COGNIPLANT

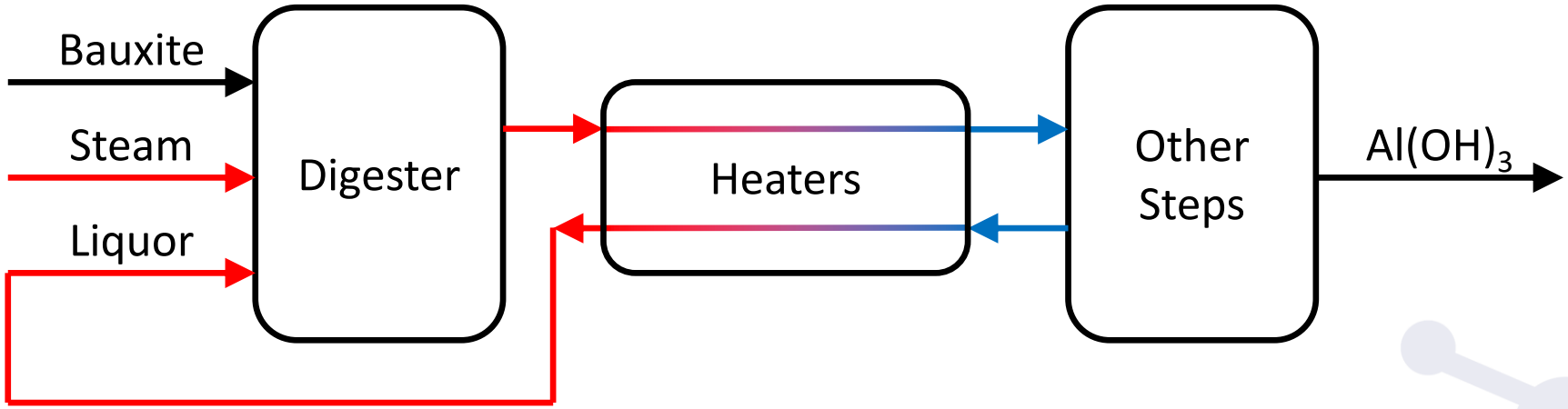
Training
Aughinish Alumina

22-06-2023

COGNIPLANT Project has received funding from the EU Horizon 2020 Research and Innovation Programme, under Grant Agreement No. 869931

SPIRE
Sustainable Process Industry through Resource and Energy Efficiency

Challenges in operation



It's all about efficiency!

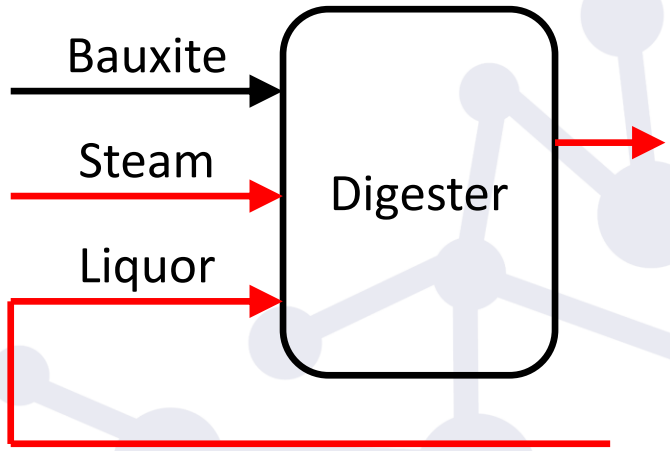
- Reduction of steam use in digester
- Maximum heat recovery in heaters
- Reduction in gas consumed

Challenge

- Steam provides heat to keep digester at a set temperature
- Excessive steam use results in increase in gas consumed
- Priority is to minimize the excess without compromising production

