British Embassy Berne

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ENERGY & CLIMATE HACK

31 August & 1 September 2021



British Embassy Berne

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Open Data .ch

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Bundesamt für Umwelt BAFU
Office fédéral de l'environnement OFEV
Ufficio federale dell'ambiente UFAM
Uffizi federal d'ambient UFAM

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Bundesamt für Energie BFE
Swiss Federal Office of Energy SFOE

Energie Stadt Bern

Energie Wasser Bern ewb

swisstopo

YASAI
GROW MORE WITH LESS

Empa
Materials Science and Technology

u b
UNIVERSITÄT BERN
OESCHGER CENTRE
CLIMATE CHANGE RESEARCH

FHNW GEOMATIK

e-swissolar

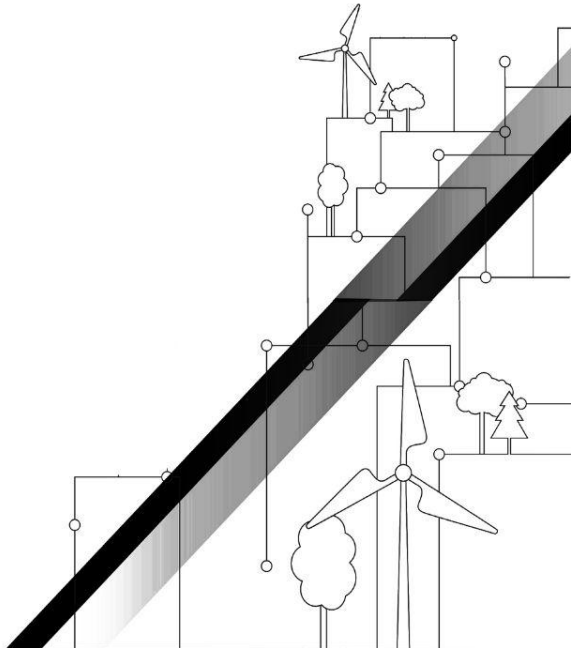
aliunid

OST
Ostschweizer Fachhochschule



Anita Stalder, Innovation Manager
Andrea Gribi, Smart City projects
Energie Wasser Bern

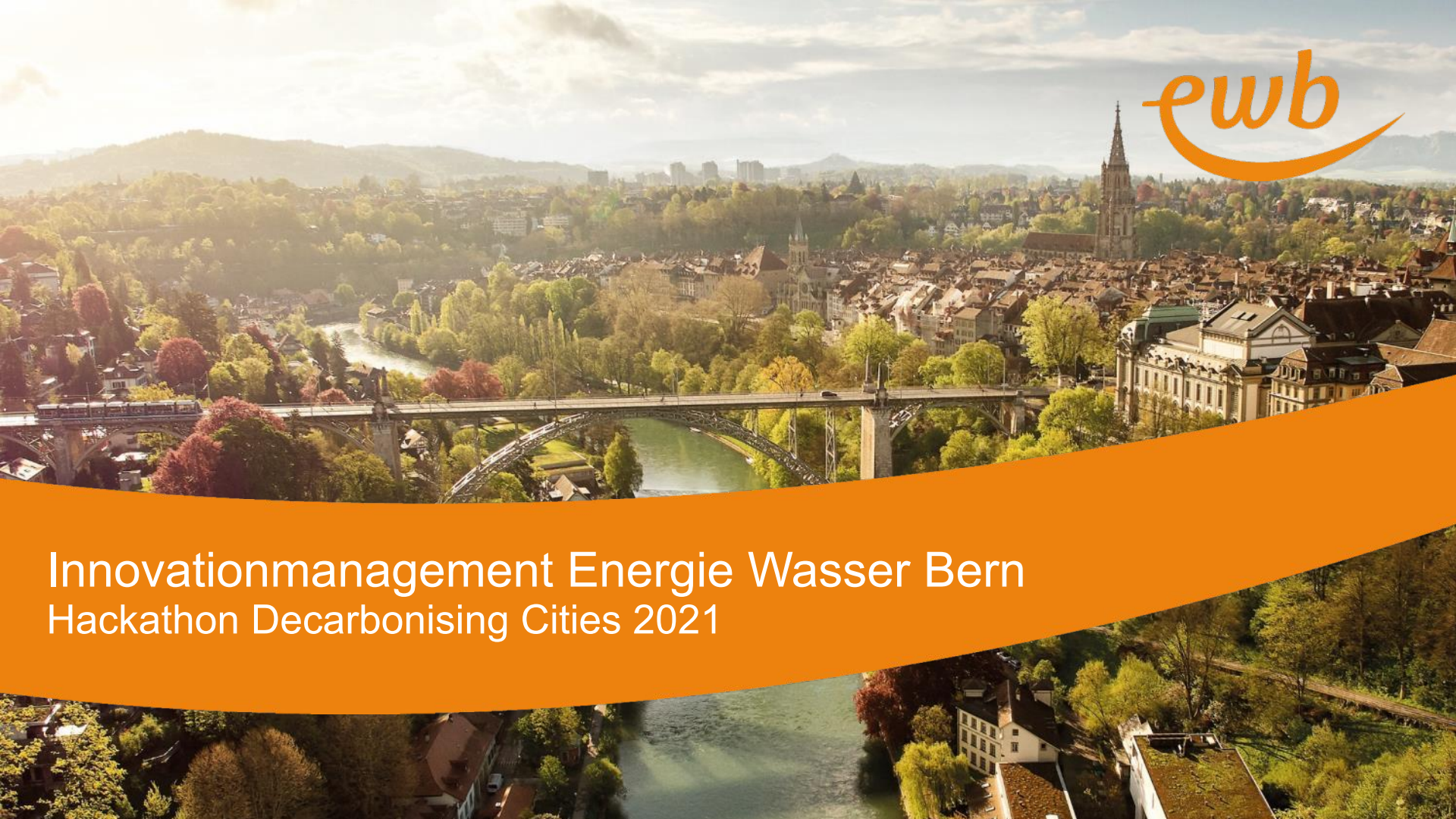
Energie Wasser Bern
ewb




Hello Hackathon!
Do you need some energy?
We give you some
& we give energy to Berne!


Grüessech &
Härzlech Willkomme!
Hello & Welcome!
Oh, this is Berne by the way.
Nice, isnt‘ it?


What is our mission?
„Mir hautä Bärn am loufe“
we keep Berne running & help to become a decarbonised city



Innovationmanagement Energie Wasser Bern

Hackathon Decarbonising Cities 2021



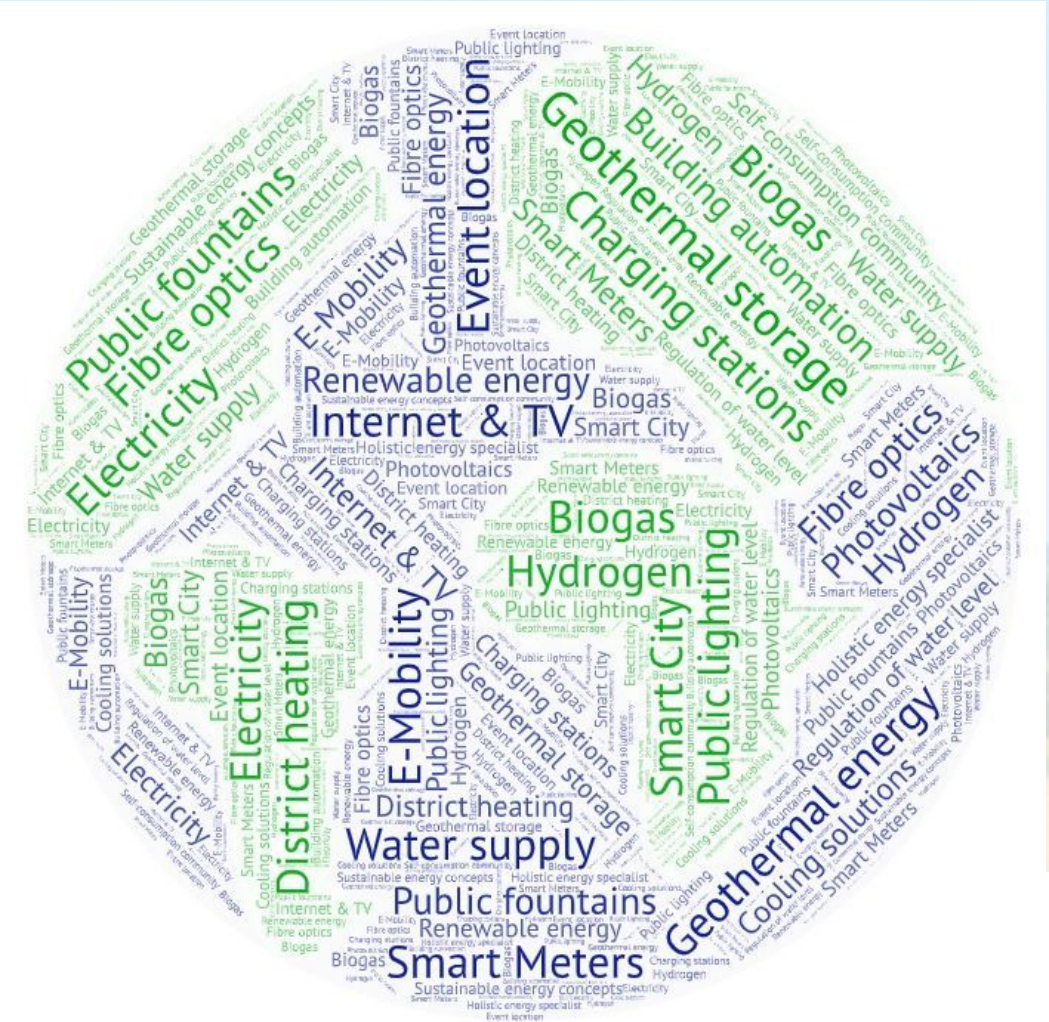


we are…

… Andrea Gribi & Anita Stalder,
responsible for innovation &
Smart City projects @ewb


Yes, we are an energy service provider,
but we offer much more to our customers and our city than energy!

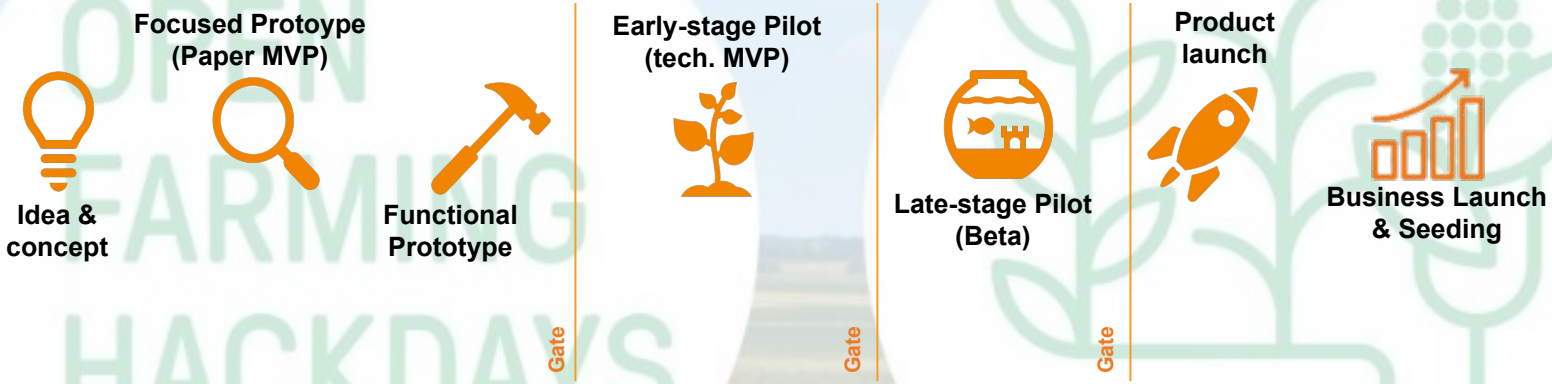
- Wor(l)dclou


Event location
Public lighting
Biogas
Fibre optics
Geothermal energy
Event location
Hydrogen
Building automation
Biogas
Self-consumption community
Geothermal storage
Public fountains
Sustainable energy concepts
Electricity
Fibre optics
Charging stations
Water supply
Smart Meters
Regulation of water level
E-Mobility
Photovoltaics
Event location
Renewable energy
Biogas
Internet & TV
Smart City
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Biogas
Fibre optics
Photovoltaics
Hydrogen
Holistic energy specialist
Public fountains
Regulation of water level
Water supply
Cooling solutions
Smart Meters
Internet & TV
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Biogas
Hydrogen
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Charging stations
Geothermal storage
Fibre optics
District heating
Water supply
Sustainable energy concepts
Holistic energy specialist
Public fountains
Renewable energy
Biogas
Smart Meters
Sustainable energy concepts

Innovation is everywhere…

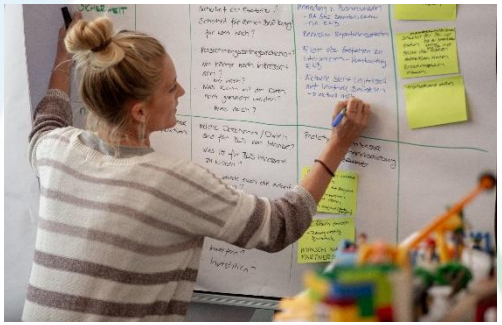


Innovation process ewb





How are projects initiated?









- ✔ **Trendmanagement**
  Trendscouting & Strategy
- ✔ **Open Innovation**
  Collaboration with partners
- ✔ **Innovationbox program**
  Involvement of employees

Ideation Journey: www.ewb.ch/nachhaltigkeit/innovation



Projects

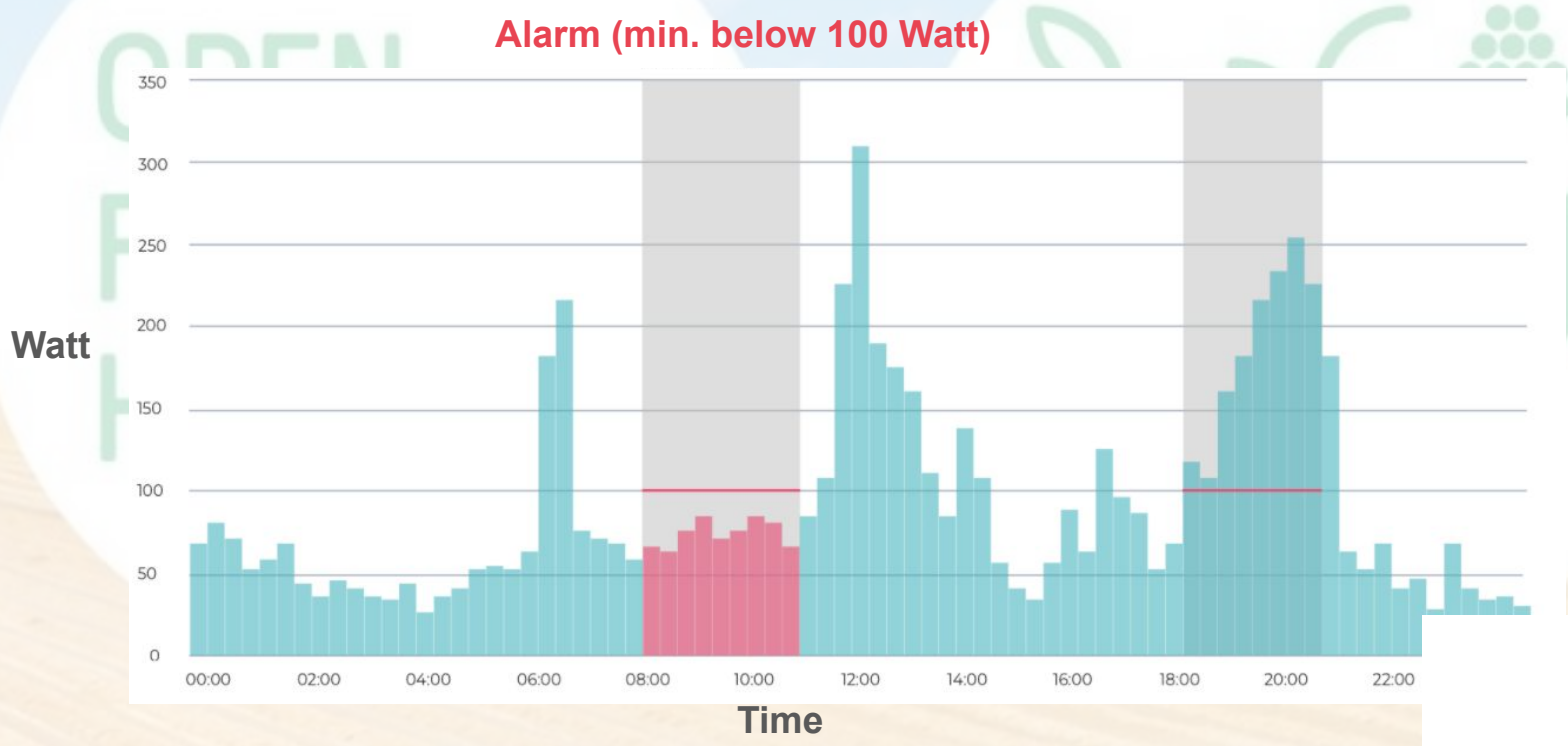


siima

Providing safety for an independent life

siima
by Energie Wasser Bern

siima - How it works?





