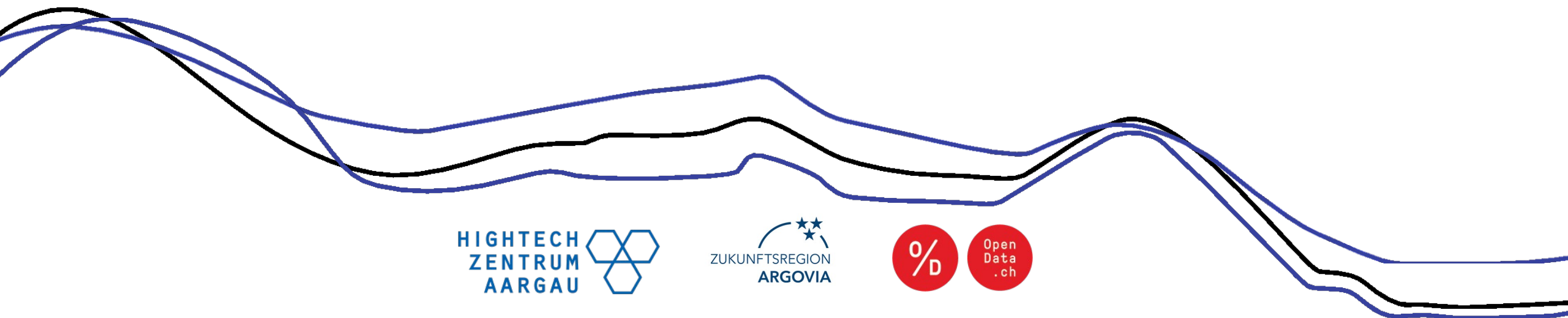


Welcome!

ENERGY DATA HACKDAYS



24-25th of September 2021 in Brugg, Switzerland



ENERGY DATA HACKDAYS



HIGHTECH
ZENTRUM
AARGAU



AEW
Ihre Energie.

swissgrid

Mit Unterstützung von

 **energieschweiz**



EPFL

Lucerne University of
Applied Sciences and Arts
**HOCHSCHULE
LUZERN**

PAUL SCHERRER INSTITUT
PSI

 **OST**
Ostschweizer
Fachhochschule

Kompetenzzentrum
Energy Management (ior/cf-HSG)
 **Universität St. Gallen**

n|w Fachhochschule
Nordwestschweiz

 **Empa**
Materials Science and Technology

EKZ

 **sgsw**
St. Galler Stadtwerke



geoPro
Suisse

 **KANTON AARGAU**

 **TECHNOPARK®
AARGAU**

 **NCCR
Automation**

NUSSBAUM_{RN}

 **SEP®**
Swiss Energy Planning

 **BEN Energy**

Energy Lab. 

KICKSTART

Friday

From 8:30 Registration Desk; Coffee & Gipfeli

9:15 Welcome & Keynotes

- Martin Bopp (Hightech Zentrum AG),
- Matthias Galus (BfE),
- Michael Koller (CTO EKZ),
- Peter Burgherr (Paul Scherrer Institut)

9:45 Presentation of the Challenges

10:45 Constituting Teams

and start Hacking!

12:30 Lunch

17.30 Project documentation

18:00- 18:30 Exchanging about the state of the projects

Open End

Saturday

From 8:00 Coffee & Gipfeli

15:00 Deadline project-slides
documentation

16:00 Keynote

- Cédric Aubert, (geoPro Suisse)

16:15 Final project presentations

17:15 Closing word

- Peter Morf (HTZ)

17.30 Apero!

Cédric Aubert
CEO

GeoPro Suisse

Shape the Future of Energy!

Just use the data !

Cédric Aubert

CEO geoPro Suisse

the value of the data

using data
is a
mindset

the new gold rush

data & analytics
is a
fascinating combination

energy data hackdays
is
a spirit

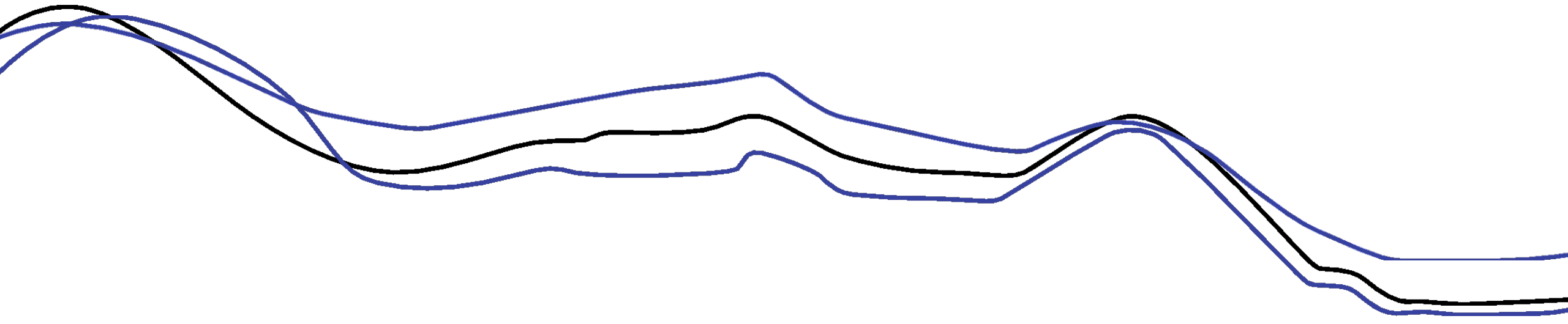
Bravo
for your commitment
to get more of the data

don't stop the data

Cédric Aubert, CEO
056 588 09 09
cedric.aubert@geoprosuisse.ch

geoPro Suisse AG
Rütistrasse 3
CH-5400 Baden

4 min Pitch !



- 1 - Photovoltaic Forecasting
- 2 - Building IoT Security
- 3 - Local Sustainability Booster
- 4 - Understanding Big Energy Data
- 5 - Smart Meter Open Dataset
- 6 - Spatio-temporal Model of an On-Shore Wind Farm
- 7 - Smart Meter Insights Market
- 8 - Digital Twins for Domestic Heating Systems
- 9 - Customer Data Analysis
- 10 - Trends in Tertiary Energy Prices

- 11 - Pre Qualification Test
- 12 - Climate-Neutral Cities - St. Gallen Example
- 13 - Where Does My Electricity Come From?
- 14 - Trend Scouting For The Energy Industry
- 15 - Electricity "Heartbeat" 2035 in the Canton of Zurich
- 16 - "Green" Charging E-Mobility
- 18 - Interoperability plug-test for smart meter's local CII
- 19 - ReFi - Regenerative Finance

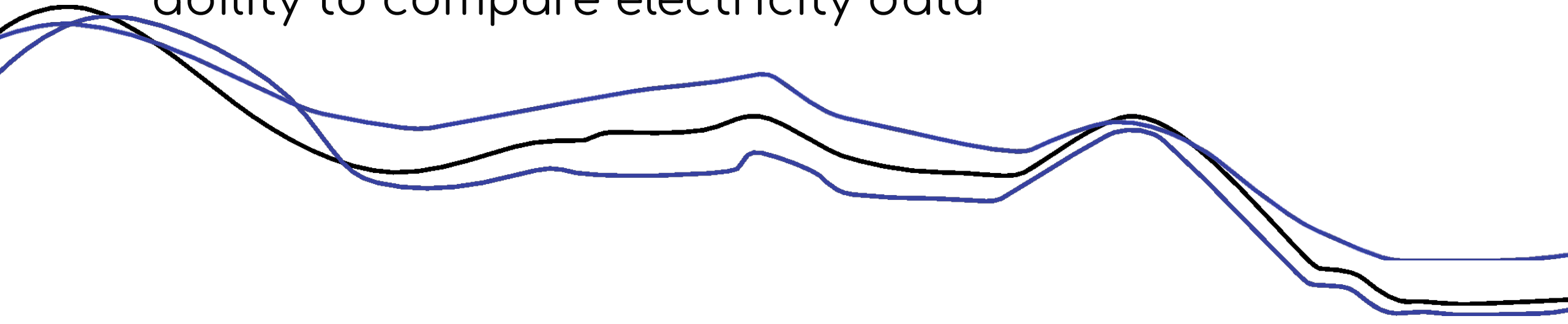
Swiss Electricity Demand

Source: Swissgrid, 15
minute time resolution

Swiss Electricity Demand

04

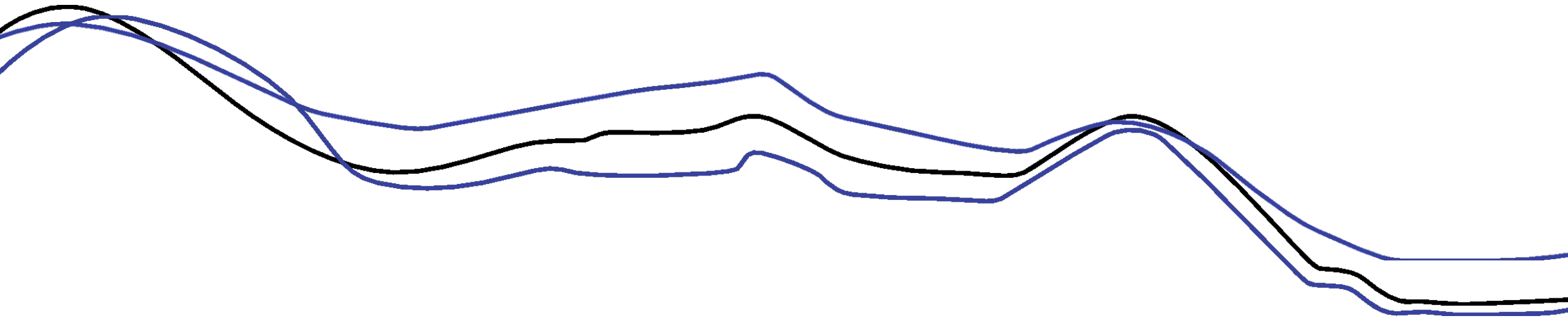
- **Problem:** Need to better understand the high-resolution energy data
- **Tool:** Platform for model-based and historical data comparison using novel indicators
- **Result:** More insight in ongoing energy transition and ability to compare electricity data



Main Learnings

04

- Resolution really matters
- Visualizations can be misleading

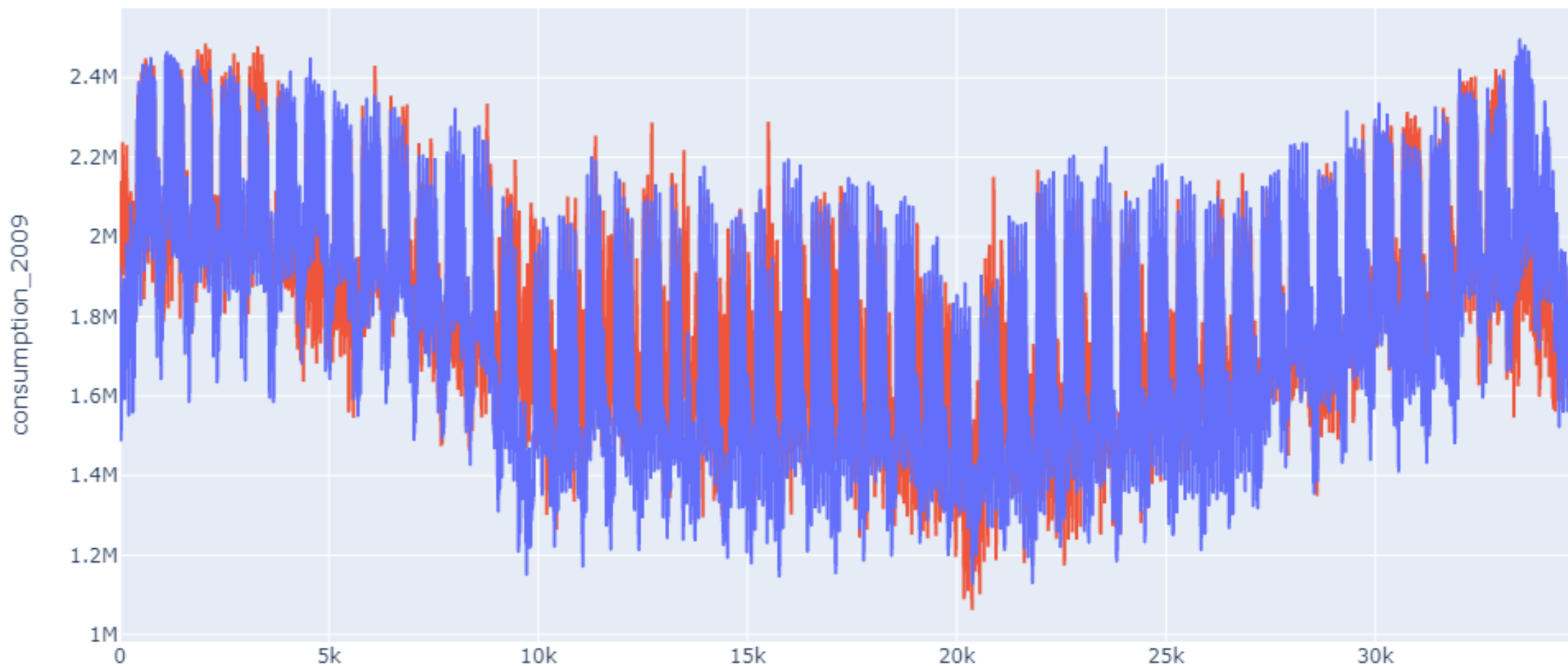


Resolution really matters

blue = 2009
red = 2019

04

Swiss electricity consumption
source: Swissgrid.ch

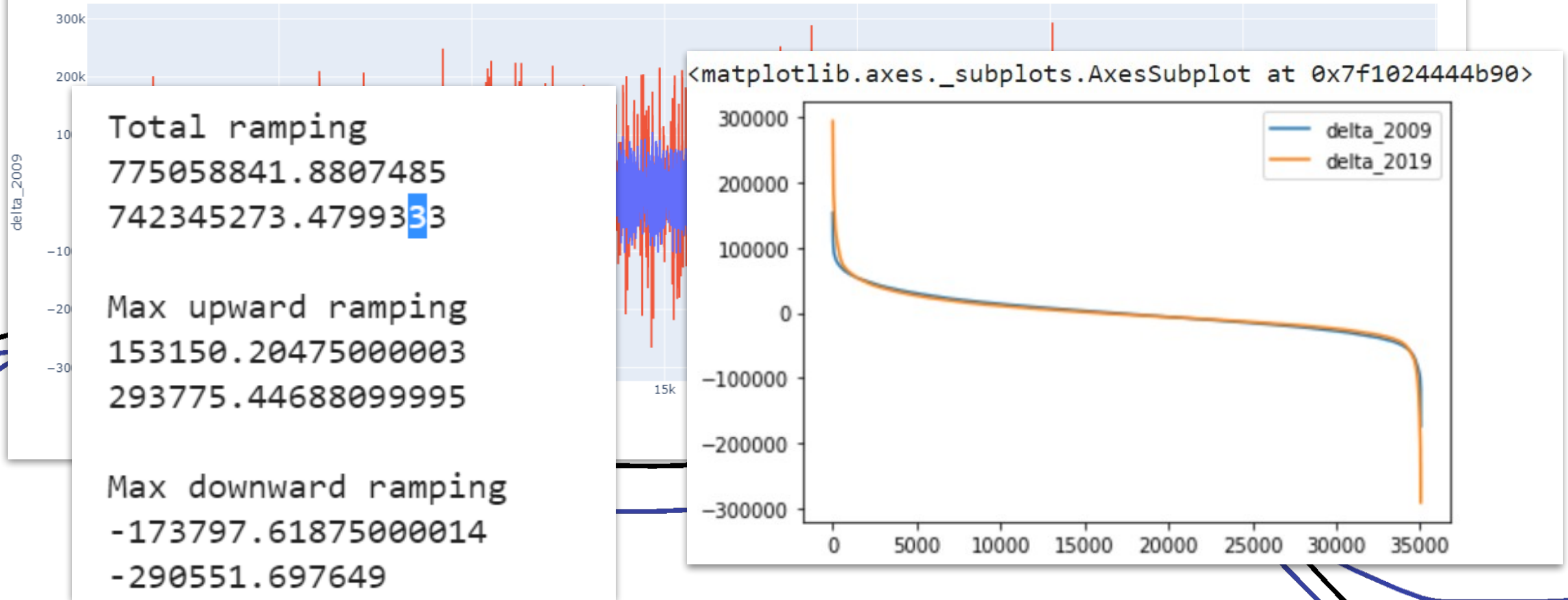


Visualizations can be misleading

blue = 2009
red = 2019

04

Swiss electricity consumption
source: Swissgrid.ch



Conclusion & Next steps

Thank you Google Colab & Open Data Hack Days!

Future work:

Continue the work,
make it object-oriented,
and create the actual platform for the data analysis.

Team Info:

Tim Breitenbach: tim.breitenbach@axpo.com

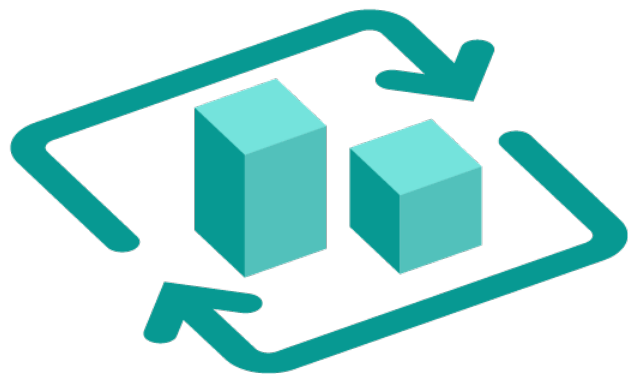
Irene Cucchi: icucchi2@gmail.com

Pranjal Jain: jainpranjal746@gmail.com

Marius Schwarz: mschwarz@ethz.ch

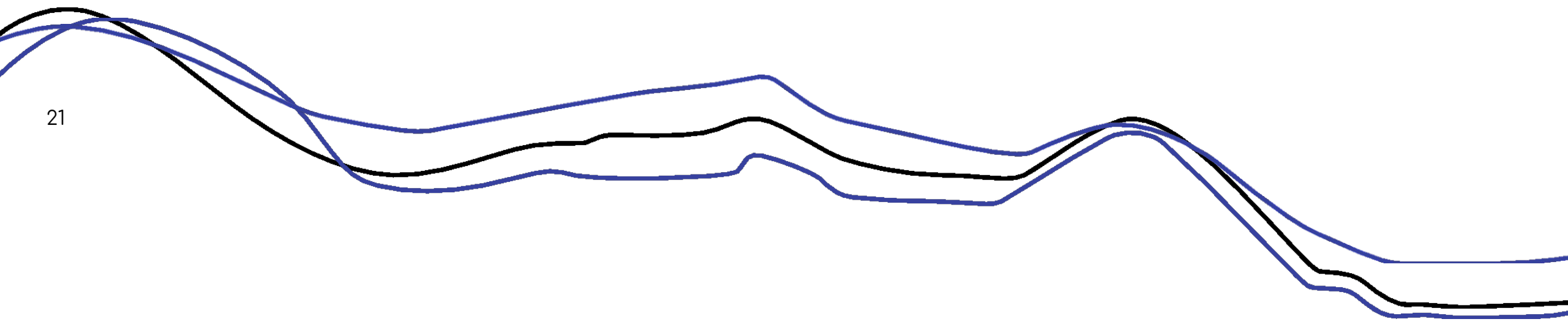
Melin Walet: melindominiquewalet@gmail.com

Find our code on [Github](#)!



National Centre of Competence in Research **Automation**

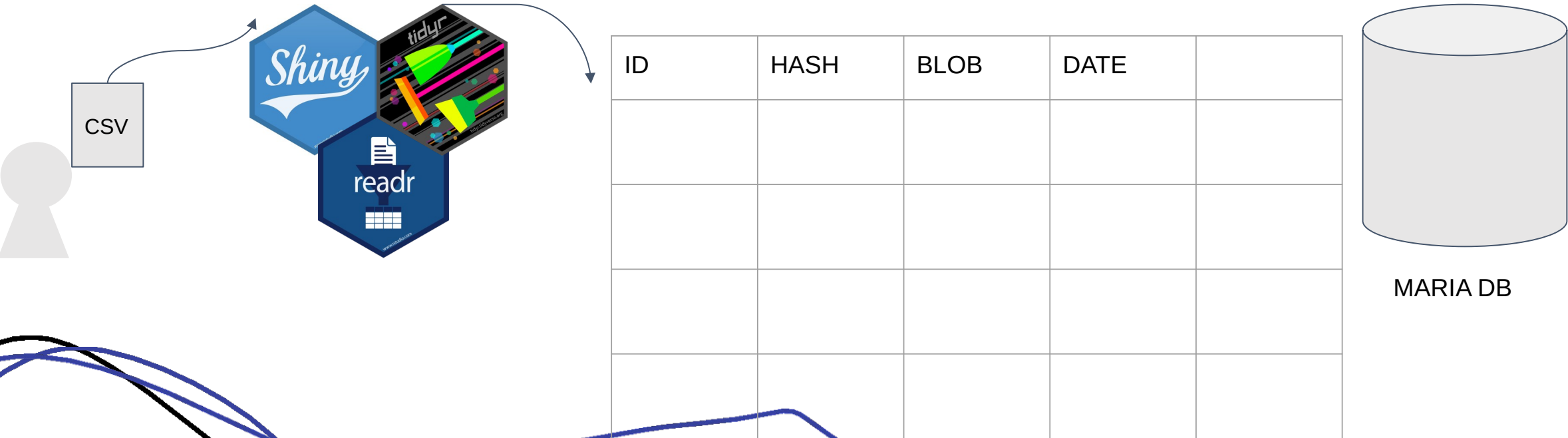
Smart Meter Open Dataset





● IDEA

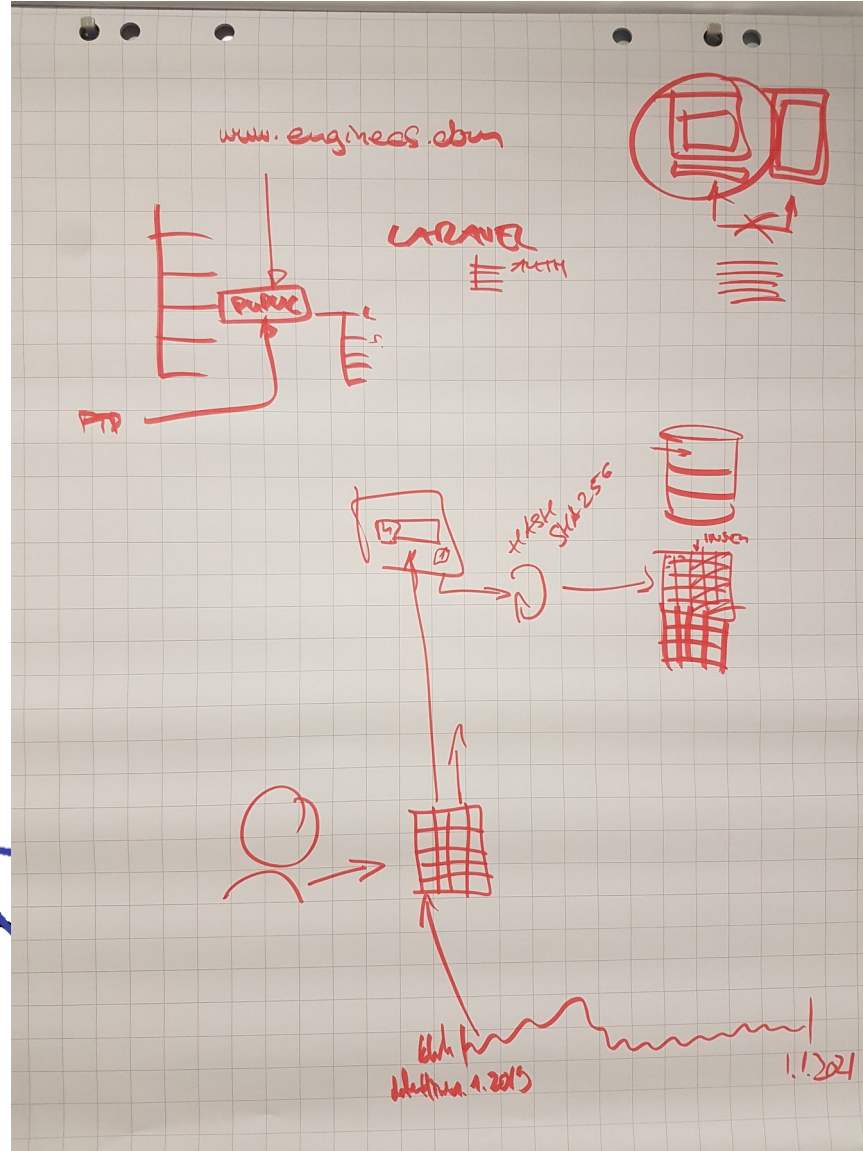
05





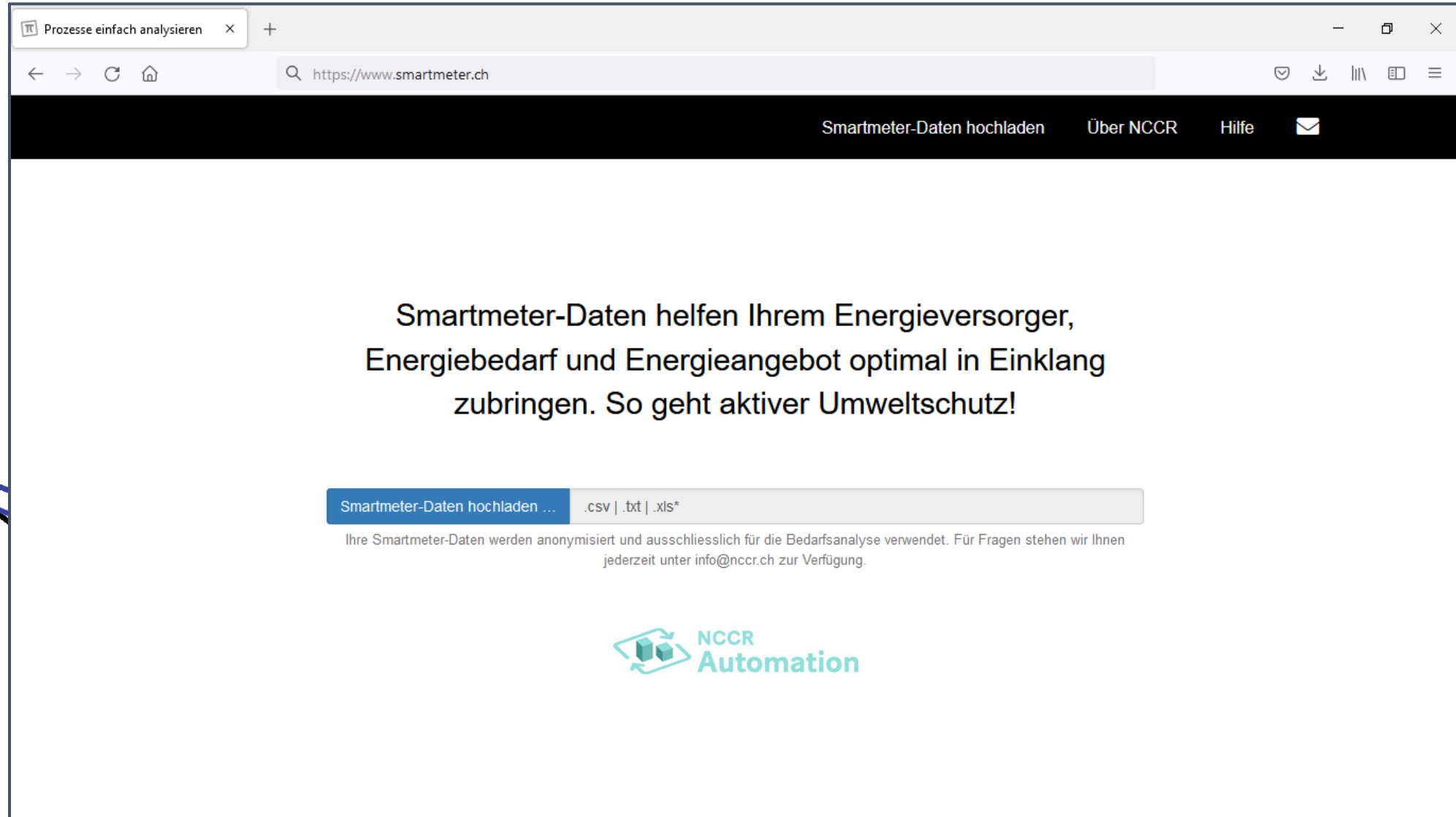
● CONCEPT STAGE

05



● PLATFORM MOCK-UP

05



• ISSUES/ WHAT'S NEXT

05

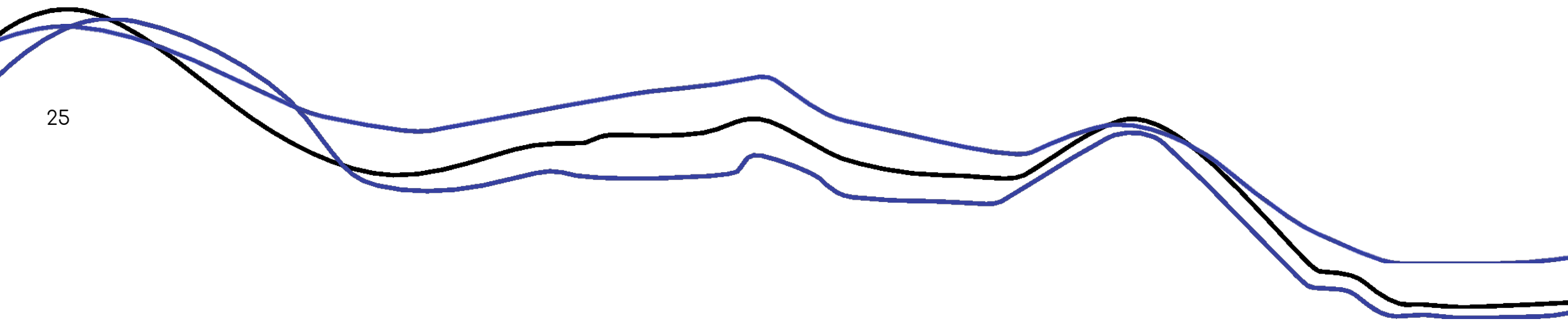
Problem with File uploads:

