ETH zürich

Analytics Club

TIME SERIES FORECASTING OF ENERGY DEMAND DATA

DATATHON 2025

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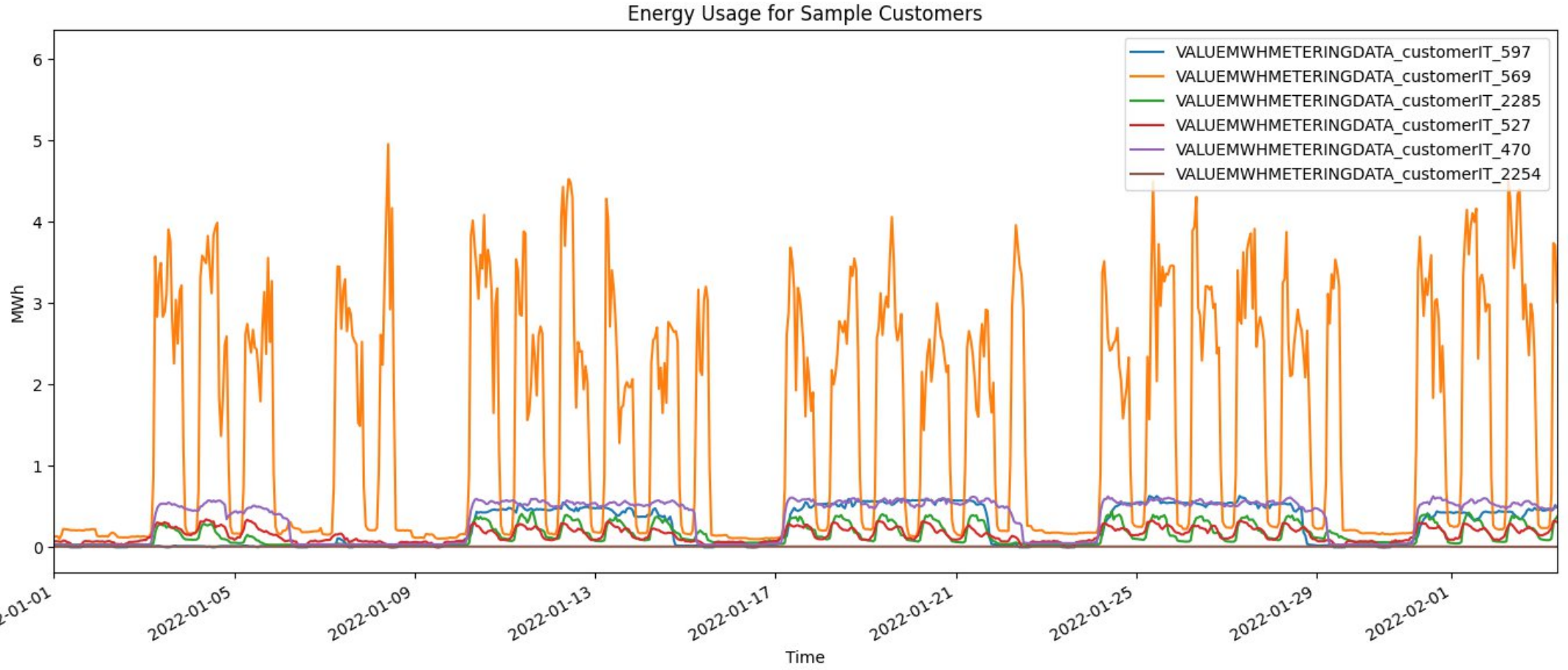
What data are we working with?