Challenges & Learnings

- Focus on the customer problem
  not on your company problems
- Belief in your ideas
  if they are validated from your customers

siima
by Energie Wasser Bern

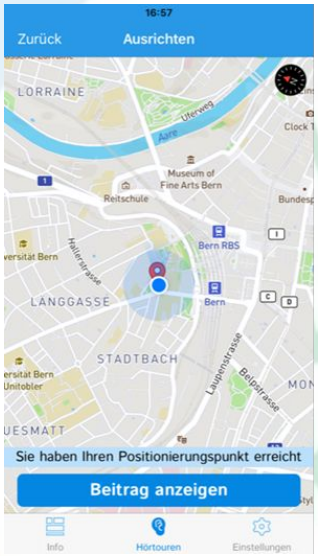


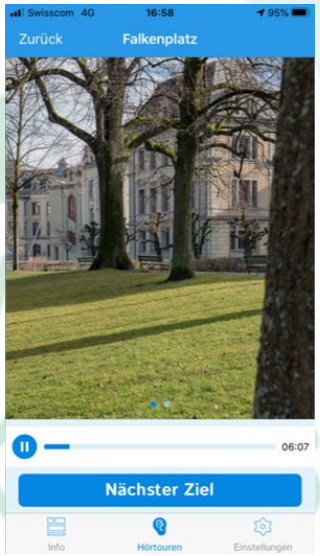
KU:BE

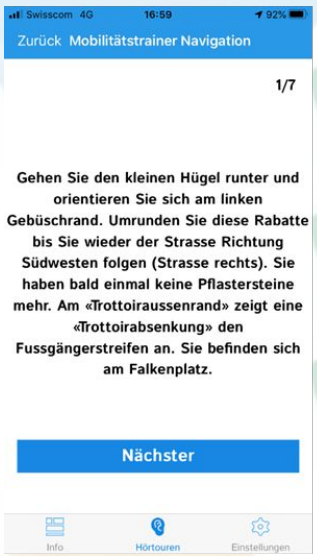
Audio City Tour

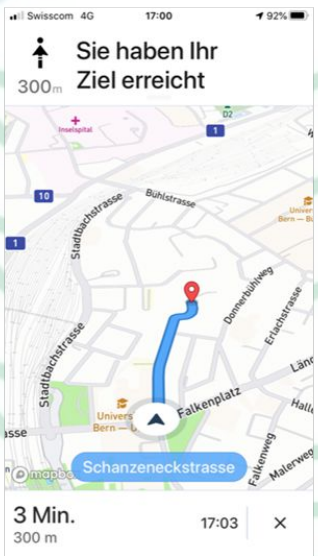
Stadt Bern ewb bls BERNMOBIL

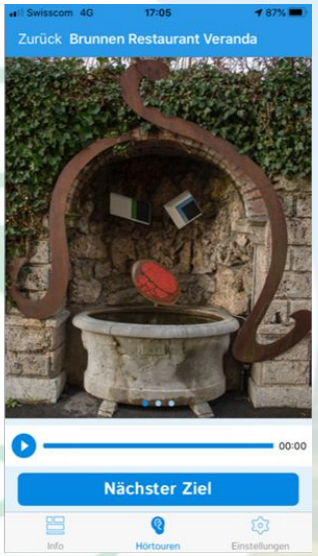
KU:BE - How it works?













Challenges & Learnings

- Work in Eco-Systems (Smart City)
  even if it's not (yet?) your core business

- Testing not just talking
  «does GPS work or not»?

Stadt Bern ewb bls BERNMOBIL



e(wb)-car charging

charging the e-car at the streetlight

ewb MOVE SIEMENS Ingenuity for life ubitricity energieschweiz Stadt Bern



Challenges & Learnings

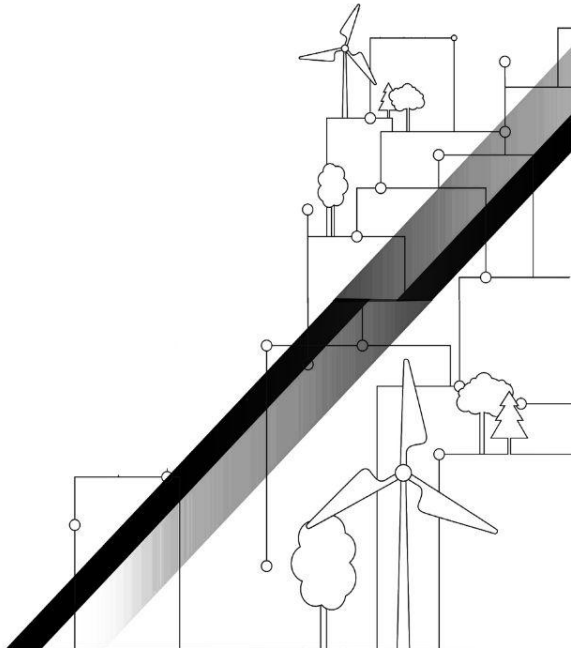
- Do market tests, even there are still unsolved problems

  the charging capacity is still slow, it’s hard to find places to install charging stations, different parking zones, and so on…


There are still a lot of challenges...
That‘s why we are here
@ Hackathon Decarbonising Cities


„Dankä!“
Thank you for your attention & good luck!
innovation@ewb.ch

Till Richter, Head Data
ALIUNID





when energy breathes

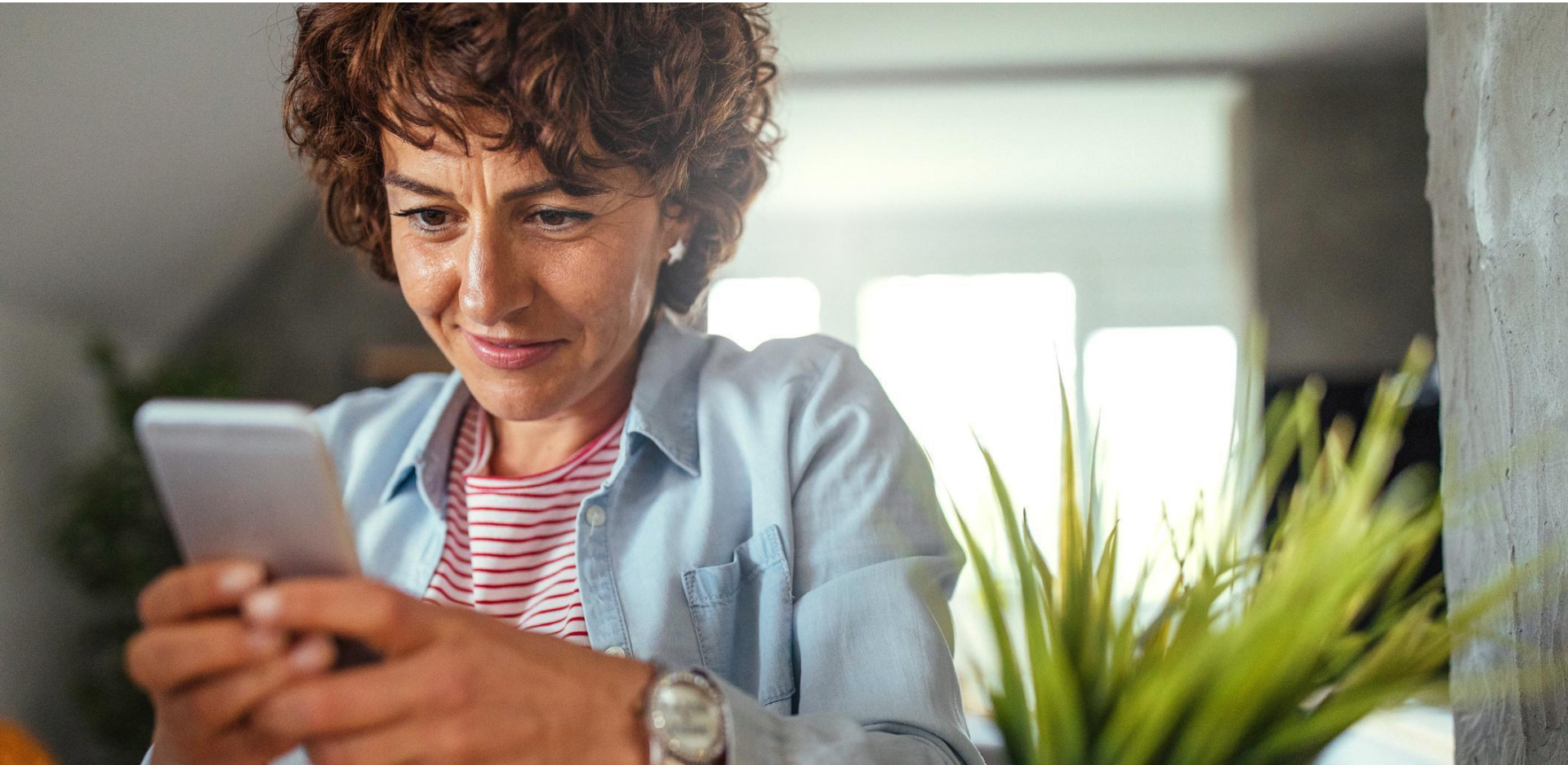
Energy & Climate Hack
Decarbonising Cities

September 2021

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Europäische Kommission

How can we help Isabelle reduce her CO2 footprint?



Average carbon emissions caused by our electricity consumption account for 23% (UK) and 10% (CH).



The carbon intensity of electricity varies over time.
How can Isabelle determine her own CO2 footprint?



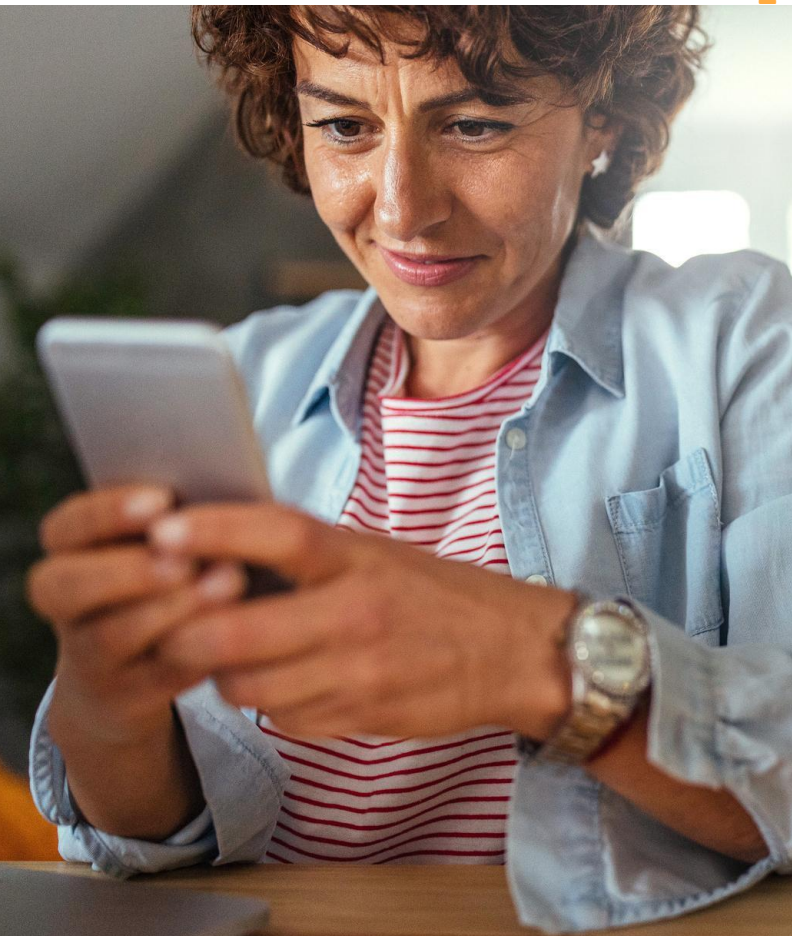
Isabelle needs real-time data from her smart meter!





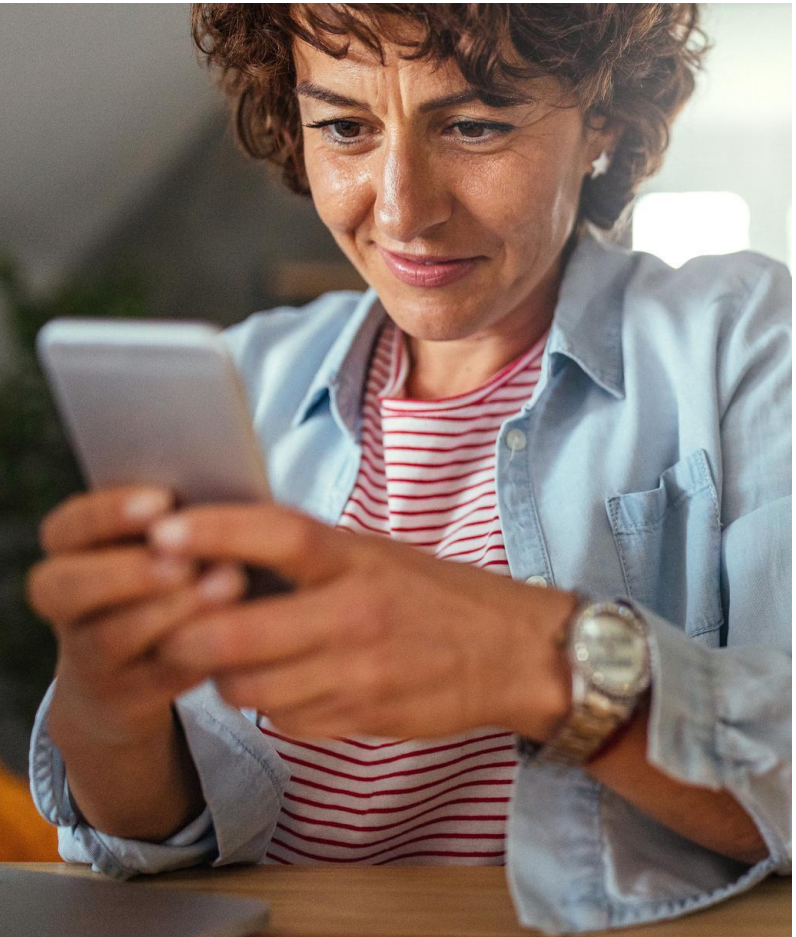
aliunid

aliunid shows Isabelle's electricity consumption and CO_2 footprint in real-time.



