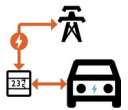


V2G Liberty: The open stack that could

How we enable EV owners to be ahead of the industry, with open source software.



Who we are

**Seita** Energy Flexibility



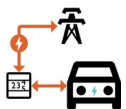
Smart backend for energy flexibility apps.



POSITIVE  **DESIGN**



UX- & Service Design
for a positive impact.

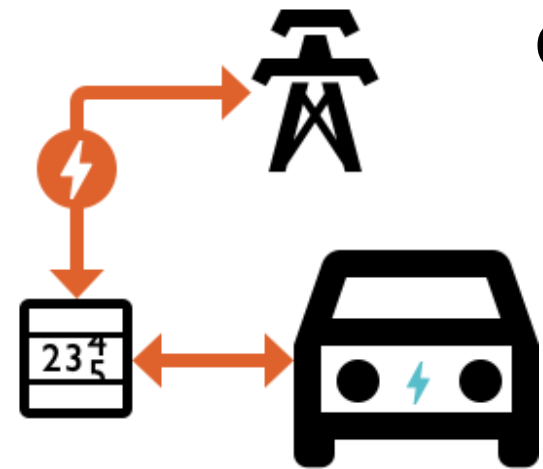


DLFENERGY
FlexMeasures

Vehicle-to-Grid: What and why?

EVs which can send power back to the grid.

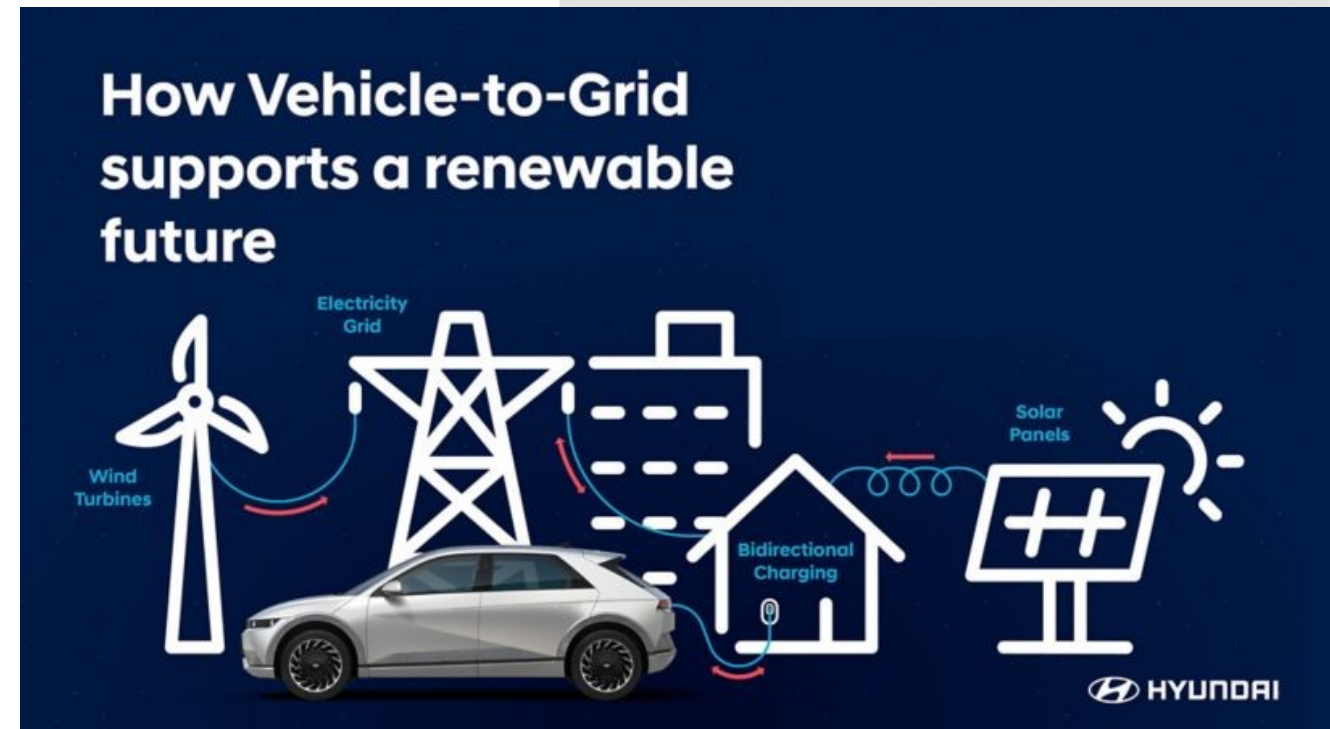
- Support the grid
- Use your own solar energy
- Lower your energy bill
(buy low, sell high)



