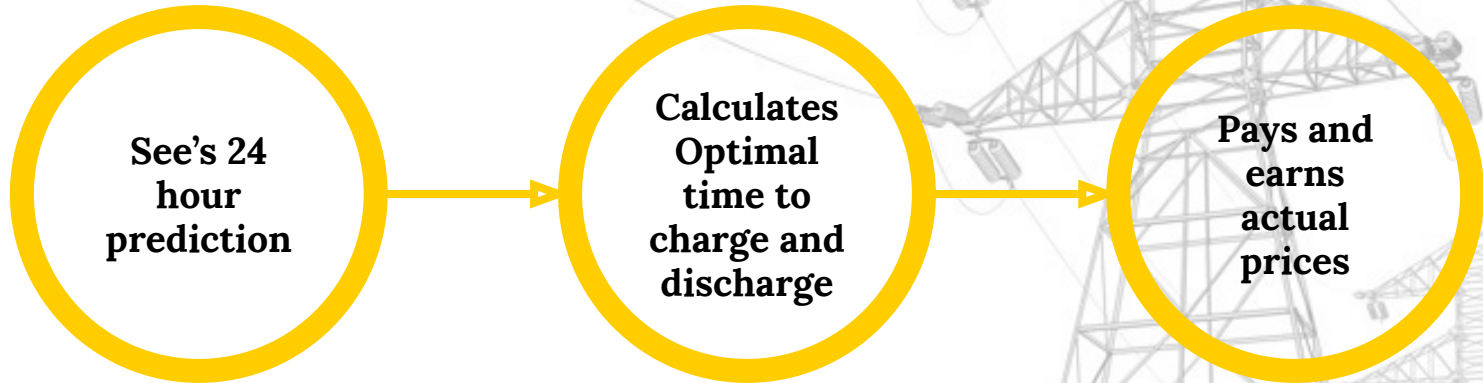
This leads to the full Capacity in just under 3 hours.

Target

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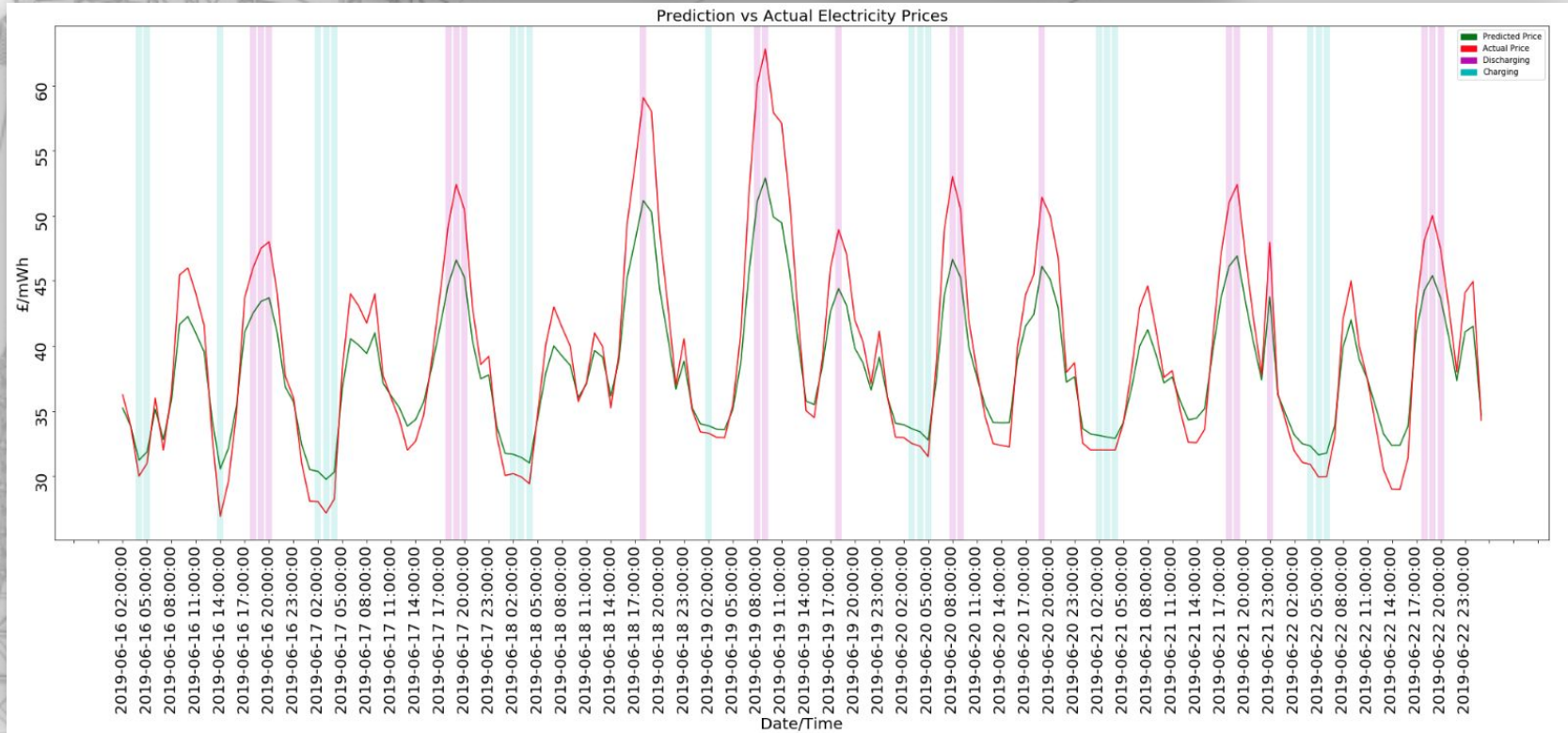
Battery Decision Process

See's 24 hour prediction

Calculates Optimal time to charge and discharge

Pays and earns actual prices

Charging Cycle

Prediction vs Actual Electricity Prices

Legend:
- Predicted Price
- Actual Price
- Discharging
- Charging

Y-axis: £/mWh

X-axis: Date/Time (2019-06-16 02:00:00 through 2019-06-22 23:00:00)

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** *?*