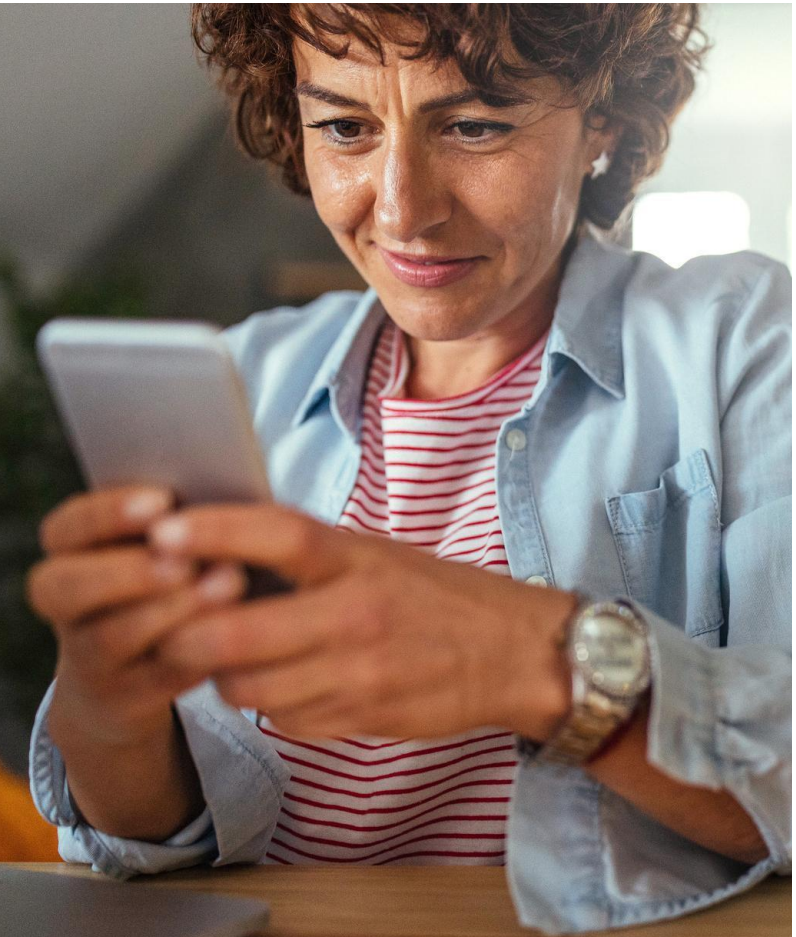


aliunid will tell Isabelle when the best time is to do her laundry…



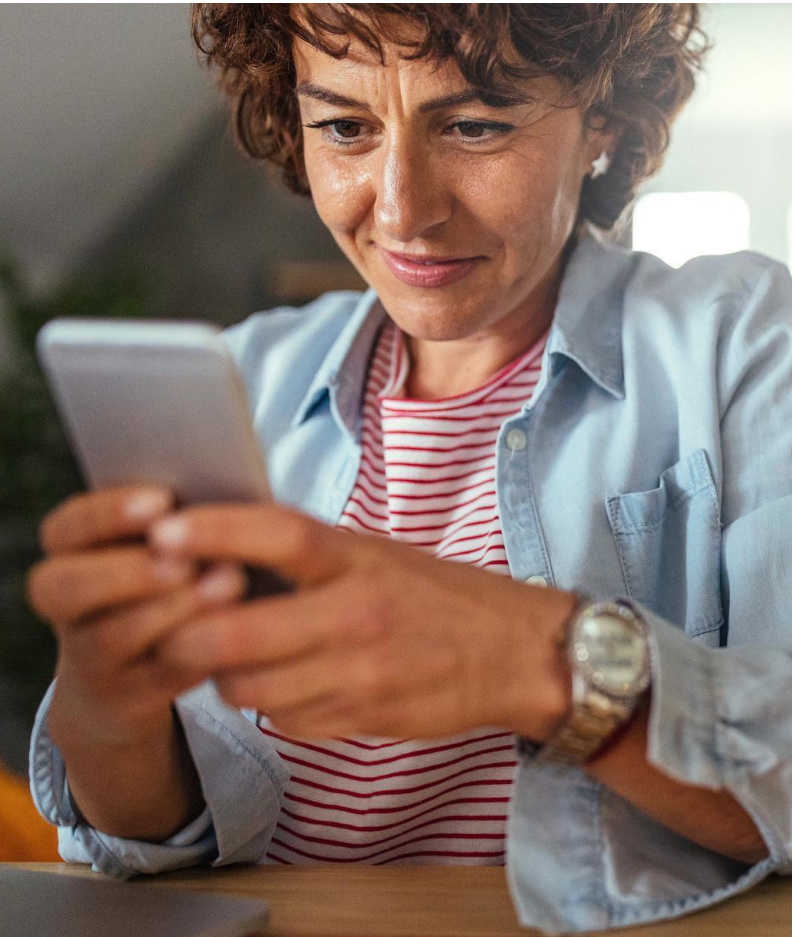


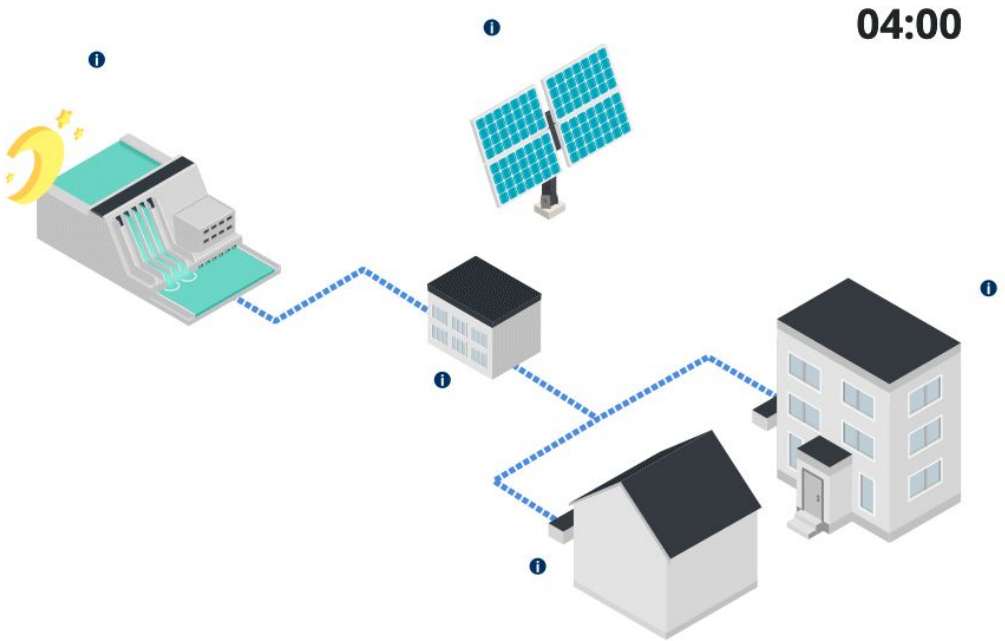
…and when to charge her electric car at low carbon intensity.





With aliunid, Isabelle can buy renewable energy in real-time.





How can we help Martin to keep his grid stable?



With higher shares of electricity from renewable energy, the need for balancing production and consumption is getting more challenging.



Extending the grid infrastructure to allow for decarbonization requires significant investments.



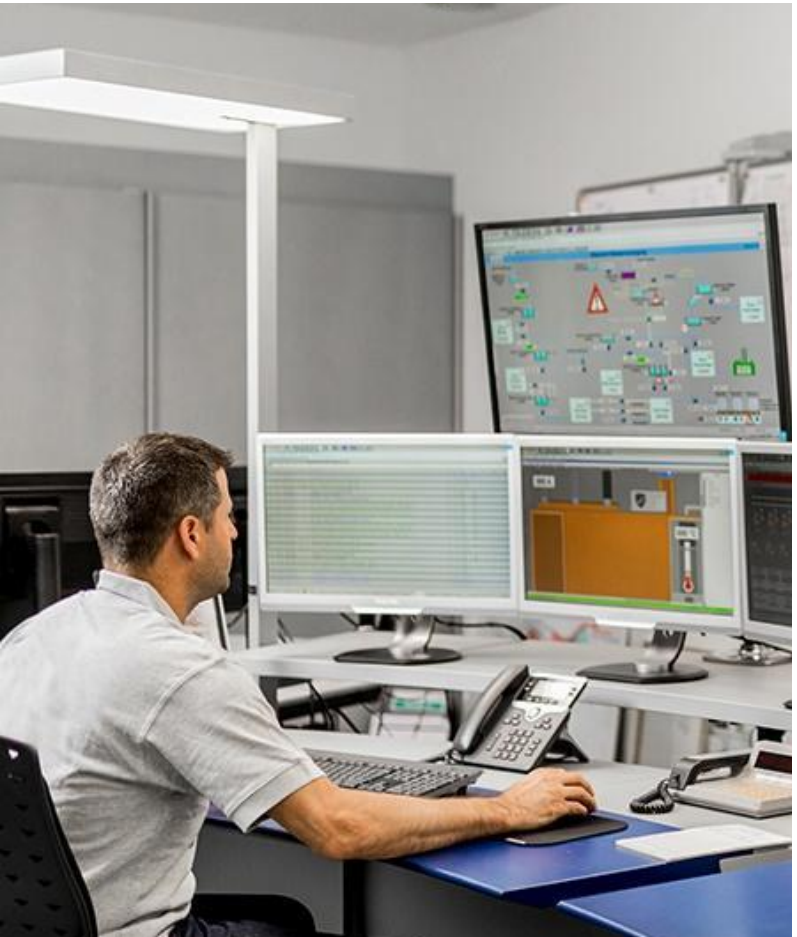
Martin needs real-time data from his electric grid.





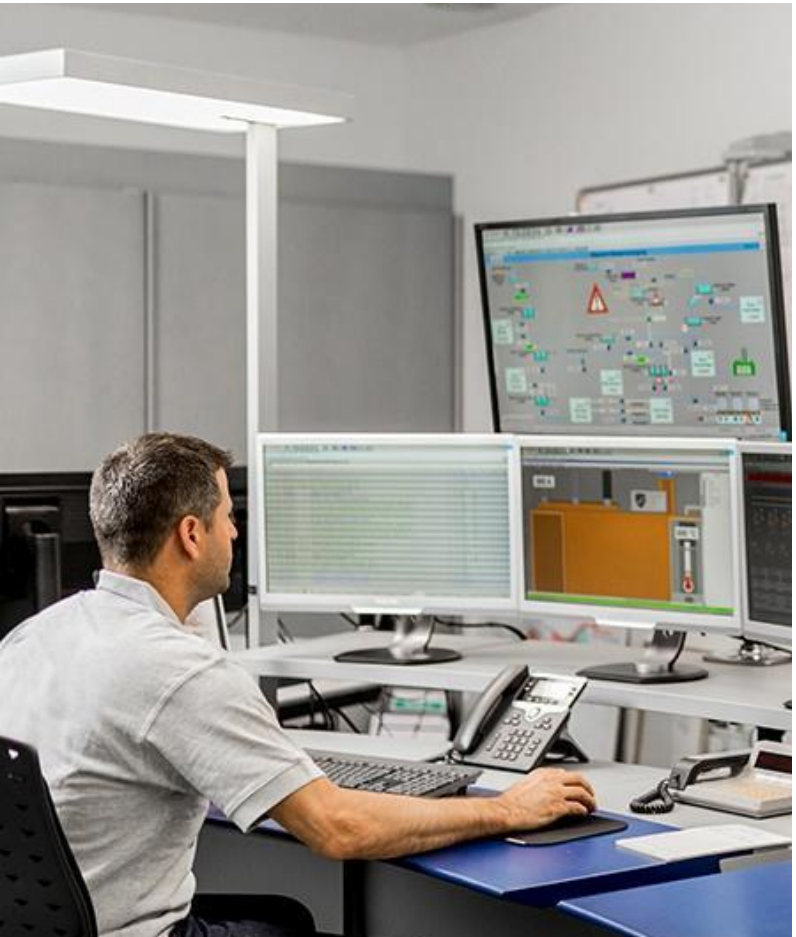
aliunid

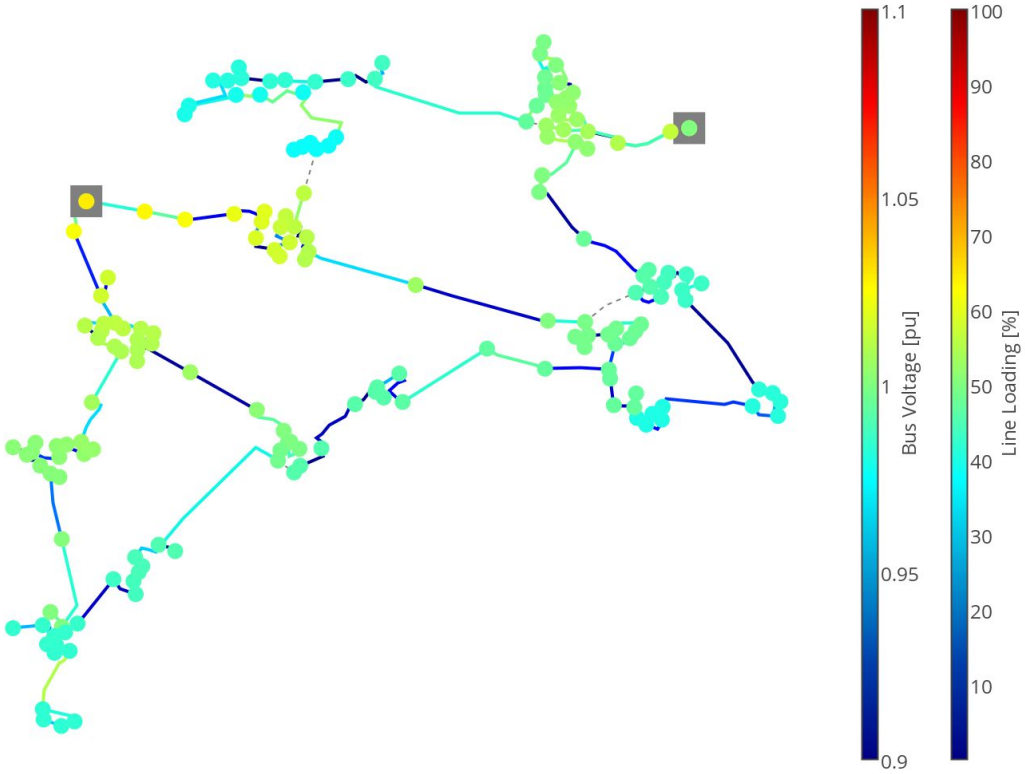
aliunid will allow controlling flexible loads to avoid overloading the grid.



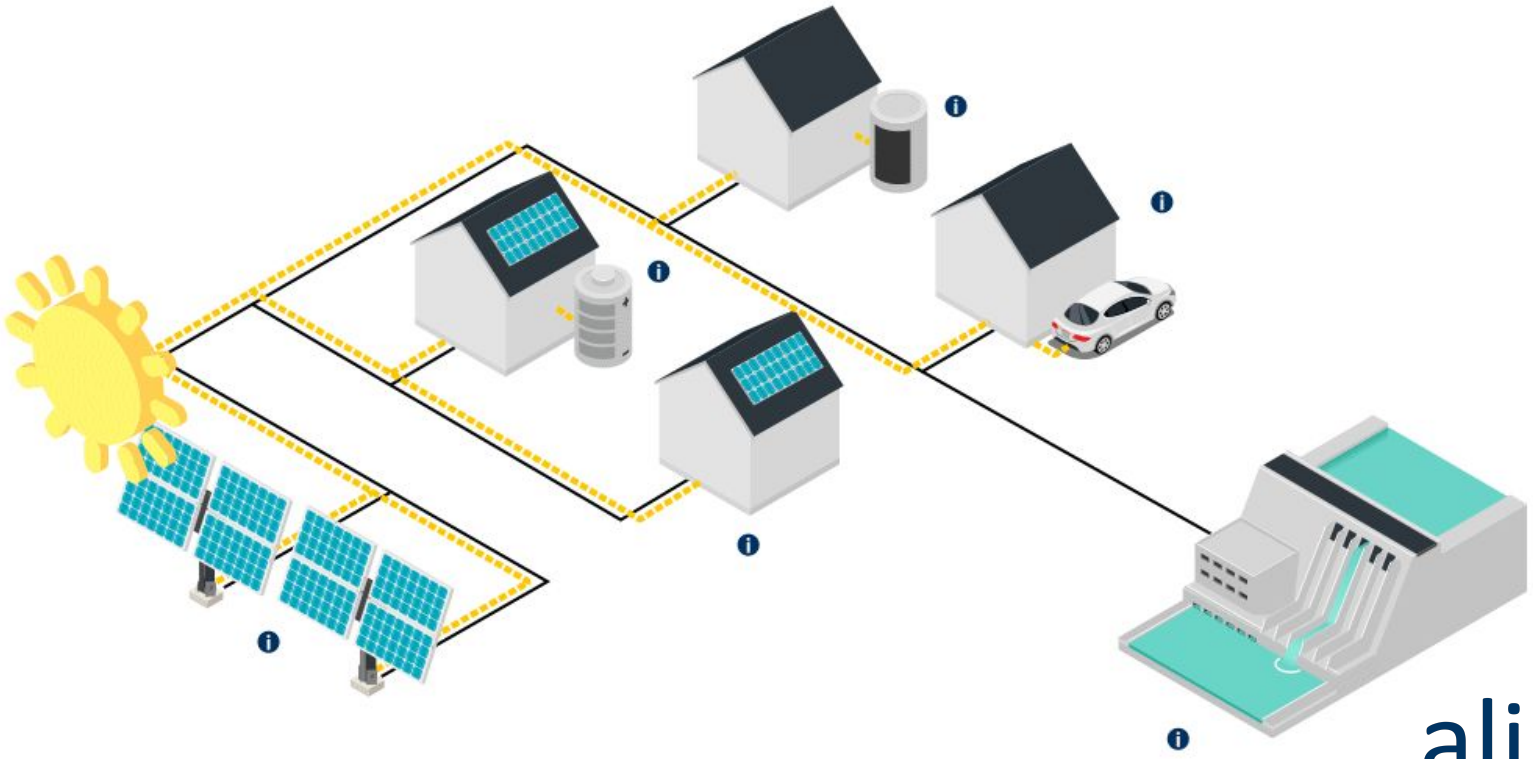


aliunid will show in real-time the how much EV charging is contributing to grid load.



