# Pytown Capstone Energy Use Case

Predicting energy generation

PyLadies Amsterdam Bringing ML Models into Production Bootcamp
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# The team

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## Hassan

Data Scientist

Chemnitz, DE

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- Expertise in predictive data modelling and deploying data-driven services
- Delivering insights

## Dânia Meira

Data scientist

Berlin, DE

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- Worked mostly on ML models, deployment only on-premise

# Approach - End-to-end Batch Naive Forecast

**Data preprocessing**: aggregate daily: energy load -> consumption ; wind and solar predictions -> generation

**Model training**: train naive forecast - average consumption of the same day of the week, considering N weeks before

**Model evaluation**: backtest with a sliding window approach, optimize for MAPE

**Model deployment**: deploy the best performing model as an Azure Machine Learning Batch pipeline Model

**Model post-processing**: compare energy consumption forecast with energy generation from wind and solar predictions, classify the energy consumption per day (normal, middle, low charge), persist results to Azure Blob Storage (to be used by Power BI).

**Model monitoring**: design a basic technical and model specific monitoring

# Challenges - Batch pipeline on the cloud

Challenge 1

**Data Registering**

- Uploaded but not registered

Challenge 2

**Run pipeline on the cloud**

Understand the interface

- Input
  - Tabular data
  - Index of DF
- Output
  - List or DF
  - Length

Challenge 3

**Connect data to Power BI**

From cloud storage to local environment

# Avg consumption on the same day of the week

| data_index_ | dayofweek | load_pred_mw |
|---|---|---|
| 2020-01-01 00:00:00+00:00 | 2 | NaN |
| 2020-01-02 00:00:00+00:00 | 3 | NaN |
| 2020-01-03 00:00:00+00:00 | 4 | NaN |
| 2020-01-04 00:00:00+00:00 | 5 | NaN |
| 2020-01-05 00:00:00+00:00 | 6 | NaN |
| 2020-01-06 00:00:00+00:00 | 0 | NaN |
| 2020-01-07 00:00:00+00:00 | 1 | NaN |
| 2020-01-08 00:00:00+00:00 | 2 | NaN |
| 2020-01-09 00:00:00+00:00 | 3 | NaN |
| 2020-01-10 00:00:00+00:00 | 4 | NaN |
| 2020-01-11 00:00:00+00:00 | 5 | NaN |
| 2020-01-12 00:00:00+00:00 | 6 | NaN |
| 2020-01-13 00:00:00+00:00 | 0 | NaN |
| 2020-01-14 00:00:00+00:00 | 1 | NaN |
| 2020-01-15 00:00:00+00:00 | 2 | 10178.149906 |
| 2020-01-16 00:00:00+00:00 | 3 | 10708.442896 |
| 2020-01-17 00:00:00+00:00 | 4 | 10806.161266 |
| 2020-01-18 00:00:00+00:00 | 5 | 10006.685330 |
| 2020-01-19 00:00:00+00:00 | 6 | 9754.771028 |
| 2020-01-20 00:00:00+00:00 | 0 | 11005.889968 |