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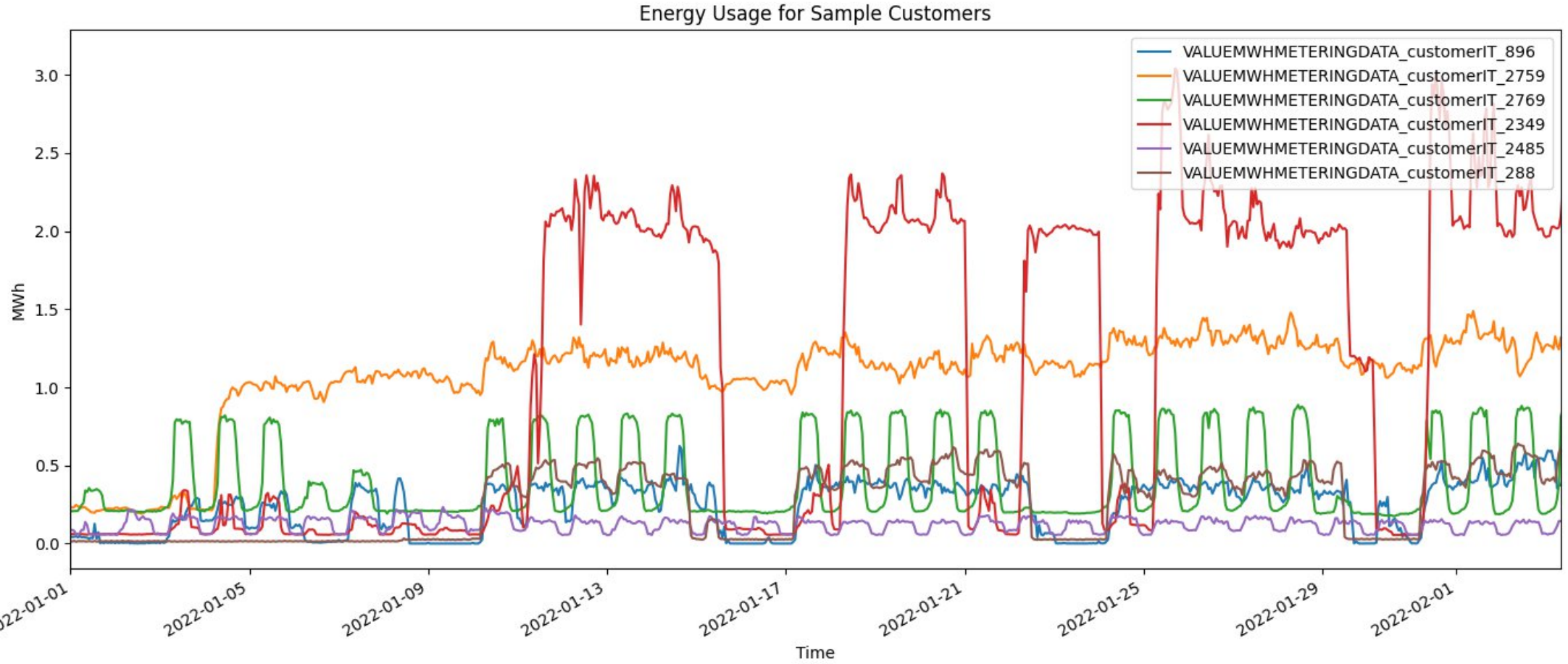
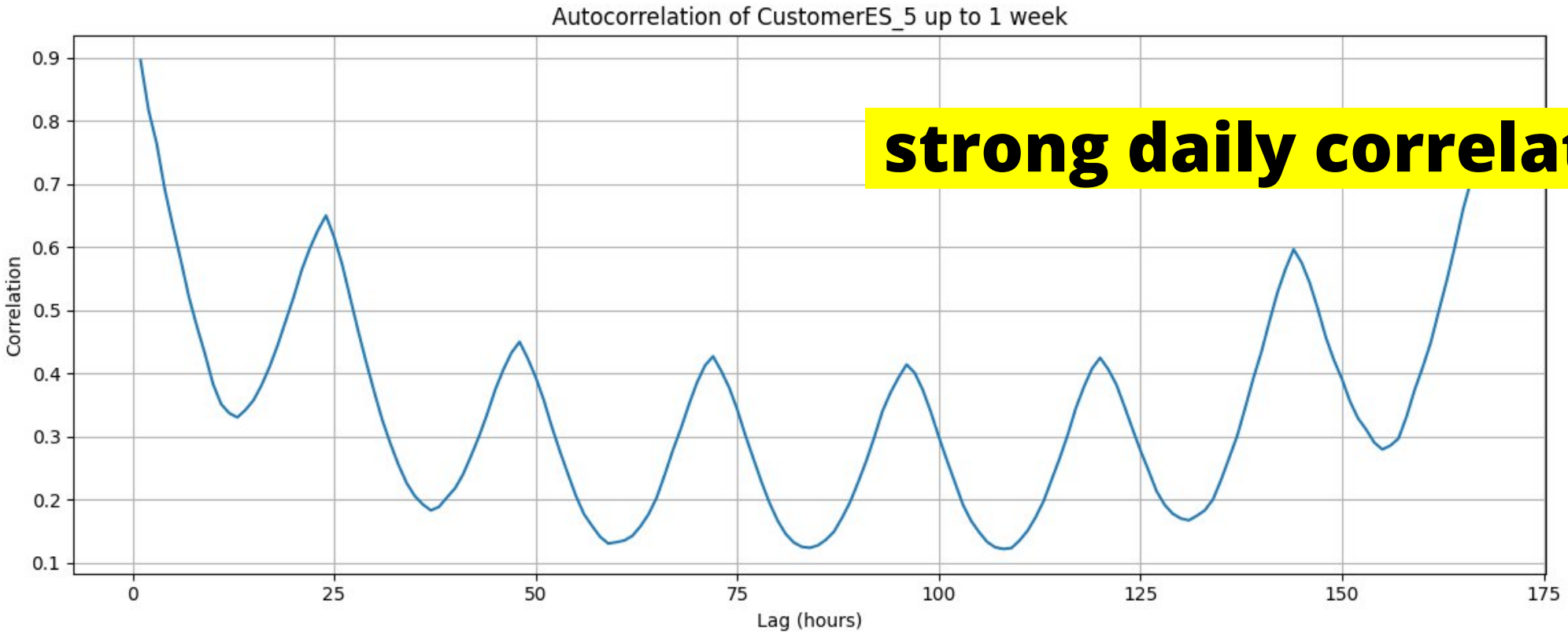