EPEX day-ahead price spreads within a day have grown 300% Between 2019 and 2021. (Source: Vattenfall Markt Expertise Desk)

Where is it? Do we want it?

There are big plans, but industry is taking their time to build integrated (and possibly siloed solutions).



The V2G Liberty project

Kickoff: Fall 2021 in Utrecht

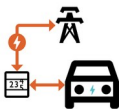
Now: 1 year of data, 5 new locations

Why?

- Didn't want to wait for industry
- Showcase open source stack
- Challenge ourselves

What will I show today?

- Stack
- Design
- Some outlooks



What do we need? (what is available?)

*EV with CHAdeMO
(Nissan Leaf)*



*V2G-capable charger
(Wallbox Quasar —
talks modbus, not yet
OCPP)*



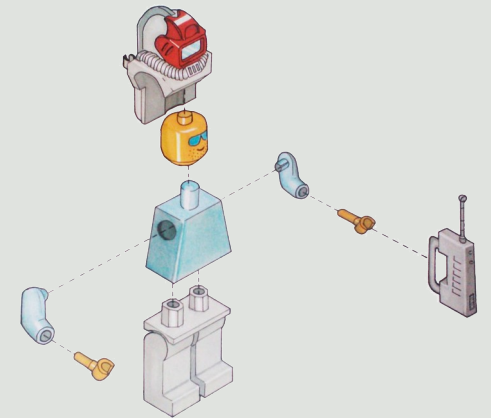
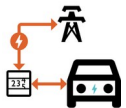
*Local computer
(Raspberry PI)*



*Ideally, an
energy
contract with
dynamic tariffs*



*... or even
solar panels*



The software (HEMS)

V2G Liberty



Car calendar

Charge Now!
(optional)



Car actuals



User pref +
Car actuals



Dis- / charge
Schedule

Start/stop
(dis-)charge

Public data

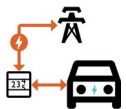


LIVING
LAB

Home assistant



- Software for home automation
- Free & open-source
- Cheap hardware
- Local control → privacy
- Web-based user interface
(+ apps for Android and iOS)



Among many others these companies provide add-ons for Home-assistant:



amazon alexa



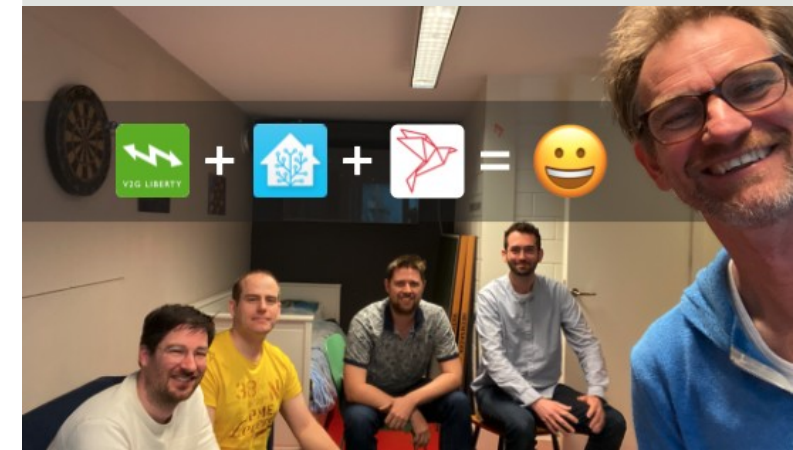
Google Assistant



Apple Homekit



SONOS



FlexMeasures

FM's goal is to answer this question: "What are the best times to run flexible assets, like batteries, heat pumps or industry processes?"