- Diversity of file formats
- Heterogeneity from the same vendor: e.g. CSV export depends on browser language:
%d.%m.%Y %H:%M:%S is not %m/%d/%Y %l:%M:%S %p

New Approach (to come):

- API based data extraction from smart meter operators,
e.g. smart-me via OAUTH2.0 token

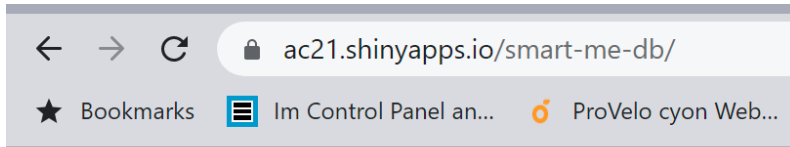
25





● PROTOTYPE for SMART-ME meters:

05



Smart-Me Open Dataset

Das ist ein einfacher Demonstrator, der nur mit einem realen Smart-Me Account funktioniert. Mehr über Smart-Me:

www.smart-me.com

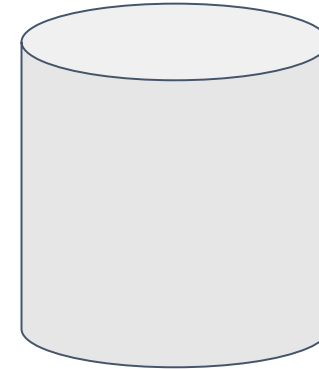
Benutzername (E-Mail)

Passwort

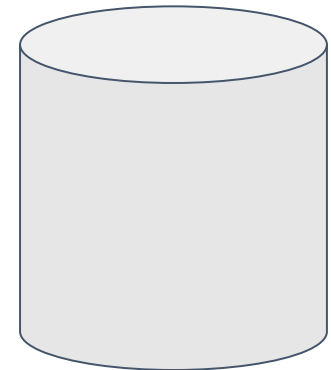
Login [Passwort vergessen](#)

FRONTEND

OAuth 2.0



SMART
METER
PLATFORM



MARIA DB



APP.DATALOVE.CH



- NEXT STEPS

05

Make it look less like a phishing attack

Add legal framework

- **TEAM**
BEN:
sawicki@bluewin.ch

05

MARTIN:
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PETER:
peter.janes@abdagon.com



Spatio-temporal model of an on-shore wind farm



On-shore wind farm near a coast in Brazil



Problem definition

06

Wind turbines in a wind farm influence each other due to wake effects, which reduces the generated power output of certain turbines

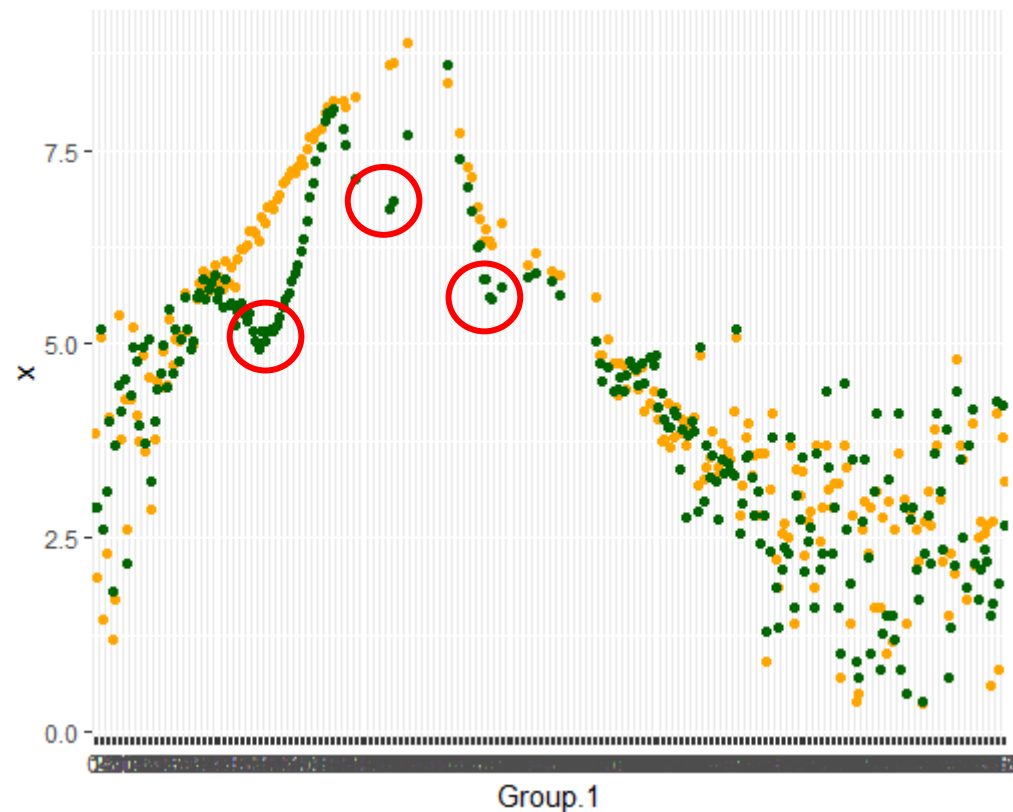
- Visualise and analyse the wind farm
- Build a graph network representing the wind farm and make power output prediction



<https://www.researchgate.net/profile/Dries-Allaerts/publication/321171743/figure/fig3/AS:614362846859266@1523486925733/Aerial-picture-of-the-Horns-Rev-II-wind-farm-in-which-the-windturbine-wakes-are.png>

Wind farm visualisation and analysis

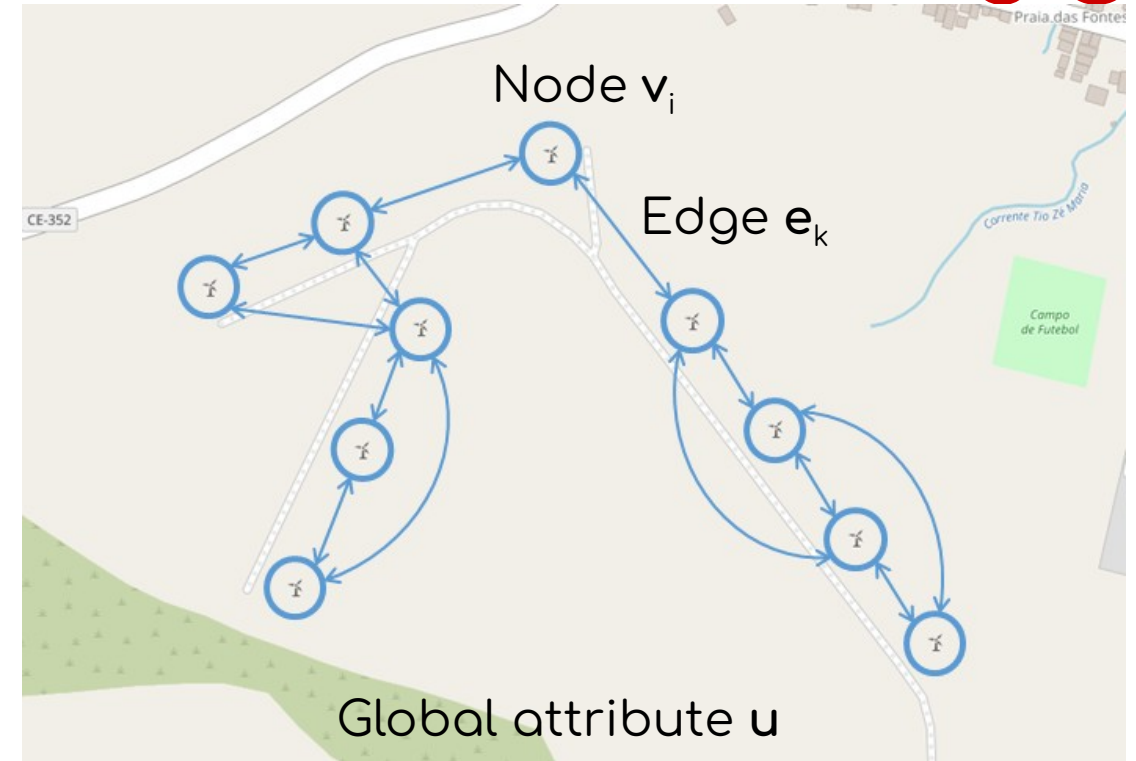
06



The Graph Network

06

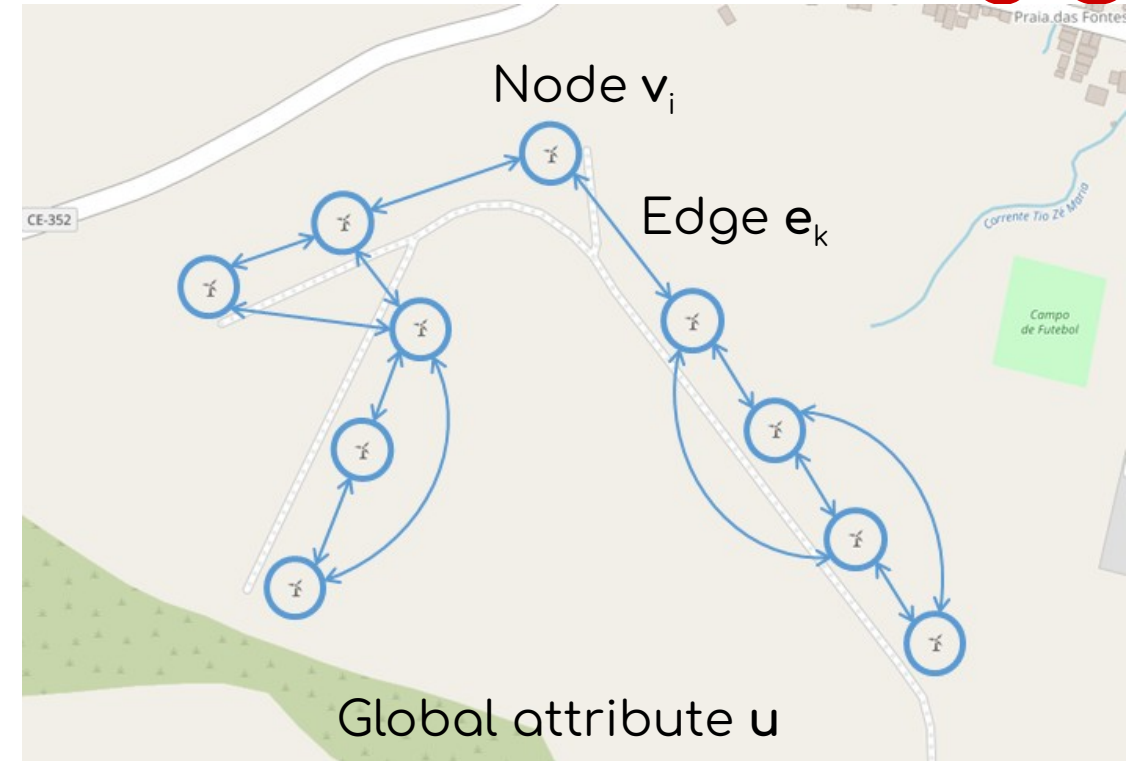
- Natural representation of a wind farm by a graph is possible
- Model turbine interactions - Wake effect
- Short term power prediction
 - Control strategies
 - Grid balance
 - Energy market predictions



The Graph Network

06

- Node v_i contains the measured wind speed
- Edge e_k relates two nodes (wind turbines) by their **distance** from each other and their **azimuth**
- The global attribute u is the **wind direction**, measured at a single location for the whole wind farm, and **time stamp**



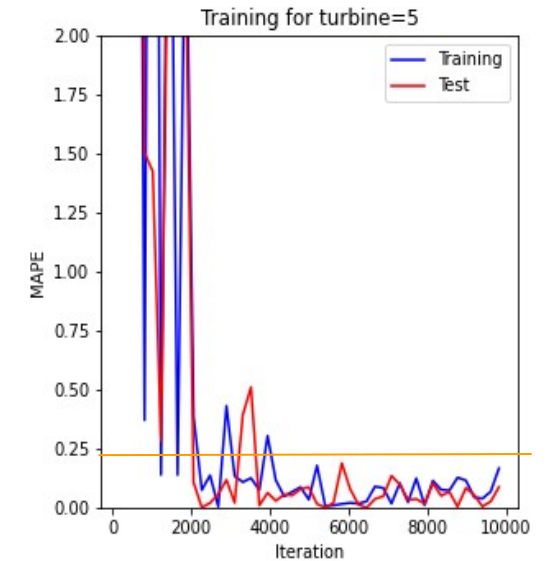
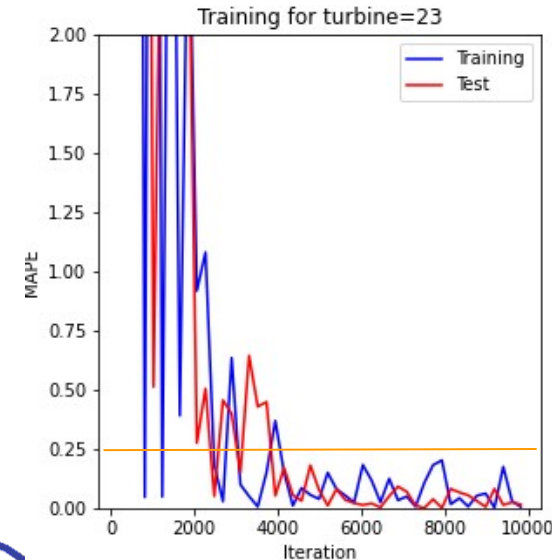
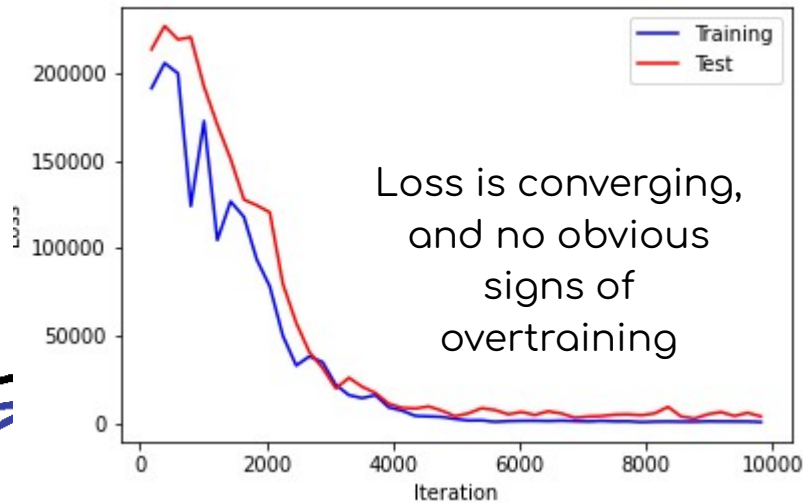
33

- architecture: Encode - Message Passing - Decode
- 3 (x 3) learnable functions: acting on nodes, edges and globals separately

Power output predictions

06

- Loss function is the Mean Absolute Error (average over turbines)
- Training performed on a subset of the data (300 time stamps)



34

Precision of power prediction ~ 5-25%

Some large statistical fluctuations
(only small subset used for training)

Conclusions and next steps

06

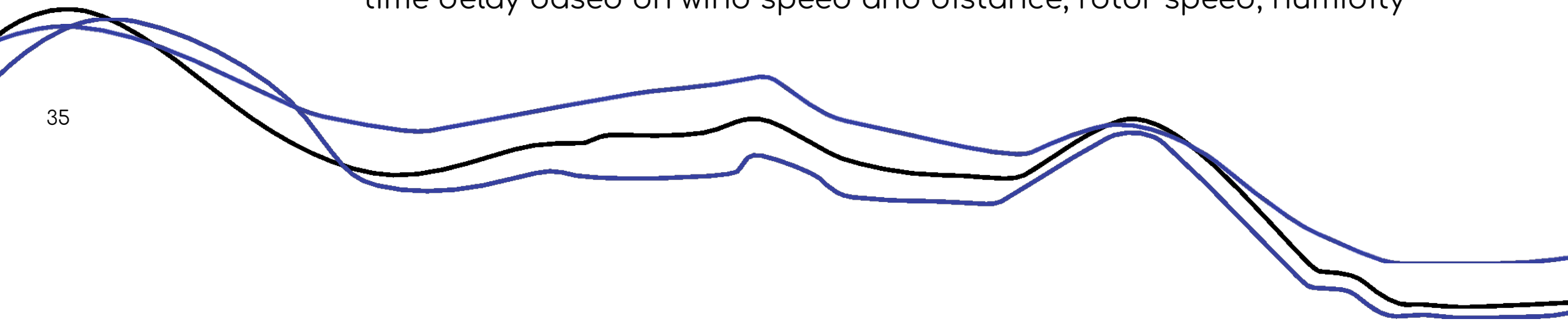
Conclusions

- Valuable information available in the data for the graph network
- So far only test on small subset with good results

Next Steps

- Use entire data set
- Change and test different node and edge features, e.g. temperature, time delay based on wind speed and distance, rotor speed, humidity

35



Team

06

Florian Hammer - florian.hammer@ost.ch

OST - Ostschweizer Fachhochschule

Maria Giulia Ratti - mariagiuliaratti@hotmail.it

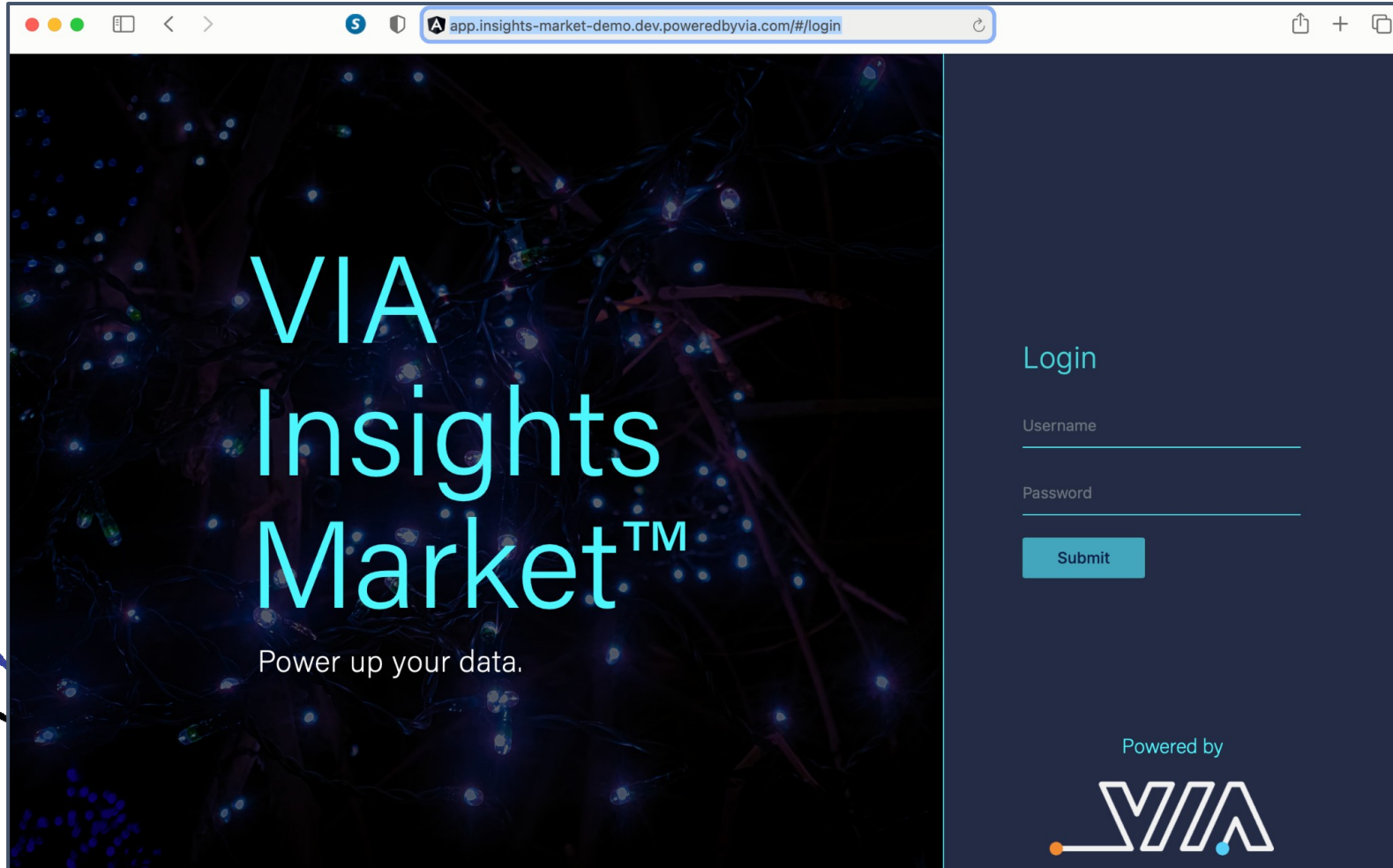
ETH Zürich

Régis Michael Andreoli - regis.andreoli@gmail.com

HSLU

Smart Meter Insights Market

07



The screenshot shows a web browser window with the URL `app.insights-market-demo.dev.poweredbyvia.com/#/login`. The page features a dark background with a network of glowing blue nodes and lines. On the left, the text "VIA Insights Market™" is displayed in a light blue font, with the tagline "Power up your data." below it. On the right, there is a login form with the heading "Login", fields for "Username" and "Password", and a "Submit" button. At the bottom right, it says "Powered by" followed by the VIA logo.

VIA
Insights
Market™

Power up your data.

Login

Username

Password

Submit

Powered by

VIA

Let's do the Numbers ...



1

4

5

7

9

New Market Opportunity

Cybersecure building sustainability data



1 4 5 7 9

Demos to Swiss Utilities

Commitment of time and interest



1 4 5 7 9

Recommendations to New Swiss Utilities



Network effect and word of mouth

1 4 **5** 7 9

New VIA Insights Market™ Users

User feedback!



1 4 5 7 9

New Model Proposals

Momentum!



1

4

5

7

9

Remember the Existing Models?



Ready to Use Model

Nonintrusive Load Monitoring

Containerization date: Sep 24 2021

A sequence-to-point (seq2point) model for non-intrusive load monitoring (NILM). NILM or energy disaggregation is the task of separating the household energy measured at the aggregate level into constituent appliances. This model has been trained on the Reference Energy Disaggregation Dataset (REDD). This model will estimate the energy consumption of an appliance given the total house energy consumption.

(<https://github.com/MingjunZhong/transferNILM>)

Ready to Use Model

Load Forecasting

Containerization date: Sep 24 2021

Load forecasting minimizes utility risk by predicting future consumption of energy by users of the electricity network. Patterns can be learnt by ML models and predictions can be made. This model is based on individual load curve forecasting using a Temporal Convolutional Network. It has been trained on the Low Carbon London Dataset. Electricity consumption is very closely related to human behaviour, which in itself can be highly unpredictable. Models can therefore be enhanced or adapted to include clustering, load profiling or aggregation.

(<https://paperswithcode.com/paper/deep-learning-for-time-series-forecasting-the>)

Ready to Use Model

Anomaly Detection

Containerization date: Sep 24 2021

Deep Learning model for Anomaly Detection. Anomalies - often referred to as outliers, abnormalities, rare events, or deviants - are data points or patterns in data that do not conform to a notion of normal behavior. Anomaly detection, then, is the task of finding those patterns in data that do not adhere to expected norms, given previous observations. In the context of electricity consumption, this can be a useful indicator of equipment failure, or unexpected behaviour of users or loads, and so can be helpful in diagnostics or energy efficiency applications. An LSTM anomaly detection model has been trained using the LCL Data Set. The original model was developed for forecasting stock market data, but was retrained using the LCL dataset to provide anomaly detection based on time series load curve data.

(<https://github.com/amin2997/Anomaly-Detection-in-Time-Series-Data-with-Keras>)

9 New Model Proposals



Analysis Proposal

Virtual EN50160 Power Quality Measurement Campaign

Registration date: Sep 23 2021

A model is trained on synthetic faults and other data sources (such as PMU data) in the laboratory. The model is also tested in the laboratory using smart meter data and data from previous EN50160 campaigns. The trained model will then be deployed to smart meters for the virtual campaign. The model will identify and classify faults locally at the smart meter, then report intermediate results to a second, centralised model, which will build a report for the DSO.

Analysis Proposal

VPP Resource Forecasting For Aggregator

Registration date: Sep 23 2021

The model analyses historical availability and performance of energy resources and predicts the future availability (power, energy) of resources for a VPP.

Analysis Proposal

Energy Community Supply / Demand Optimisation

Registration date: Sep 23 2021

The model forecasts community energy demand and community energy generation to identify mismatches and recommend storage or demand response actions.

9 New Model Proposals



Analysis Proposal

Utility Control Room Decision Support Tool Grid State Forecasting

Registration date: Sep 23 2021

The model uses temporally and spatially heterogeneous data from available smart meters, distribution system sensors, and measurements from DER to extract knowledge relevant to grid violations to increase situational awareness for secure grid operational planning.

Analysis Proposal

Customer Clustering For Dynamic Tariff Selection

Registration date: Sep 23 2021

The model analyses the load curve of the consumer and classifies them into one of k types. Based on the type, different tariff options can be offered to the customer.

Analysis Proposal

Calculate My Energy Savings From PV On My Rooftop

Registration date: Sep 24 2021

Data visualisation showing benefits of installing PV on a rooftop. A comparison of savings between my household vs the energy costs of others who already have PV installed

9 New Model Proposals



Analysis Proposal

EV Clustering For V2G Applications

Registration date: Sep 23 2021

A model analyses balancing and ancillary market price signals and EV charging data (geo-spatial, electrical). EV suitability for combination into a virtual power plant is proposed to offer best solution for the grid service.

Analysis Proposal

CO2 Footprint Of My Consumption

Registration date: Sep 24 2021

What is my CO2 footprint of energy consumption, show the footprint of yesterday, and when you change consumption, how does it change the CO2 footprint?

Analysis Proposal

Model To Support Business Case / Investment Appraisal

Registration date: Sep 24 2021

<https://www.bfs.admin.ch/bfs/en/home/services/recherche/stat-tab-online-data-search.html>
Business models Mapping growth of EV etc. Comparing datasets between cities Learning where intervention could be most relevant

And Interaction!