“Customer Profiles”

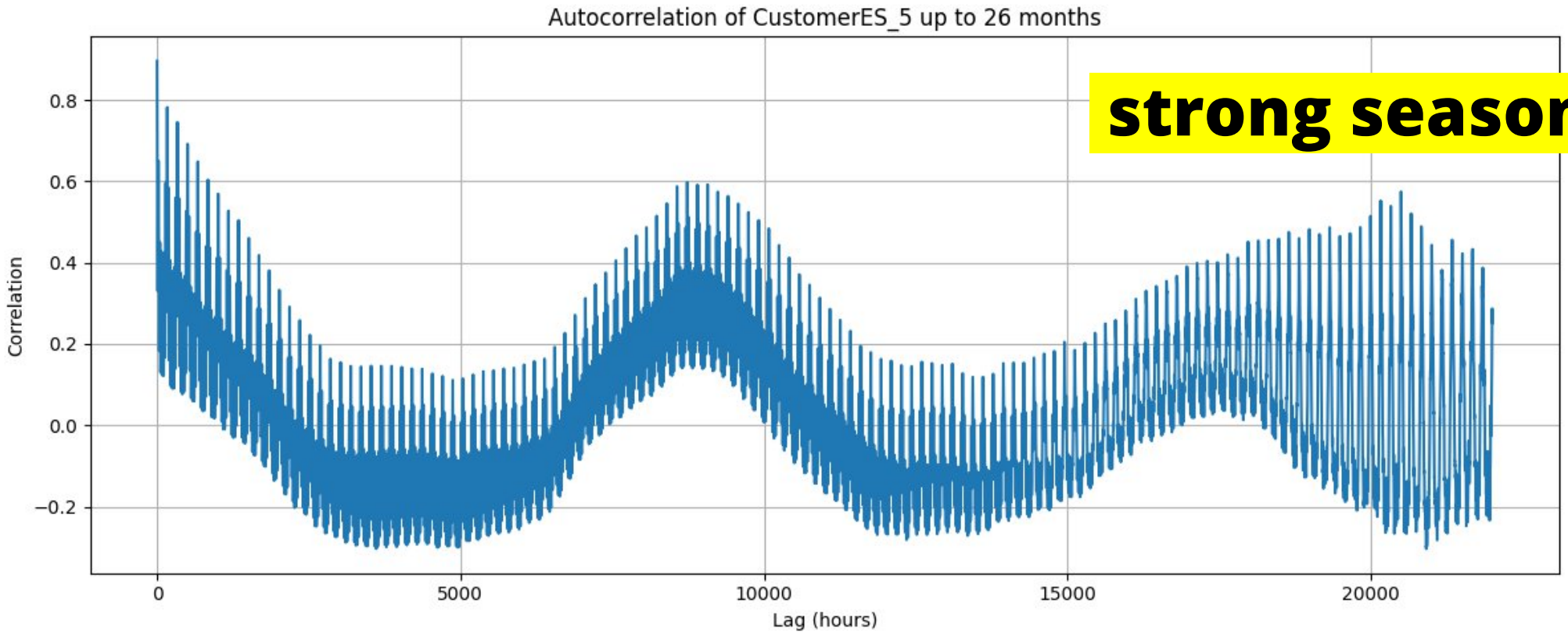
- private households
  - periodic
  - day/night differences
  - weekend/holiday dips
- factories/infrastructure
  - constant