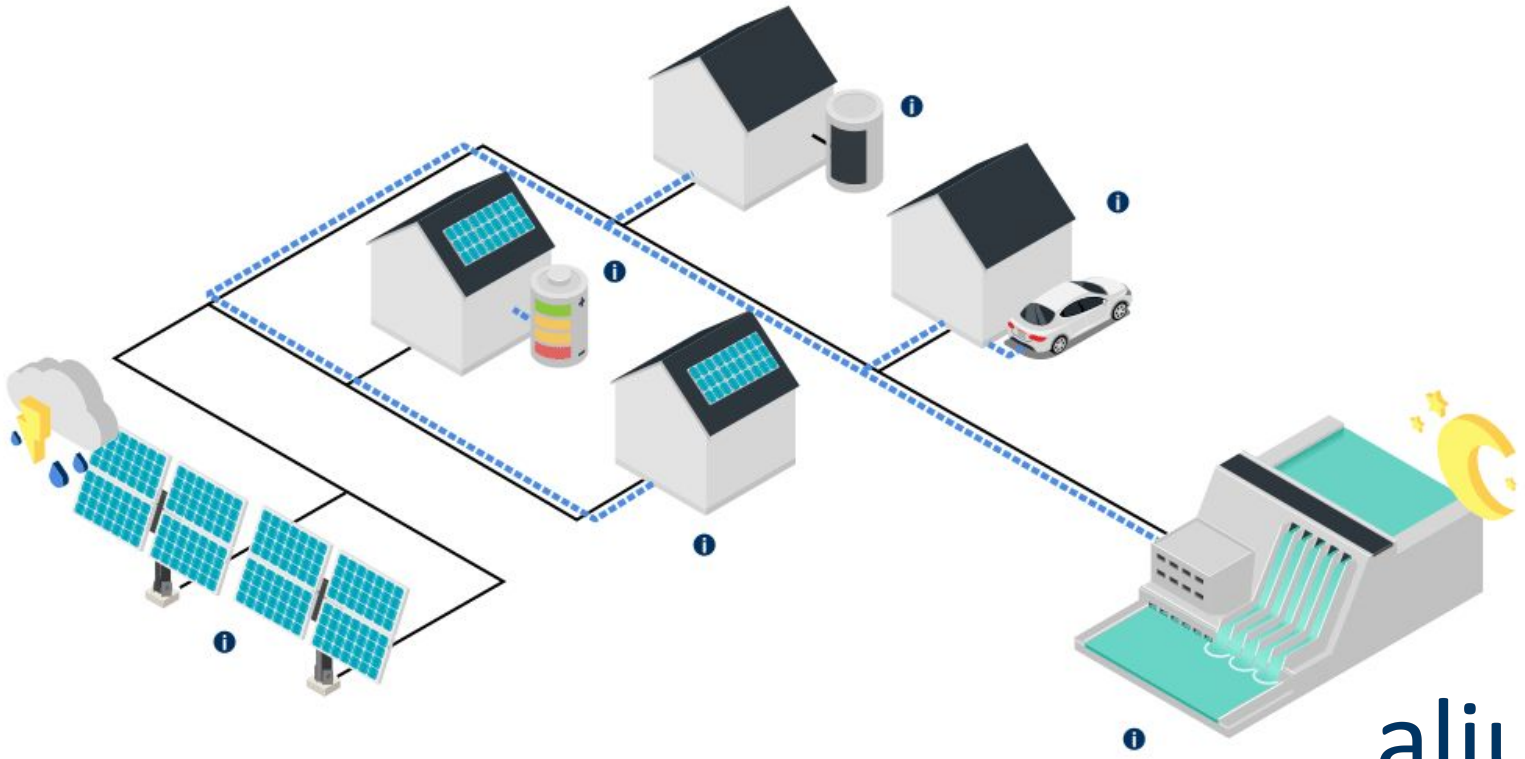


In aliunid, we build an energy system that breathes. It inhales when the sun shines…



aliunid

…and exhales when there is little renewable energy in the system.



aliunid

Join our Team! We have three vacancies.
www.aliunid.com



Many thanks! Stay in touch

Till Richter, Head Data
till.richter@aliunid.com

aliunid AG
Bleichemattstrasse 31
5001 Aarau

Follow us on



2 Local Sustainability Booster

3 Vertical Farming

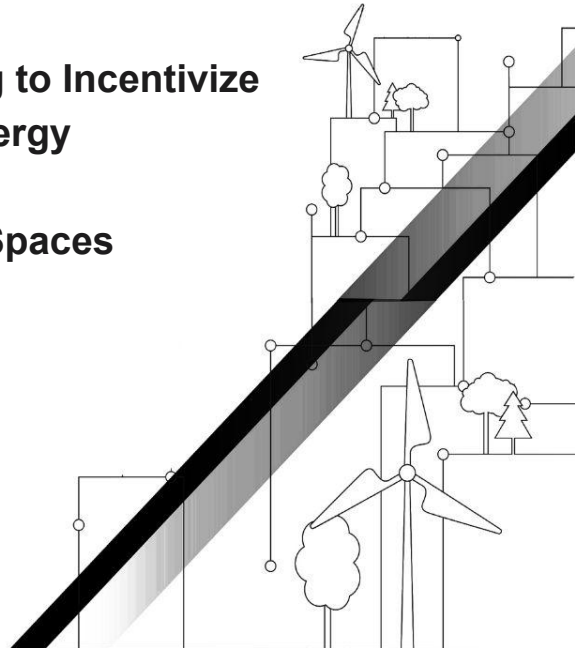
4 NEST Building Modelisation

6 Heat-spots in Bern

7 DLT for the energy transition

8 Load-shifting to Incentivize Renewable Energy

9 Cool Urban Spaces



Project Nr 2

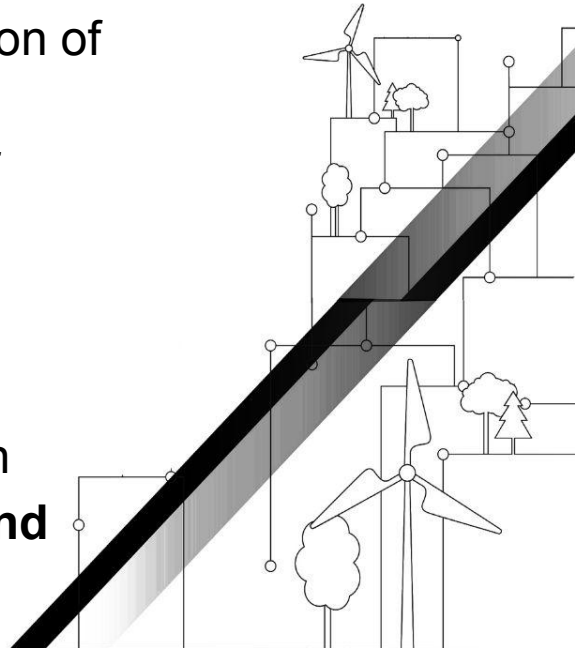
Local sustainability booster



Team: Dylan Johnson, Oliver Paul, Lucas Tochtermann

The Challenge

- In order to achieve the goals for the swiss energy strategy we must **increase sustainable energy production and consumption**
- There are metrics for the current status of the expansion of PV, renewable heating and e-mobility
- We want to find out **which are the key influencers** of these sustainable indicators at municipality level



The Idea

- If the group can identify important factors leading to an increase of these sustainable indicators, **resources and funds can be allocated in an efficient way**

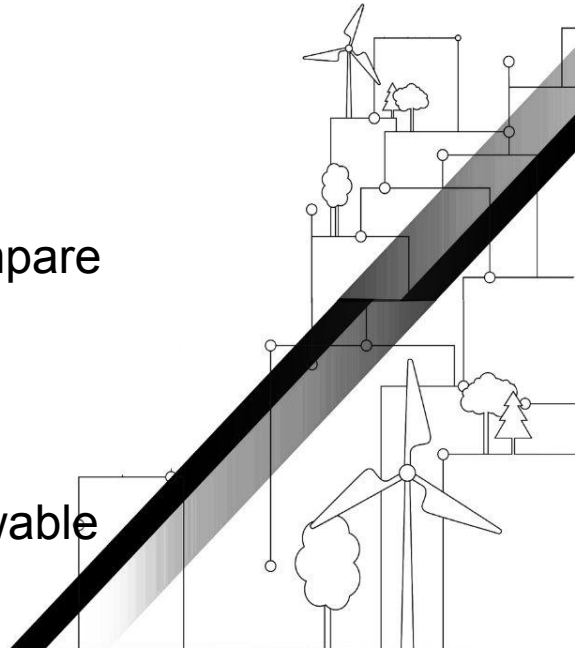
What we did

- Gather data (socio-demographic, weather, topographic, infrastructure, political and electricity-costs)

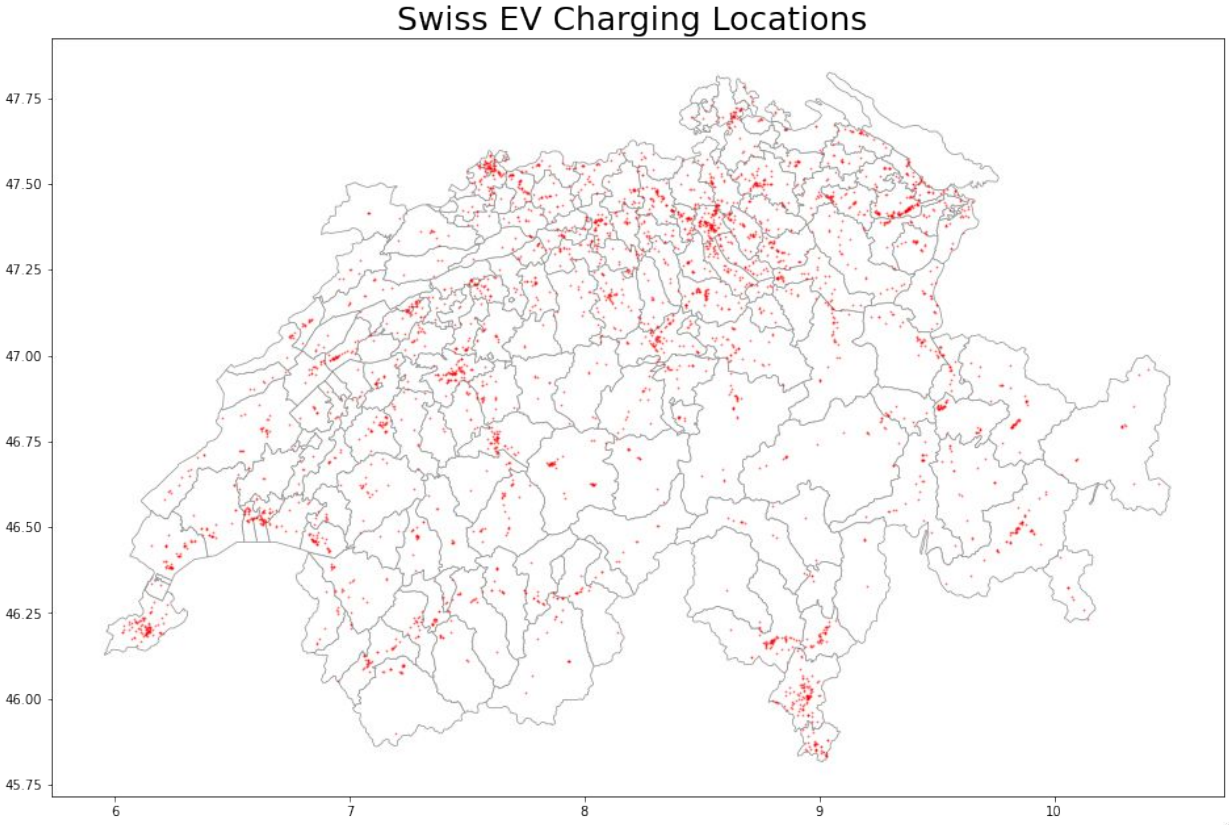
- Visualize correlations, spatial data and do feature engineering

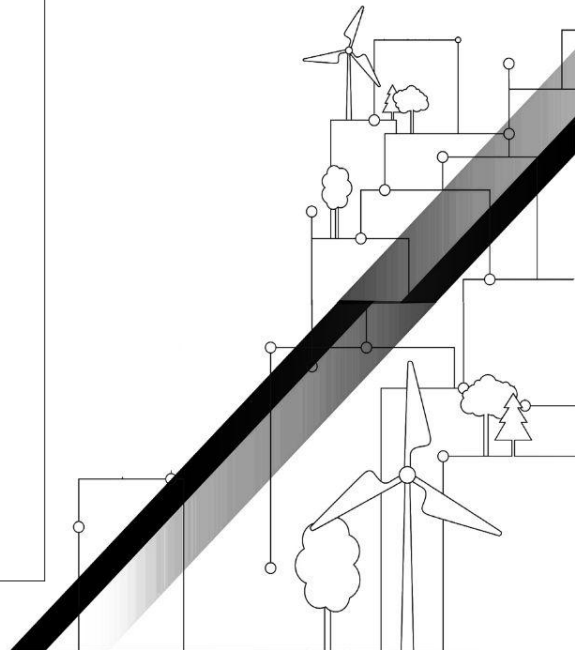
- Run statistical and Machine Learning models and compare the results

- The idea! Find a function x -> y which describes the relationship between demographic features and renewable behaviours

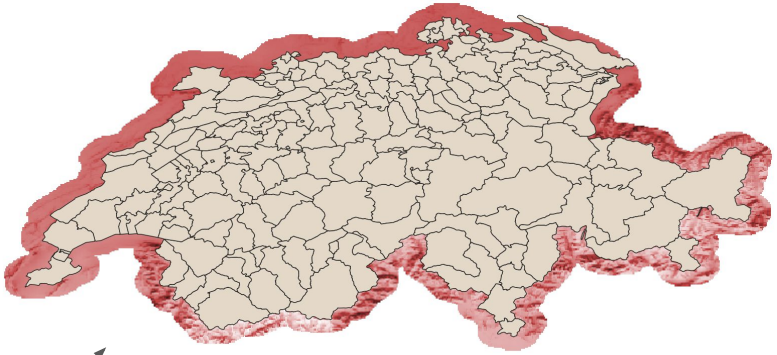


Visualizations





Visualizations





Extracting spatial image data and merging with district and municipality data



Significance testing linear models

EV share

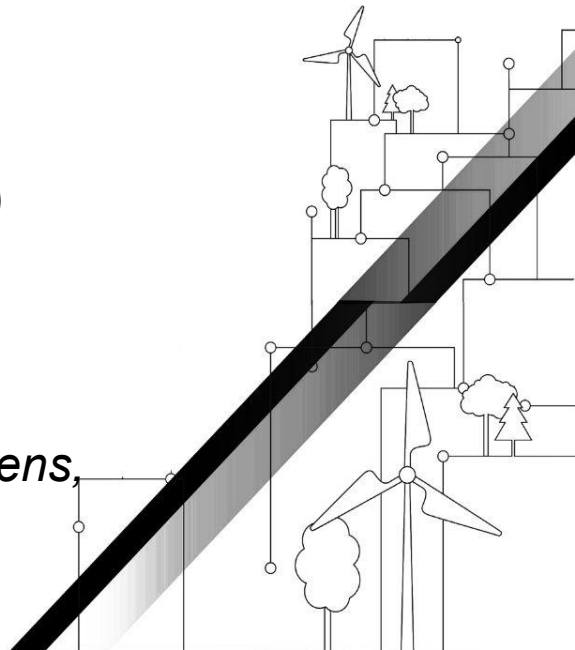
- *Income (+), electricity tariff (-), pop density (+) with older populations (40-64 +), carbon taxes (+)*

