Bad Forecasts

- "The horse is here to stay but the automobile is only a novelty, a fad."
- "There is no reason for any individual to have a computer in his home"
- "The truth is no online database will replace your daily newspaper"

Why forecasting?

- No forecasts are perfect...

- ...but we still need to make *decisions*.

- Better forecasts inform better business decisions.

- We can consider the electricity market as an example

Electricity Demand

- Forecasts at different **horizons** play an important role in the operation of electricity markets.
- Long term forecasts (10 to 30 years horizon)
    - Used by by policy makers or investors to decide how to invest in infrastructure.
- Short term forecasts (24-hour horizon)
    - Used for operations, e.g. scheduling which generators produce electricity.

```
In [1]: import pandas as pd
        from datetime import datetime
        elec = pd.read_csv('electricity.csv', header=0, index_col=0, parse_dates=False, s
        elec['SETTLEMENTDATE'] = pd.to_datetime(elec['SETTLEMENTDATE'])
        print(elec.head())
```

```
            SETTLEMENTDATE  TOTALDEMAND    RRP PERIODTYPE
REGION
NSW1   2021-04-01 00:30:00      7012.00  35.46      TRADE
NSW1   2021-04-01 01:00:00      6815.37  34.21      TRADE
NSW1   2021-04-01 01:30:00      6495.25  32.83      TRADE
NSW1   2021-04-01 02:00:00      6308.43  32.71      TRADE
NSW1   2021-04-01 02:30:00      6179.93  31.87      TRADE
```
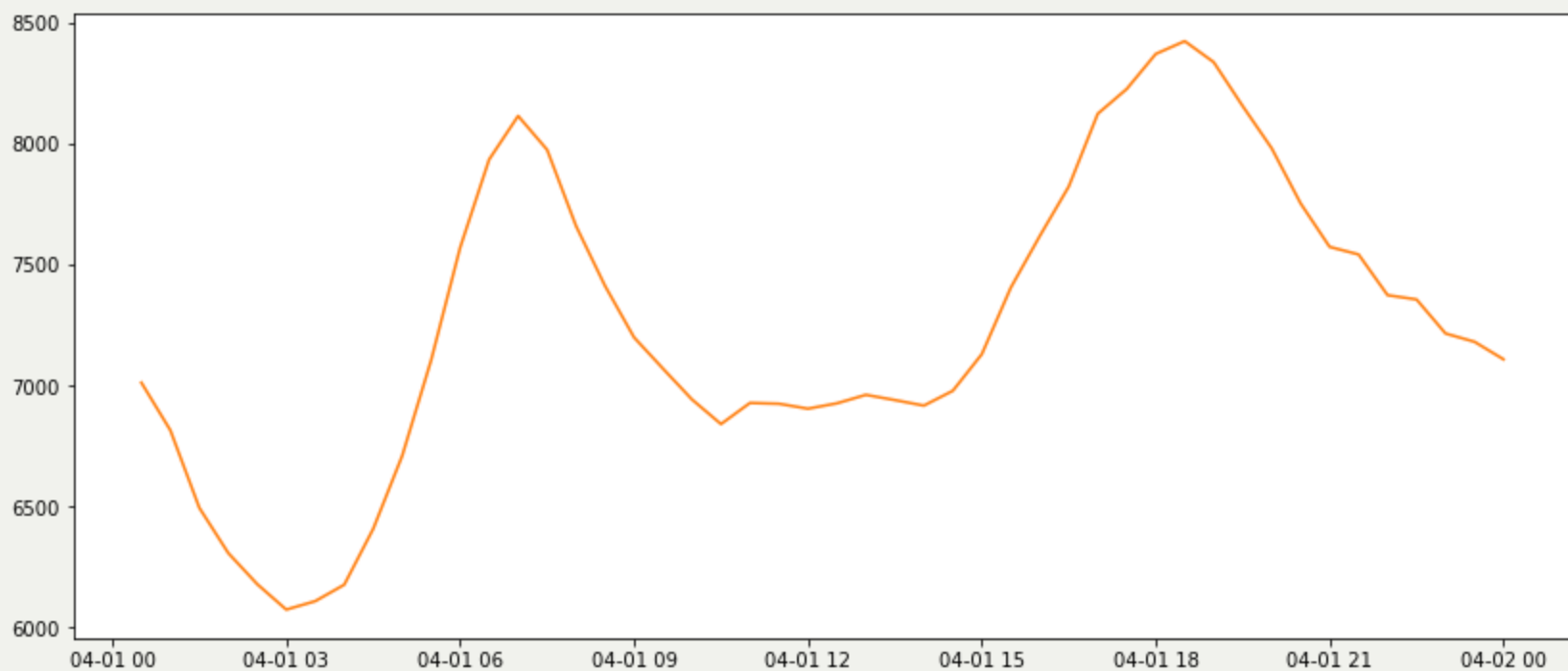
```
In [2]: import matplotlib.pyplot as plt
        fig, ax = plt.subplots(figsize=(14, 6))
        ax.plot(elec.SETTLEMENTDATE, elec.TOTALDEMAND, color='tab:orange', label='NSW Ele
```