Browser tabs: Notes - Evernote, Swiss Hackathon 2021 - Google, 210925_Project_Pitches_ENR, VIA Insights Market™

Address bar: app.insightsmarket.solvewithvia.com/#/models/9319533a-0331-490c-a772-3c0cb76d4854/proposal

Navigation: Apps, Gmail, VIA - Google Drive, Evernote, Kate / Colin Agen..., VIA - Calendar - T..., Reading List

VIA Insights Market™

Model Catalog My Assets Logout

[< Back to Model Catalog](#)

Analysis Proposal

EV Clustering For V2G Applications

Published by viainsights

Description

A model analyses balancing and ancillary market price signals and EV charging data (geo-spatial, electrical). EV suitability for combination into a virtual power plant is proposed to offer best solution for the grid service.

Votes

2 0

Inputs

Please see the table below for required inputs.

Column Name	Data Type	Description
timestamp	datetime	timestamp
charge	float	charge

Registration Date

Sep 23 2021

Model ID

9319533a-0331-490c-a772-3c0cb76d4854

Tags

Digital Twins For Domestic Energy Systems 08

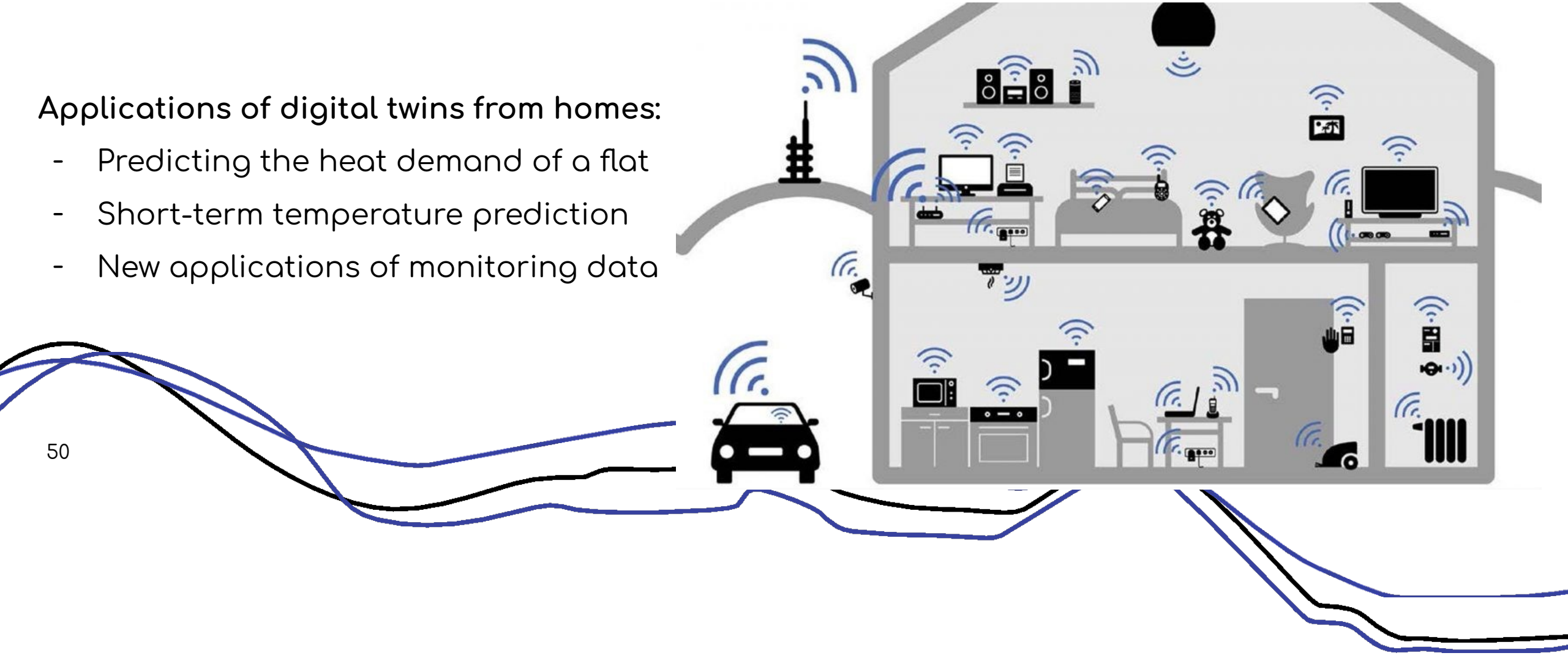


What did we work on?

08

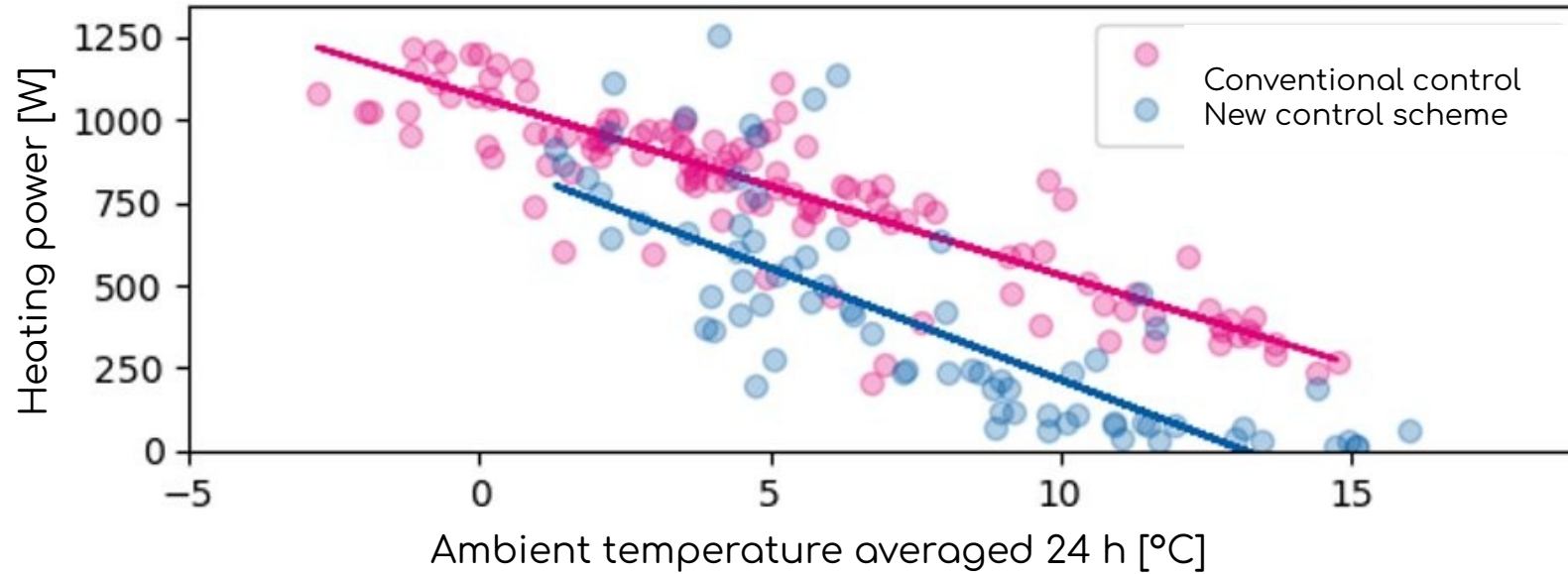
Applications of digital twins from homes:

- Predicting the heat demand of a flat
- Short-term temperature prediction
- New applications of monitoring data



Impact of different controlling schemes

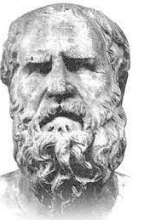
08



New control scheme offers potential for energy savings.

Difficulty to compare two different years:

“You cannot step into the same river twice”

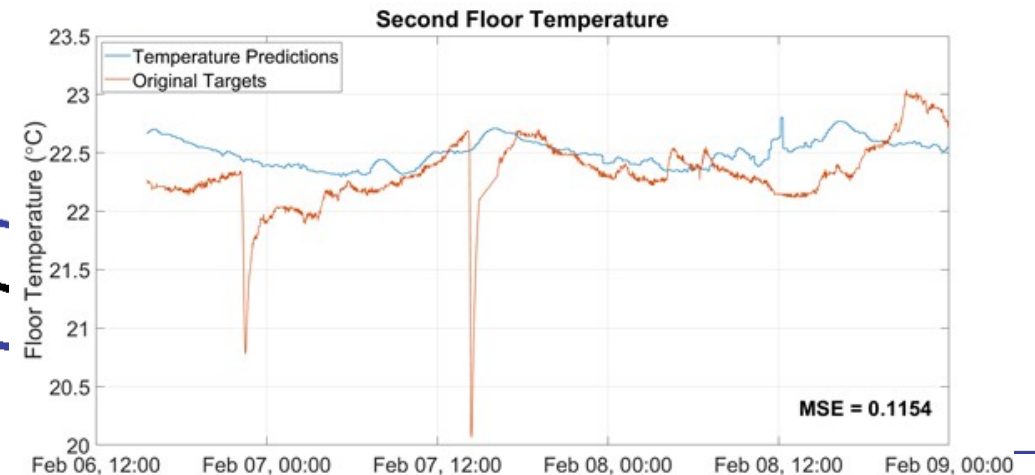
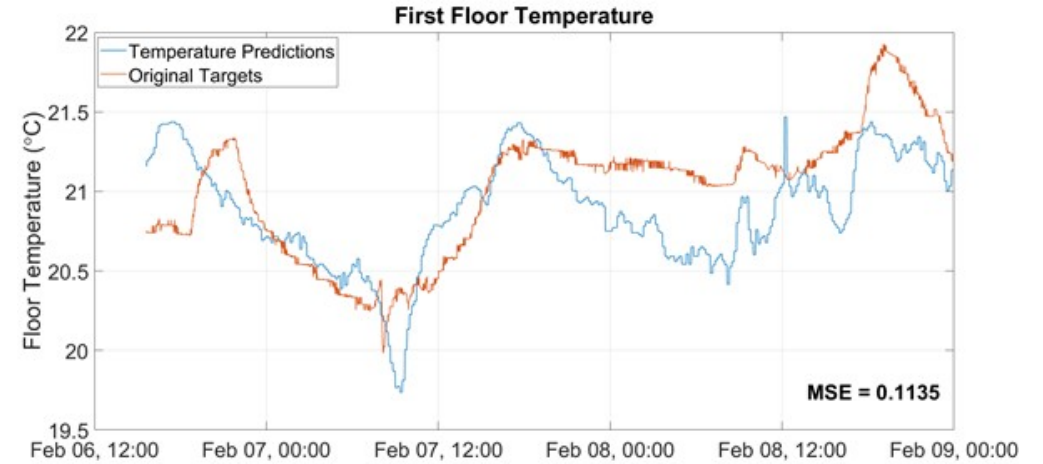


Short-term modelling (min - h prediction)

08

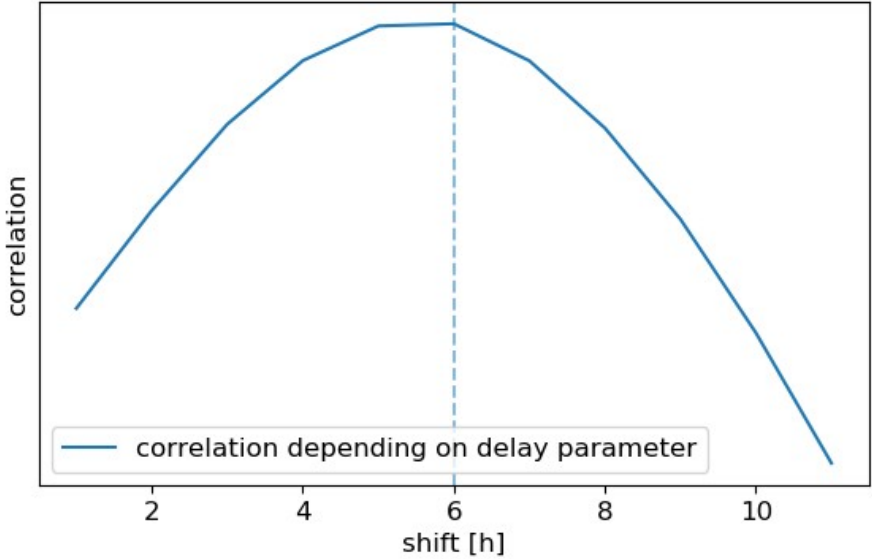
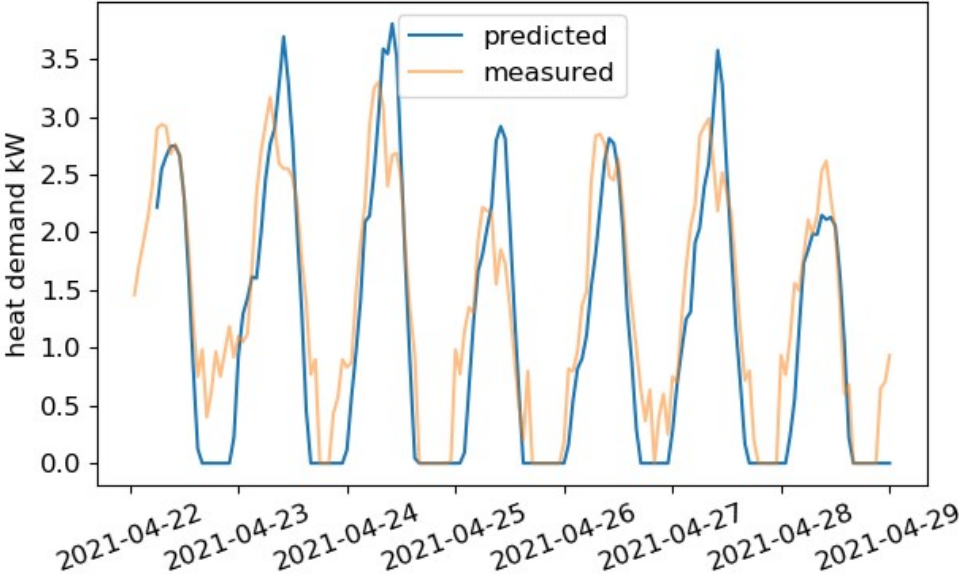
Feedforward neural network for short-term prediction of floor temperature prediction.

MSE ~ 0.11 for the evaluated period.



Heat demand prediction (h - d prediction)

08

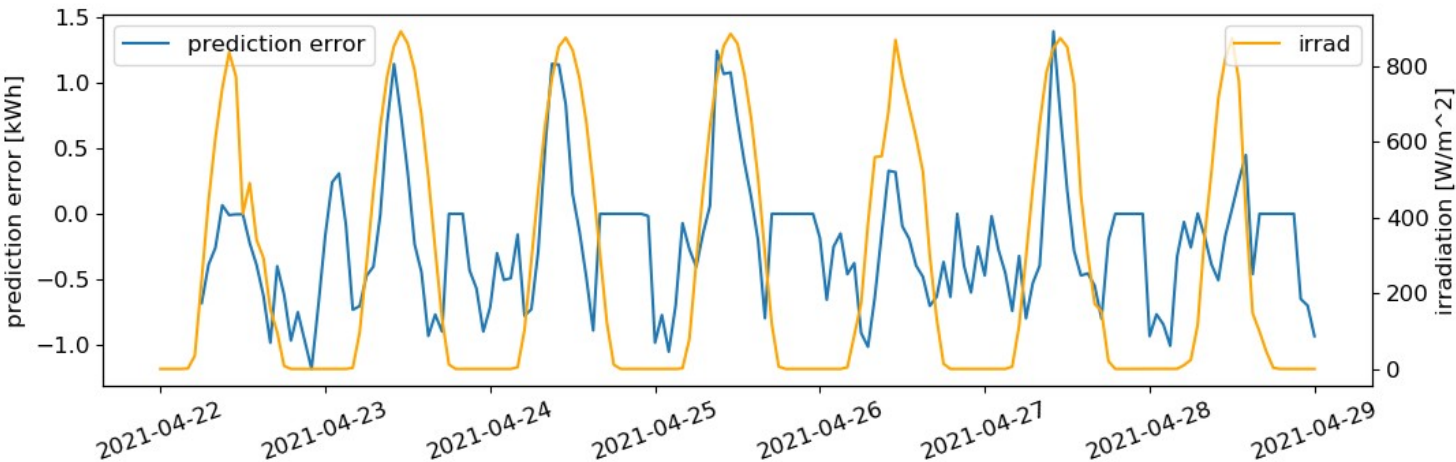


Model based on heating degree hours



53

Residuals explainable with irradiation



Ecosystem for Digital Twins 08



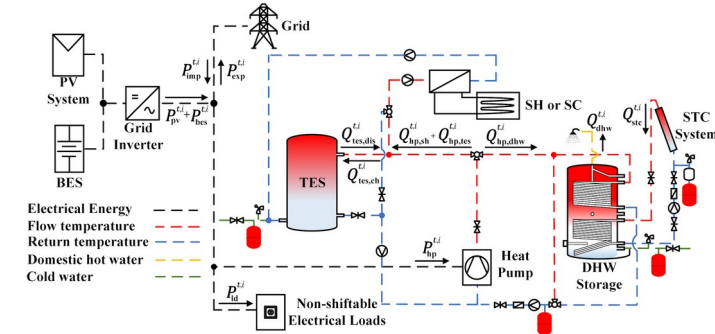
Sensor data from

- room sensors
- heat sources
- distribution systems
- external weather data



Novel services

- Smart DHW preparation
- Heating system control with vacation mode
- Smart water distribution services
- Integration of different types of DER's.
- Increased flexibility for the end-customers and the utilities.



Stakeholders



Inhabitants



Facility manager



Owner



Anonymous

Benefits, Fears & Obstacles

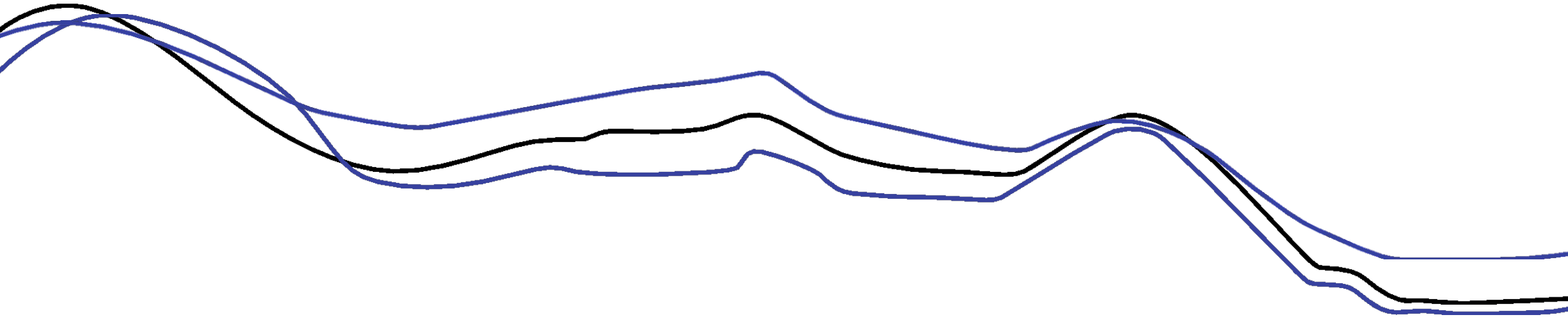
08

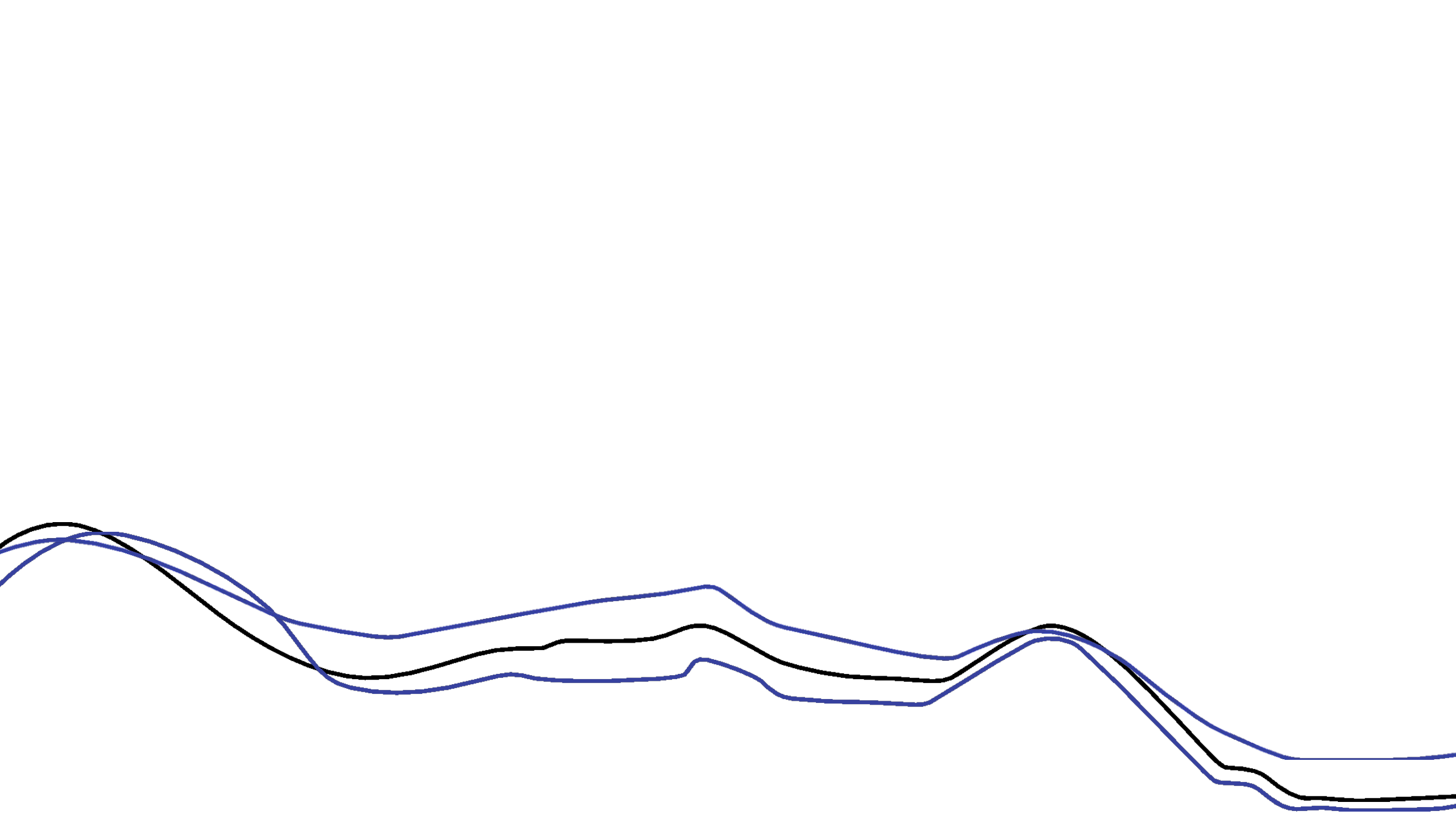
Stakeholder	Benefit	Fear and Obstacles
Inhabitant	• Higher comfort • Lower energy cost • Contribution to environmental protection	• Data privacy: ◦ What happens with my data? • Cyber security: ◦ Who can control the system? Now and in 15 years • Technology lifecycles ◦ 2 years for IT versus 15 years for energy systems • Established business models ◦ New applications may need new business models • Dependencies on suppliers • Additional energy demand for service provision
Owner / Facility Manager	• Increase of efficiency of maintenance / lower costs • Longer lifetime of heating system components	
Suppliers	• Innovative products • Novel products / services with existing products	
Utilities	• Increasing flexibility • Improvement of power quality	
Policy makers	• Lowering CO2 emissions	

Future of Project

08

- Expanding current models:
 - Adding more parameters
 - Changing the prediction horizon
- Collecting more data from different buildings
- Addressing data privacy concerns → connection to challenge 2





Contact information

08

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Hochschule Luzern
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andreas.melillo@hslu.ch
philipp.schuetz@hslu.ch

Trends in Tertiary Energy Prices 10



Primary control:
0.5 min. after outage

- Automatically generated within seconds by the generators
- Rapid response due to frequency measurement in the power plants
- Across Europe



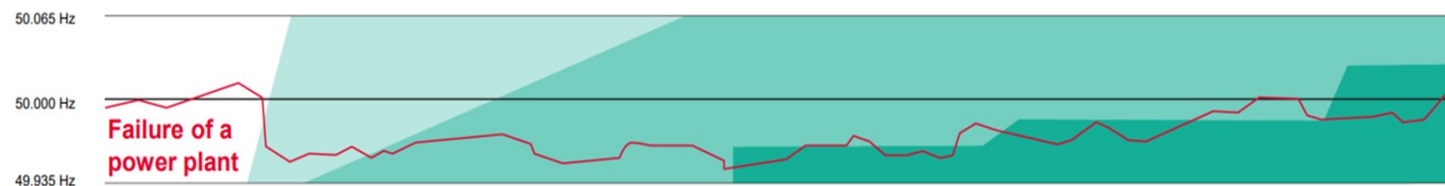
Secondary control:
5 min. after outage

- Automatically activated by the central load frequency controller at Swissgrid
- Measurements taken on Switzerland's cross-border lines
- Across Switzerland



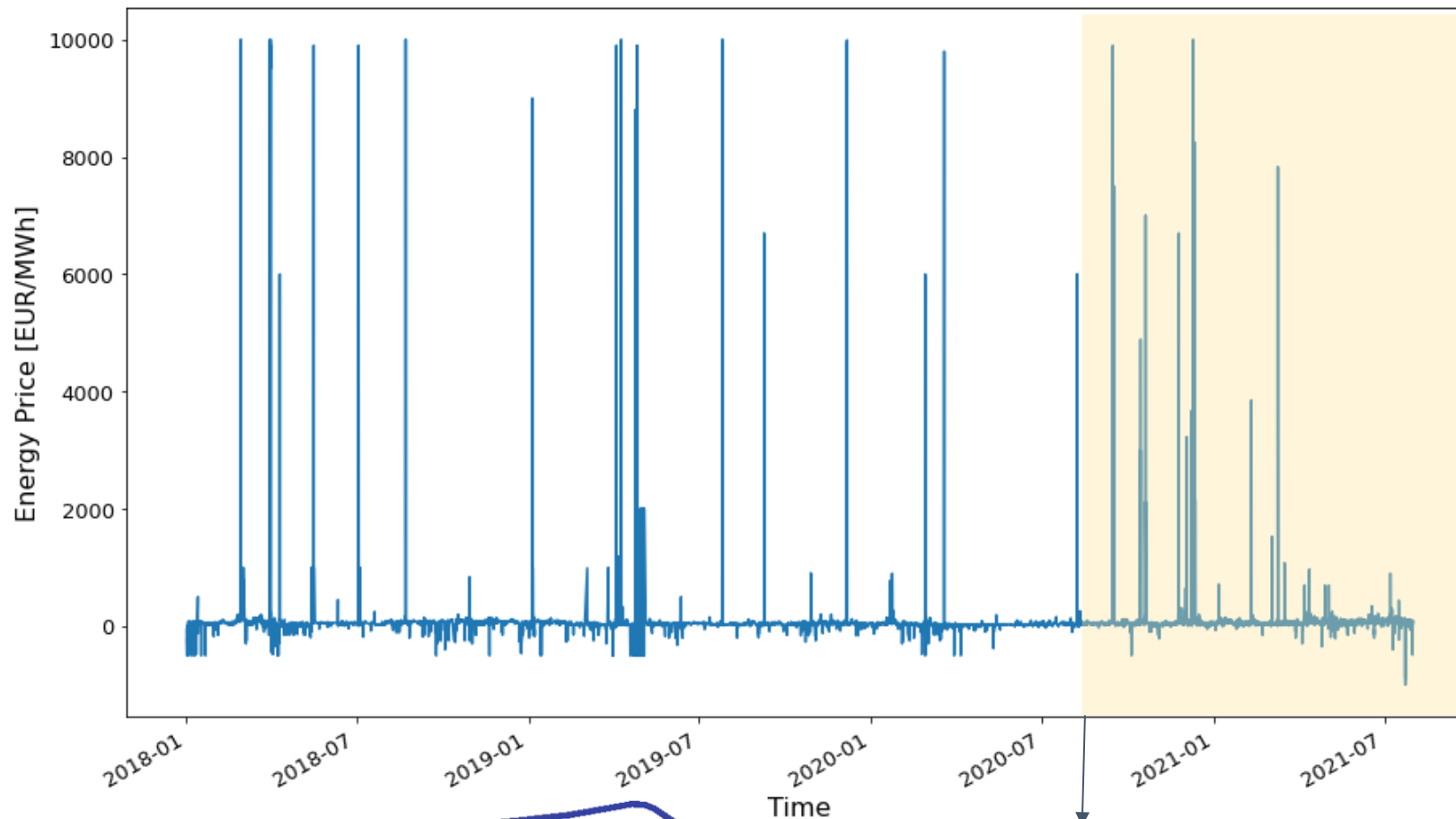
Tertiary control:
15 min. after outage

- Activated by the operator
- In case of larger and longer deviations
- Contracts with individual international providers