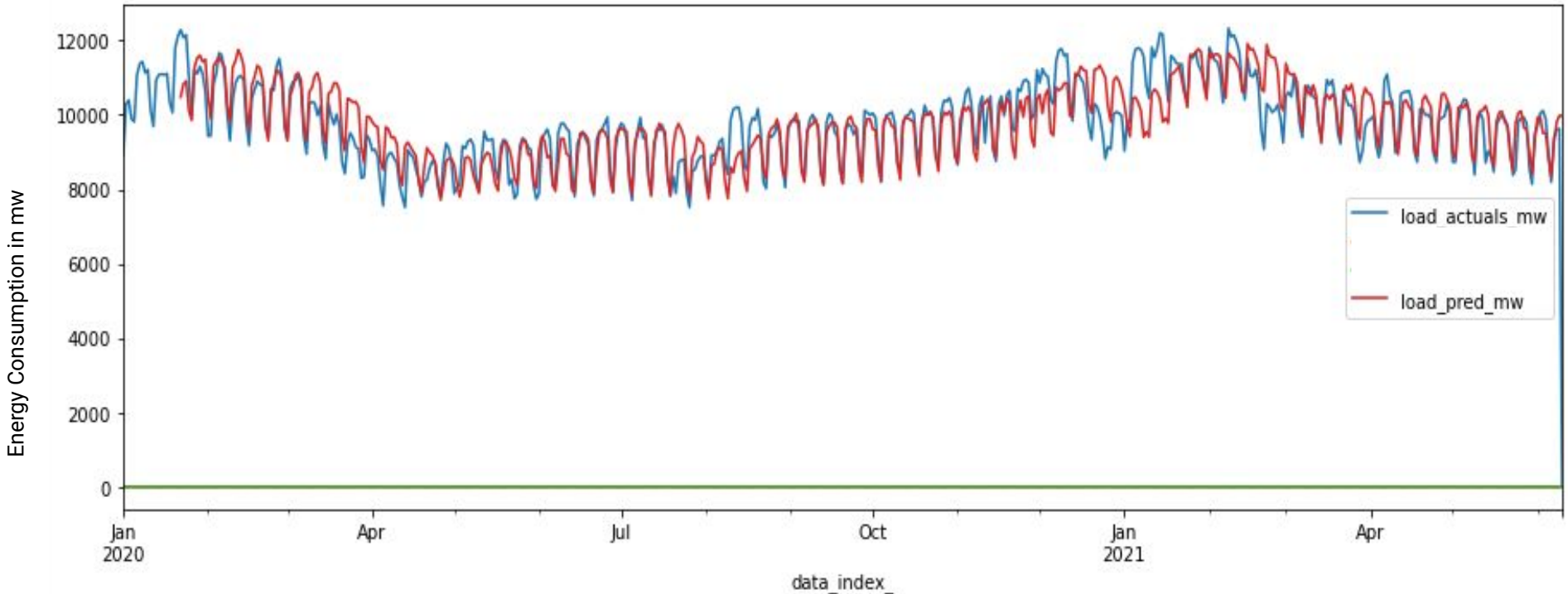
Example looking at previous 2 weeks to calculate average