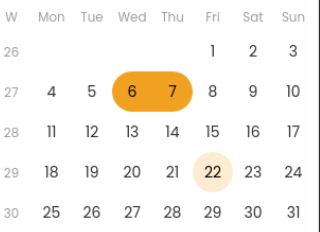
A platform for automating energy optimization throughout the day, to save CO₂ and costs.

- Python
- Developer-friendly (e.g. plugins, good docs, API, CLI, ...)
- E-mobility, industry, built environment

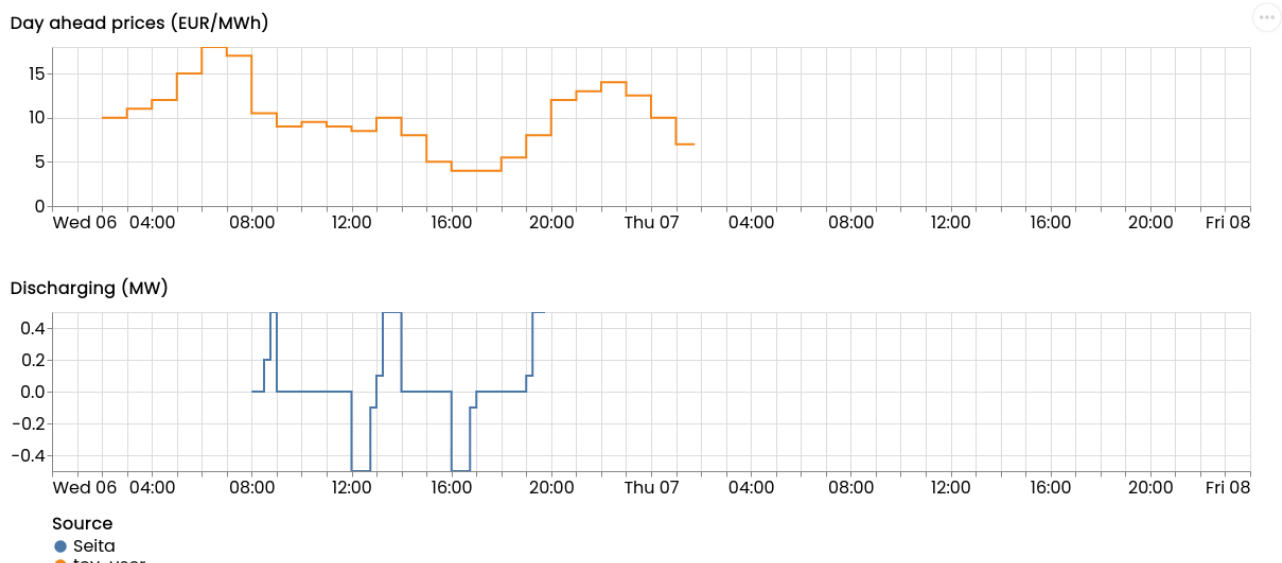


Create new asset Delete this asset

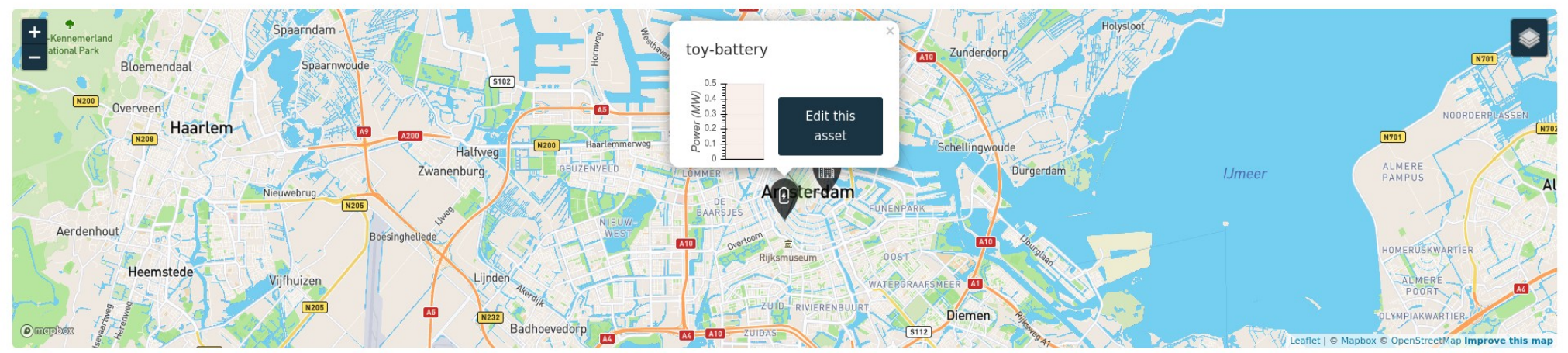
July 2022



Today Last 7 days This month



Status of my assets:



| Renewables | Solar | Batteries | Buildings | Temperatures | Wind_speeds | Radiations | Weather stations |
