OpenSTEF

FOSDEM 2024

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Alliander NV
03-02-’24

OpenSTEF

Open Short Term Energy Forecasting

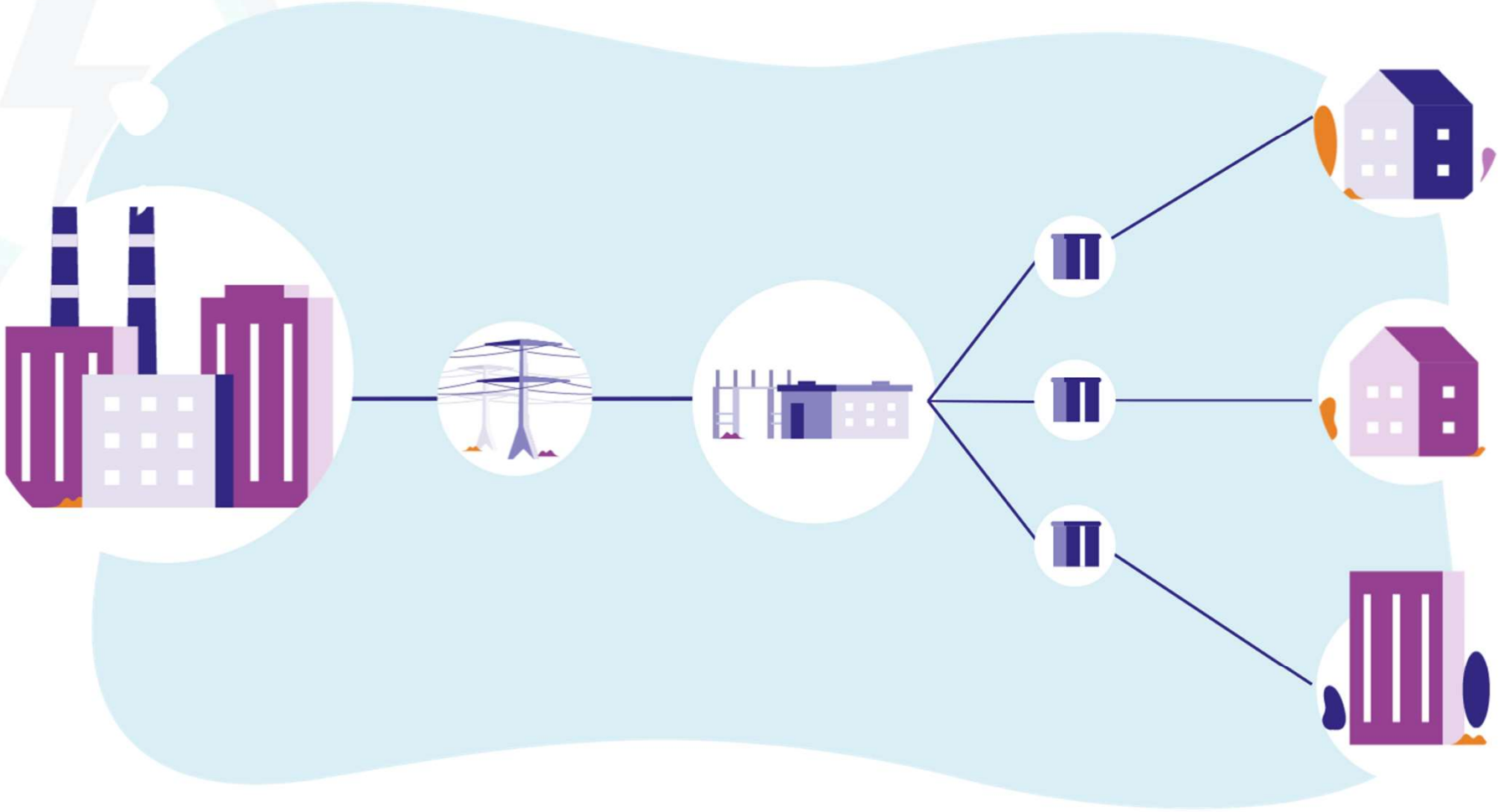
Outline

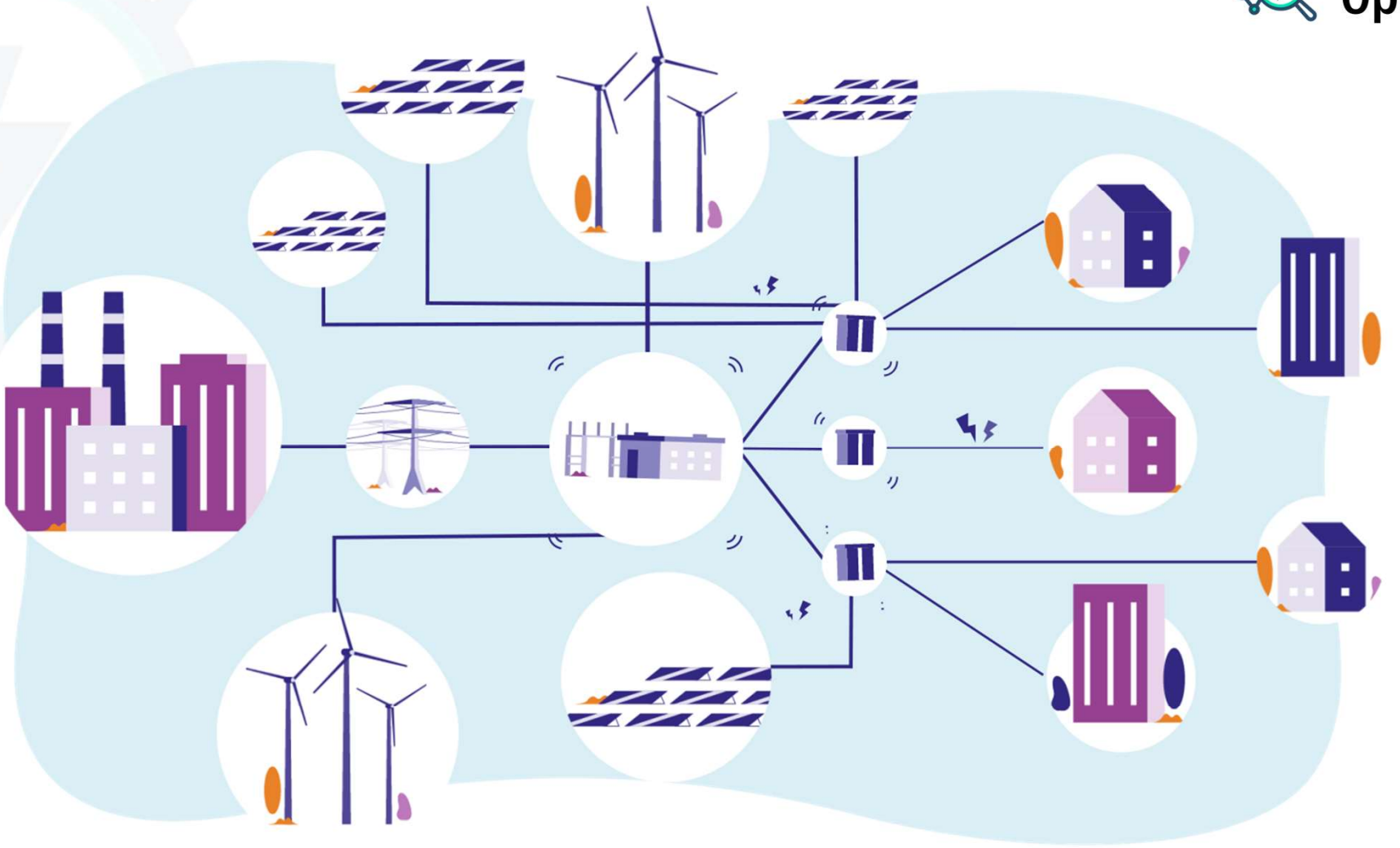
Challenges of the grid in 2024

OpenSTEF