Little difference in MAPE, not worth missing a week's prediction

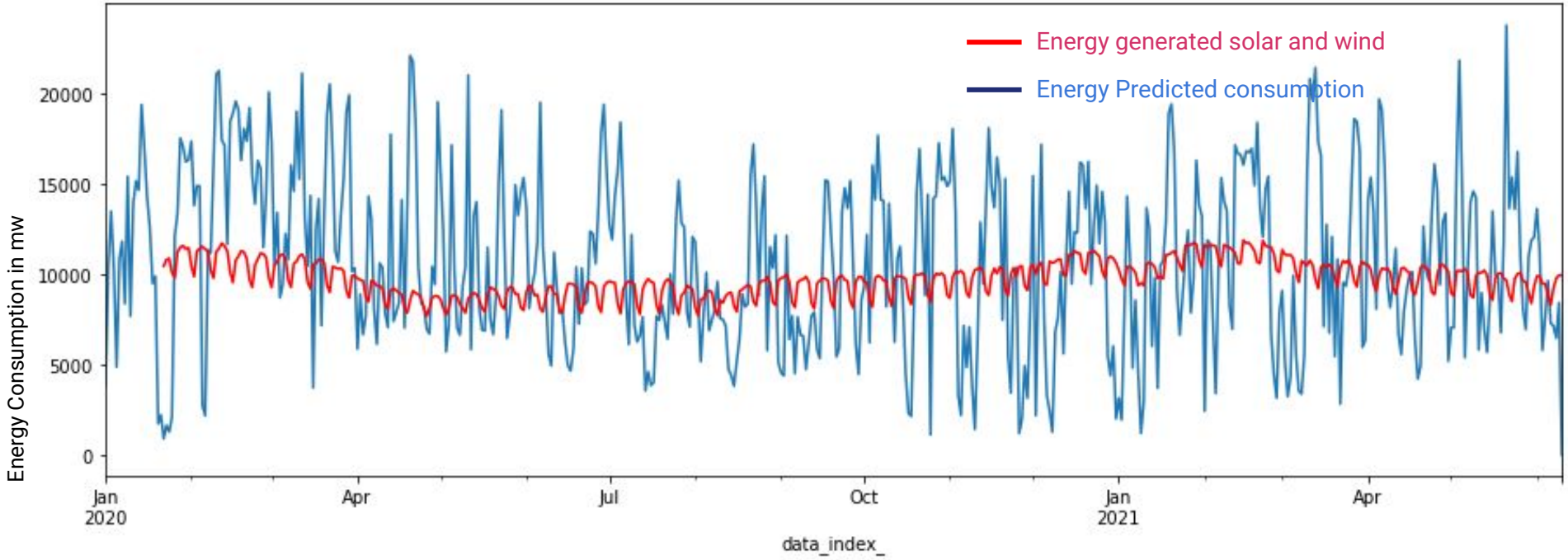
```
mape(df_load_daily, df_load_daily.load_actuals_mw)
✓ 0.6s
[(0, 0.0),
 (1, 99.96141440155532),
 (2, 26.580908781460245),
 (3, 26.520473692265178),
 (4, 26.52331795756313),
 (5, 25.881142816848723),
 (6, 26.413458601280254),
 (7, 26.851940956691394),
 (8, 27.059453655979333),
 (9, 27.433265149640484),
 (10, 27.725994962708295),
 (11, 27.85679854083038),
 (12, 28.04545630557903),
 (13, 28.29138621914685),
 (14, 28.347424431763706),
 (15, 28.402398387159145),
 (16, 28.2670147641685)]
```