➢ Development of steam prediction model to determine steam usage

➢ Recommendation of changes to inputs while maintaining set temperature



Prediction model

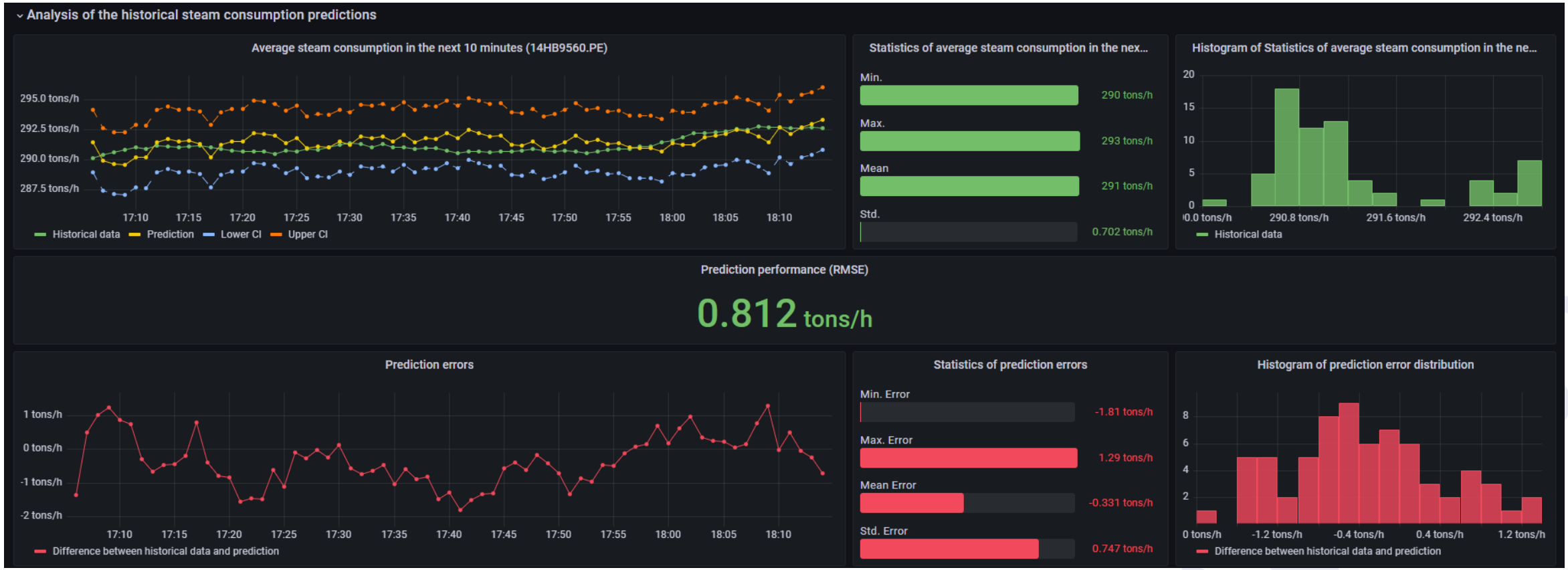
31
Original features
e.g. temperatures, pressures, mass flows