PV share

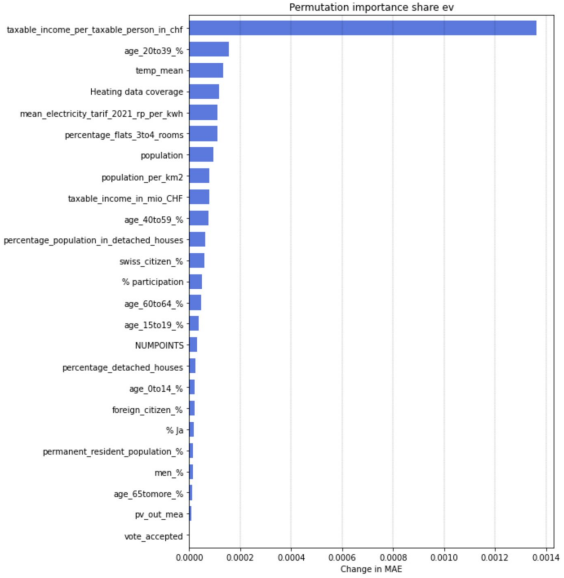
- *Larger homes (+), Swiss citizens (+), young (+), old (-) adult populations, temperature (+), carbon taxes (-)*

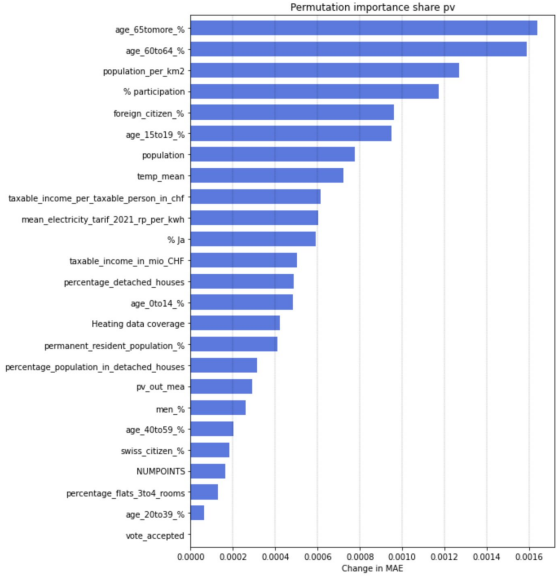
Renewable heating

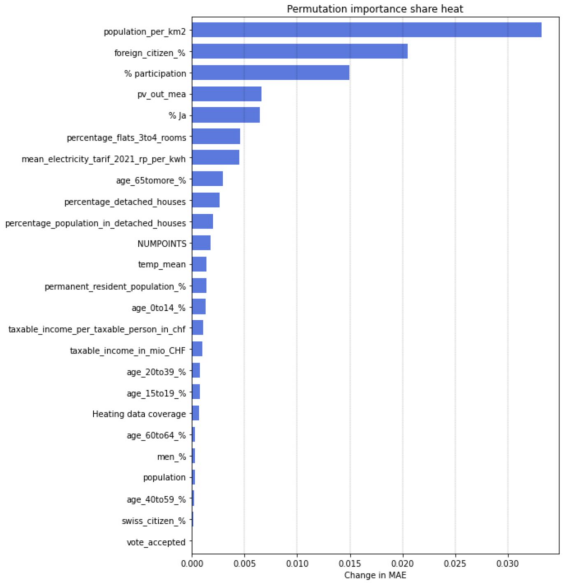
- *Pop density (-), income (-), temperature (-), swiss citizens, (+), young adults (-), child populations (+)*

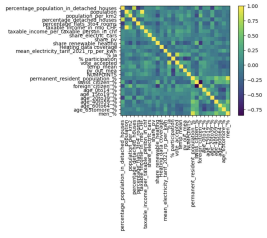


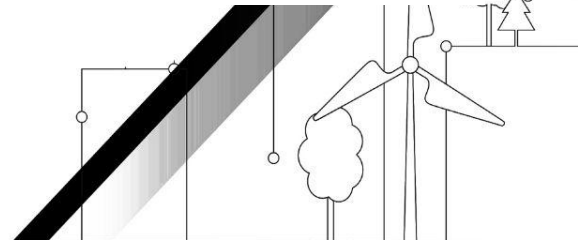
Feature importance XGboost models











While we cannot extract meaningful weights like in linear modelling, we are able to extract feature importance for a far more powerful model

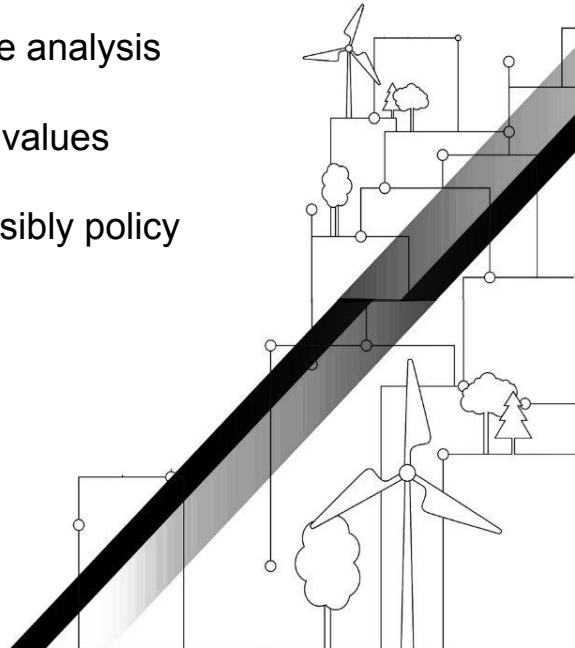
Game theory application using SHAP values 2

By using a game theory approach we can compute the interactions between features, and their effect on the target variables.

The overall importance of these values aligned with the feature importance analysis

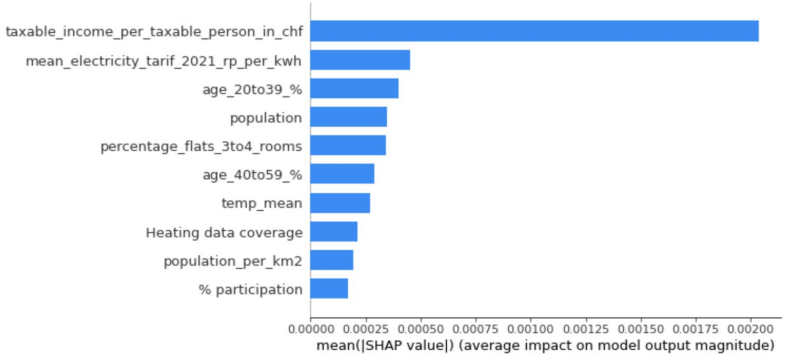
Here we can identify how the model will behave based on varying feature values

This approach allows us to generate artificial data to test scenarios or possibly policy interventions

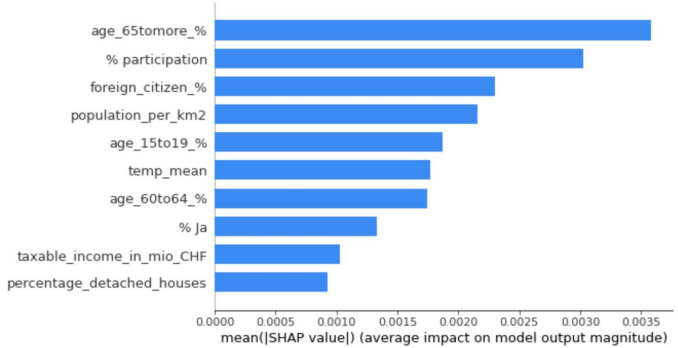


Game theory application using SHAP values 2

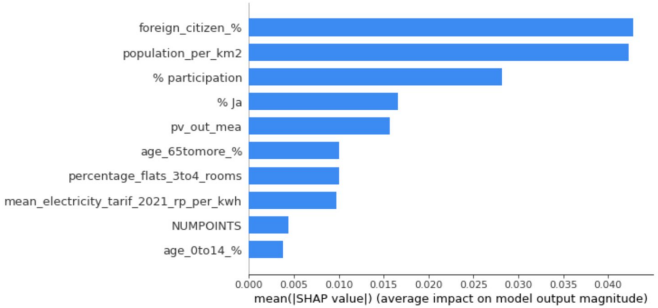
EV penetration

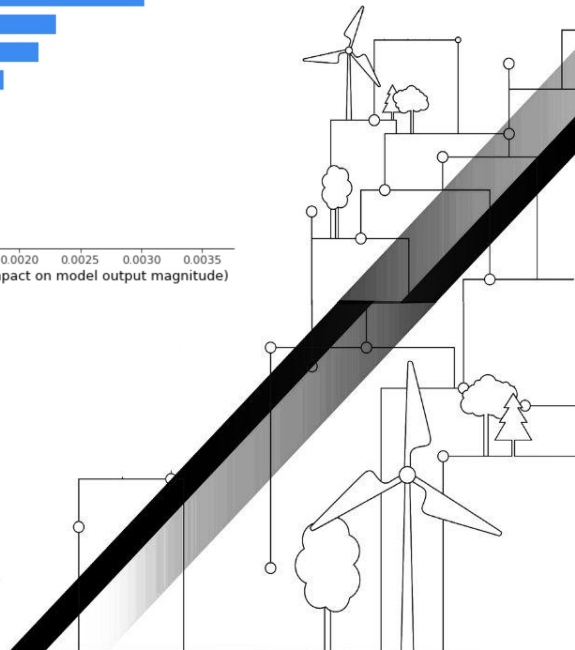


PV penetration



Renewable heating



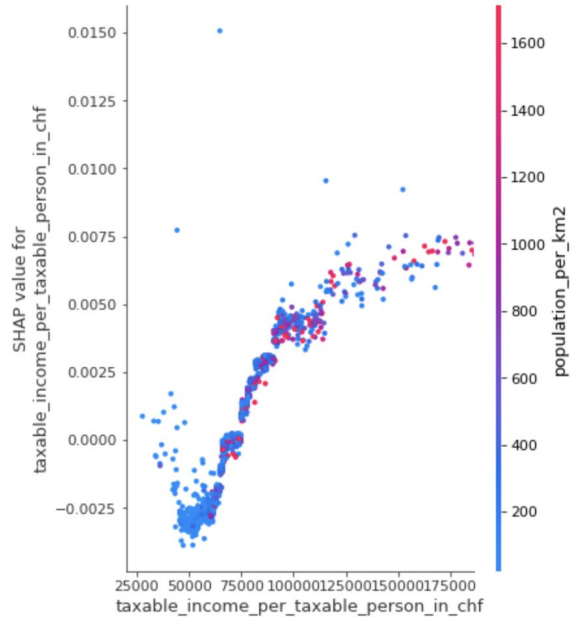


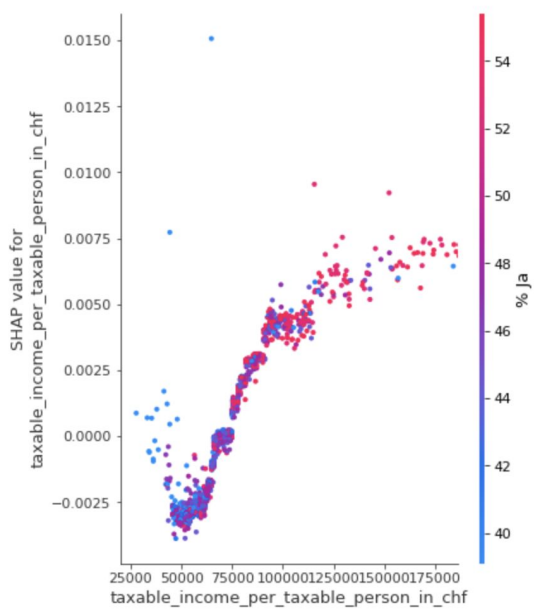
Game theory application using SHAP values 2

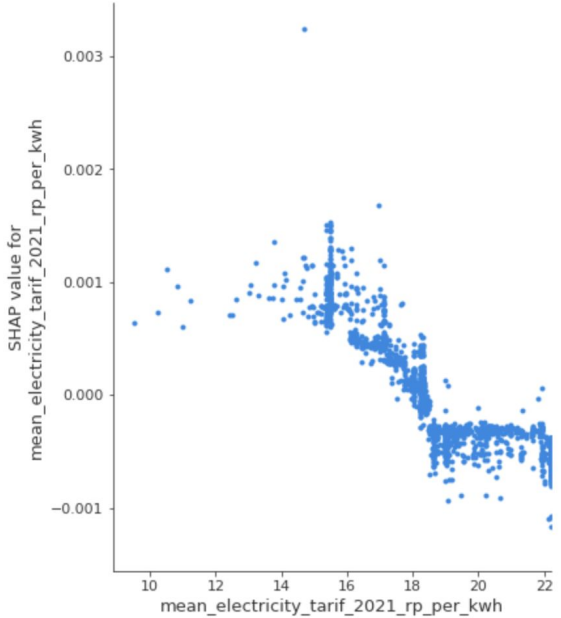
How do changes in feature values impact the models predictions? Could this be used to test new interventions? - For EV penetration

Model prediction higher value

Model prediction lower value







Game theory application using SHAP values 2

What impacts the models distribution at a single municipality level?

Dardagny, Geneva

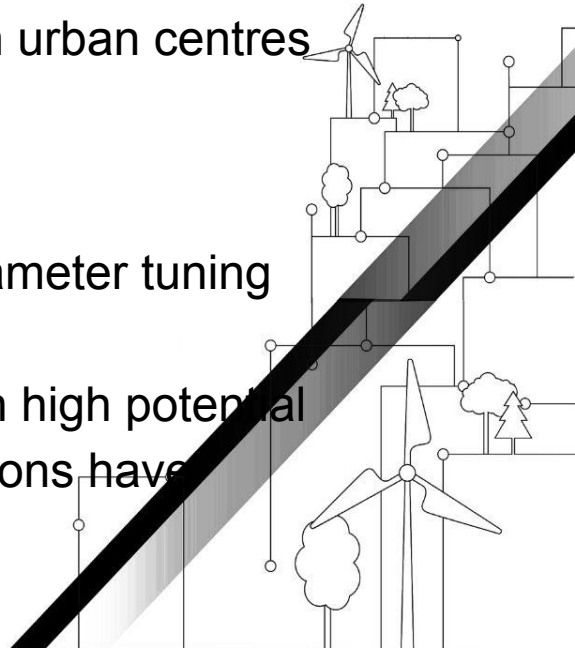


First insights / policy recommendations 2

- Electric Vehicles: Lower electricity tariffs significantly increased uptake. Targeted charging grants at MP level.
- Solar PV: Target information campaigns on older populations
- Renewable Heating: Make efforts to provide options in urban centres

Next steps

- Improve model with more relevant data and hyperparameter tuning
- Build a pipeline using future updated data
- Identify and communicate results to municipalities with high potential
- Add temporal data to understand how policy interventions have impacted behaviour in the past



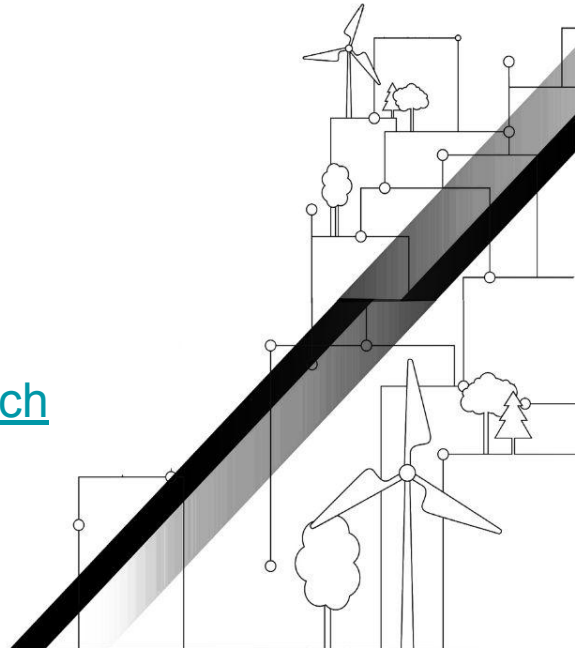
Questions ?