# Best Model - MAPE 25.5

Naive Forecast showing predicted energy consumption vs actual energy consumed

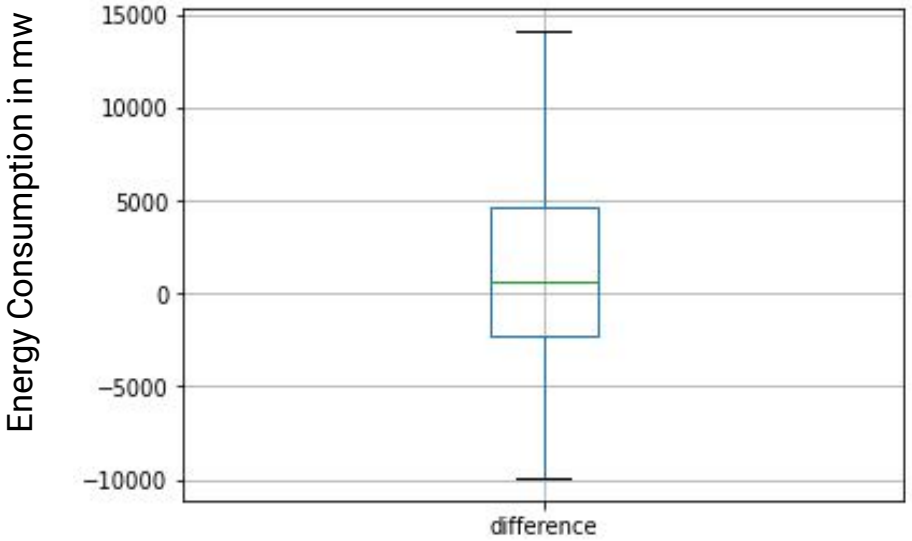


# Difference in Predicted Energy Consumption and Total Energy Generated

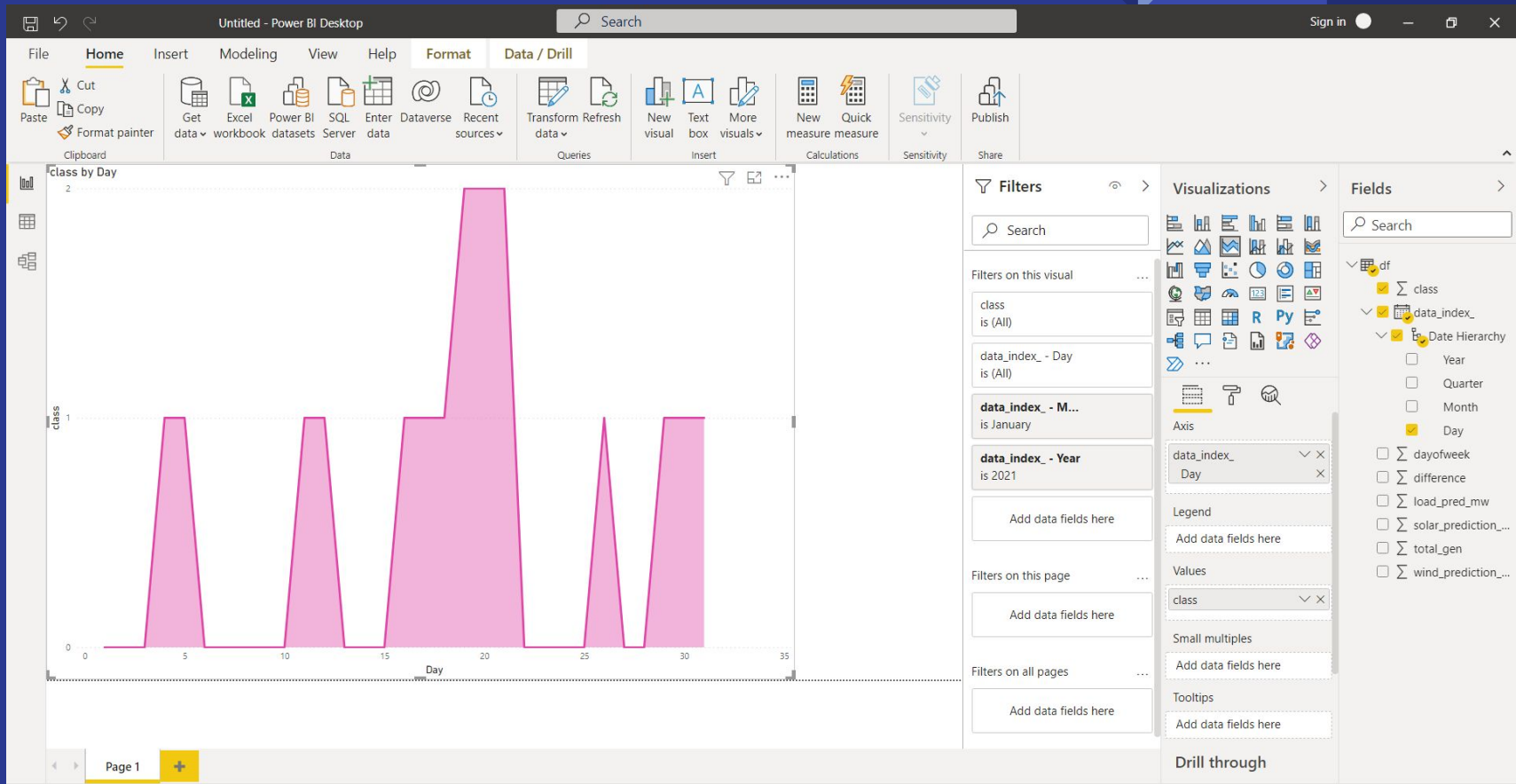


# Classification

Difference <0 : Low charge
0 < Difference < 5000: Medium charge
Difference > 5000: Normal charge



# Dashboard - Power BI



# Open tasks

- Saving output in the desired blob storage
- Write tests and documentation
- Schedule the pipeline
- Implement near real-time inference