Recent developments and collaboration

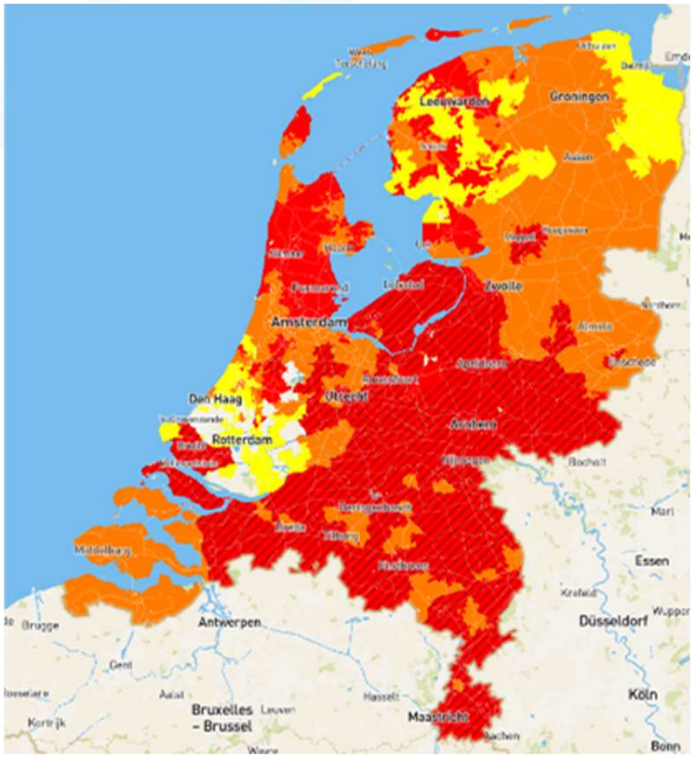
Challenges on the grid



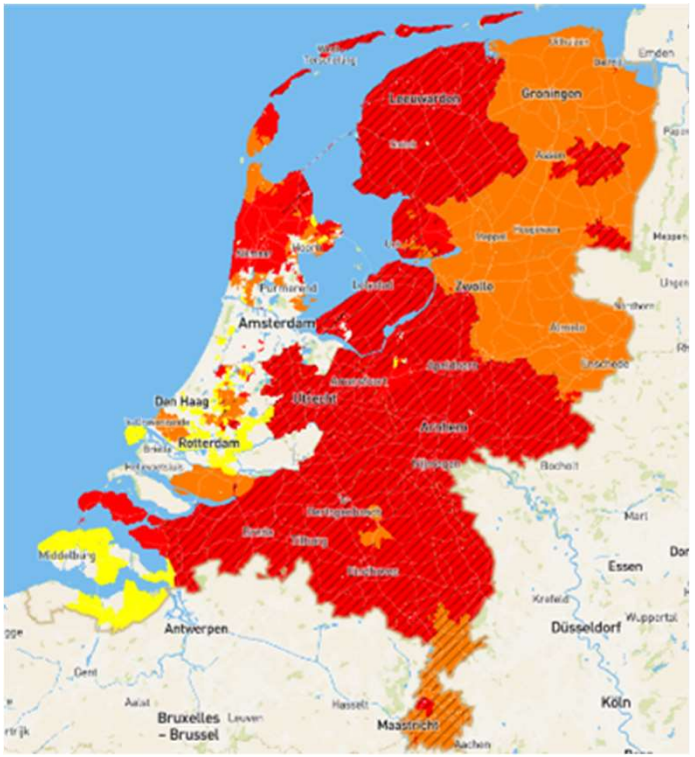


Capacity issues

Energy consumption



Energy generation



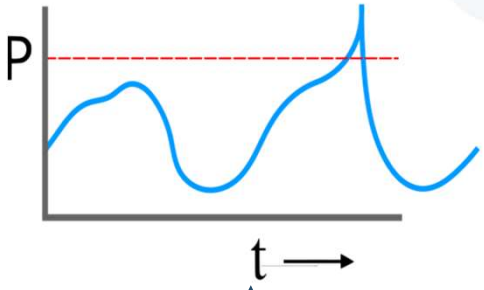
Transmission capacity

- Limited
- Congestion management
- Unavailable

How can we solve these problems?

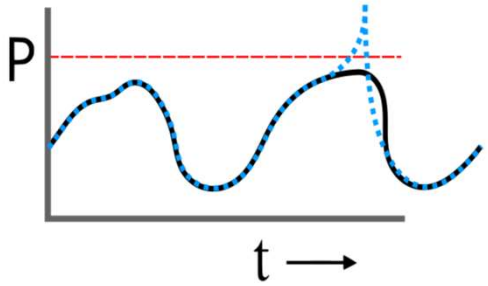
Shave the peak if grid limitations are surpassed

Forecast of load surpassed grid limitation



Use curtailment to 'shave the peak'

Realized load has no peak.