FACTORS OF INFLUENCE

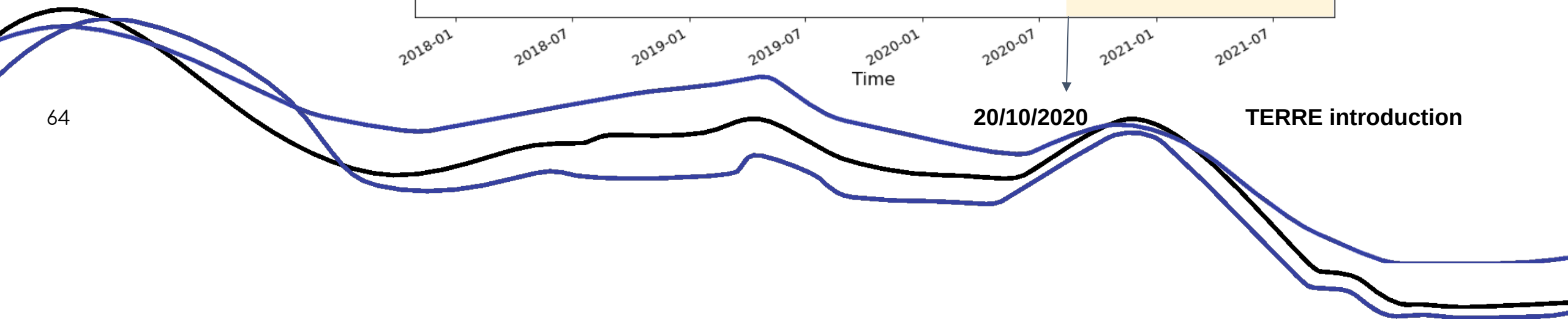
- intraday prices
- hydro planned production
- hydro available capacity
- demand for tertiary regulation

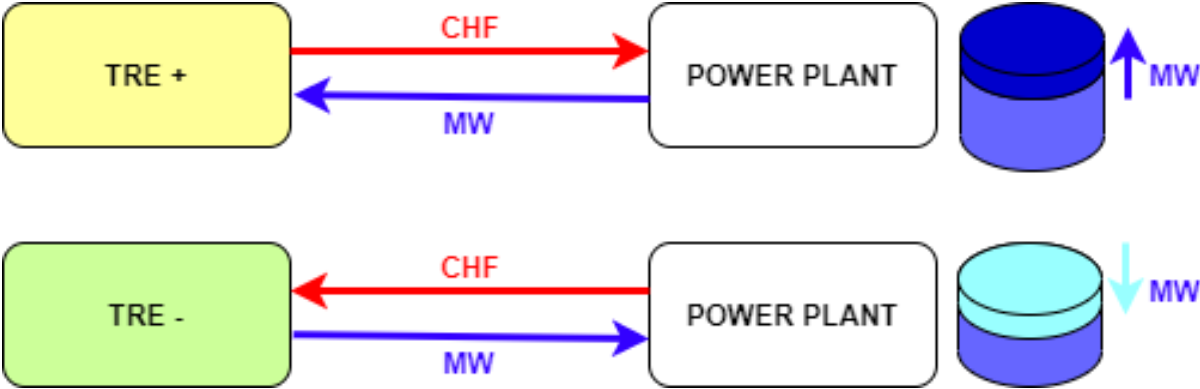


10

64

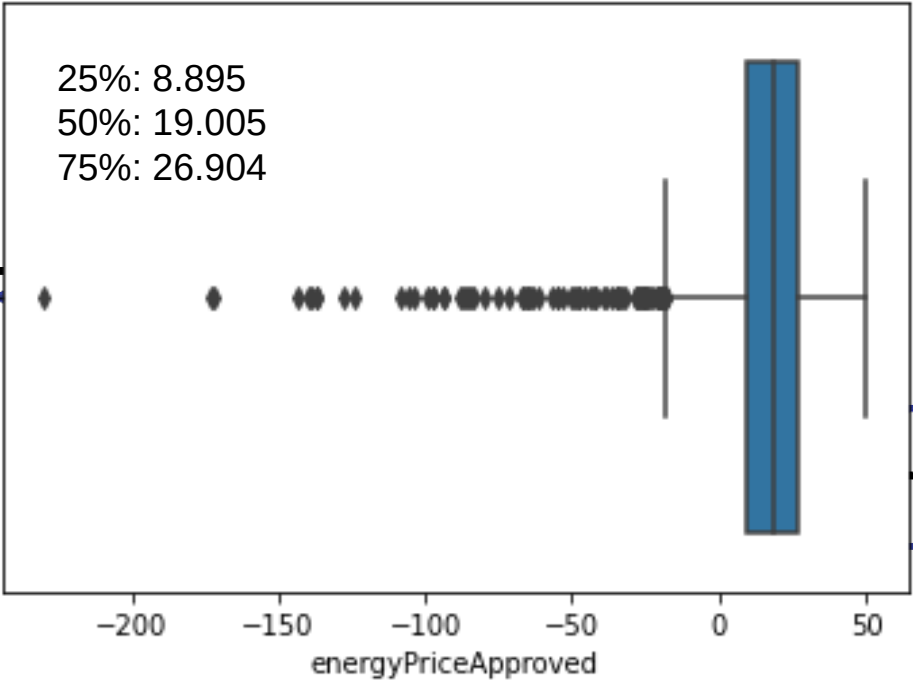
TERRE introduction



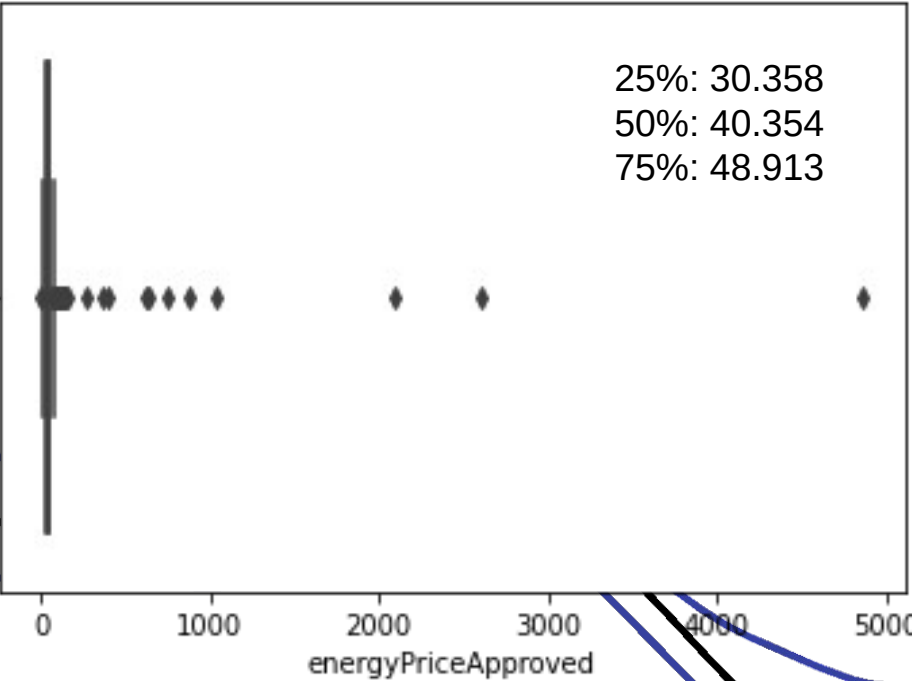


10

TRE-



TRE+



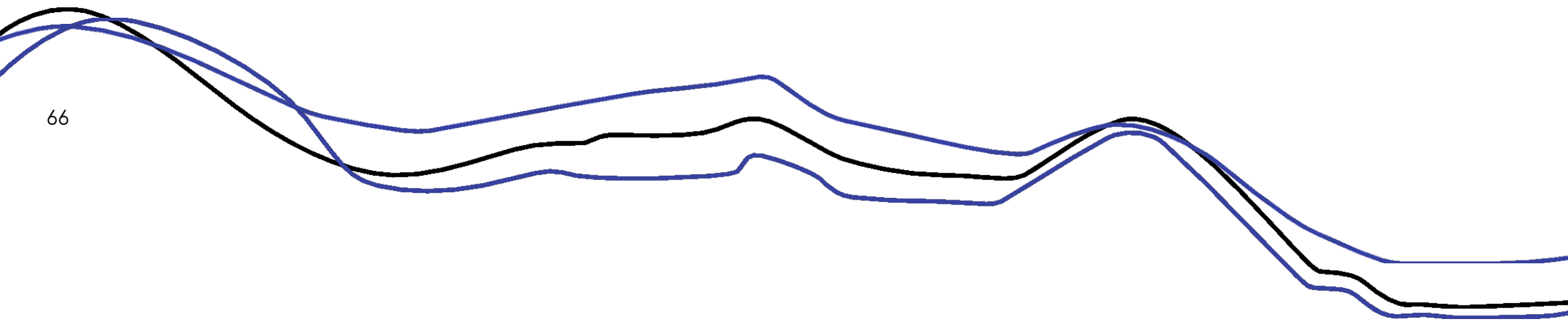
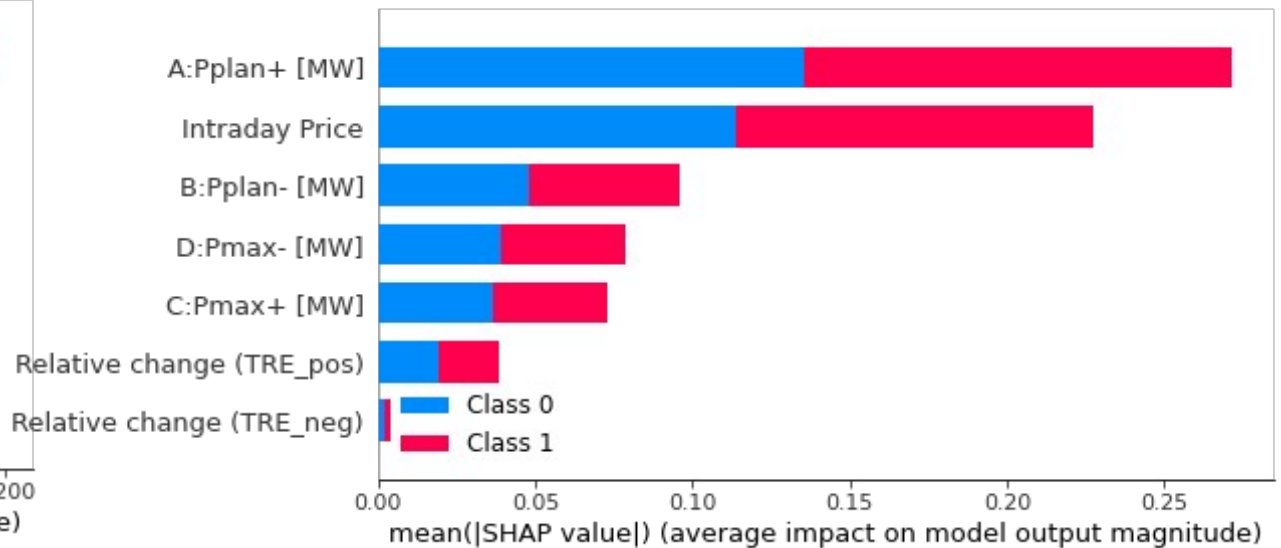
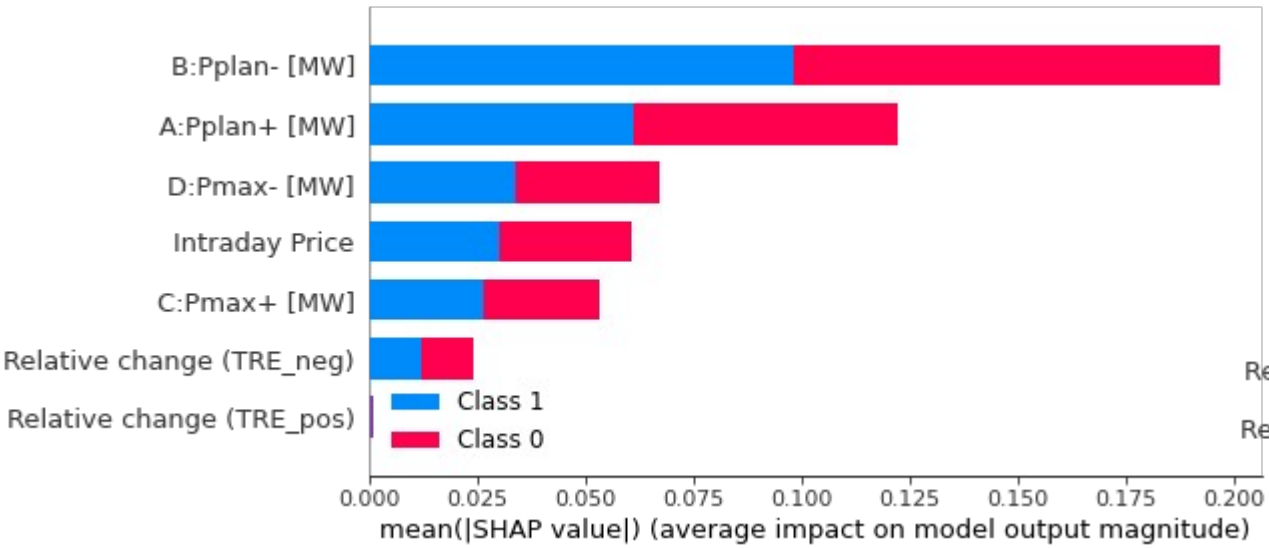


Random Forest Classifier

TRE-: Identifying Energy Price Anomalies

TRE+: Identifying Extreme Energy Prices

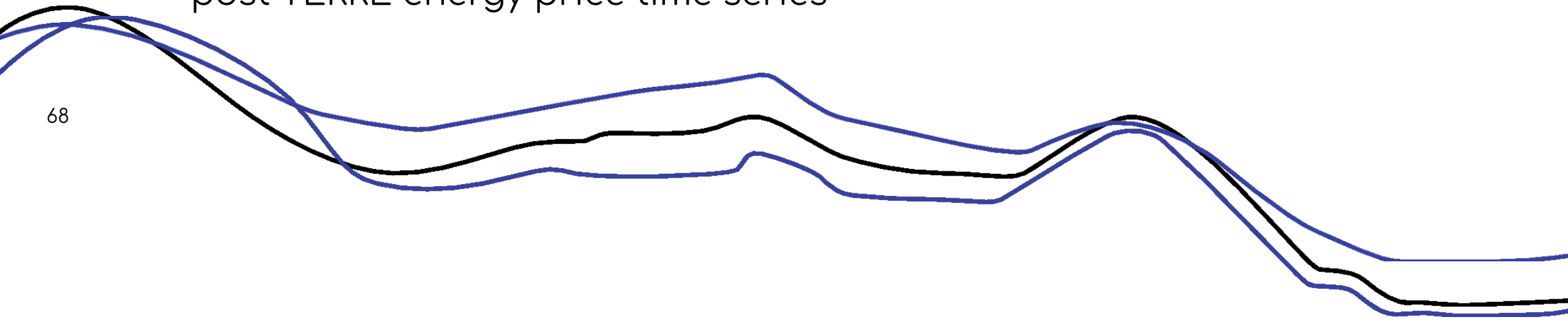
10



Future of Project

10

- Improving Feature Engineering
 - Features derived from merit order curve of energy bids
 - Percentage of plants unavailabilities
- Exploring different regression models
- Robust statistical test to compare pre-TERRE energy price time series and post-TERRE energy price time series



Group members

10

- Frederik Banis
- Gianluca Mancini (gmancini@student.ethz.ch)
- Emma Romei (eromei@student.ethz.ch)
- Azzurra Casali (acasali@student.ethz.ch)

Prequalification of resources with Limited Energy Reservoir (LER)

11



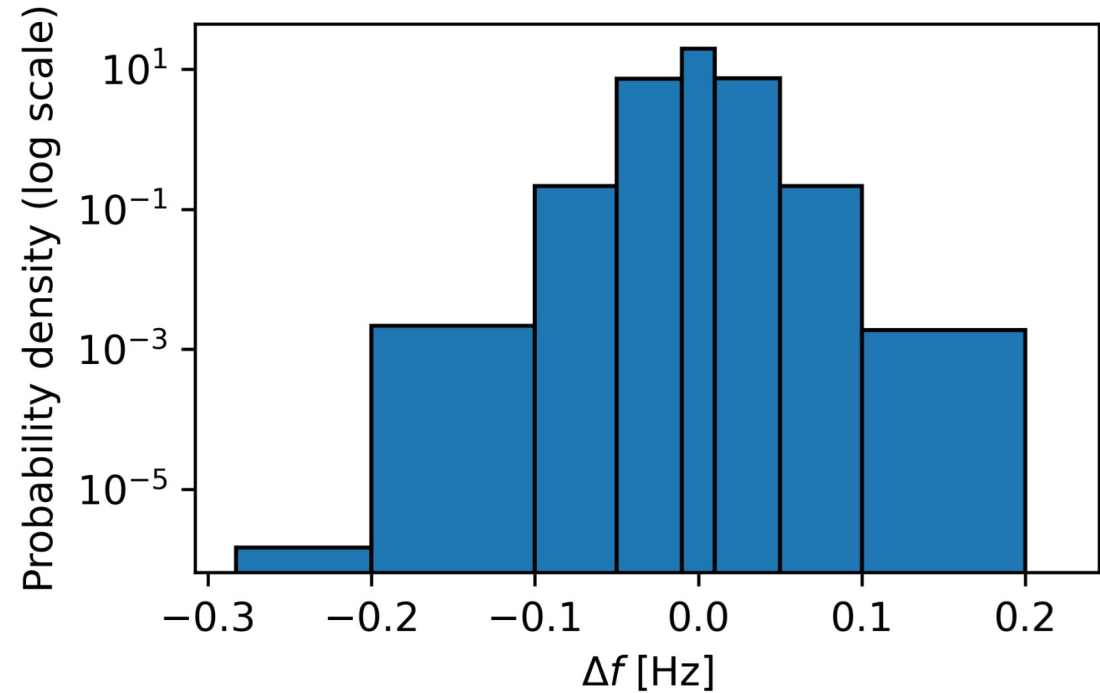
- ☐ To participate in the ancillary services markets, providers must be prequalified.
- ☐ Today's prequalification test focuses on traditional power plants.
- ☐ More and more LER resources (e.g., batteries) provide ancillary services.
- ☐ Revise prequalification (for primary and possibly secondary frequency control).

Statistical analyses of frequency deviations

4 years of frequency (FCR) data

11

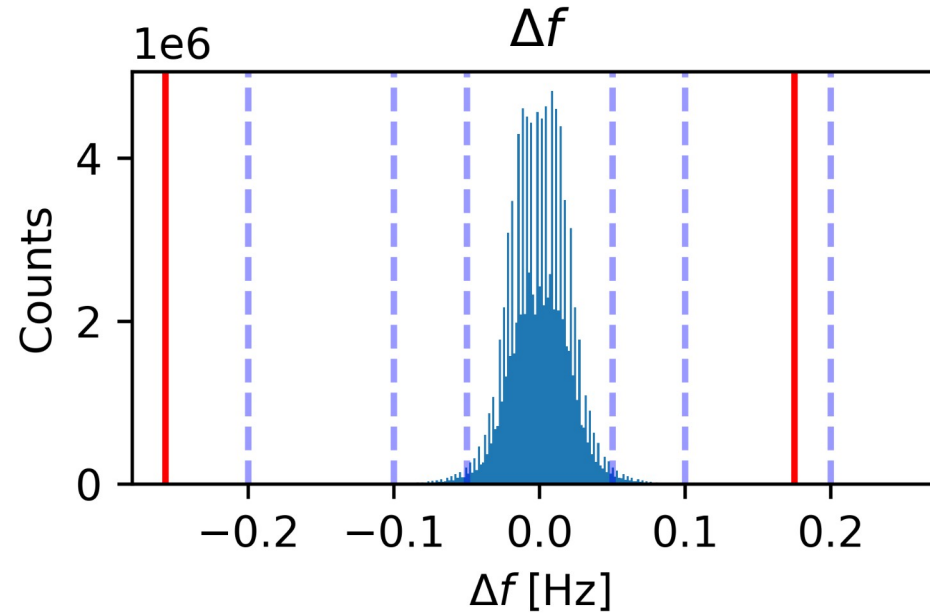
- ☐ FCR data: 2017-01 to 2021-02-01
- ☐ events where absolute deviation is larger than 200 mHz are rare
- ☐ events where an alert is triggered relatively frequent (~ 60 alert states in 48 months)



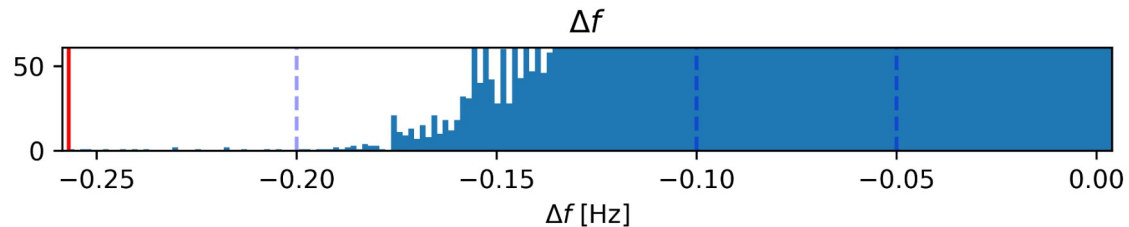
Statistical analyses of frequency deviations

4 years of frequency (FCR) data (details)

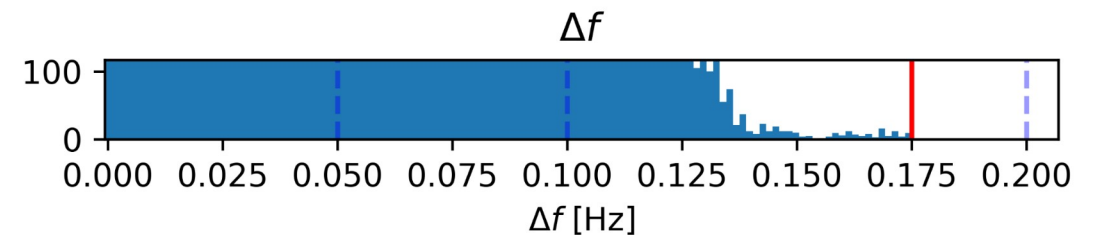
11



Left tail



Right tail

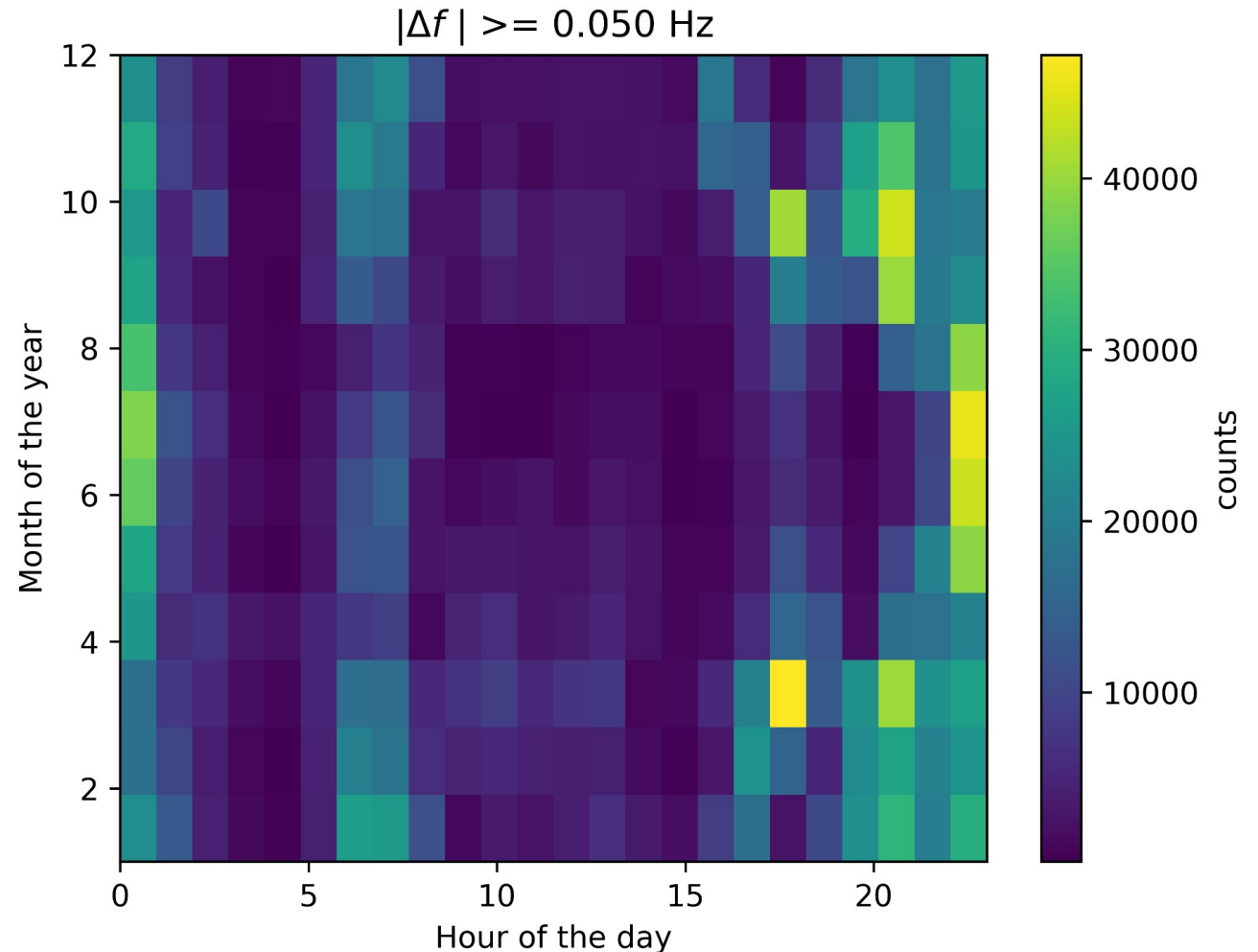


Patterns of frequency deviations

4 years of frequency (FCR) data

11

- ☐ deviation of the frequency can trigger alert states
- ☐ late evenings and midnight times are susceptible to high occurrence of large deviations
- ☐ during the summer months higher occurrence around midnight