Team

Dylan Johnson dylan@turkjohnson.com

Oliver Paul oliverjpaul@gmail.com

Lucas Tochtermann lucas.tochtermann@bfe.admin.ch



Project Nr 3

3

Vertical Farming



Team: Melanie Mathys, Daniela Ovalles, Sven Brieden & Ben Strachan

The Challenge

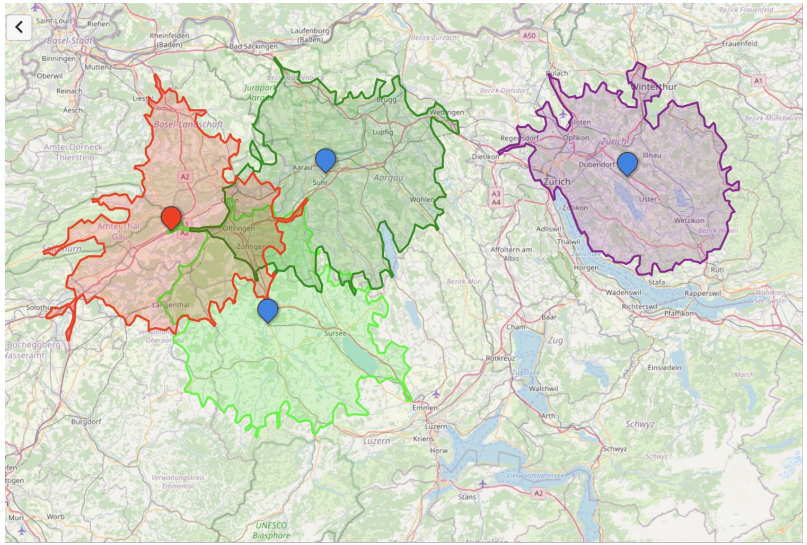
- Identify (and illustrate) ideal locations for vertical farms.

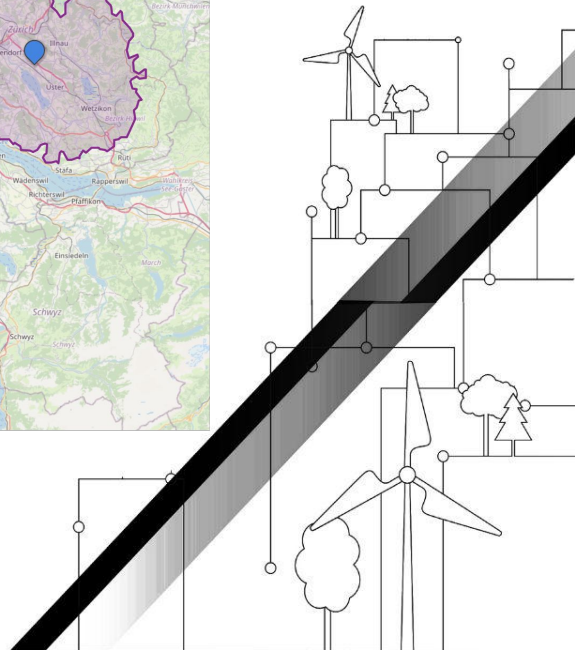
The Idea

1. Identify relevant factors
2. Look for data
3. Concept:

   Interactive Map

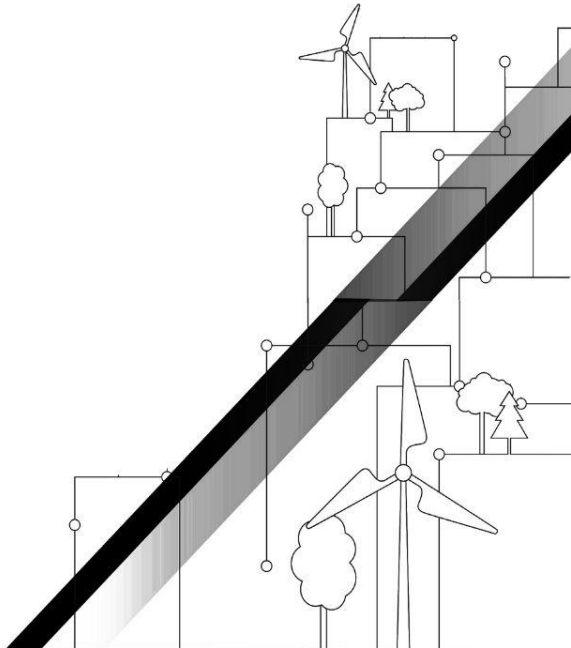
4. Implement



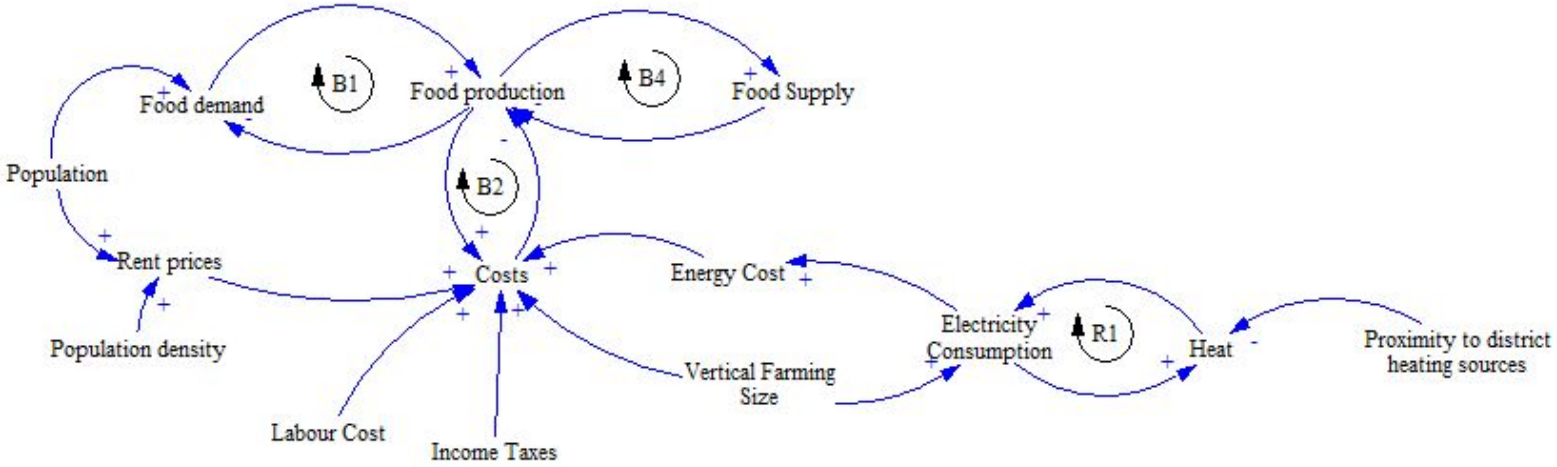


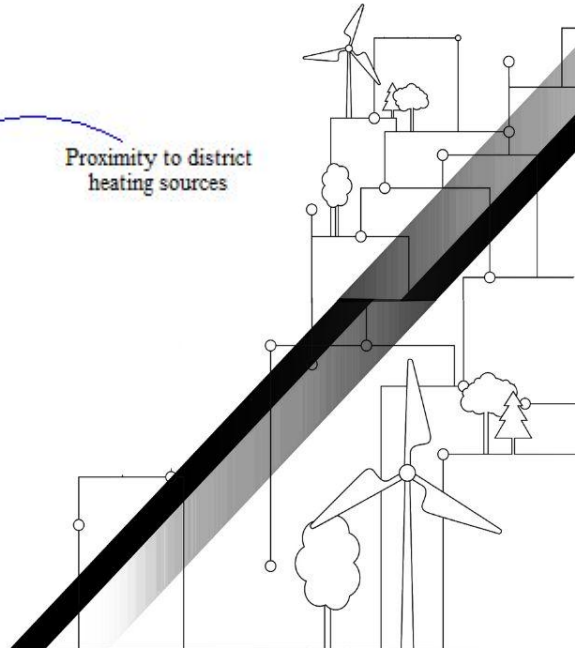
Data/Resources

Proximity to distribution centers	
Rent cost	
Proximity to regenerative power plants	
Solar Energy Potential	
Labour cost	
Income Taxes	
Proximity to district heating sources	



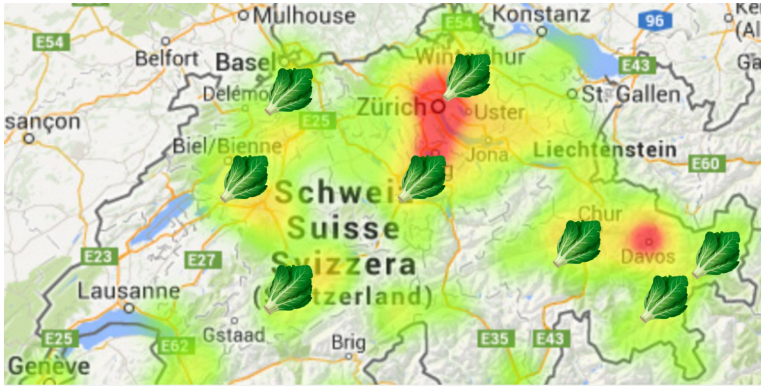
Factor interdependencies …

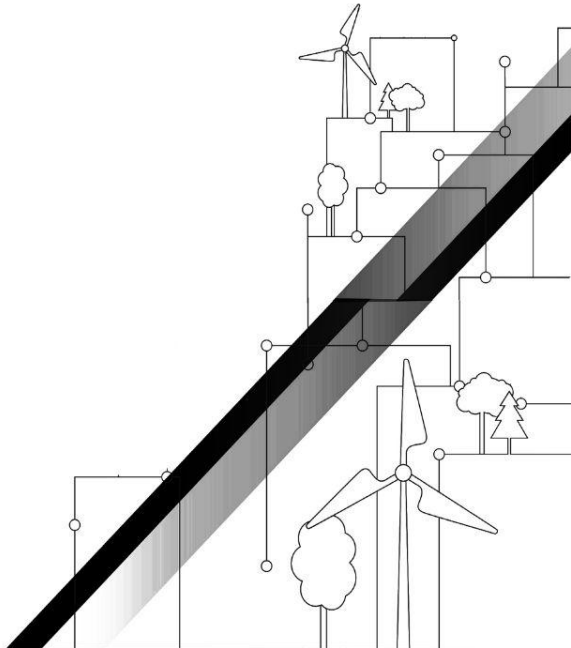




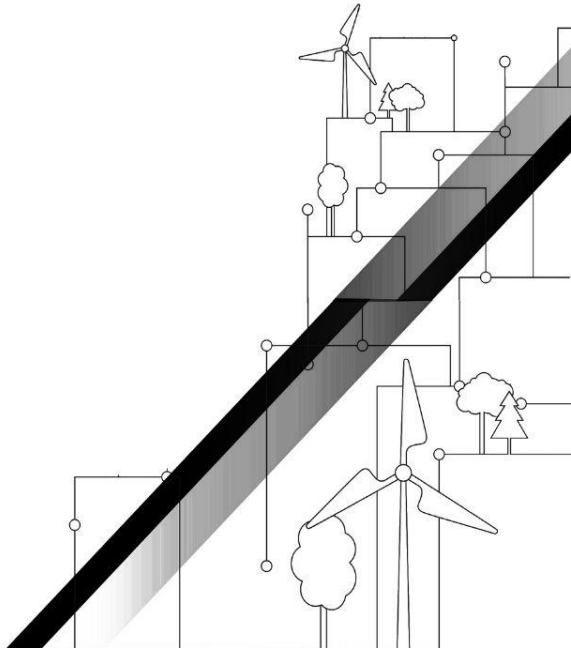
Next steps:

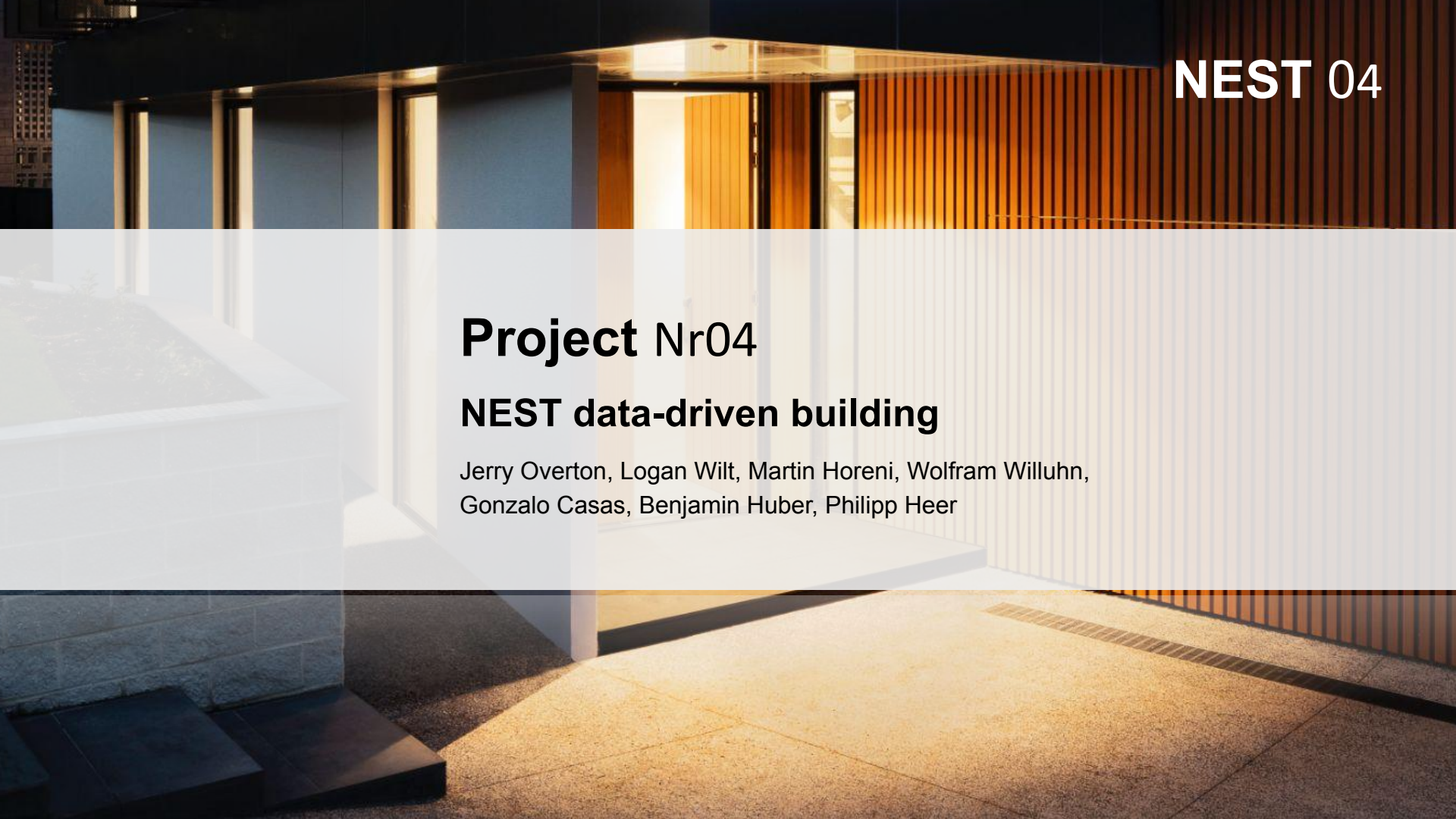
- Complete and clean data
- Look at the challenge as an optimization problem!
- Make an interactive prototype





Questions & Answers!