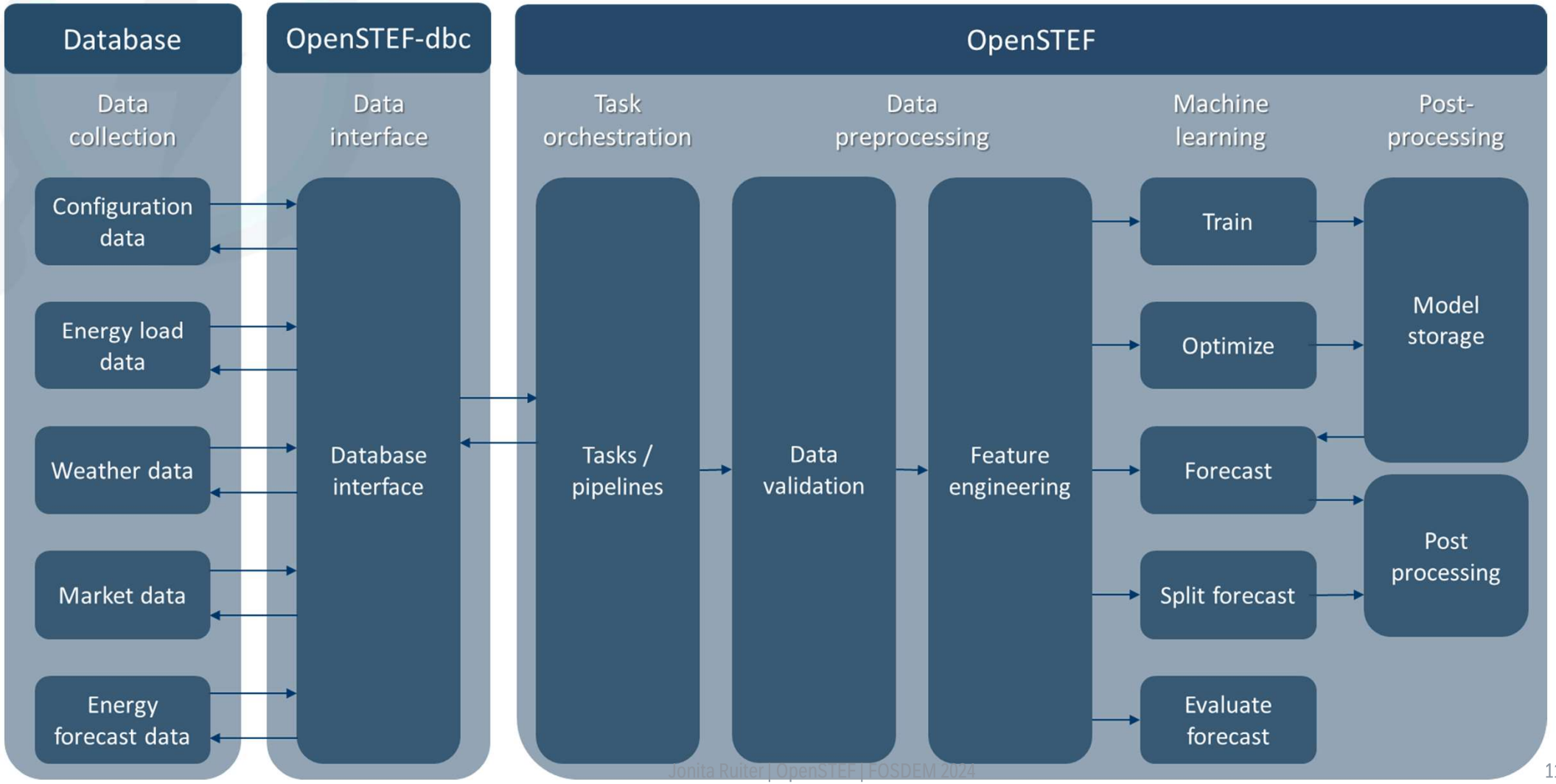
Thus, we need accurate forecasts

OpenSTEF

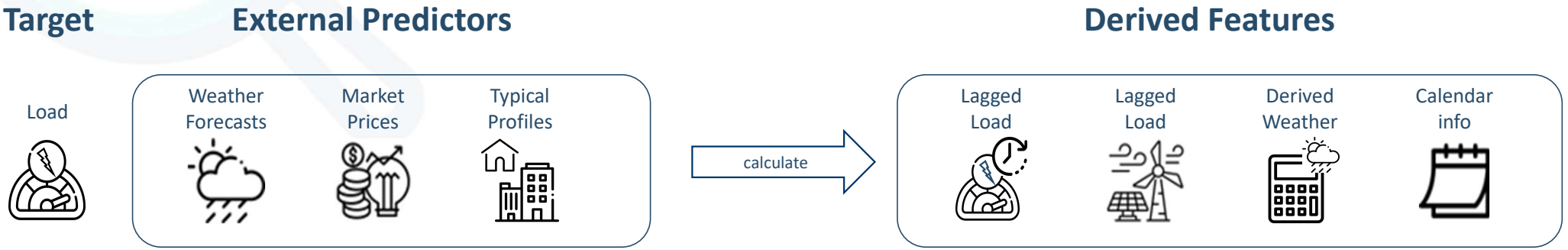
Open Short Term Energy Forecasting

What is OpenSTEF?

- Complete software stack to forecast the load on the electricity grid
- Automated machine learning pipelines:
  - Automated step-by-step process (from collecting data, to training, to forecasting) ensuring a systematic approach to making forecasts.


Database
OpenSTEF-dbc
OpenSTEF
Data collection
Data interface
Task orchestration
Data preprocessing
Machine learning
Post-processing
Configuration data
Energy load data
Weather data
Market data