243
Extension of data basis
e.g. time lags

38
Features selected
using recursive feature elimination

SVR model predicting steam consumption over next 10 minutes

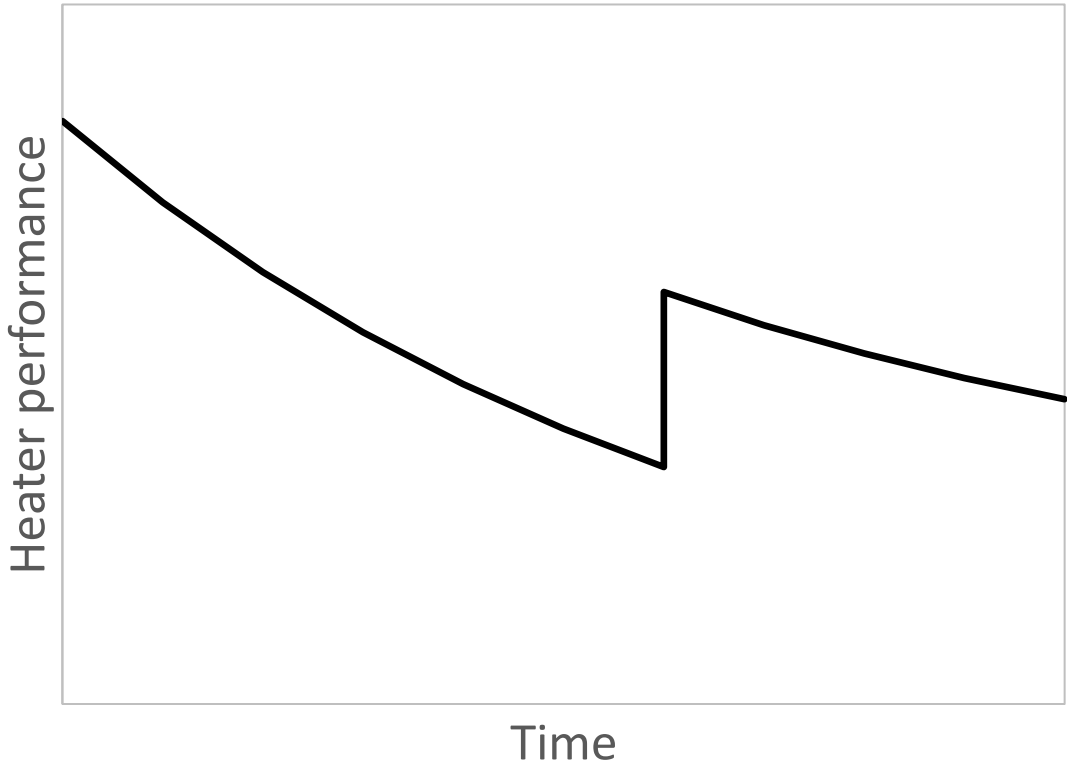
Giving recommendations



Importance of performance prediction

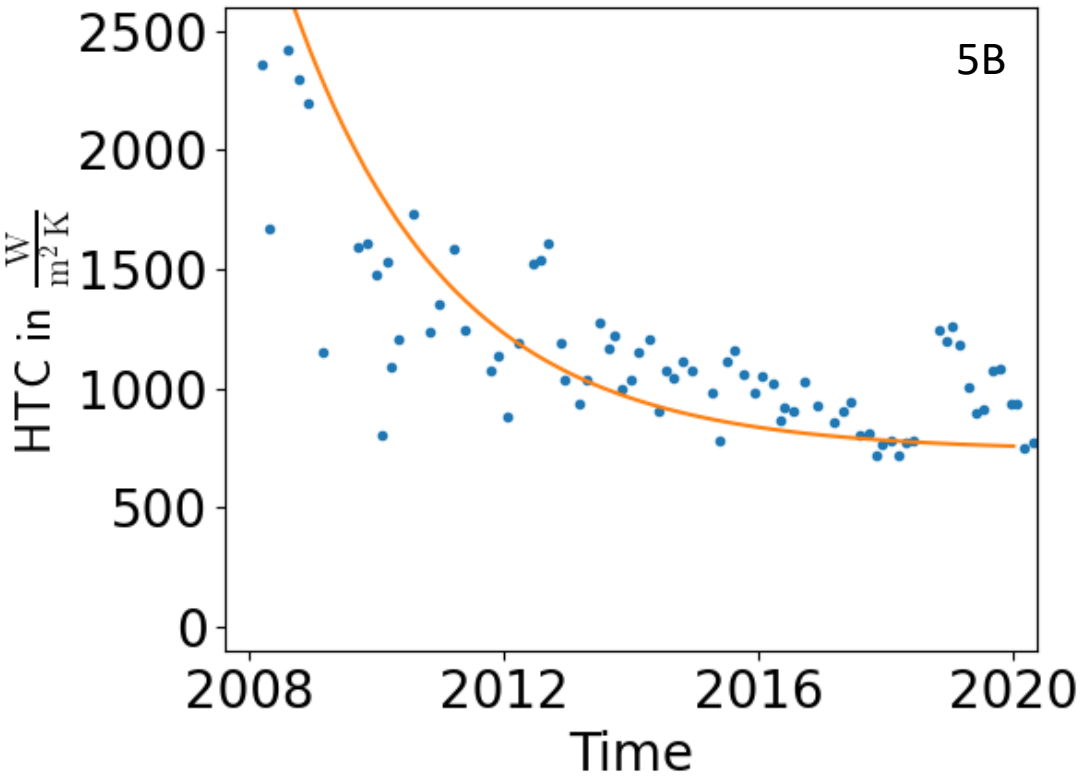
- Heater degradation due to precipitating silica
- Early maintenance: No gain
- Late maintenance: Unnecessary losses