Project Nr04

NEST data-driven building

Jerry Overton, Logan Wilt, Martin Horeni, Wolfram Willuhn,
Gonzalo Casas, Benjamin Huber, Philipp Heer

The Challenge

Manage buildings in ways that are more
sustainable and energy efficient

The Idea

Train a machine-learning algorithm to
maintain a target temperature



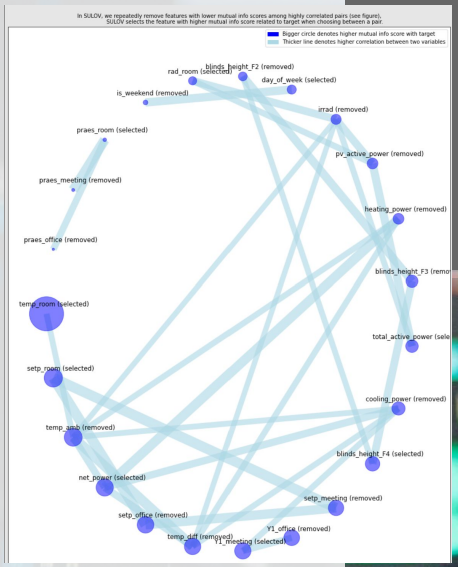
NEST 04

What we did

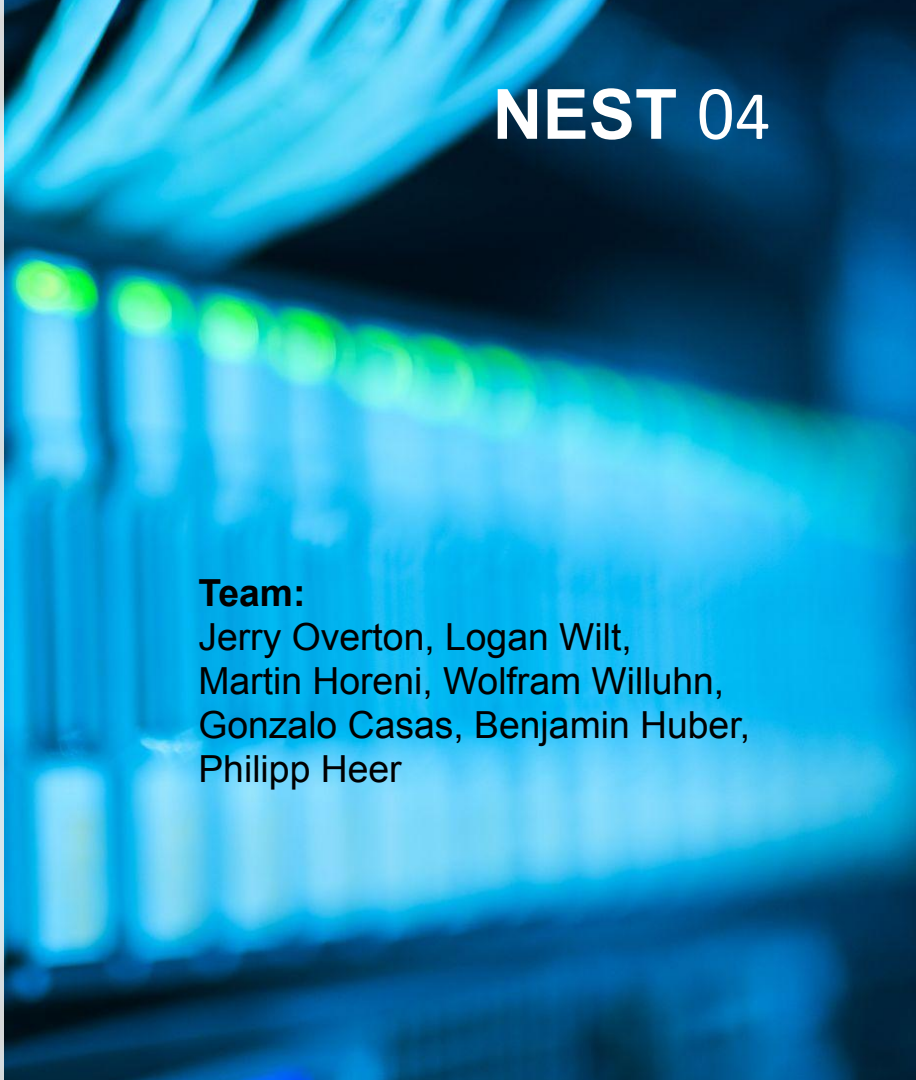
Used genetic programming to automatically
explore thousands of models

The prototype

Best pipeline: XGBRegressor
11 Optimal Features Found



Our results suggest automating the adjustment of windows blinds and power settings to help maintain a target temperature



NEST 04

Resources/Data

NEST Open Building Data

Google Collab

Next Steps

Run with larger data sets

Explore new features

Team:
Jerry Overton, Logan Wilt,
Martin Horeni, Wolfram Willuhn,
Gonzalo Casas, Benjamin Huber,
Philipp Heer

Project Nr 6

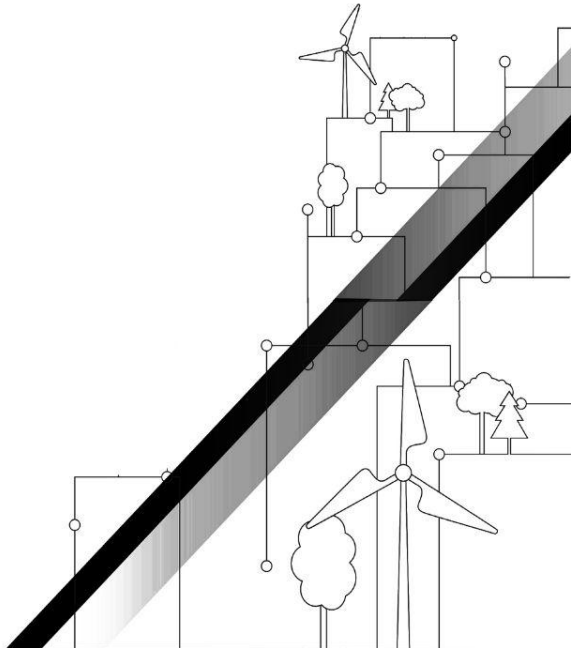
6

Wärmcity Bärn

hack.opendata.ch/project/762

Slack: **#06_heat-spots-in-bern**
GitHub: https://github.com/matthme/heat-spots-berne

Team: Moritz, Izzi, Matthias, Oleg



Challenge: #MakeOurDaytimeDataGreatAgain

Develop a transfer function ... to correct for the estimated radiative bias of each station of the monitoring network.





Resources / Data

- ✓ Raw temperature data of all stations of the monitoring network
- ✓ Meteorological parameters measured at the three reference stations
- ✓ Publications - Burger, M., Gubler, M., Heinimann, A. and Brönnimann, S. (2021)

TBD:

- Land-cover data
- Building geometry data



In [66]:
```
from ipyleaflet import Map, Heatmap
from random import uniform
import time
```

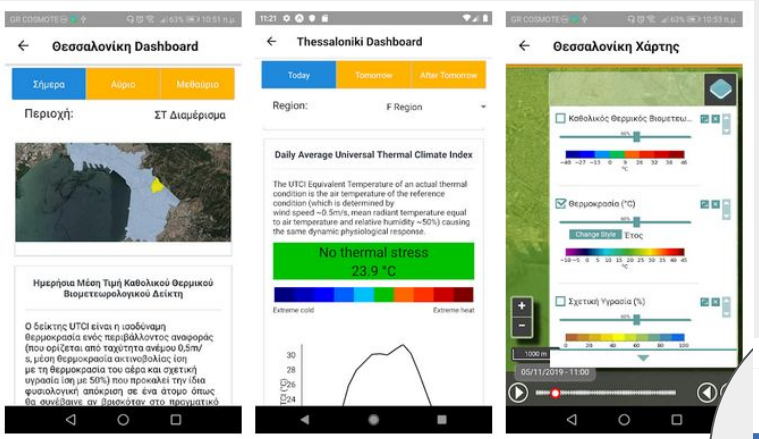
In [67]:
```
import pandas as pd
```

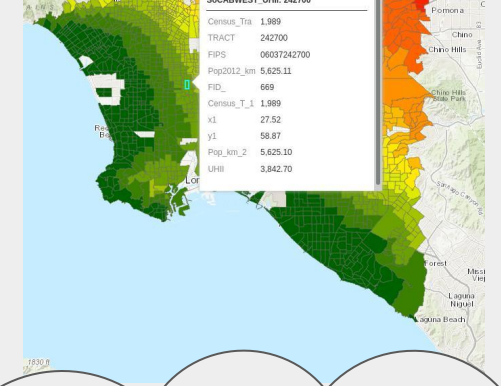
In [68]:
```
df = pd.read_csv("data/data_harmonized_1.csv")
df.head()
```

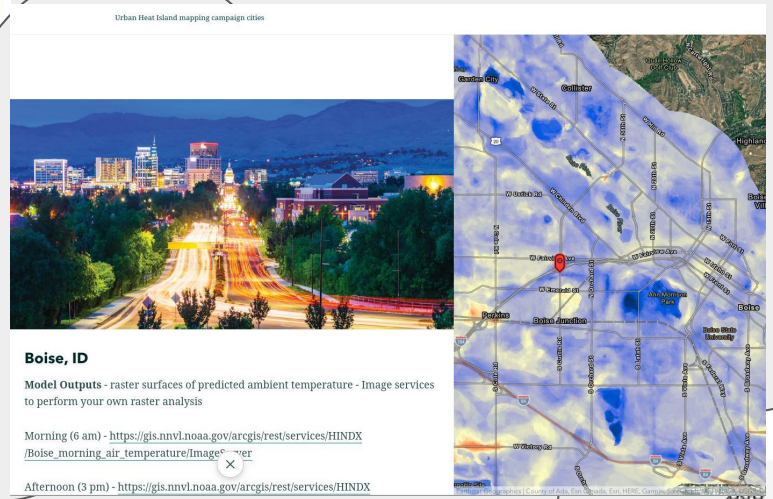
Out[68]:

	time (UTC)	1	2	4	6	9	10	12	13	15	...	46	54	56	57	
0	2018-07-30 04:00:00+00:00	18.140	16.141	16.427	15.760	17.475	17.855	17.284	16.332	18.331	...	18.426	16.808	17.284	15.664	17.
1	2018-07-30 04:10:00+00:00	18.140	16.046	16.237	15.664	17.379	17.665	17.189	16.237	18.236	...	18.236	16.523	17.094	15.664	17.
2	2018-07-30 04:20:00+00:00	18.140	16.046	16.141	15.473	17.379	17.570	17.284	16.141	18.140	...	18.236	16.523	16.999	15.569	17.
3	2018-07-30 04:30:00+00:00	18.045	16.046	16.237	15.378	17.284	17.570	17.379	16.046	18.140	...	18.236	16.903	16.808	15.569	17.
4	2018-07-30 04:40:00+00:00	17.379	16.237	16.141	15.378	17.284	17.760	17.189	16.046	17.855	...	18.331	17.284	16.808	15.569	17.

5 rows × 78 columns





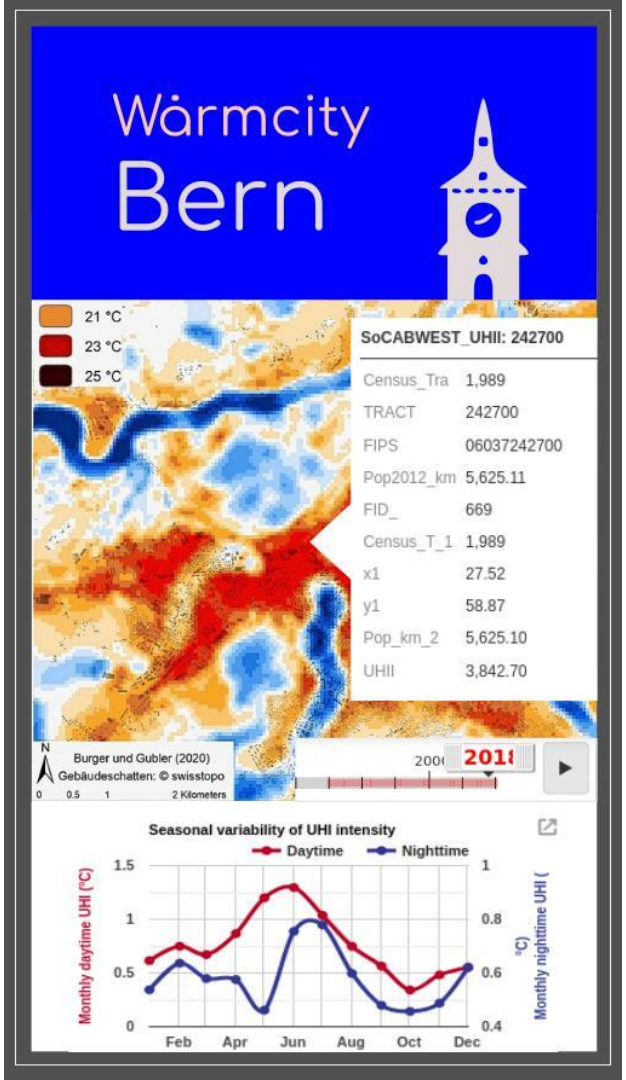


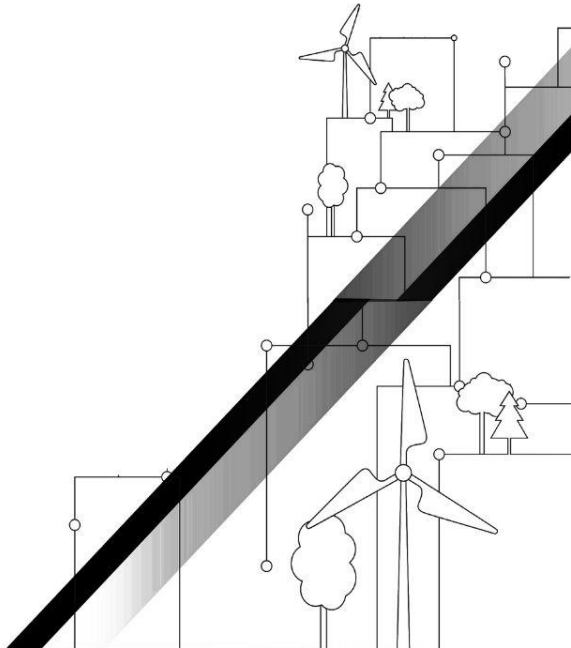
	04:0		6.141	16.	
1	2018-07-30 04:10:00+00:00	18.140	16.046	16.	
2	2018-07-30 04:20:00+00:00	18.140	16.046	16.141	17.
3	2018-07-30 04:30:00+00:00	18.045	16.046	16.23	15.569 17.
4	2018-07-30 04:40:00+00:00	17.379	16.237	16.141	15.569 17.

5 rows × 78 columns


20:10
0 kb/s
0 kb/s
1.58K s
Unknown
6
PM density µg/m³
10.0
0.0
20:08:00
20:08:20
20:08:40
20:09:00
20:09:20
20:09:40
20:10:00
Time
PM 1
PM 2.5
PM 4
PM 10
PM 1
PM 2.5
2
Temperature
(C°)
20.70
Pressure
(hPa)
95179.70
Humidity
(%)
43.70
PM 4
PM 10
2
Locations of Interest
+
Liebefeld Park
PM 1
PM 2.5
PM 4
PM 10
Temperature
(C°)
Pressure
(hPa)
Humidity
(%)
Schweizerhof
PM 1
PM 2.5
Data


UNDER
CONSTRUCTION


Wärmcity
Bern
21 °C
23 °C
25 °C
SoCABWEST_UHII: 242700
Census_Tra 1,989
TRACT 242700
FIPS 06037242700
Pop2012_km 5,625.11
FID_ 669
Census_T_1 1,989
x1 27.52
y1 58.87
Pop_km_2 5,625.10
UHII 3,842.70
Burger und Gubler (2020)
Gebäudeschatten: © swisstopo
0 0.5 1 2 Kilometers
2011
Seasonal variability of UHI intensity
Daytime
Nighttime
Monthly daytime UHI (°C)
Monthly nighttime UHI (°C)
1.5
1
0.5
0
0.8
0.6
0.4
Feb
Apr
Jun
Aug
Oct
Dec



Project Nr 7

DLT 4 financing the energy transition

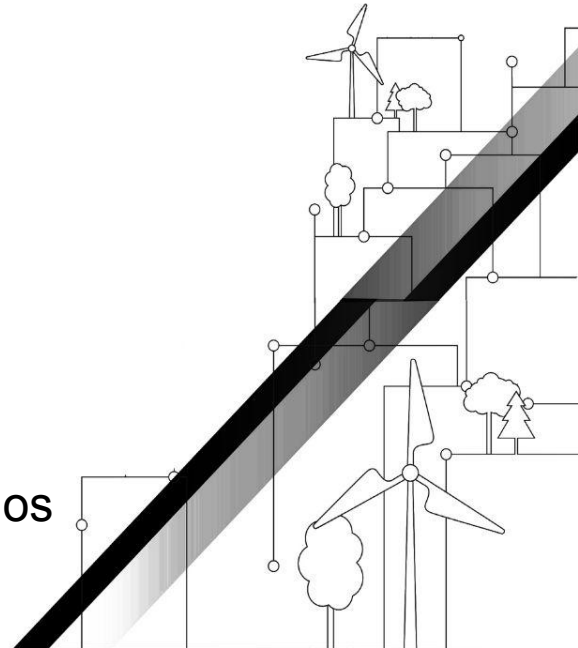


Supported by

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Bundesamt für Energie BFE
Swiss Federal Office of Energy SFOE

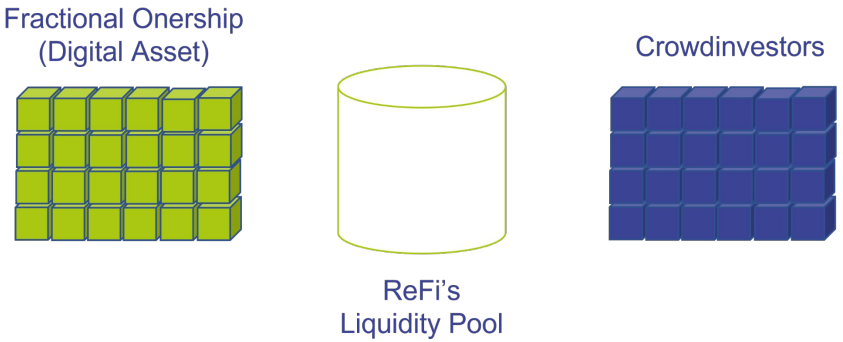
Team: Sabine, Phoebe, Lorenz, Marcel, Saeed, Vasileios