Energy forecast data
Database interface
Tasks / pipelines
Data validation
Feature engineering
Train
Optimize
Forecast
Split forecast
Evaluate forecast
Model storage
Post processing

Methodology



A **single model** is trained for **all lead times**

	Target	External Predictors		Derived Features			
Datetime	Load	Windspeed	APX	E1C_AMI_A	Load yesterday	Wind energy	Dew point	Holiday
2023-01-01T10:00:00Z	8.2	3.2	45.0	0.0012	7.5	0.20	8.9	No
2023-01-01T10:15:00Z	8.6	3.8	45.0	0.0015	7.7	0.23	9.1	No
…								

A **single model** is trained for **all lead times**

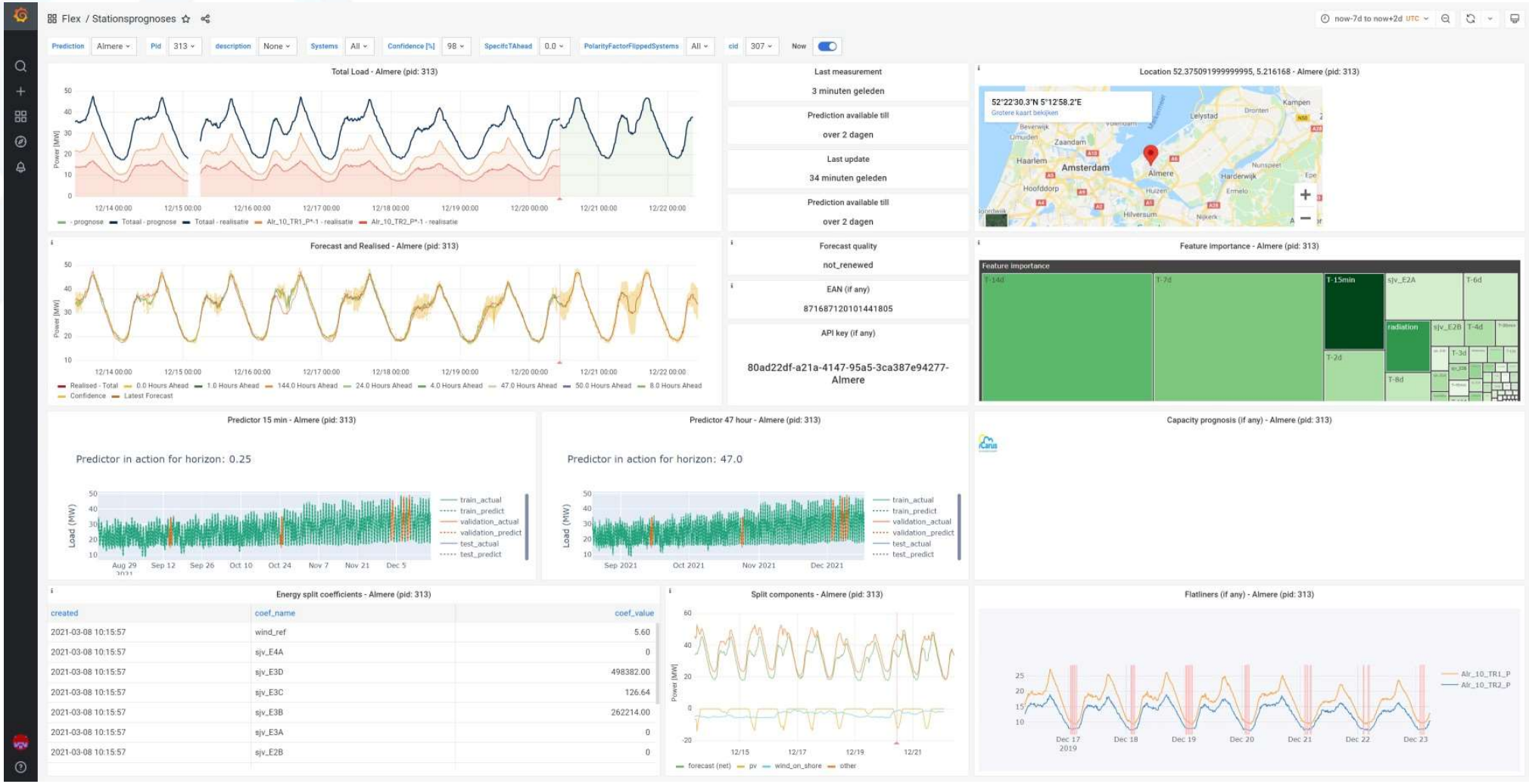
Duplicate data for every training horizon.