➢Performance prediction necessary

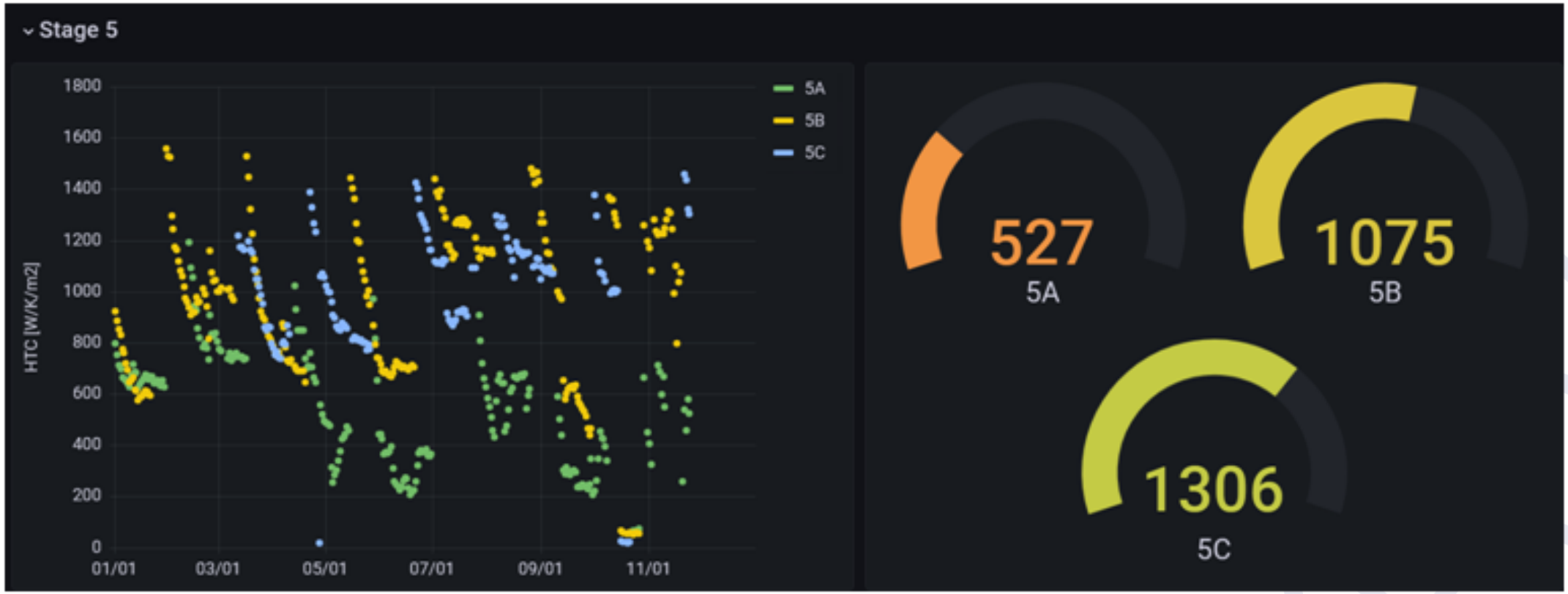


Approach using historical data

- Data preprocessing
  - Discard offline times
  - Discard unphysical values
  - Isolation forest
- Fitting remaining data



Results


Stage 5
1800
1600
1400
1200
1000
800
600
400
200
0
HTC [W/K/m2]
01/01
03/01
05/01
07/01
09/01
11/01
5A
5B
5C
527
5A
1075
5B
1306
5C

Conclusion

- Complex process is split into simpler subprocesses
- Subprocesses can be modeled using data-driven approaches
- More efficient plant operation possible based on models

Question & answers

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