What correlations can we measure?



strong daily correlations

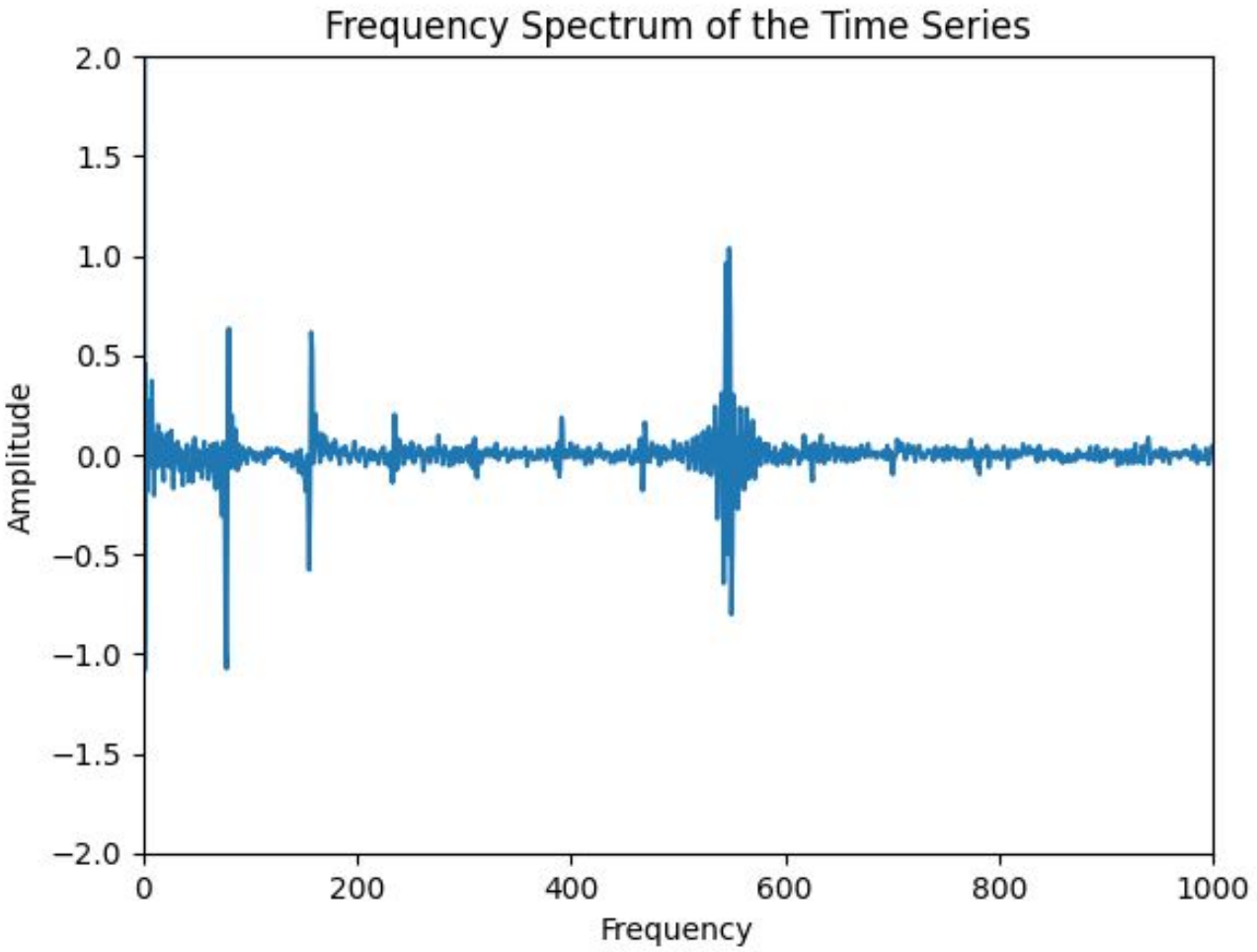
What correlations can we measure?



strong seasonality

Fourier Analysis

- identify daily and weekly correlations
- use frequency peaks as features



How could one tackle this problem?