	Target	External Predictors			Derived Features				Time horizon
Datetime	Load	Windspeed	APX	E1C_AMI_A	Load yesterday	Wind energy	Dew point	Holiday	Horizon
2023-01-01T10:00:00Z	8.2	3.2	45.0	0.0012	7.5	0.20	8.9	No	0.25
2023-01-01T10:00:00Z	8.2	3.2	45.0	0.0012	7.5	0.20	8.9	No	47.0
2023-01-01T10:15:00Z	8.6	3.8	45.0	0.0015	7.7	0.23	9.1	No	0.25
2023-01-01T10:15:00Z	8.6	3.8	45.0	0.0015	7.7	0.23	9.1	No	47.0
…									

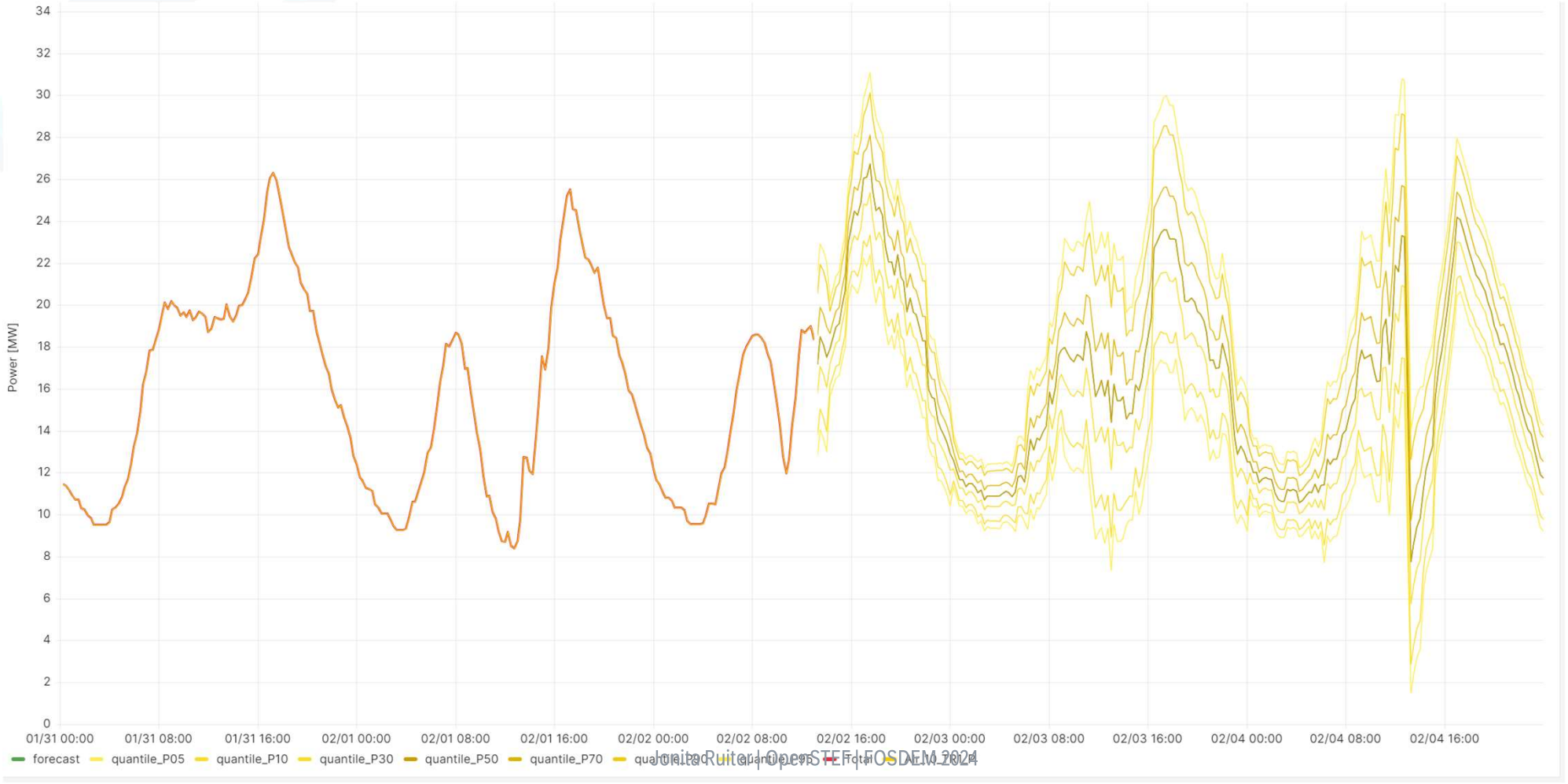
Now, a forecast can be made using the trained model

model.predict

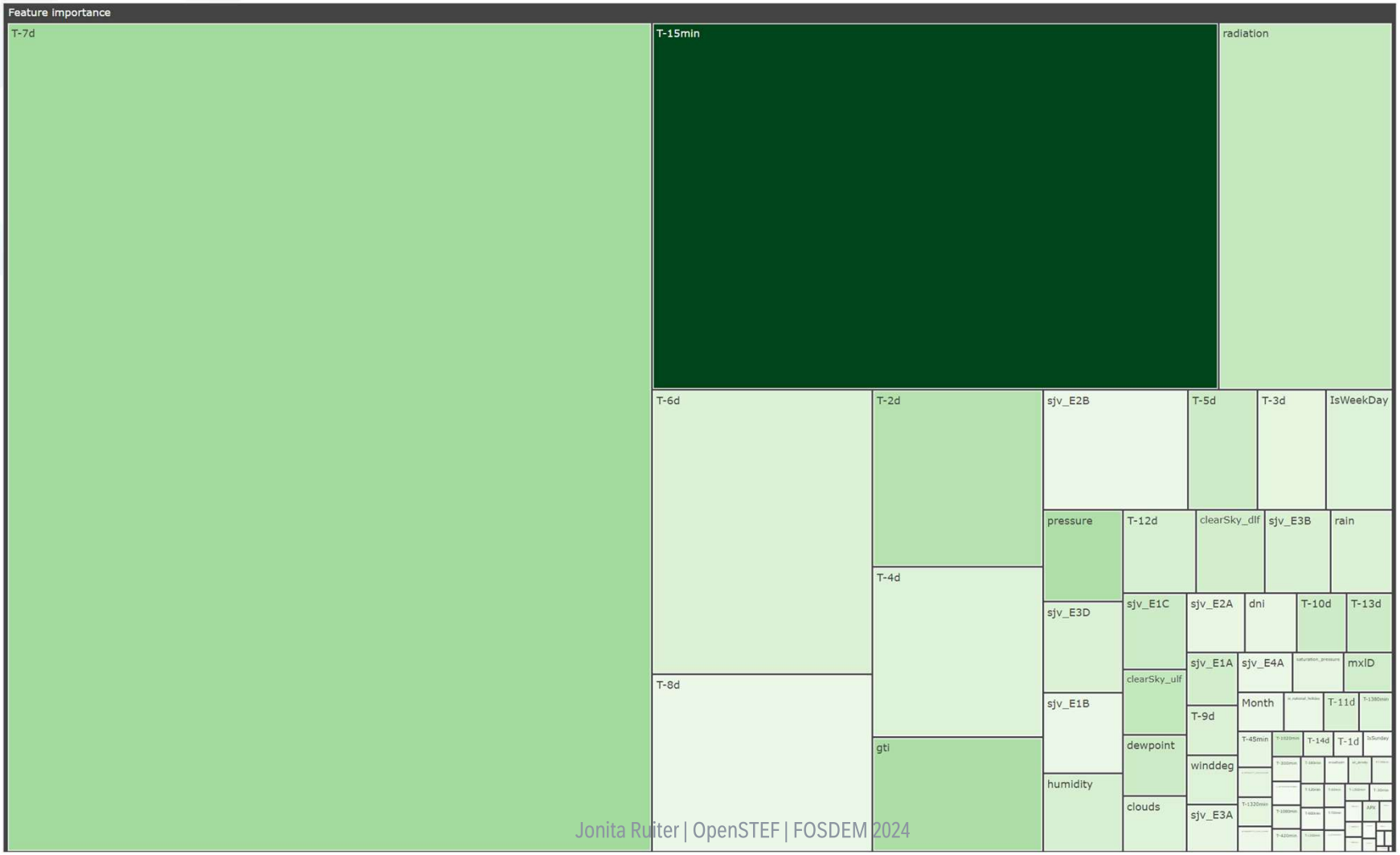
Datetime	Forecast
2023-06-01T11:00:00Z	10.5
2023-06-01T11:15:00Z	10.8
…	
2023-06-03T10:30:00Z	12.3
2023-06-03T10:45:00Z	12.4