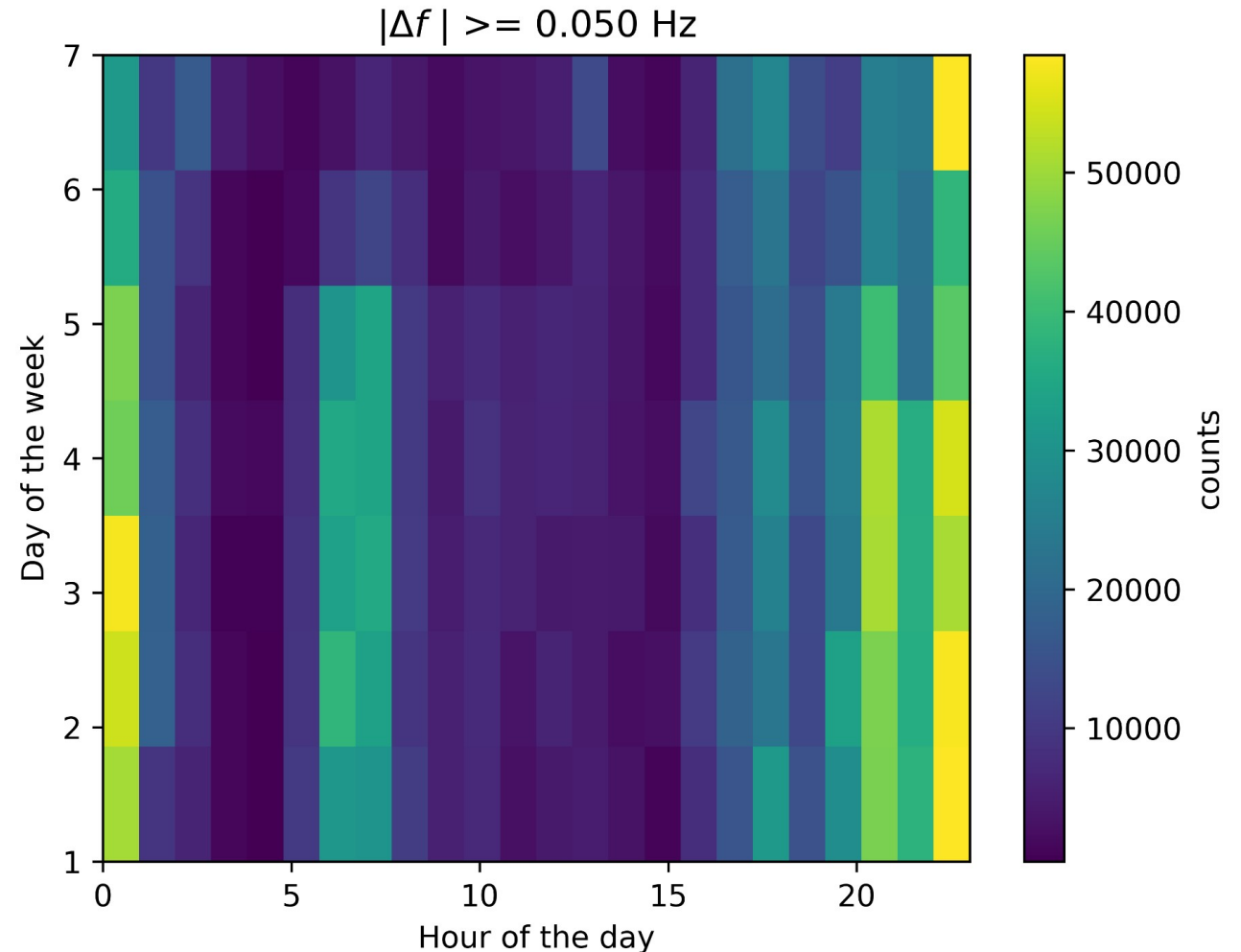


Patterns of frequency deviations

4 years of frequency (FCR) data

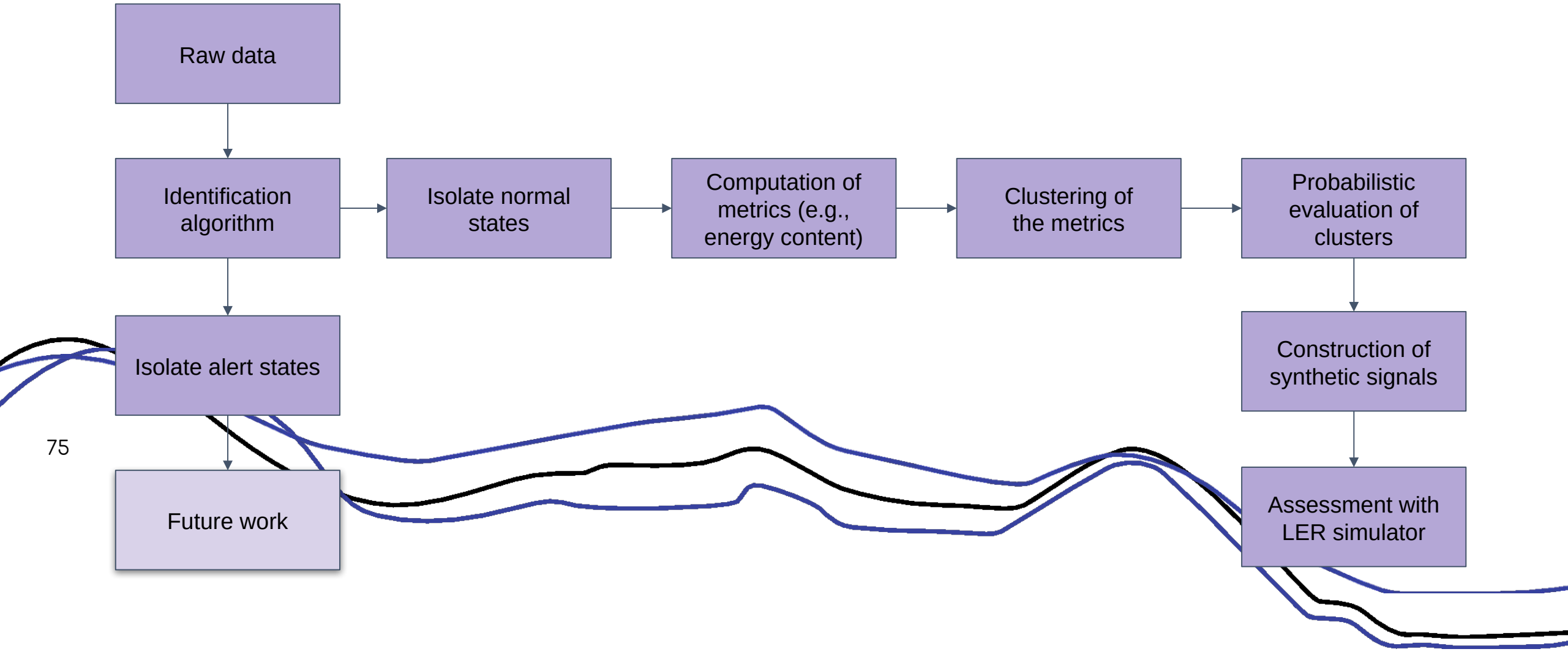
11

- ☐ differences mainly observed during the week, mainly between work days and weekends
- ☐ early morning hours show very little deviations, good reference for long periods of normal state



Data processing pipeline to generate frequency profiles

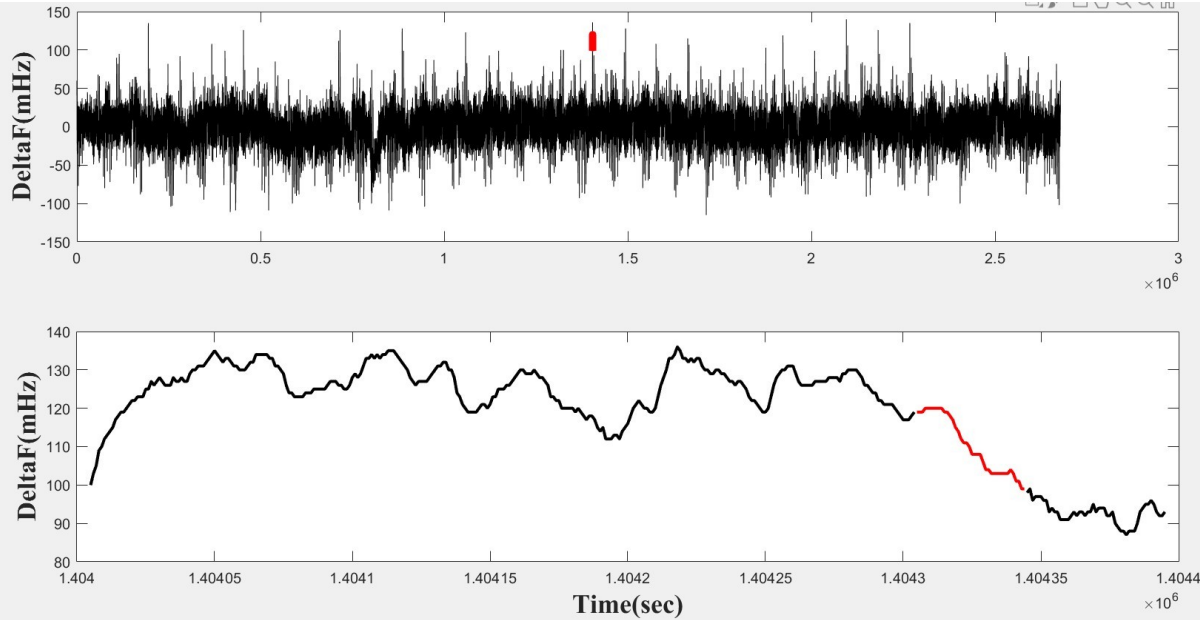
11



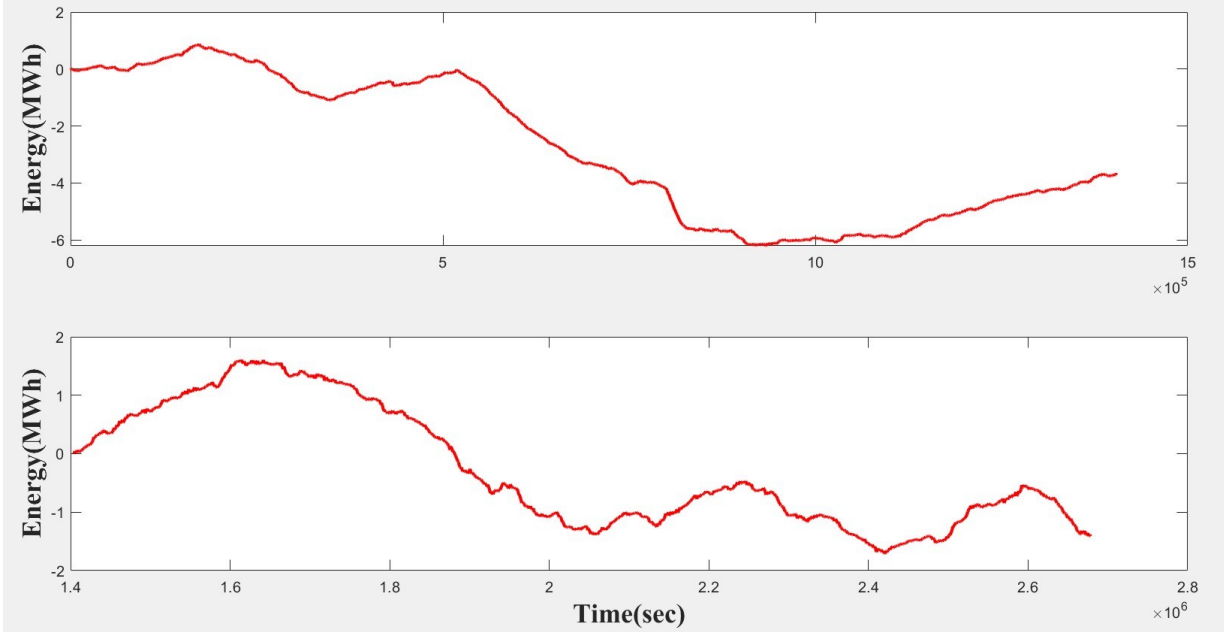


Analysis, labeling and clustering of normal and alert states: Example

11



Frequency deviation plot with alert state identified

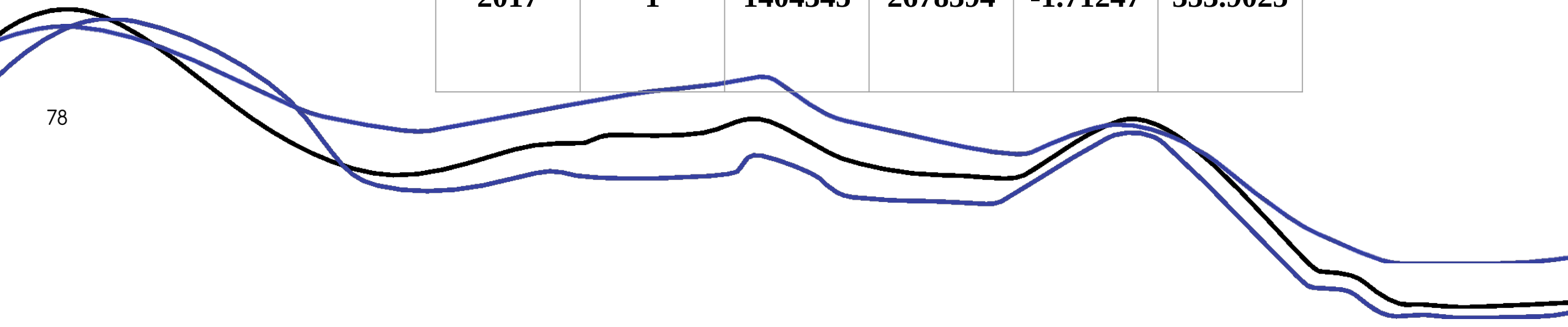


plot of requested energy

Analysis, labeling and clustering of normal and alert states: Intermediate results

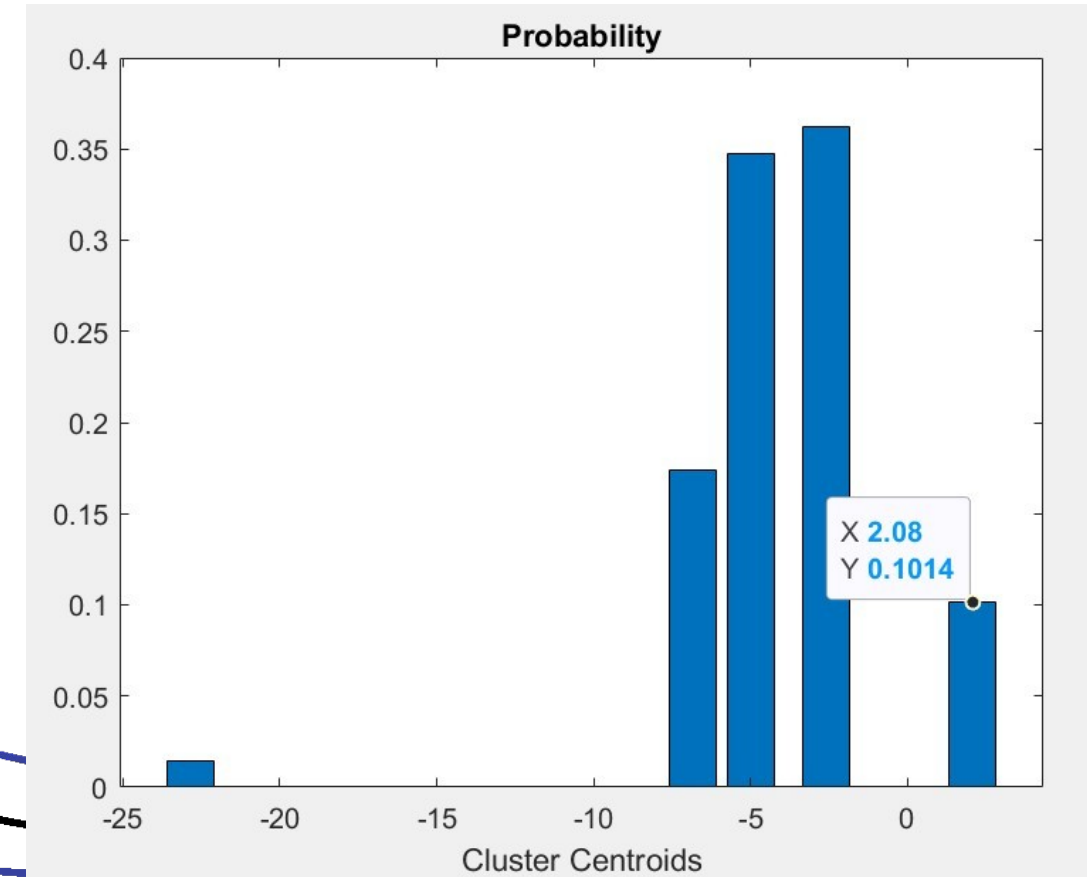
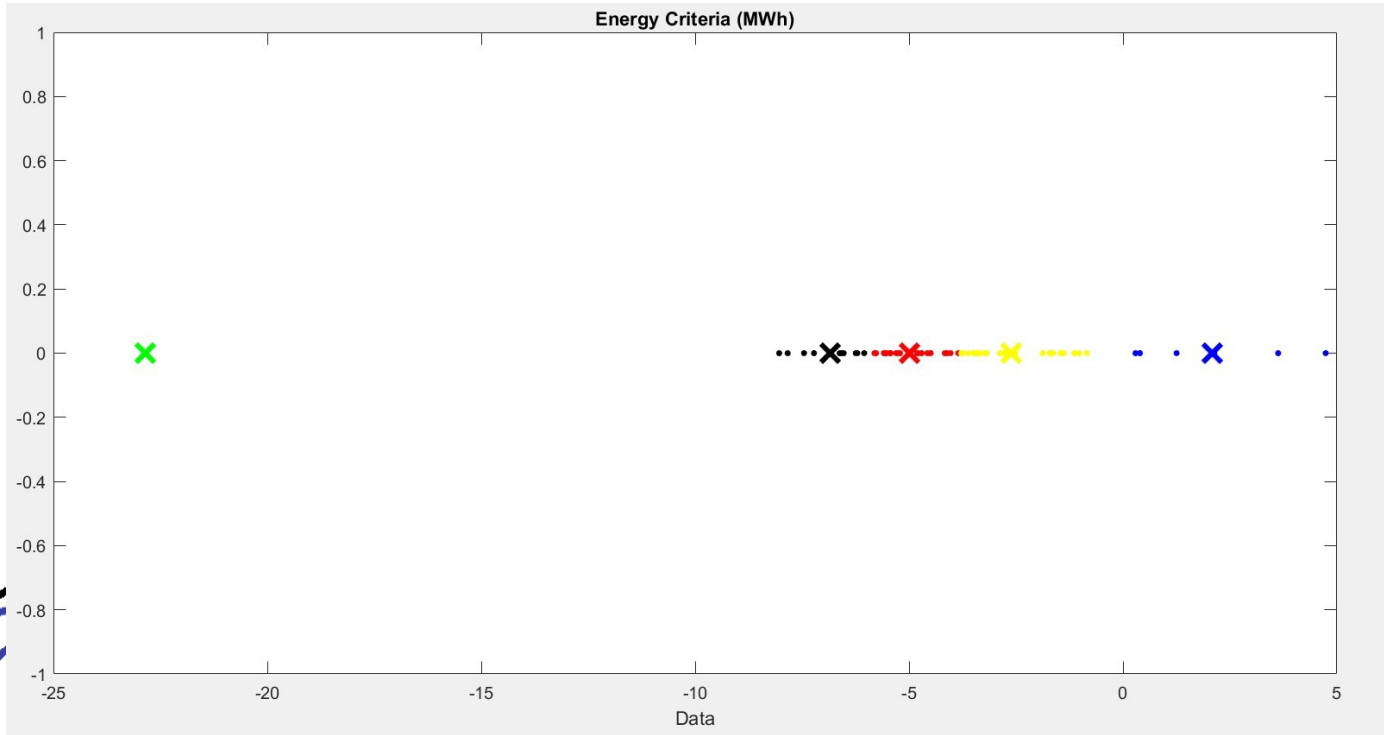
11

Year	Month	Starting Time	Ending Time	Energy Criteria (MWh)	Duration (h)
2017	1	1	1404304	-6.20965	390.0842
2017	1	1404345	2678394	-1.71247	353.9025



Analysis, labeling and clustering of normal and alert states: Intermediate results

11



Next Steps

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- ❑ Integrating the energy management strategy into deriving the energy criteria
- ❑ Deriving other criterias to test
 - Power capacity
 - maximum power ramping capability
 - Energy management strategy of the LER-frequency provide
 - fixing a specific initial value for the SOC
 - taking into account the energy requested during both normal and alert states

Participants

11

- Hossein Sekhavatmanesh (FHNW):
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- Braulio Barahona Garzon (HSLU):
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Climate-Neutral Cities

St.Gallen Example

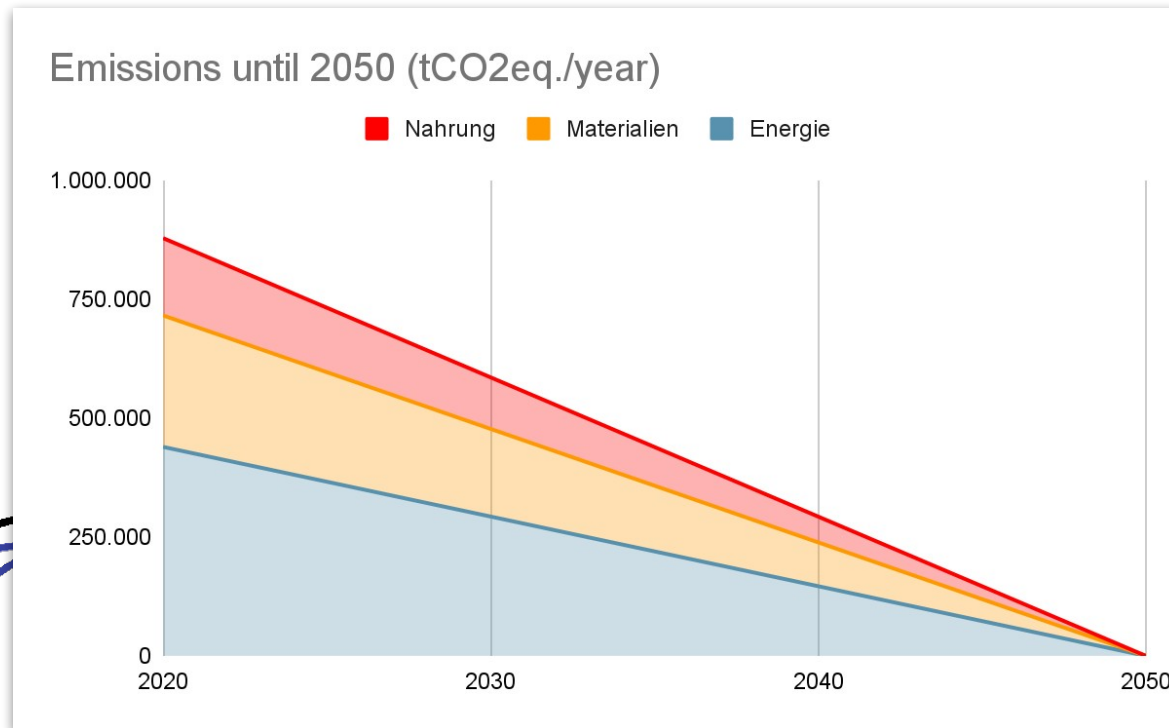
12



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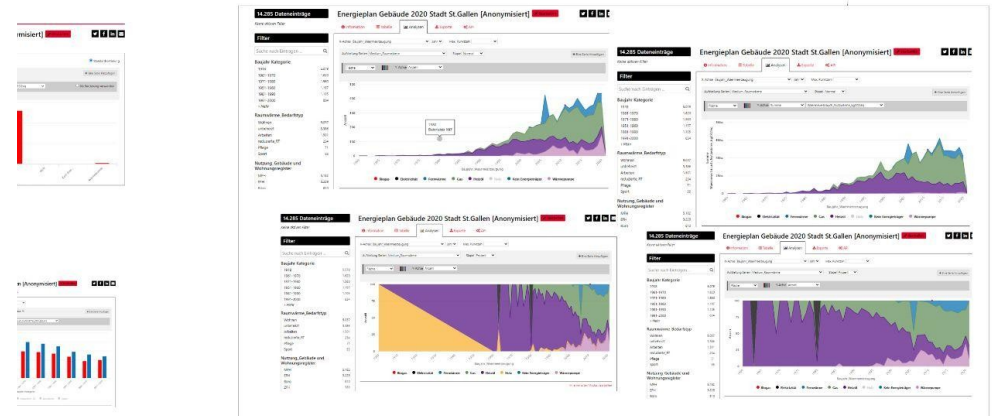
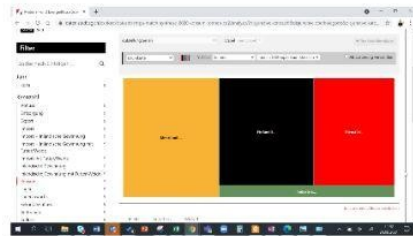
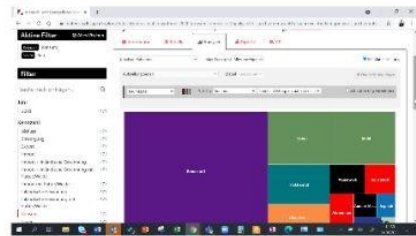
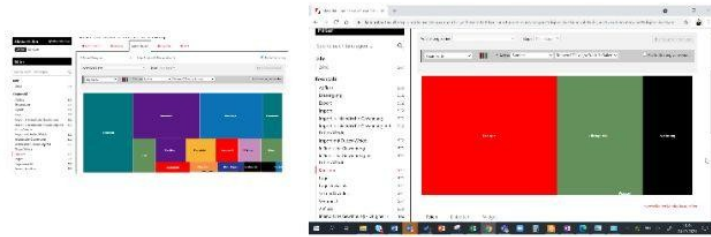
The question

12



Data Analysis - Open Data Platform

12



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- Food
- Fuel for Mobility (cars)
- Heating for building

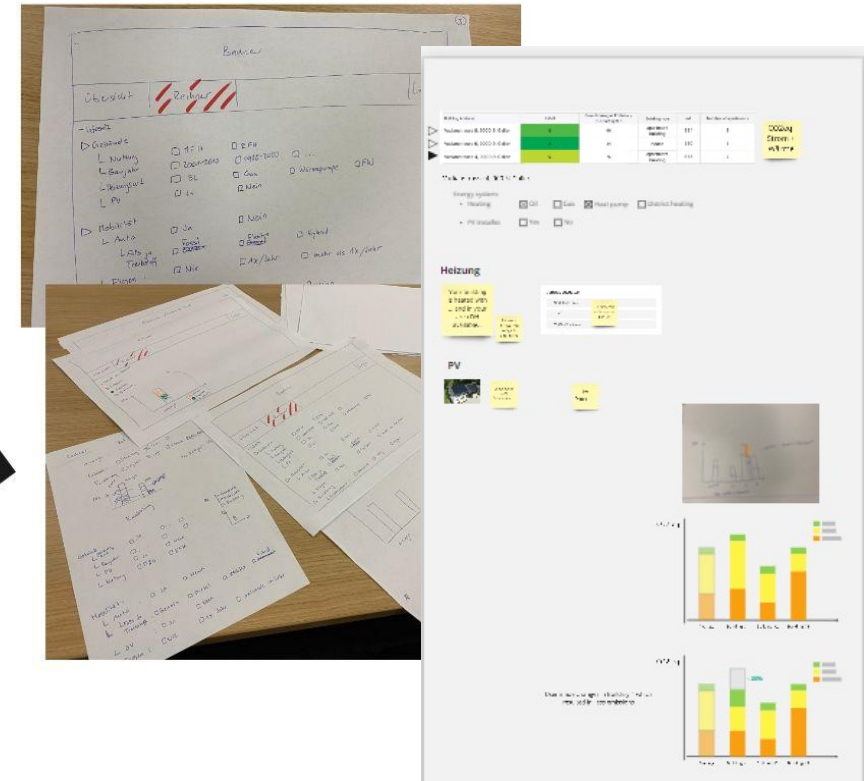
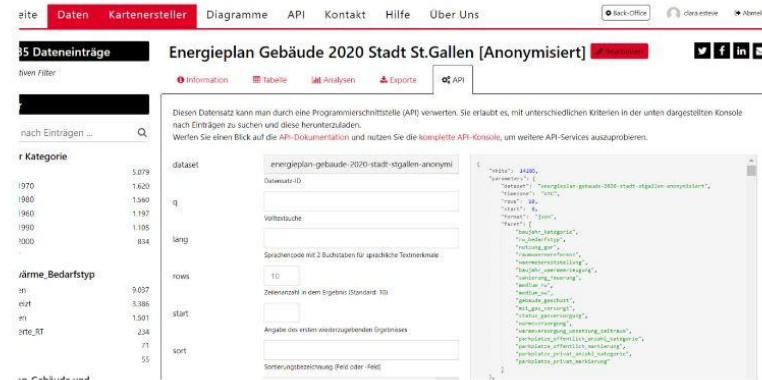
Residential buildings with:

- Gas heating system
- Oil heating system



CO2 calculation

API connection



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Live platform

12

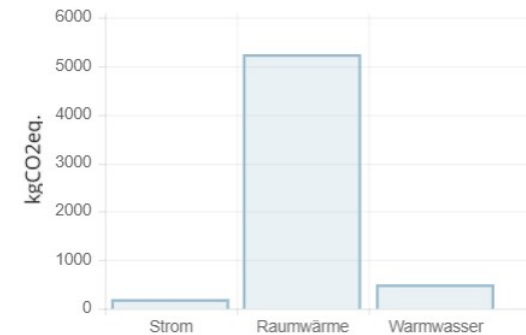


Calculator

Welcome on the platform for climate neutral cities.