Out[2]: [<matplotlib.lines.Line2D at 0x7fcfdd9826d0>]
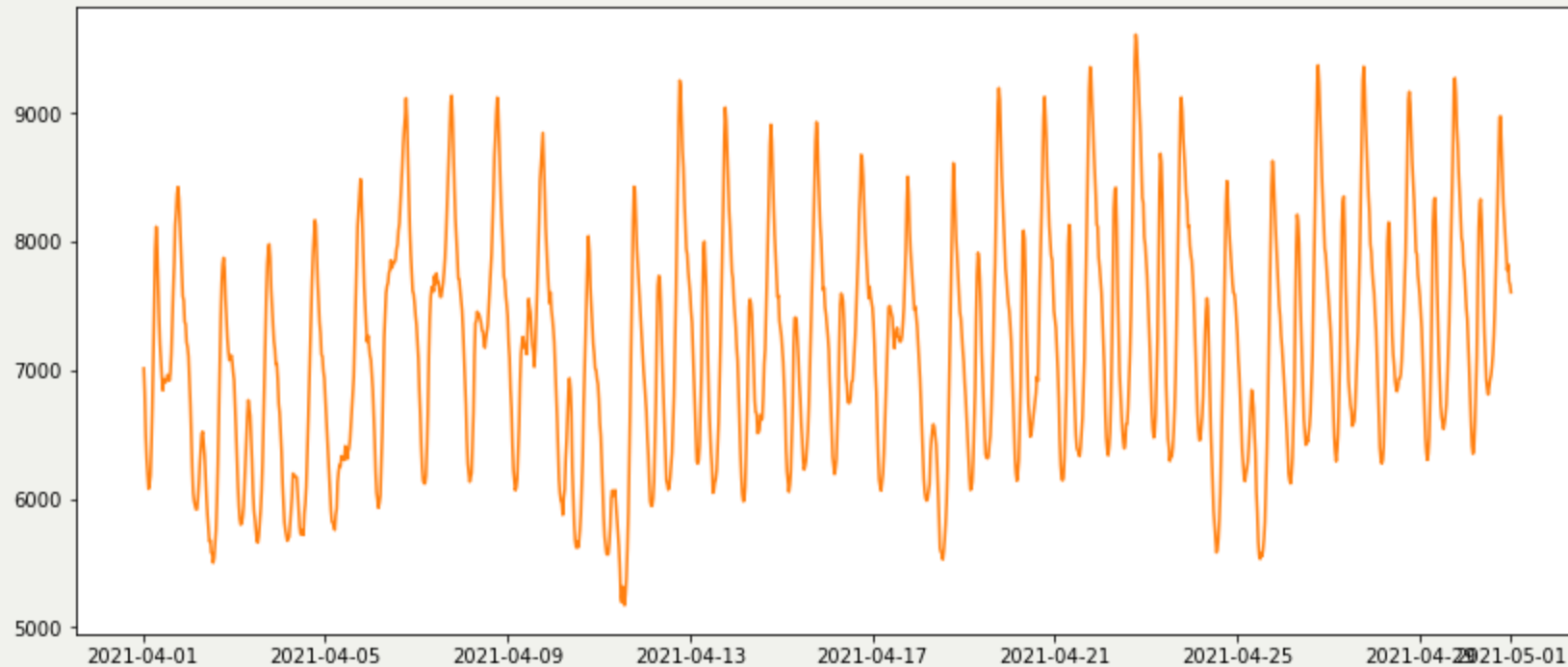
```
In [3]: elec_ow = elec.head(n=2*24)
        fig, ax = plt.subplots(figsize=(14, 6))
        ax.plot(elec_ow.SETTLEMENTDATE, elec_ow.TOTALDEMAND, color='tab:orange', label='N
```

Out[3]: [<matplotlib.lines.Line2D at 0x7fcfdd17e5b0>]

Patterns

- Electricity demand is lower
    - Overnight/ middle of day
    - On weekends and public holidays
    - In months with moderate temperature
- All this can be deduced just by looking at the series itself!

Forecasting v Prediction

- In other courses you have made predictions $\hat{y}_t = f(\mathbf{x})_t$, where $\mathbf{x}_t$ are some independent variables.

- A forecast is just a prediction in the future, however

  - To exploit $f(\mathbf{x}_t)$ you must have $\mathbf{x}_t$ available before y_t

- In this course we *mostly* look at methods which only use the history of the variable we are trying to forecast.

Think probabilistically

- We often think of forecasts as single number or *point forecasts*, for example

  - Electricity demand at 3PM tomorrow will be 8000 MWh

- Sometimes decisions may depend of the variance of a forecast, i.e.

$$Var(y_{T+h}|\mathcal{F}_T)$$

- Other decisions may depend on quantiles, i.e.

$$q : \Pr(y_{T+h} \leq q|\mathcal{F}_T) = \alpha$$

In real life

- Rain probability in weather apps.

- Bank of England Fan charts (source)

What can we forecast?

We can forecast a variable well when:

1. We understand the factors that contribute to it;

2. When more data is available;

3. When the future is simlar to the past;

4. When the forecasts do not affect the quantity we are trying to forecast.