Flex / Stationsprognoses
Total Load - Almere (pid: 313)
Last measurement
3 minuten geleden
Prediction available till
over 2 dagen
Last update
34 minuten geleden
Prediction available till
over 2 dagen
Location 52.375091999999995, 5.216168 - Almere (pid: 313)
52°22'30.3"N 5°12'58.2"E
Forecast and Realised - Almere (pid: 313)
Forecast quality
not_renewed
EAN (if any)
871687120101441805
API key (if any)
80ad22df-a21a-4147-95a5-3ca387e94277-Almere
Feature importance - Almere (pid: 313)
Predictor 15 min - Almere (pid: 313)
Predictor in action for horizon: 0.25
Predictor 47 hour - Almere (pid: 313)
Predictor in action for horizon: 47.0
Capacity prognosis (if any) - Almere (pid: 313)
Energy split coefficients - Almere (pid: 313)
created
coef_name
coef_value
2021-03-08 10:15:57
wind_ref
5.60
sjv_E4A
0
sjv_E3D
498382.00
sjv_E3C
126.64
sjv_E3B
262214.00
sjv_E3A
0
sjv_E2B
0
Split components - Almere (pid: 313)
Flatliners (if any) - Almere (pid: 313)

Forecast


Power [MW]
34
32
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
01/31 00:00
01/31 08:00
01/31 16:00
02/01 00:00
02/01 08:00
02/01 16:00
02/02 00:00
02/02 08:00
02/02 16:00
02/03 00:00
02/03 08:00
02/03 16:00
02/04 00:00
02/04 08:00
02/04 16:00
forecast
quantile_P05
quantile_P10
quantile_P30
quantile_P50
quantile_P70

Feature importance plot



Community & upcoming events

LFENERGY OpenSTEF

Community

Want to try OpenSTEF?

Join our workshop!

Date: March 1, 2024

Time: 2:00 PM - 4:00 PM GMT+1

Location: Virtual

What to expect:
- Introduction to OpenSTEF
- Hands-on Experience

Sign up here!

Want to know more about OpenSTEF?

- Github: https://github.com/OpenSTEF/openstef
- Website: https://openstef.energy/
- Docs: https://openstef.github.io/openstef/
- Wiki: https://wiki.lfenergy.org/display/OS/OpenSTEF
- Installation: $ pip install openstef

Sign up here for the workshop!

Do you have more questions, remarks or want to see if we can collaborate?

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