Your buildings in overview

Building Address	Label	Greenhouse gas emissions (tCO2/year)	Building type
Vadianstrasse 8, 9000 St.Gallen	B	6	MFH Wohnen
Vadianstrasse 6, 9000 St.Gallen	A	15	MFH Wohnen
Vadianstrasse 4, 9000 St.Gallen	C	0	unbeheizt
Vadianstrasse 6, 9000 St.Gallen	A	17	Gewerbe_Industrie Arbeiten
Vadianstrasse 4, 9000 St.Gallen	C	21	MFH Wohnen



Heating system

Your building is heated with gas , which emits a lot of CO2. Your building is located in an area where district heating is available. With district heating you would cut the emissions of the building by 50%.

Change your heating system

- ☒ Gas
- ☐ District heating
- ☐ Oil
- ☐ PV

<https://sgsw-json-test.bubbleapps.io/version-test/rechner>

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Next steps

12

Automate
calculation
and
recommen
dations

Improve
visuali-
sation

Add a cost
function

Link
buildings
with
owners

Extend the
platform
for tenants

Include
Food and
Mobility
sectors

Manual
Data
update by
users

Integrate
to sgsw
customer
portal

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Team

12

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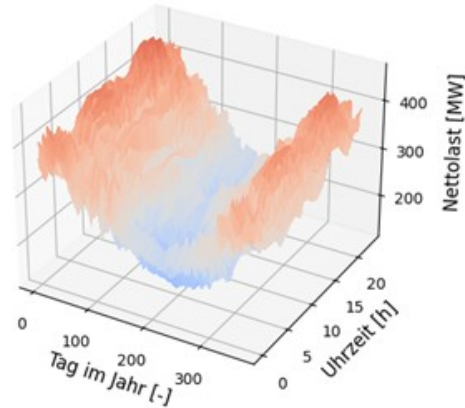


Electricity “Heartbeat” 2035 in the Canton of Zurich

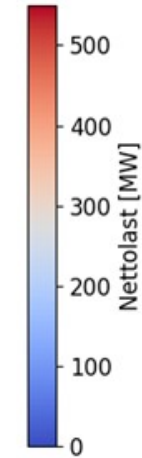
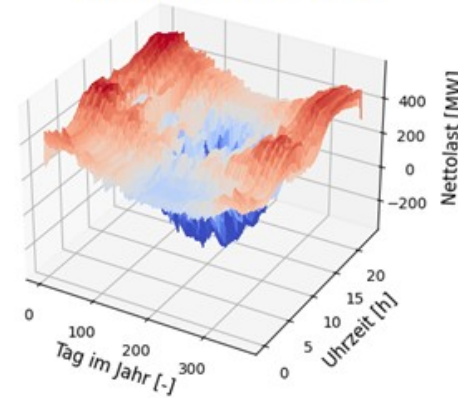
15



Gemessene Last 2019



Simulation 2035



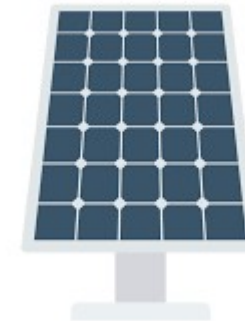
Future of Grid?

future of electricity
consumption and
production?

15

- **Switzerland Energy Strategy 2050:**
 - reducing the environmental impact of energy, foreseeing an increased decentralized energy production in the coming decades

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- **IDEA:** Geospatial visualizations in order to understand where and when electricity is produced and consumed in the grid region of EKZ
- **SOLUTION:** Web dashboard with GIS spatial visualization
- **DATA :** 100% synthetic consumption & production data for 2035 in transformer granularity for most of the transformers

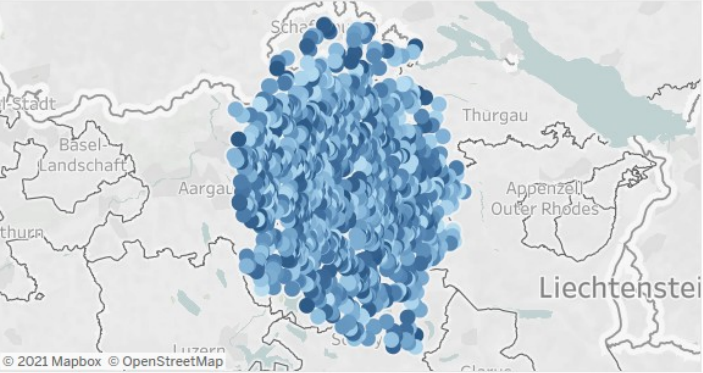
- ISSUES:

- Managing big data (High Volume, Variety)
- Multi-dimensional data
- Data curation



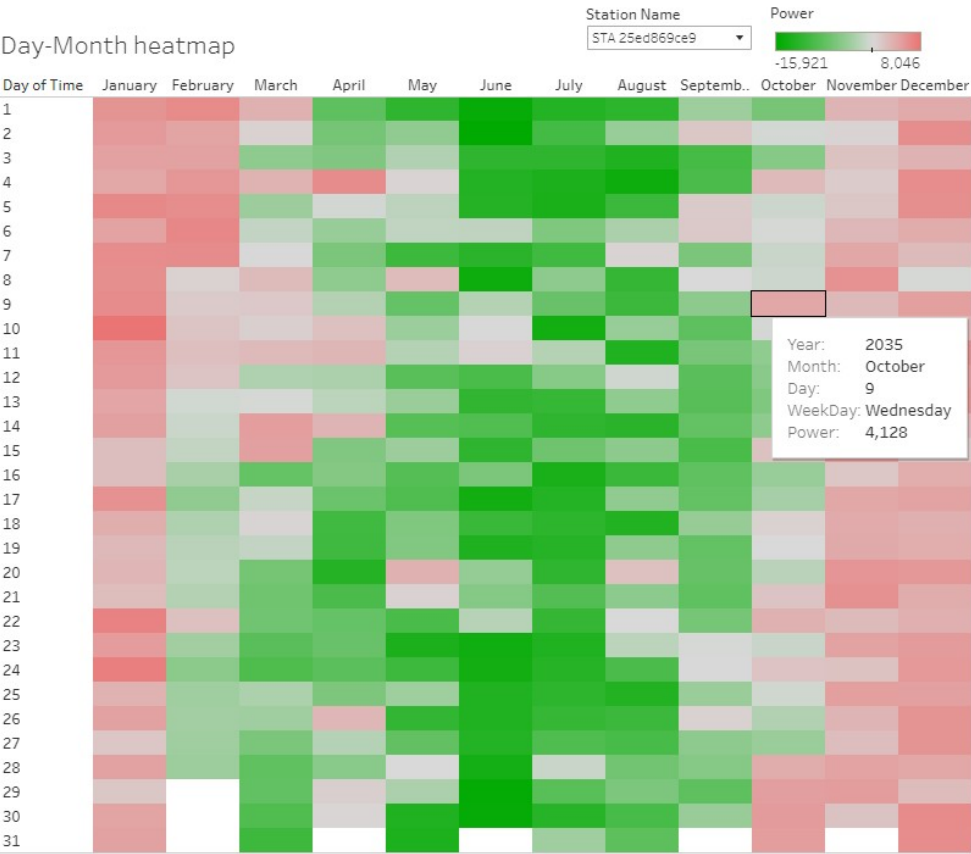
GeoSpatial Visualization for EKZ Transformers

GIS Reporting

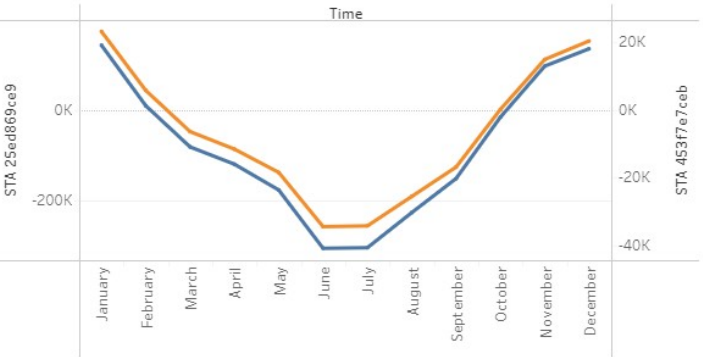


Total Annual 2035
20,007 29,989

Day-Month heatmap



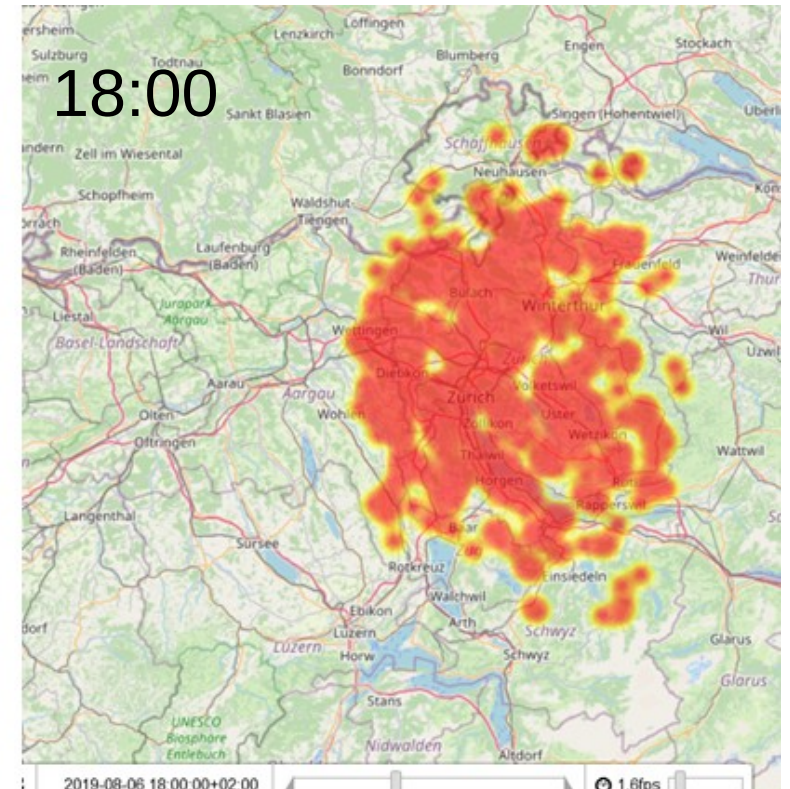
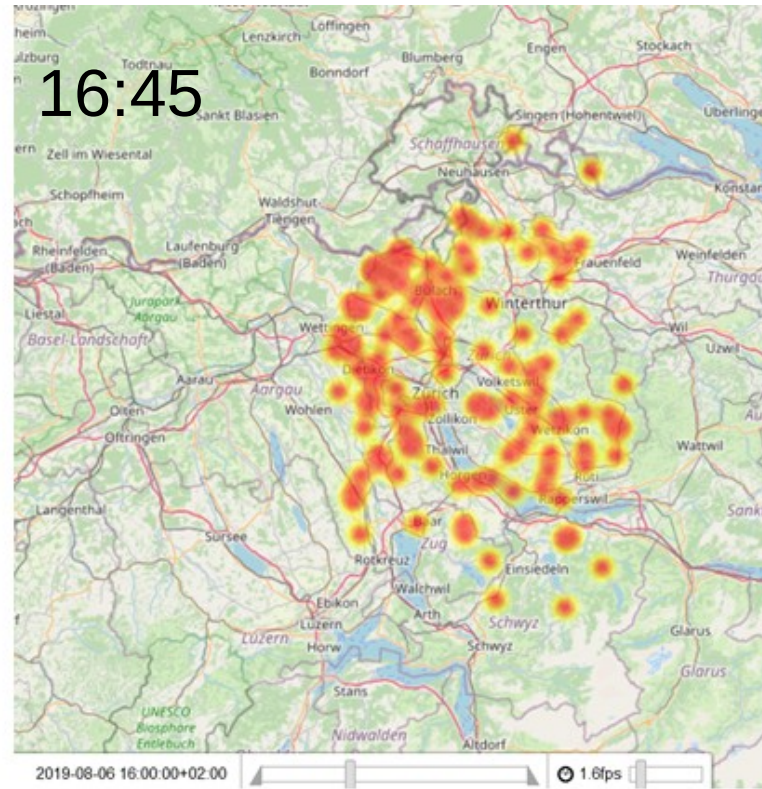
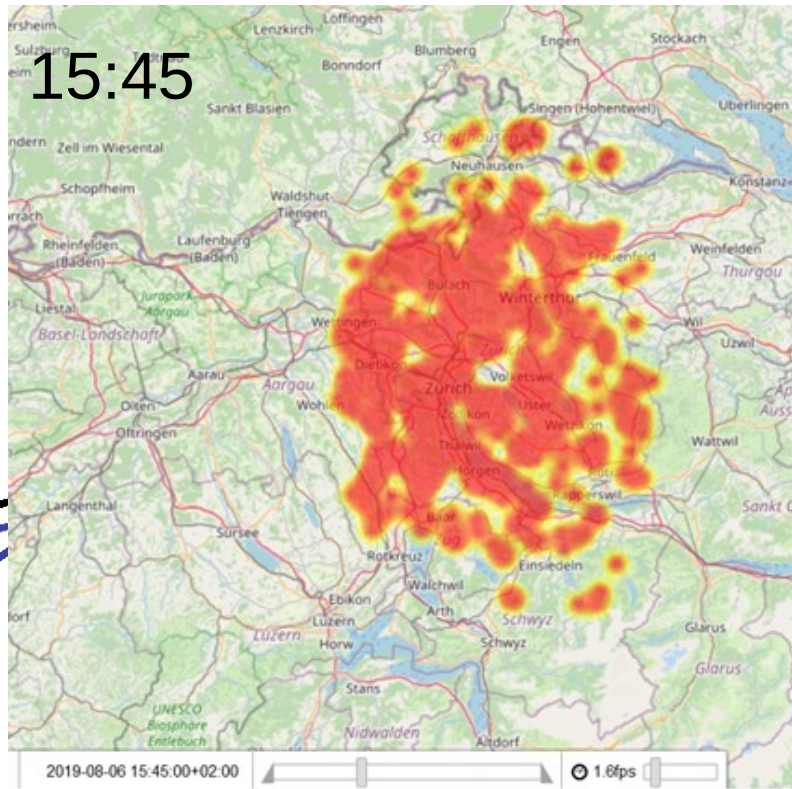
Compare Stations per Month



- NEXT Step

- Integration with other data sources (smart meter data and open access) to produce insights;
- Enhancing to 3D GIS Visualization;

PV feed-in



MEMBERS CONTACT INFO

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- Matthias Meier (matthias.meier@aliunid.com)
- Mojtaba Kamarlouei (mkamarlouei@builtrix.tech)
- Javad Hatami (jhatami@builtrix.tech)



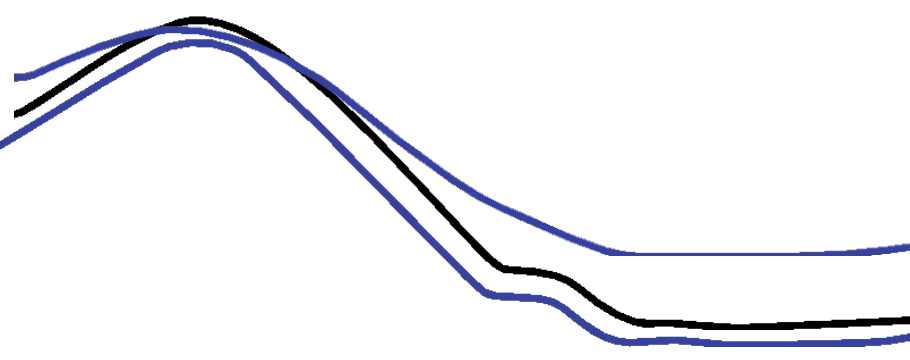
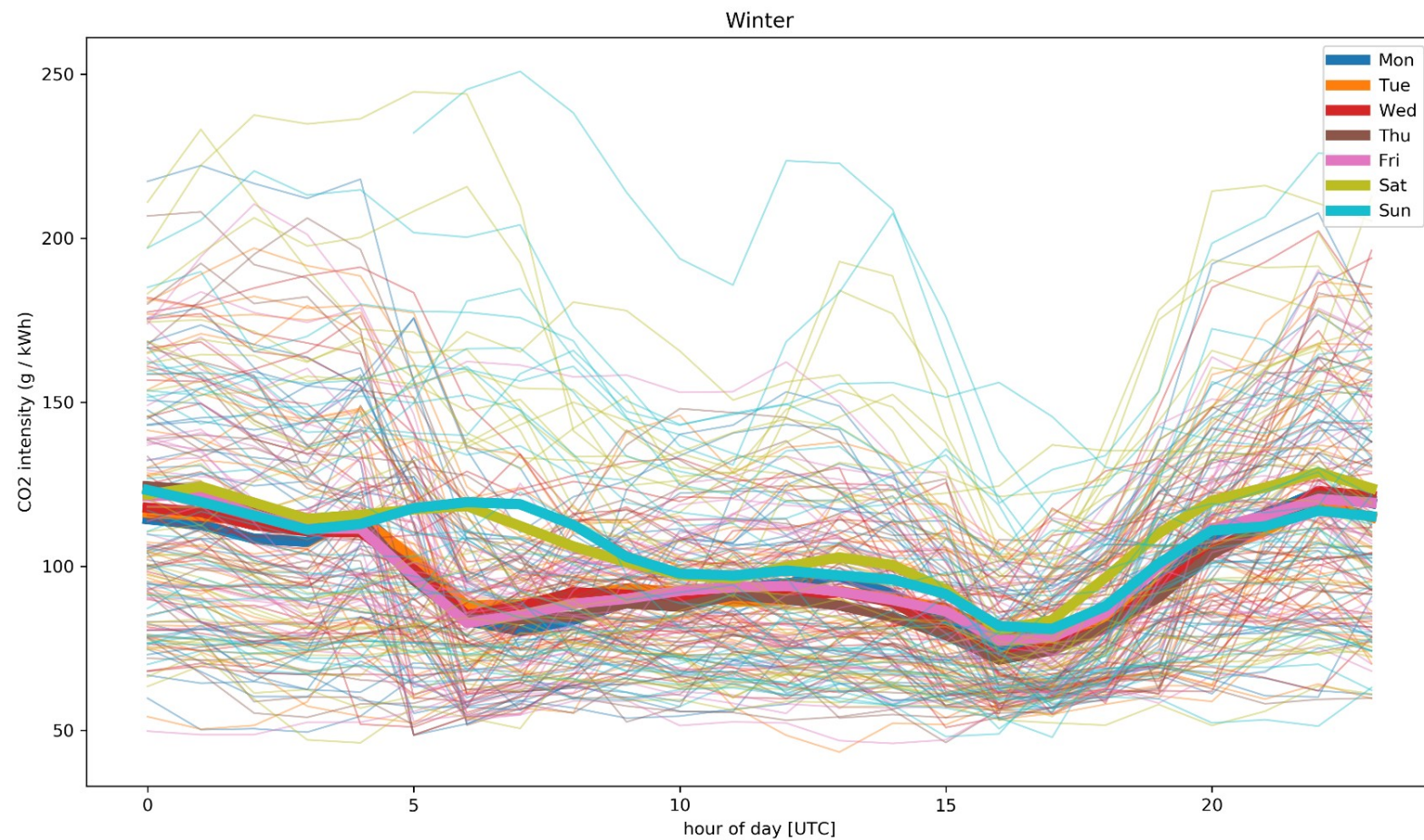
Builtrix
Connected-Building Solution

“Green” Charging E-Mobility¹⁶



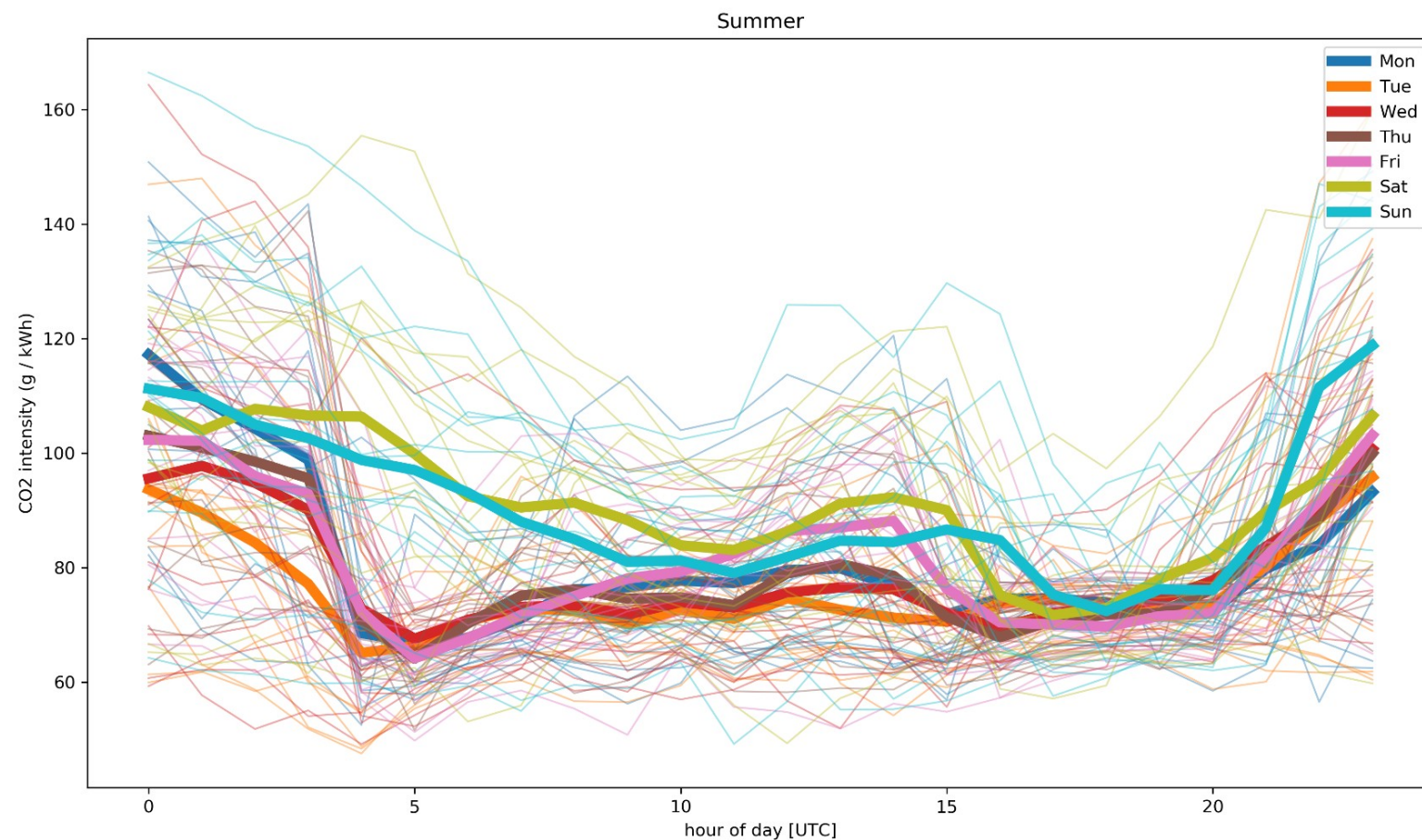
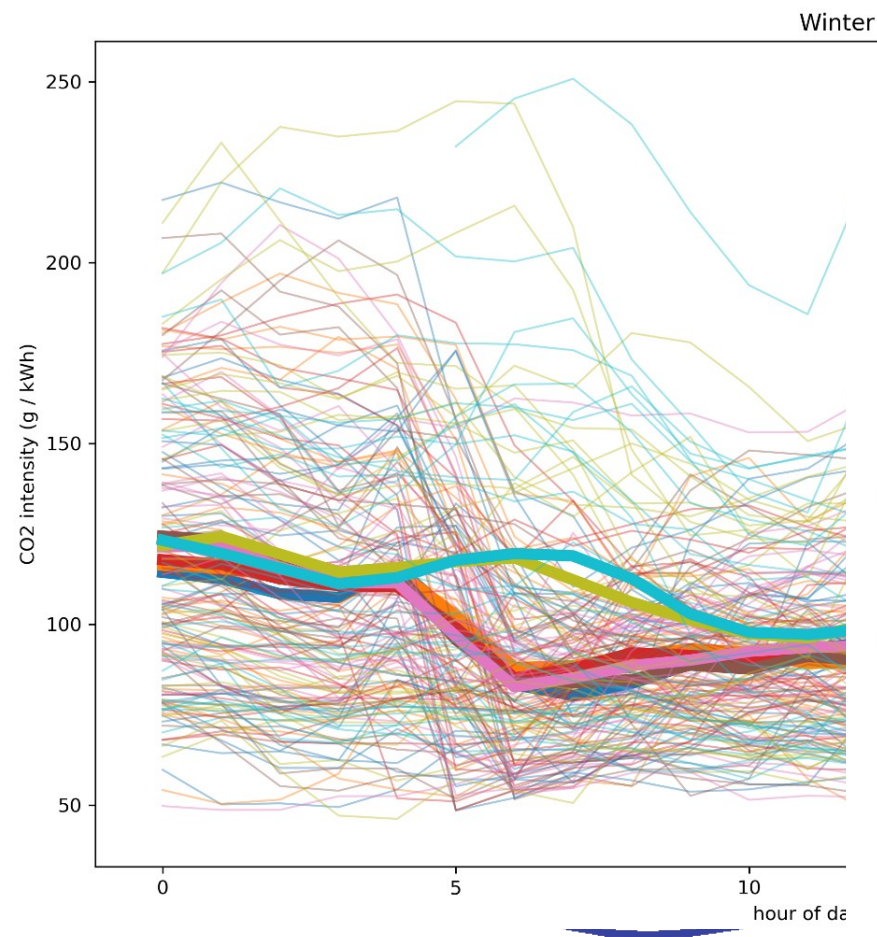
Problem Setting