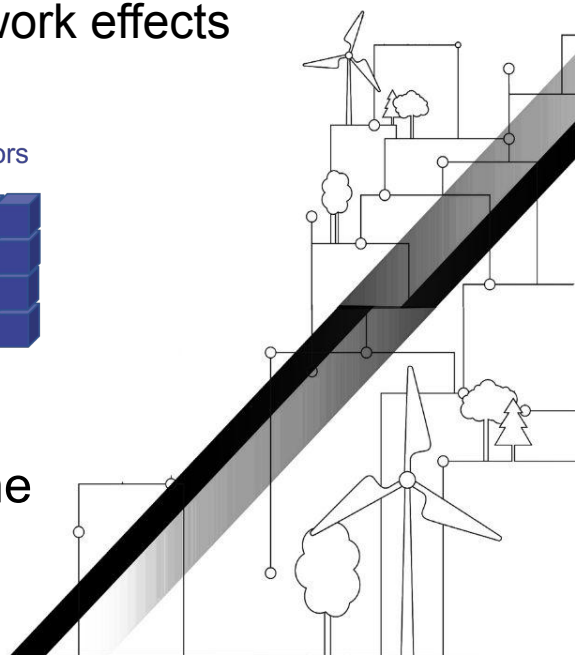
The Challenge

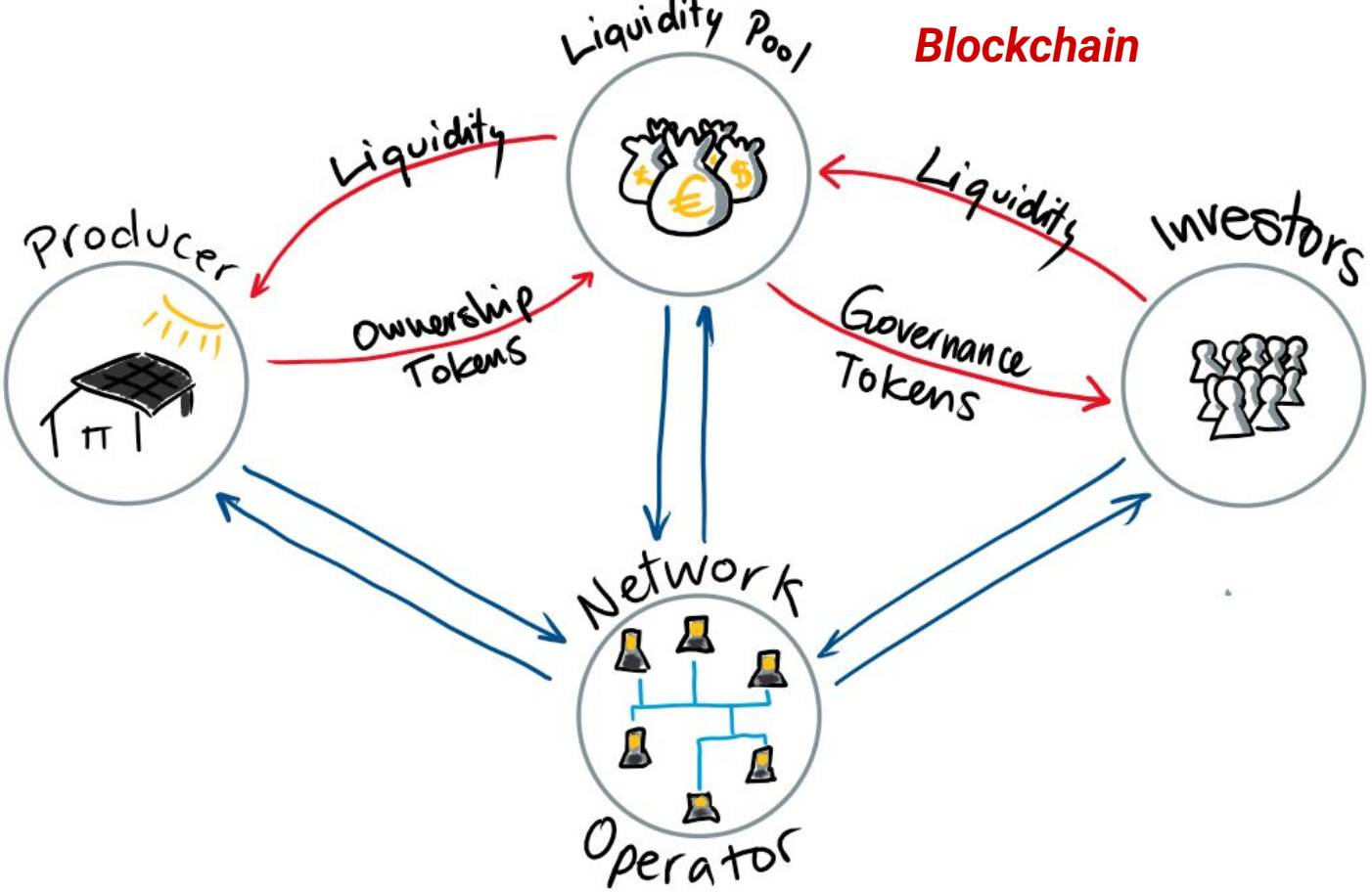
- Design an incentive model for all platform participants
- Design the transition from a central to a fully decentralised platform
- Create a strategy how the platform could achieve network effects

The Idea



Create a blockchain network and platform to facilitate the financing of small and mid sized PV installations




Liquidity Pool
Liquidity
Liquidity
Producer
Investors
Ownership Tokens
Governance Tokens
Network
Operator

Incentives

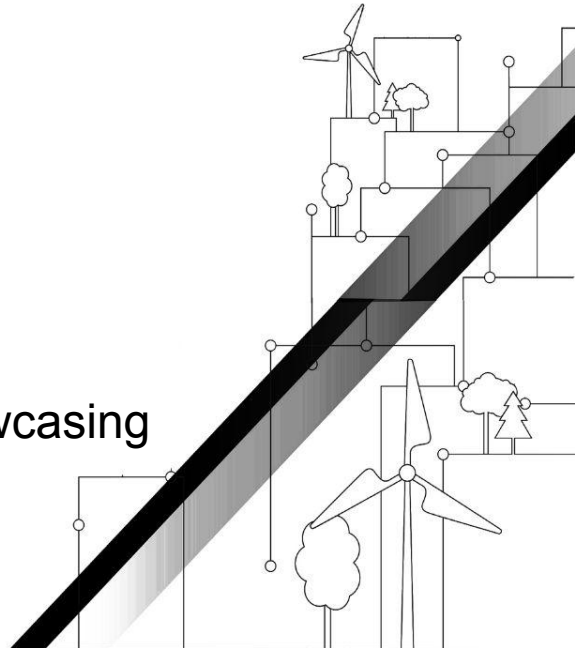
- Micro-Financing and Lending
- Socializing risks and creating governance
- Create a Certificate System for Green Energy Investment

Transition ideas

- Start with local communities (in Switzerland)
- Kickoff event

Ideas on creating network effects

- Adding a social component to this:
  forum for exchanging questions and also a website showcasing progress



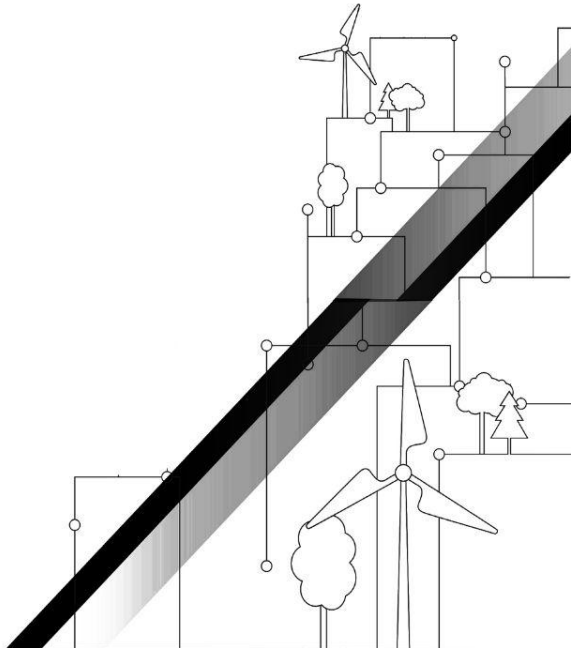
Project Nr 9

9

Cool urban spaces

Cool city

Team: Stefan Keller, Felix Reiniger, Lucas Buchli, Fabio Zahner, Remo Steiner, Jurek Müller

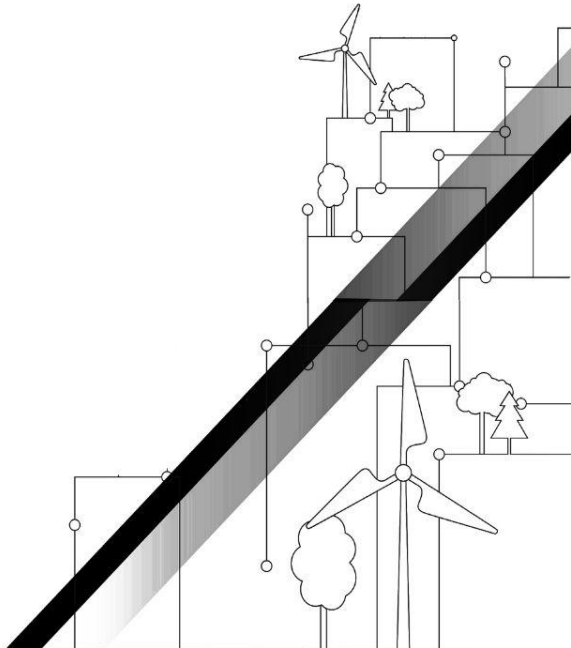


The Challenge

- Collect **citizen suggestions** to **cool down open spaces** in the neighborhood (also community sugg.)
- Bring the **ideas to the attention of owners**/responsible authorities
- Facilitate the **realization of popular suggestions**

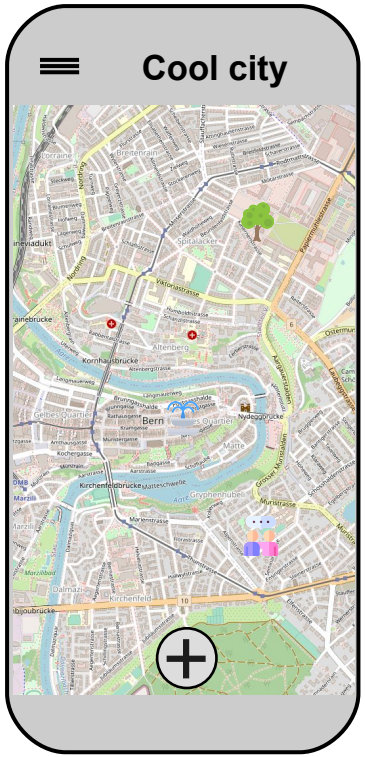
The Idea

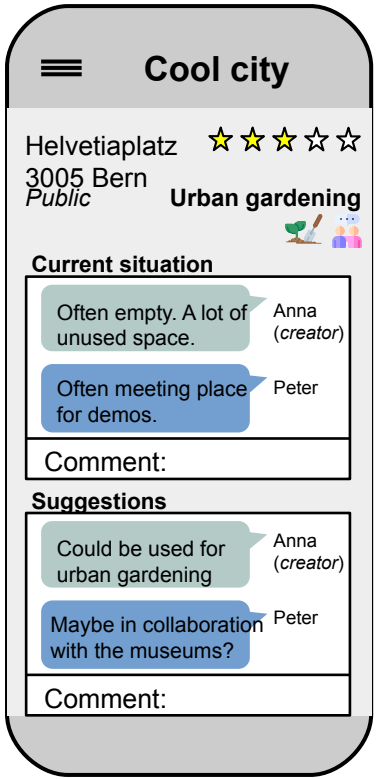
- **Map based** mobile/web application
- Suggestions can be **rated and further developed by the community**
- **Working groups** can be started in the App
- **Contact to land owners** can be facilitated via a **land register API** query

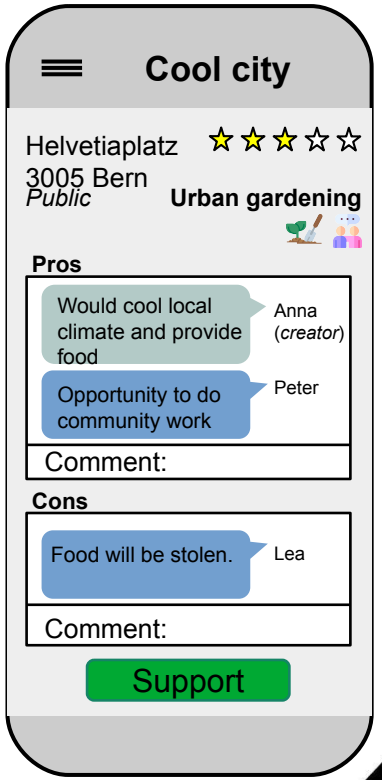


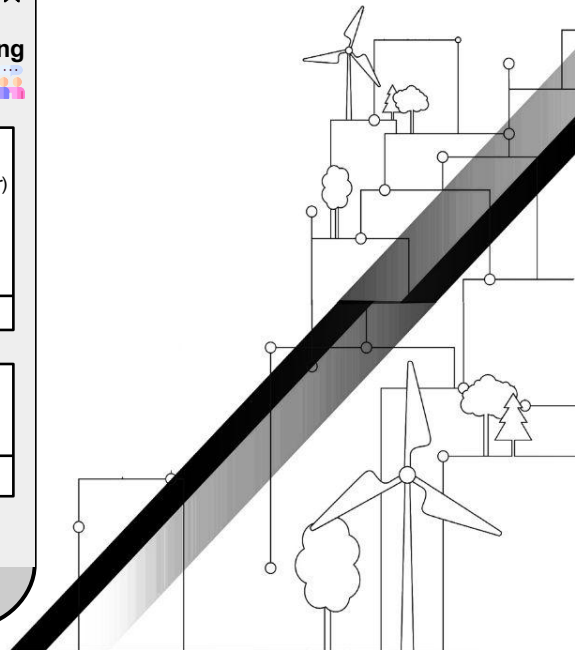
What we did

- Created a **mockup**









Resources / Data

- Frontend with **flutter**
- Backend with **python**
- **API** to the land register (only limited information)

Next steps

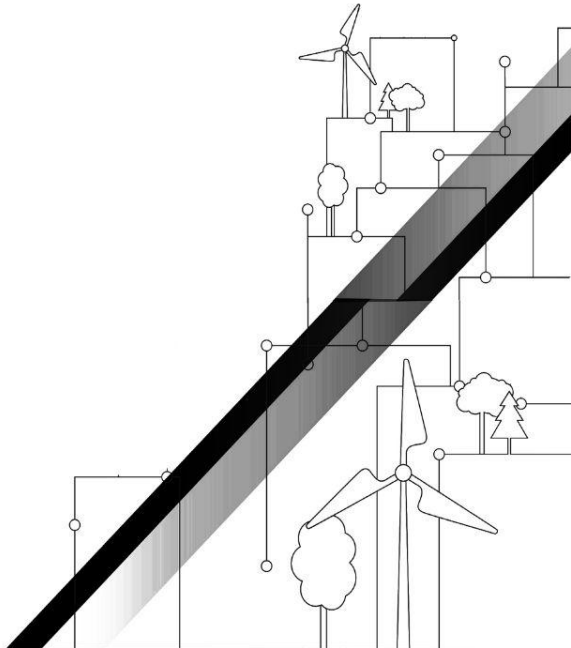
- **Prototype**: Supporter chat, User management
- **Query land register API** for cantons where the API exists
- **Potentially negotiate with cantons** about building land register API

Team: Stefan Keller, Felix Reiniger, Lucas Buchli, Fabio Zhaner, Remo Steiner, Jurek Müller



What we did

- Created a **mockup**
- Tried to get to **land owner information via API** -> Information only about responsible land register office.
- Created a **prototype** with the core functions.



2 Local Sustainability Booster

3 Vertical Farming

4 NEST Building Modelisation

6 Heat-spots in Bern

7 DLT for the energy transition

8 Load-shifting to Incentivize Renewable Energy

9 Cool Urban Spaces