- Classical Time Series Models
  - ARIMA, SARIMA (Univariate)
- Deep Learning
  - LSTM, TCN, Transformer (sequential)
- Machine Learning
  - Gradient Boosting (needs features)

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Presenting Gradient Boosting

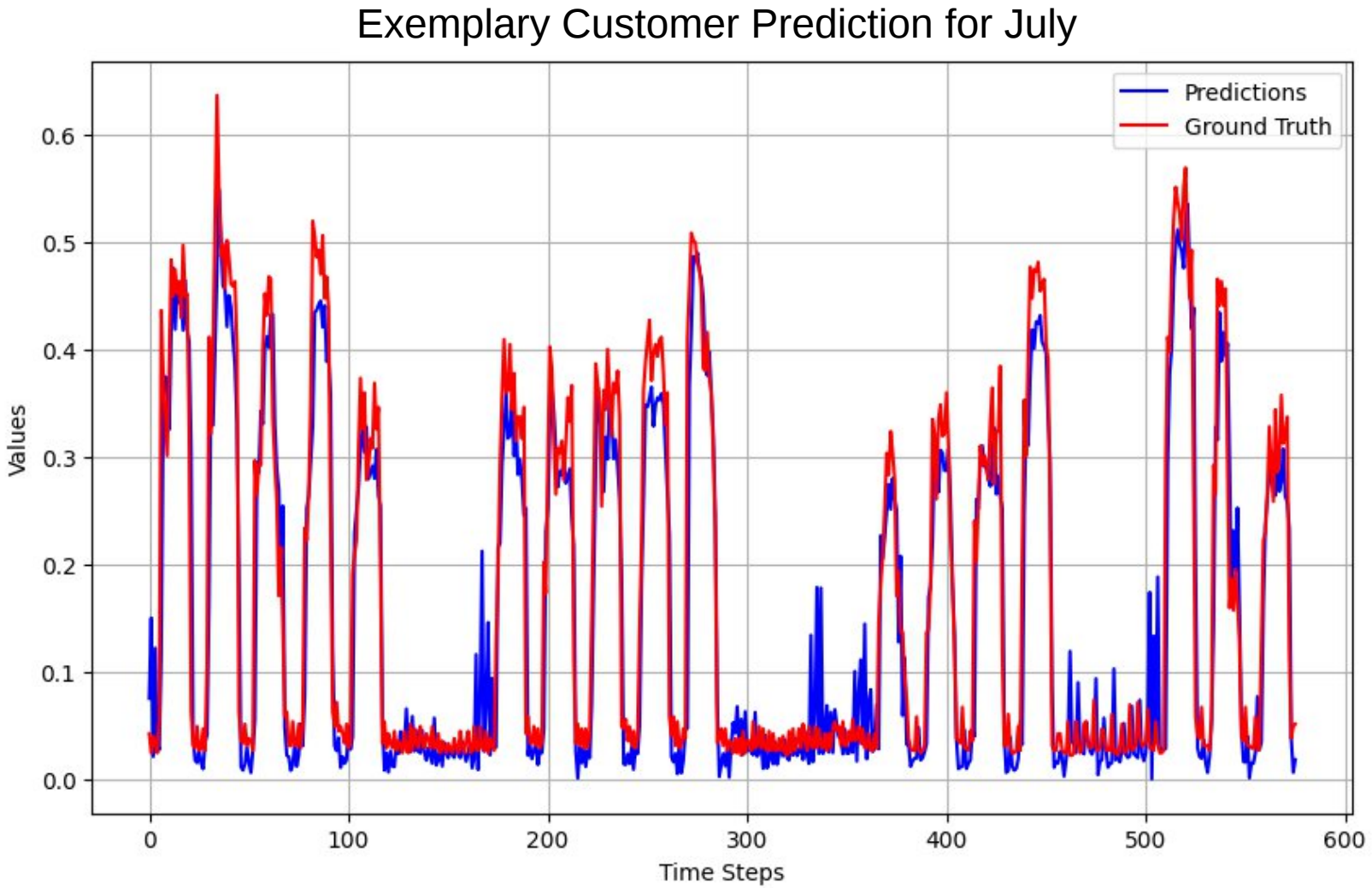
learn model function F(x) through M ‘weak learners’ $f(x)$:

$$F(x) = \sum_{i=1}^{M} f(x)$$

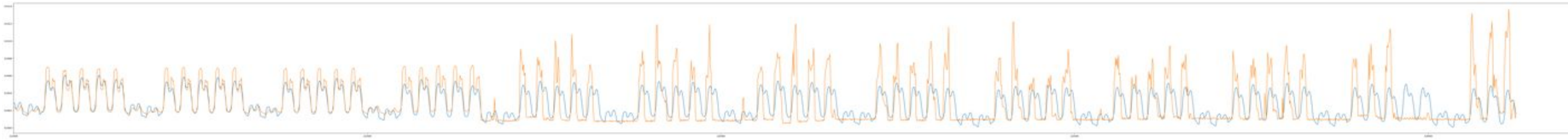
add new weak learners sequentially and expand model. Compute gradient w.r.t. previous prediction

$$F_{n+1}(x) = \sum_{i=1}^{M-1} f_i(x) + \beta f_M$$

Results


Exemplary Customer Prediction for July
Predictions
Ground Truth
Values
Time Steps
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0
100
200
300
400
500
600

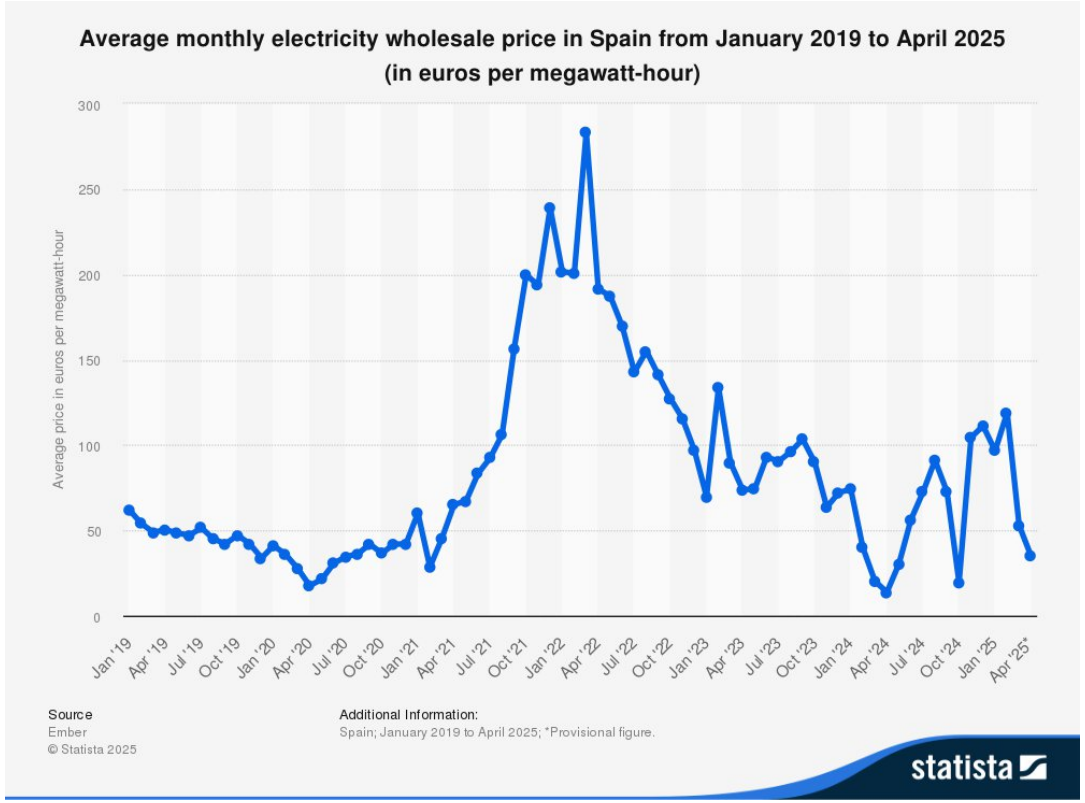
Results



– feature needed to handle sharp increases of amplitude

Outlook

– add electricity price (MWh) as feature



https://www.statista.com/statistics/1267552/spain-monthly-wholesale-electricity-price/

Thank you for your attention!

Hourly energy usage for sampled customers