16



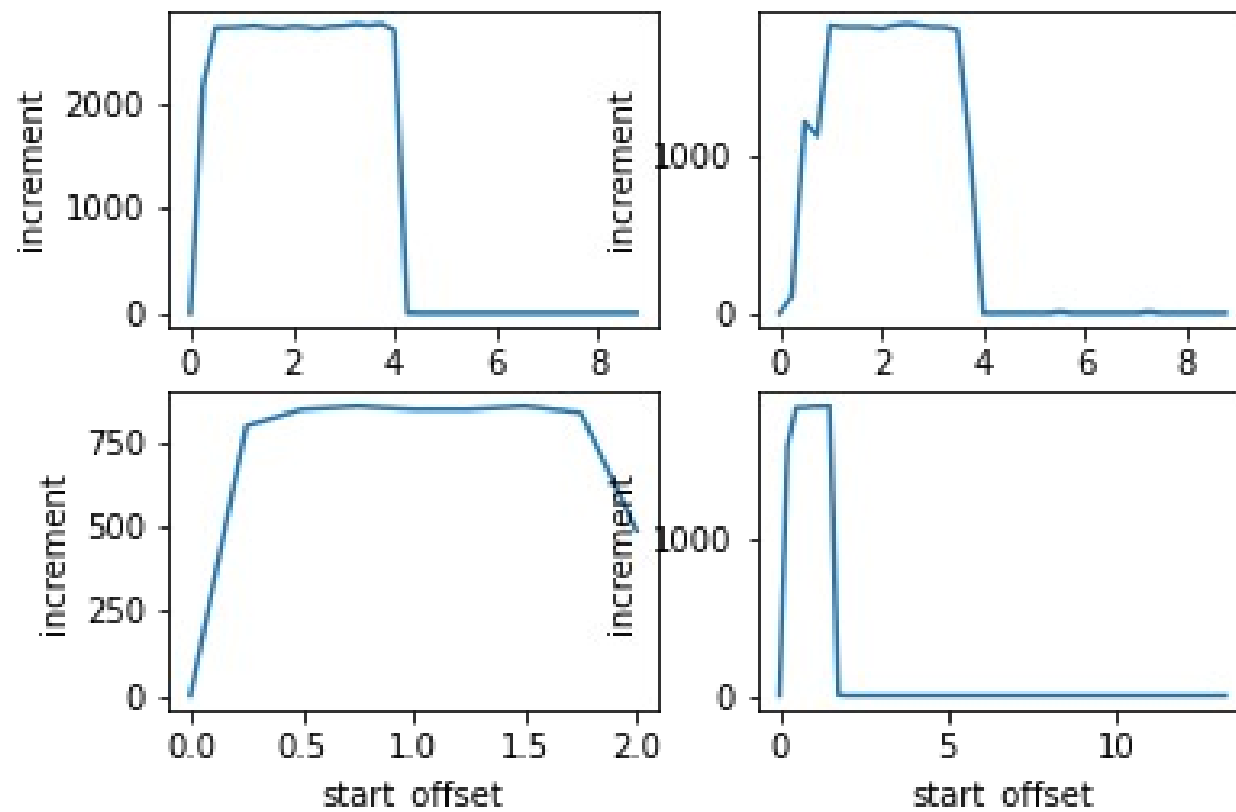
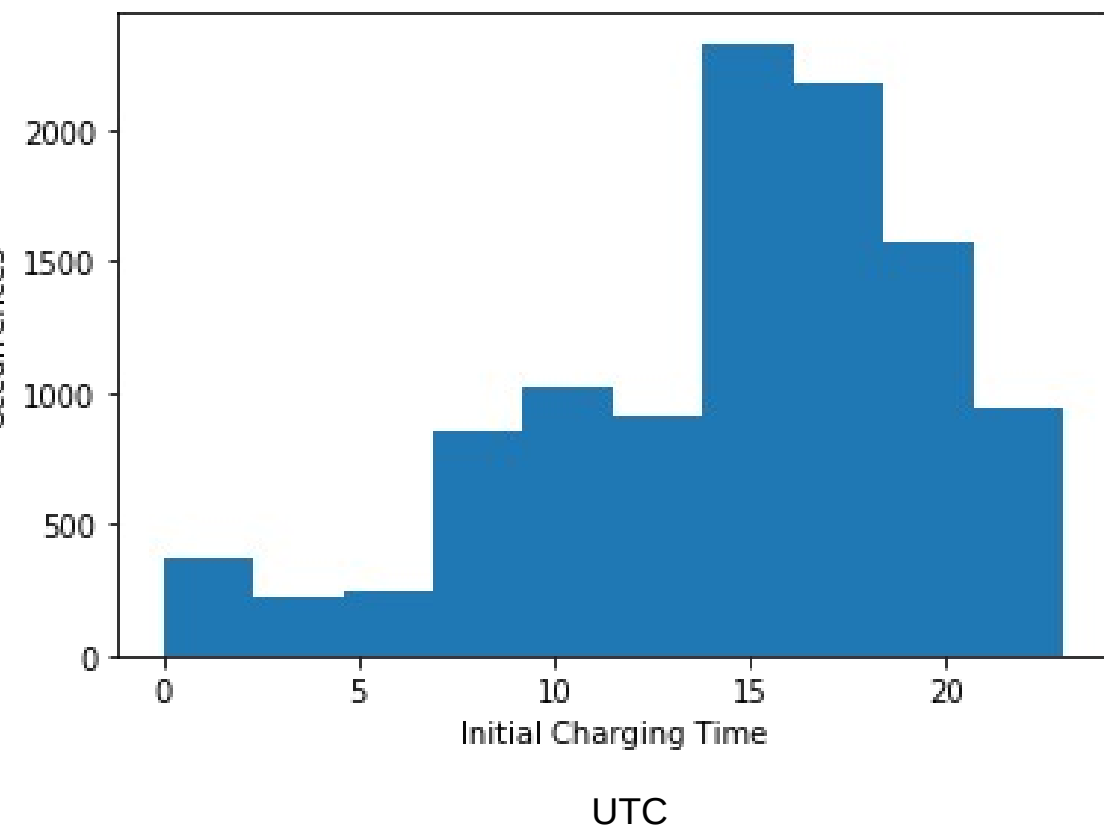
Problem Setting

16



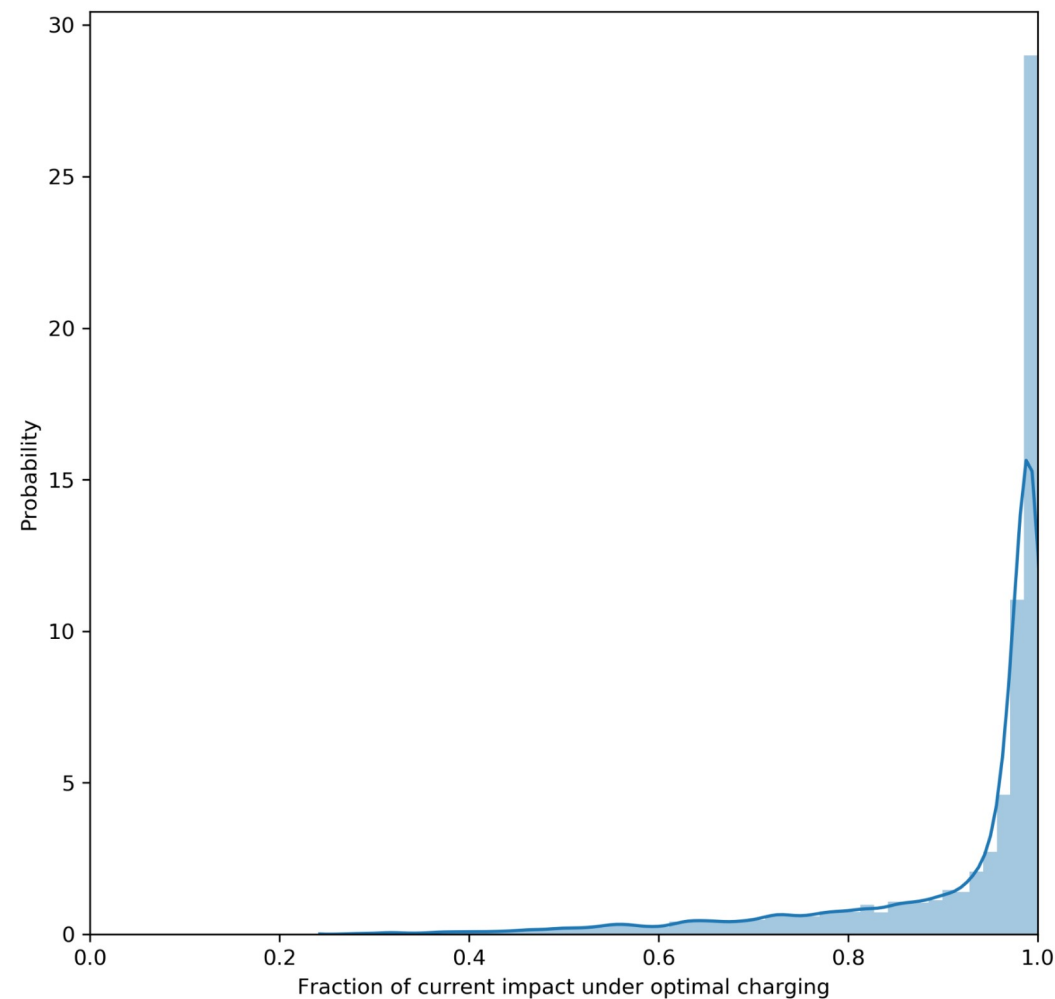
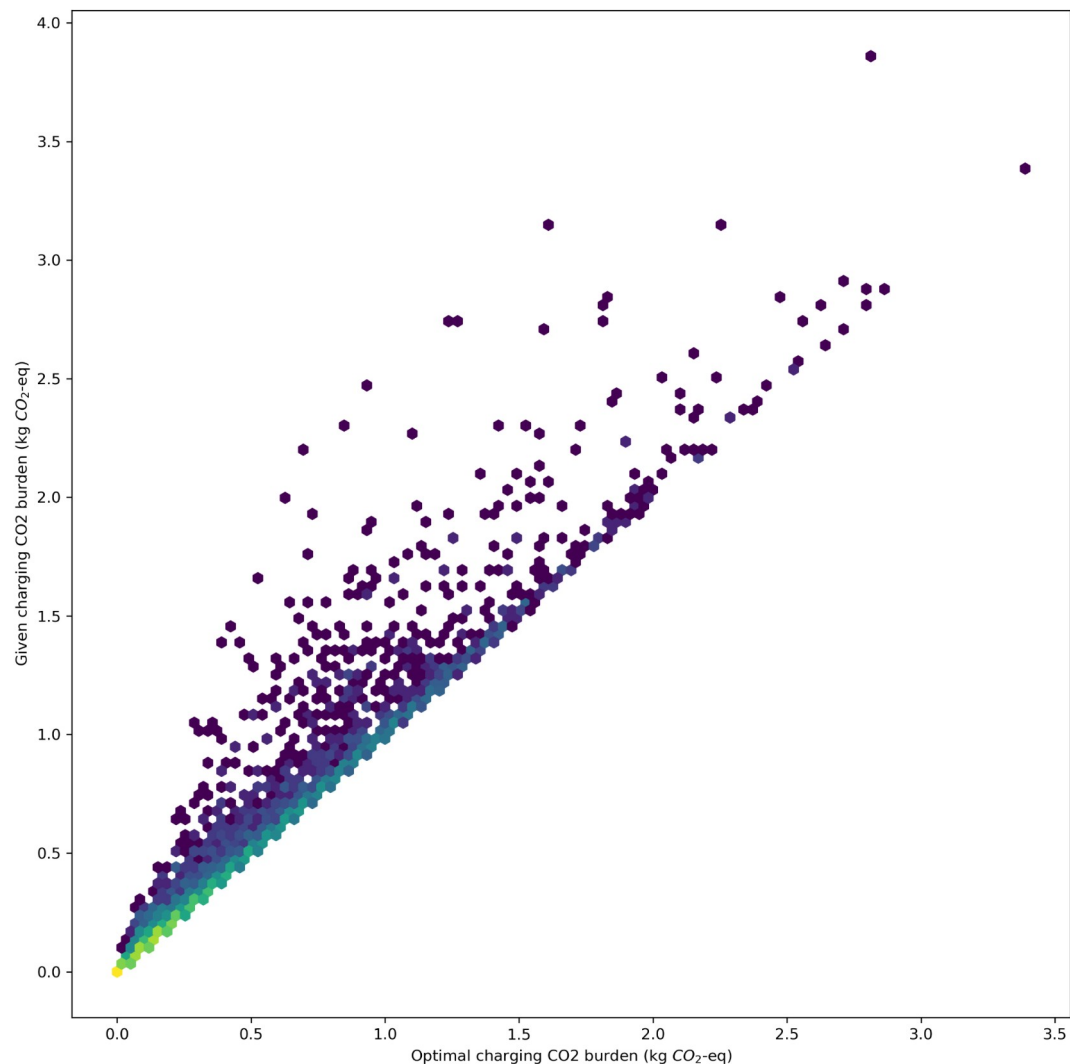
Problem Setting

16



Results: Shifting within current plugged-in period: 12% CO₂ reduction

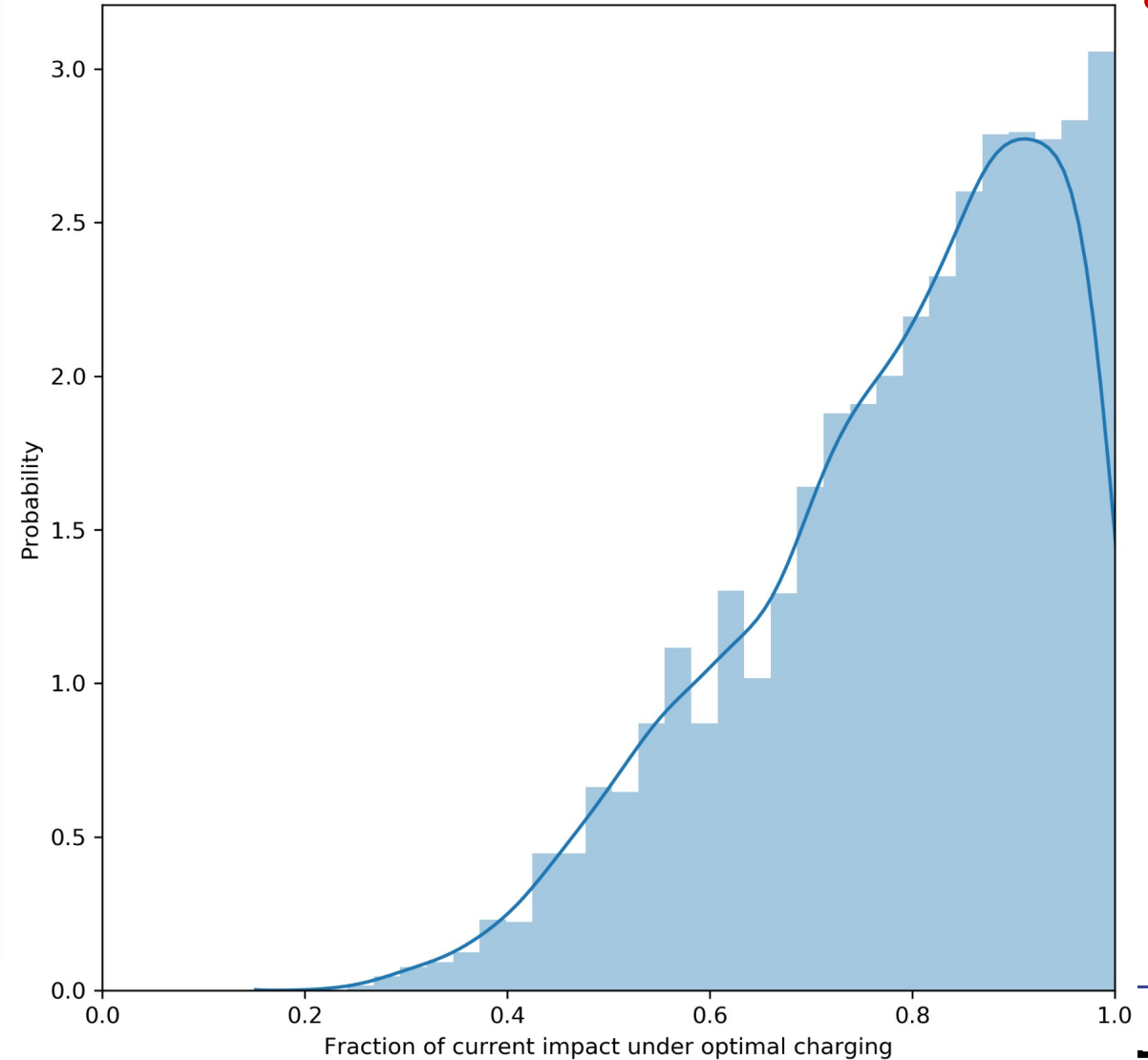
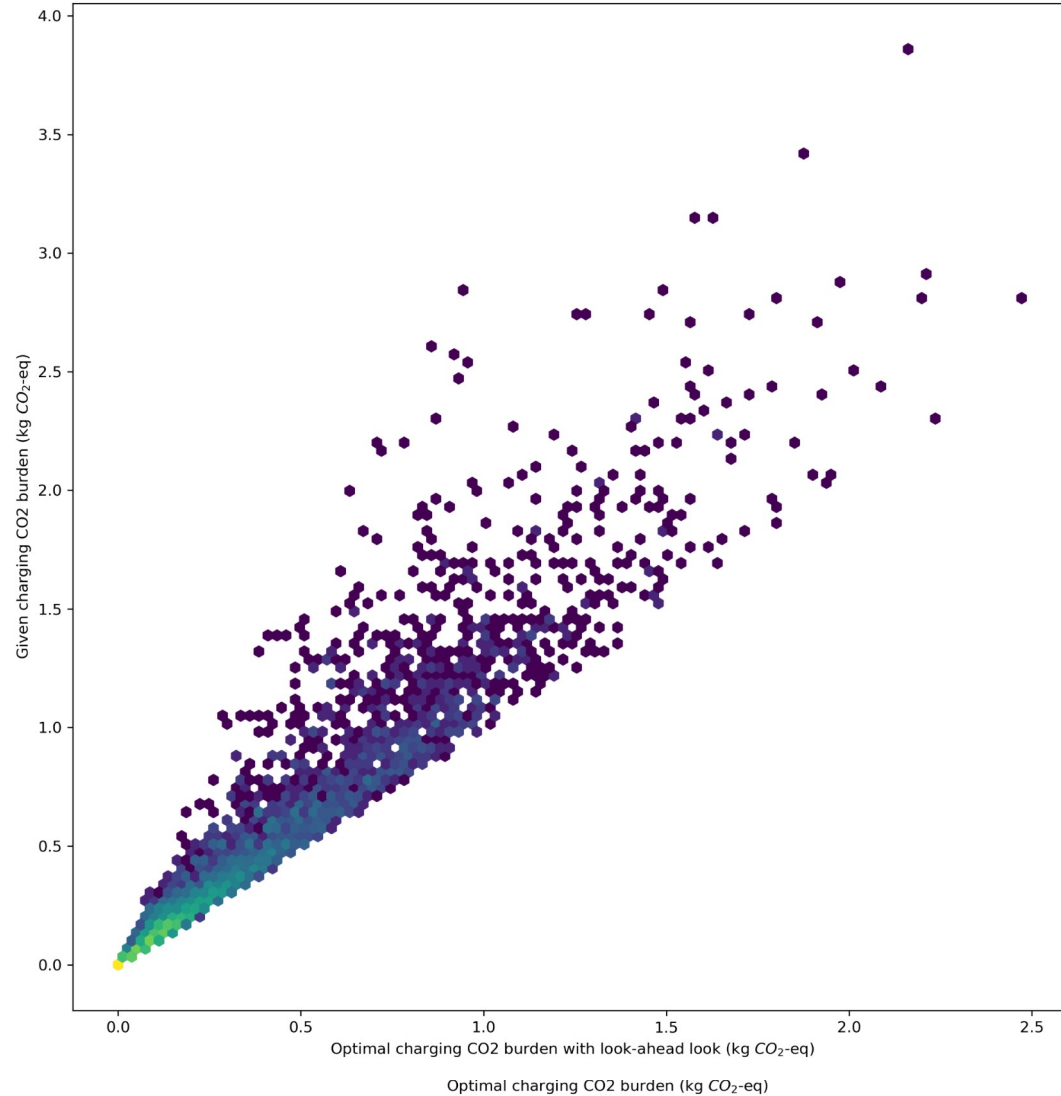
16



Results:

Shifting to next day: 25% CO₂ reduction

16

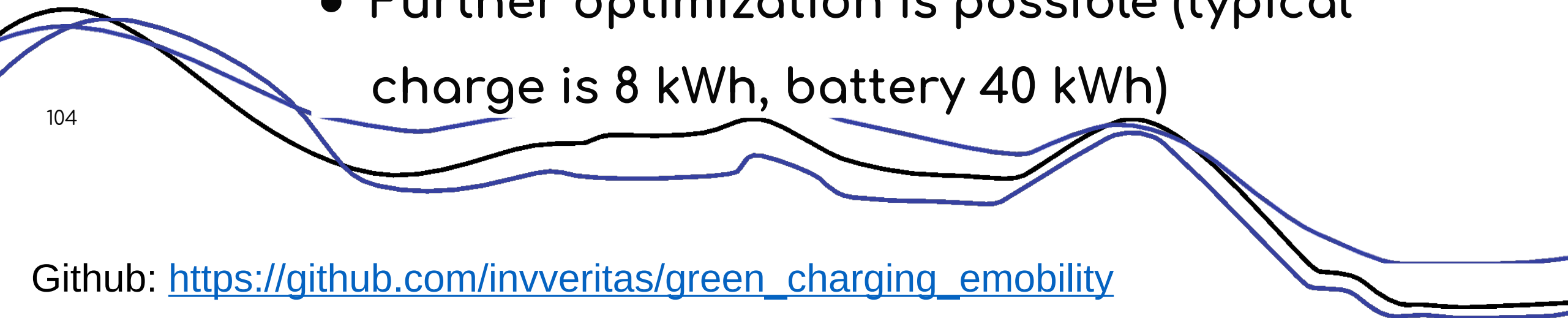


Limitations:

16

- Hackathon code
- Dirty data, not completely cleaned
- One year, changing # of stations
- We don't include grid dynamics
- Further optimization is possible (typical charge is 8 kWh, battery 40 kWh)

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Empower citizens to use their own energy data.
Using the smartmeter's local interface for visualization and automation

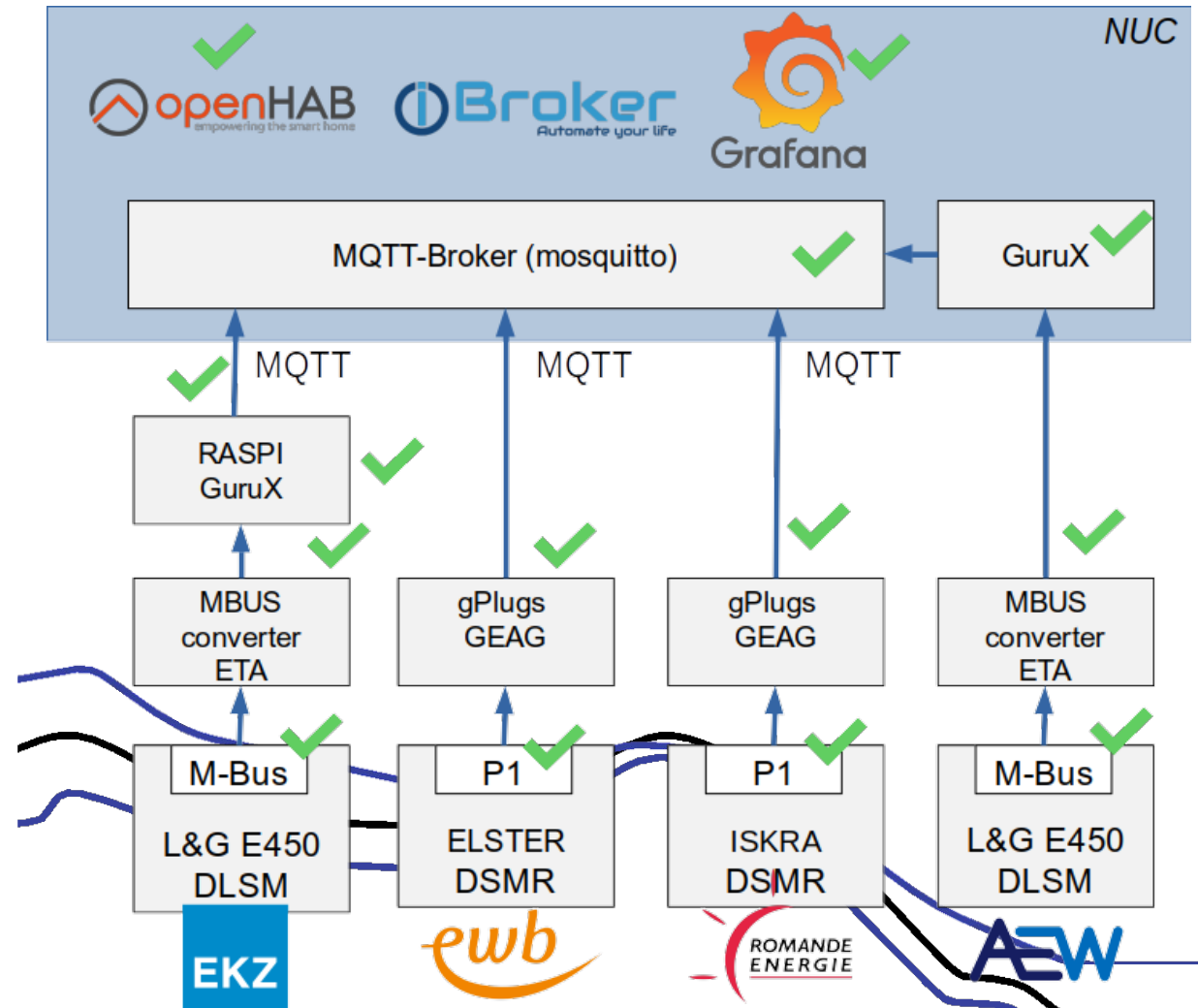
Interoperability test setup

The EKZ open source library is now able to read data from different smart meters !

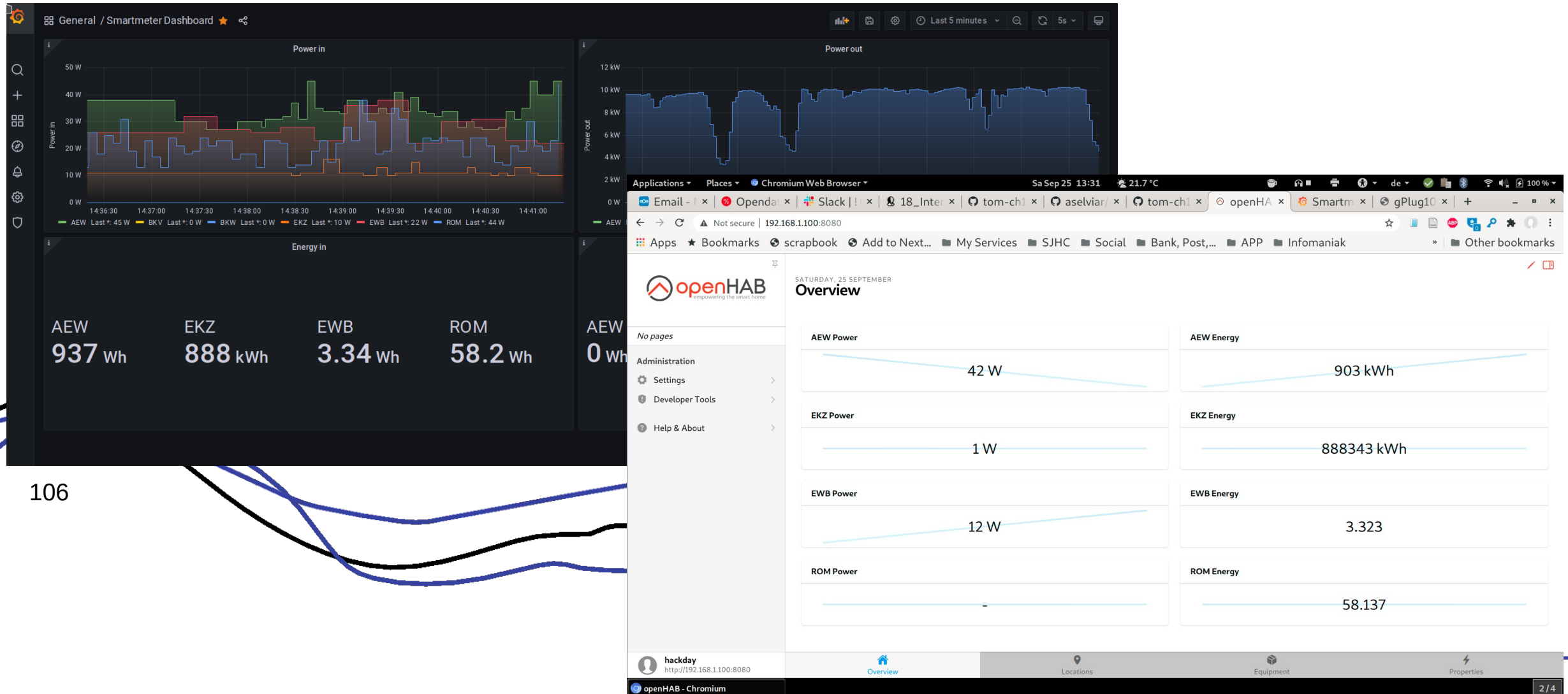
All data are read from the meter and connect to grafana and openhab

MQTT transformation adapter implemented and publishes a common profile for all meter

adding external data of renewable plant to the setup



Empower citizens to use their own energy data.
Using the smartmeter's local interface for visualization and automation



What is required to address the interoperability issue?

Establish a taskforce on VSE involving all DSO in switzerland to get harmonized publishing of OBIS data from the meter,
e.g.: Profile for consumer, prosumer ...

Embrace the open software project from EKZ to make the MQTT profile publishing publicly available → <https://github.com/scs/smartmeter-datacollector>

Start a open hardware project to have a plug and play device that implements the reading of the meter profile and publishes the MQTT profile

Build a community of users that actively maintains the projects

Empower citizens to use their own energy data.
Using the smartmeter's local interface for visualization and automation

Interoperability test setup



ReFi - Regenerative Finance

Tokenisation of Energy and Fractional Ownership of Digital Assets provide new possibilities for financing renewable energy projects

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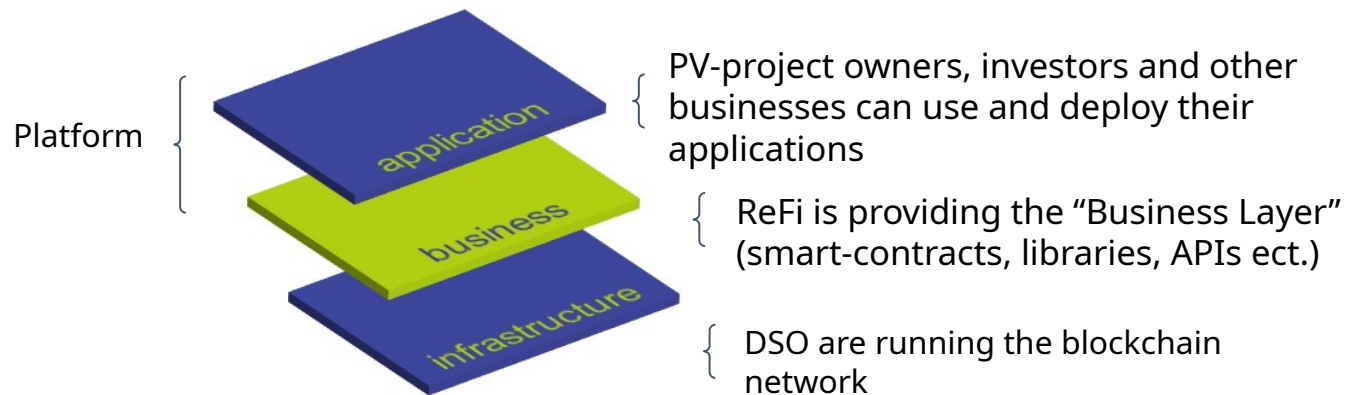
Evolution of Value Creation on ReFi

19

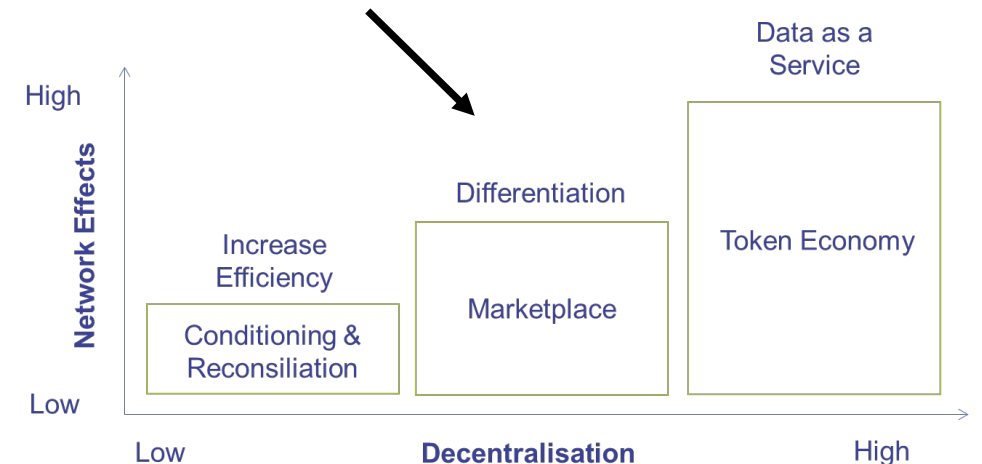
Importance of onboarding innovators



Provides the framework and facilitates a platform for investments in renewable energy assets



Solarify "tokenizes" investments into PV-projects by selling single panels (ownership)



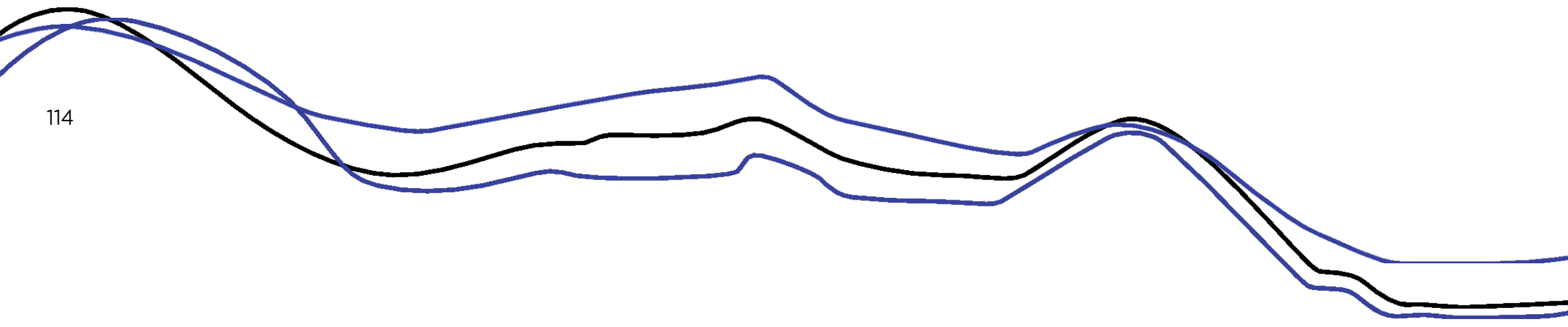


The Challenge

19

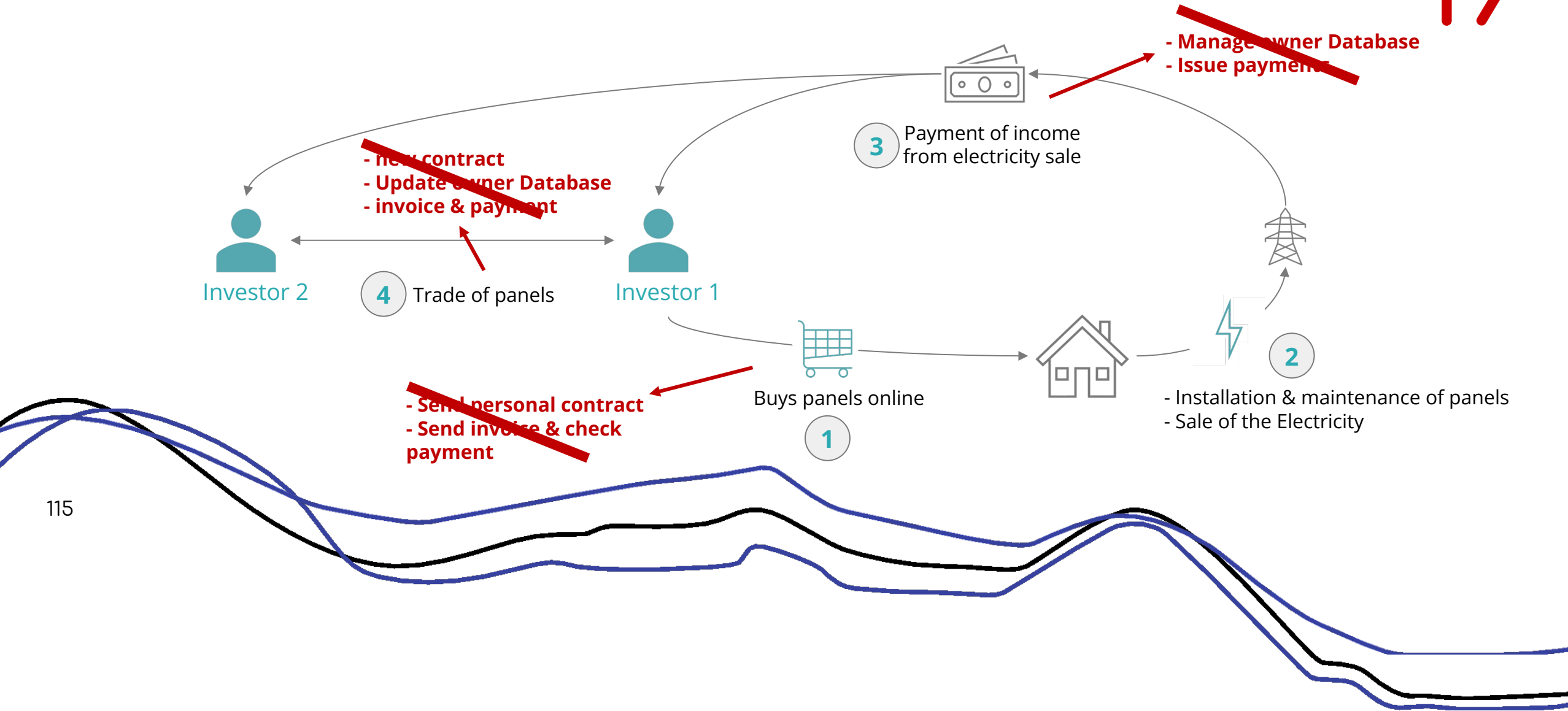
- Analyse feasibility of the off-chain tokenisation process regarding an on-chain implementation
- Develop the back-end to demonstrate the on-chain implementation

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Processes Solarify

19



SOLARIFY SO FUNKTIONIERT'S ONLINE SHOP

HOME > ONLINE SHOP: JETZT IHRE SOLARPANELS BESTELLEN > SOLARANLAGE > SOLARPANEL AU

Solarpanel auf Ingold Schreinerei AG in Better

Bestellen Sie jetzt! Für dieses Projekt sind noch 99 Solarpanels verfügbar.

Solarpanel auf Ingold Schreinerei AG in Bettenhausen
899 CHF inkl. MwSt.

Lage: Bettenhausen (BE), [Ingold Schreinerei AG](#)

Kennzahlen zum Solarpanel:

Erwartete Rückzahlung: 1252 CHF pro Panel über gesamte Projektlaufdauer

Solarpanel: vom Schweizer Hersteller [Megasol](#)

Grösse der Anlage: 99 Solarpanels

Deployed Contracts

> STABLECOIN AT 0XE78...6A8AB (BLOC)

OWNERHSIPCREATOR AT 0XD3A...B3E

approve address to, uint256 tokenId

CreateNFT

```
// SPDX-License-Identifier: MIT
2 pragma solidity ^0.7.3;
4 import "@openzeppelin/contracts/token/ERC721/ERC721.sol";
6 contract OwnerhsipCreator is ERC721
7 {
8     constructor () ERC721("Ownership PV-System", "OWP") {}
10
11     function CreateNFT() public
12     {
13         address _target = msg.sender;
14         uint256 _tokenId = totalSupply() + 1;
15         _safeMint(_target, _tokenId);
16     }
17 }
```

create NFT (1 digital PV-system)

_NFTADDRESS: 0xD3aA556287Afe63102e579

_NFTID: 1

_FRACTIONSAMOUNT: 99

_FRACTIONSPRICE: 899

_PAYMENTADDRESS: 0xe78A0F7E598Cc8b0Bb1

transact

```
29 ERC20("Bettenhausen", "SOB") {
30     nftId = _nftId;
31     nft = IERC721(_nftAddress);
32     fractionsAmount = _fractionsAmount;
33     fractionsPrice = _fractionsPrice;
34     CHF = IERC20(_paymentAddress);
35     admin = msg.sender;
36 }
37
38 //Caller transfers the Ownership-NFT
39 function fractionalise()external {
40     require(msg.sender == admin, 'only admin can fractionalise');
41     nft.transferFrom(msg.sender, address(this), 1);
42 }
43 }
```

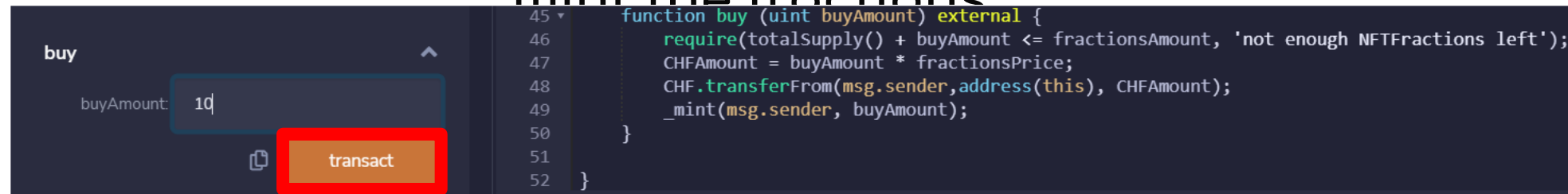
deploy fractionalization (99 panels)

ARTIKEL	PREIS	MENGE	ZWISCHENSUMME	
 × Solarpanel auf Ingold Schreinerei AG in Bettenhausen	899 CHF	− 10 +	8'990 CHF	BUY

19

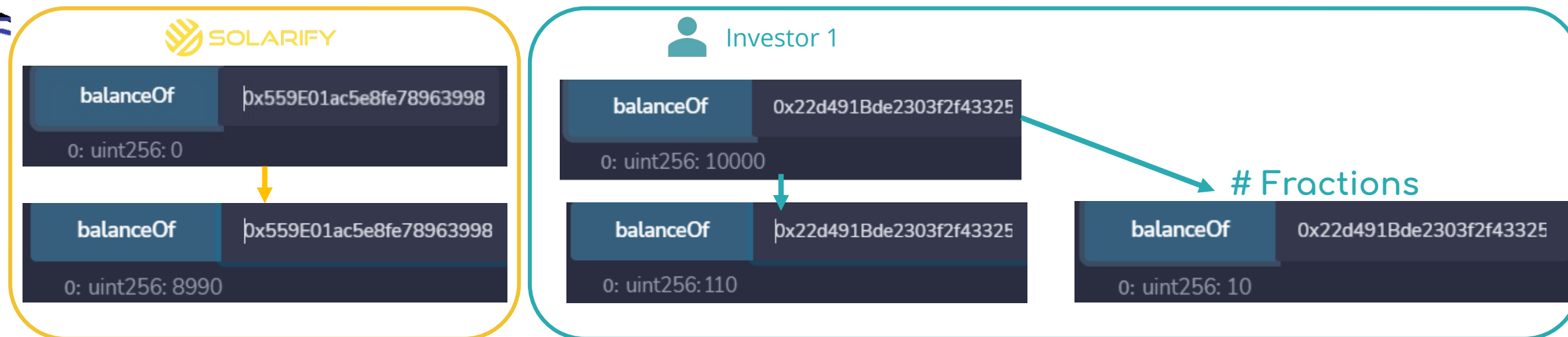


mint the fractions



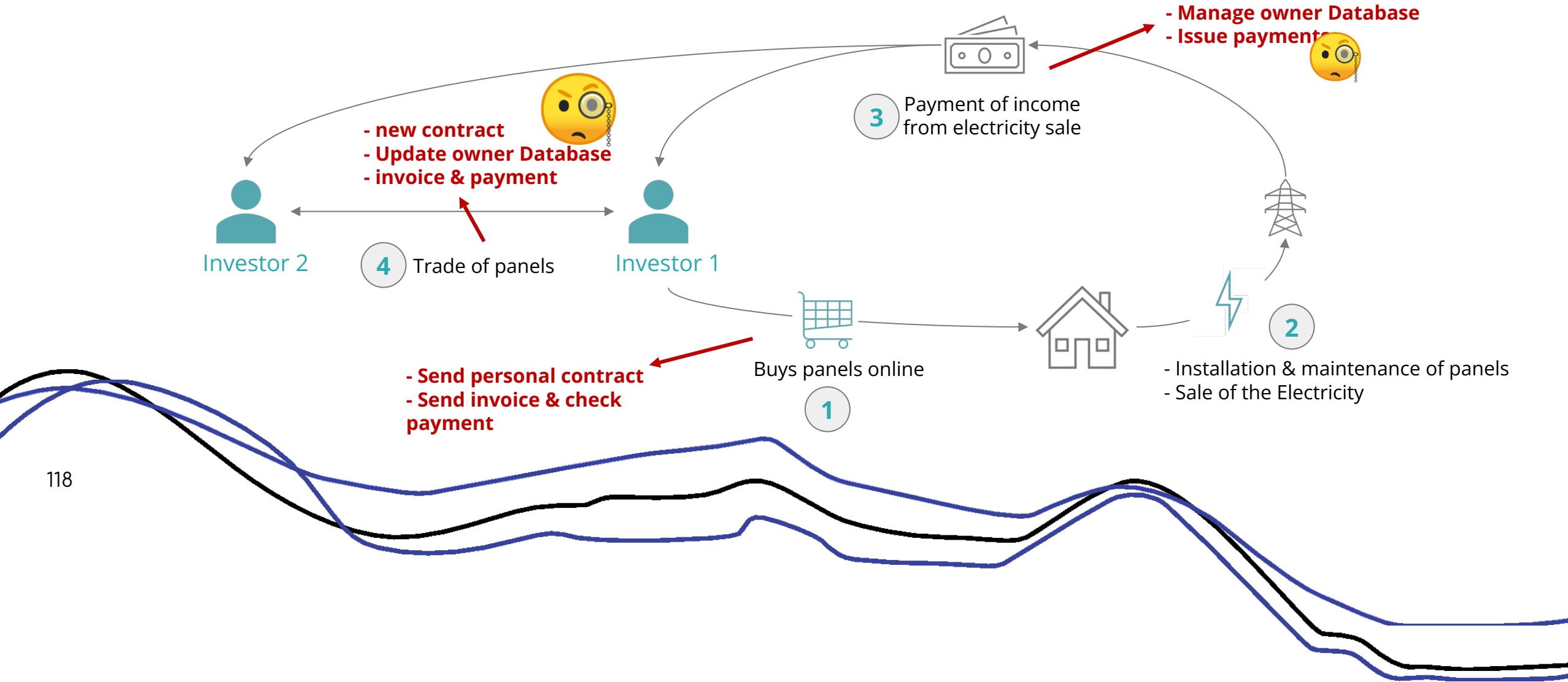
& transfer funds

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Where we are

19



Challenges & next steps

19

- Build & maintain stable network
 - including payments & marketplace
 - Frontend 🙄
- Acceptance of end users (investors)
- Deploy proposed prototype of ReFi on a testnet and run PV-project tokenization simulation

How Sustainable is this Property?

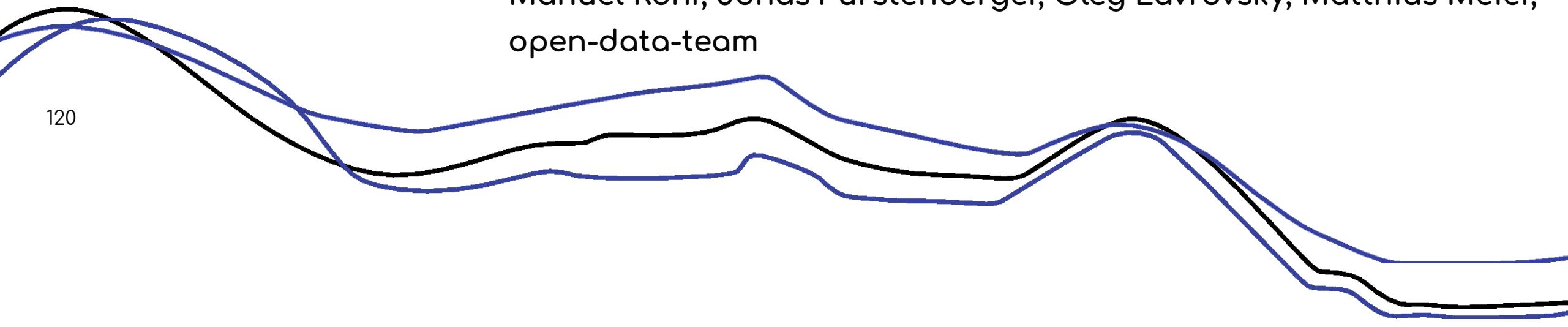
20



Challenge Owner:
EcoHabitas

Contributors:
Manuel Rohr, Jonas Fürstenberger, Oleg Lavrovsky, Matthias Meier,
open-data-team

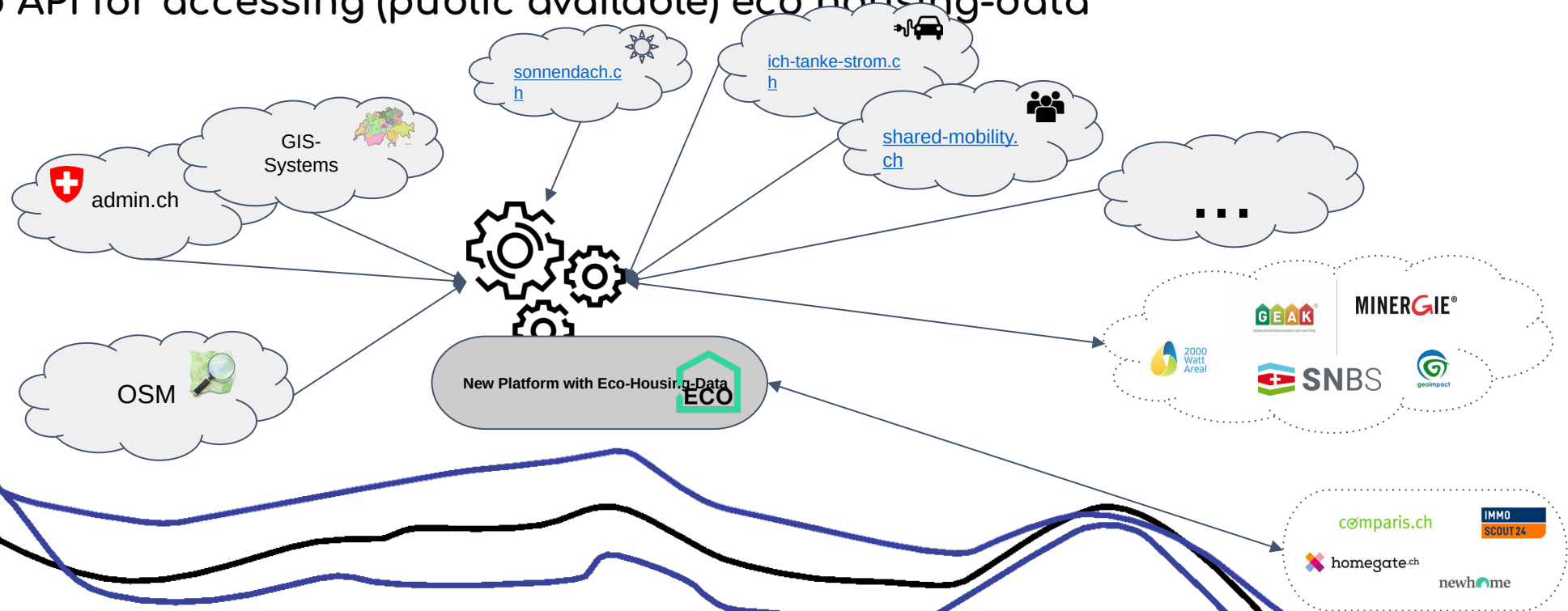
120

A line graph with two data series, one in black and one in blue. The lines fluctuate across the horizontal axis, with the blue line generally staying above the black line. The graph starts on the left, peaks, dips, and then continues with several smaller peaks and troughs before ending on the right. The y-axis is not explicitly labeled, but a value of 120 is marked on the left side.

Challenge

20

Develop API for accessing (public available) eco housing-data





Results

20

Open Habitation

Swiss open habitation API

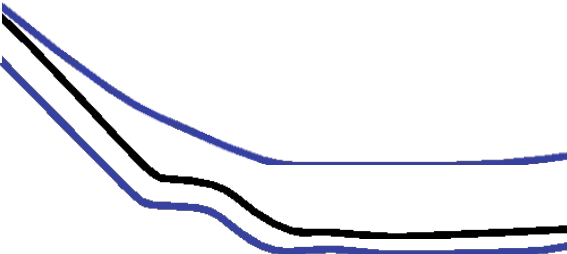
Basic Example

bodenweg 21, 3714 Frutigen|

#	Address	Production (annual)	Category	Eco Rating
1	bodenweg 21, 3714 Frutigen	860.62	Photovoltaic	E

Powered by [Opendata.ch](#) • [Source Code](#) • [#EnergyDataHackdays](#)

Link will be
published as soon
as calculation of
PV production
works





Results

20

Photovoltaic



Data provider: SwissTopo

input: Building Address

get: sub type, total power,
plant type, coordinates

+

Data provider: pvgis

input: coordinates, total
power, (inclination),
(orientation), plant type

get: yearly production

=

Data provider: Open
Habitation (opndata.ch)

input: building adress

answer: PV [y/n], plant type,
total power,
yearly production

123





Vision

20

✓
opendata.ch

?
Gebäudepass
Swiss Eenergy Planning SEP
Real Estate Market
BFE
NGO
...

TEAM
Backend Developer
Frontend Developer
Networking
Finance
...

ecohabitas.ch (eco-market)
other Real Estate Market (?)
Gebäudepass (?)
...

1
searching
partner

developing
platform

release

operation

- data
- schema
- rating/label

- open
- api
- database



Contact

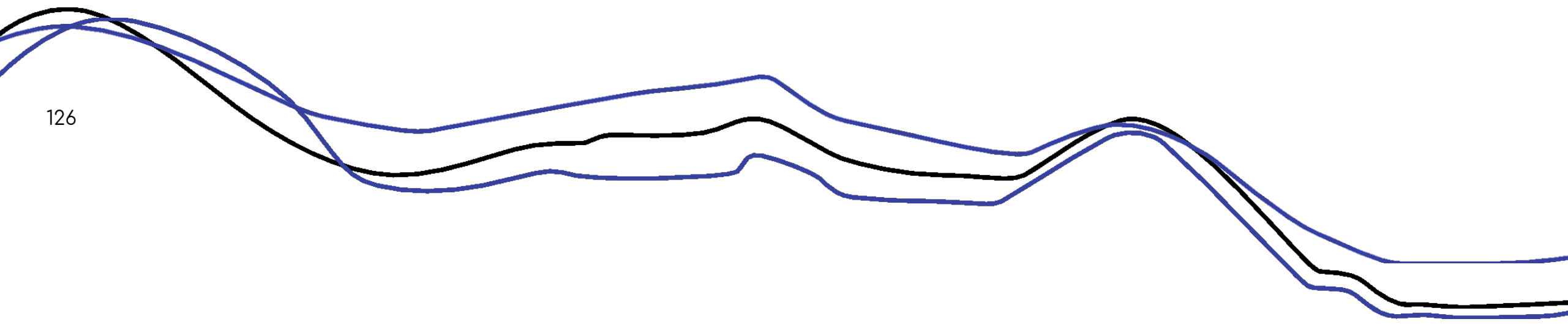
20

<https://open-habitation.herokuapp.com/>

ecohabitas.ch

info@ecohabitas.ch

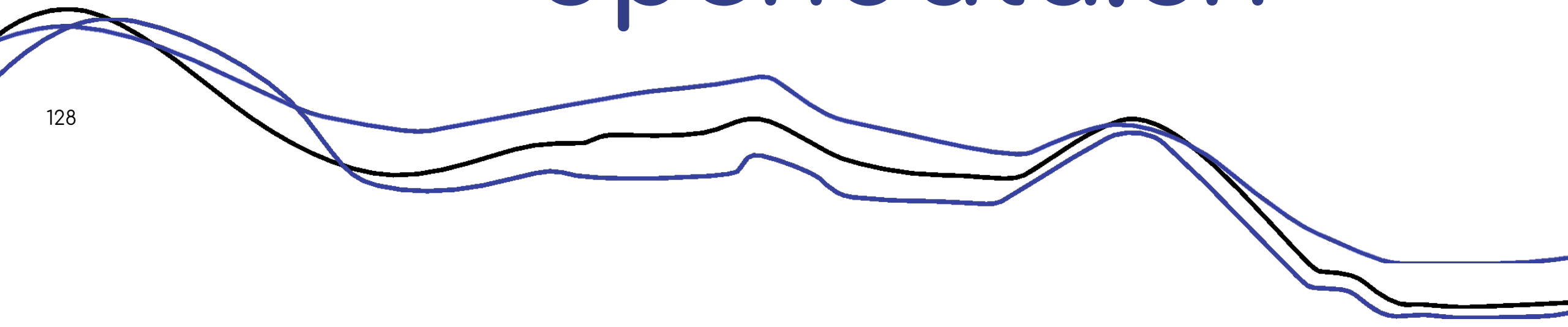
126



First...
An enormous
Thank you
to  you all

Become a member!
30chf / year,
no benefit ;) opendata.ch

128



Take part in our opendata Forum

Shedding Light on the Invisible (Data)
the art and science of opening data, hidden data
and the space in-between: climate, health, gender
and conflict!

October 12th (online)

129

opendata.ch/2021

Join our other hacks

Smart Regio Lab - October 15-16th Lenzburg

Data Hackdays BE21 - November 12-13 Bern

HSLU Sports Hackdays - November 26-27 Luzern

On our radars:

openGLAM, Legal Lab, Farming... and...

130

opendata.ch/events/

Energy Data Hackdays 2022!

See you then!

131

energydatahackdays.ch

And lastly...
An enormous
Thank you
to  you all !!