|------------|-------|-----------|-----------|--------------|-------------|------------|------------------|
| | | | | | | | |

This is the back-office in FlexMeasures.

Usually, our partners build their own UI, like we did in V2GLiberty.

V2G Liberty – HomeAssistant plugin



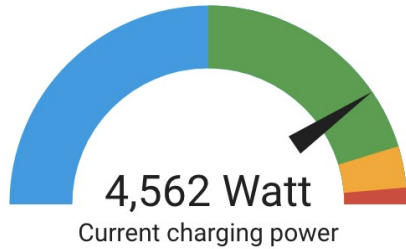
Charger



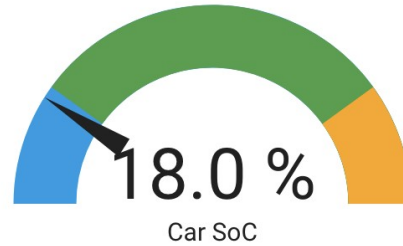
Charging



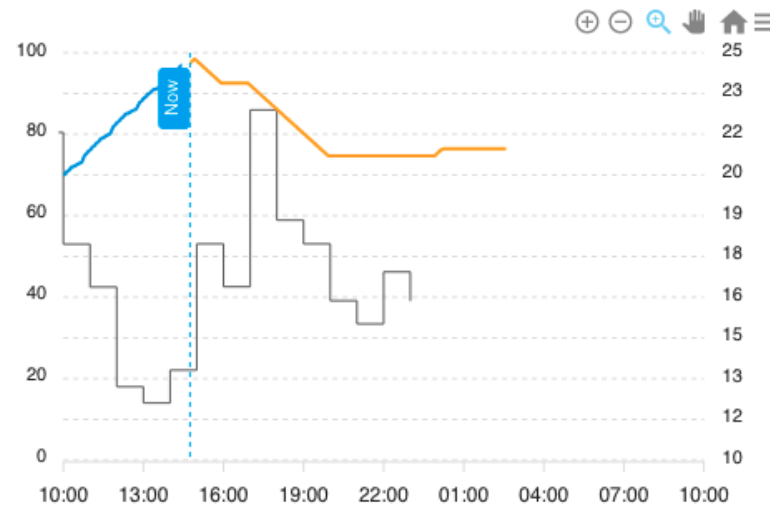
Disconnect now



Connected car



Car State of Charge (%)



Charge mode



Automatic



Max Charge Now



Off

Car reservations

Target SoC is 100% 15 minutes before start

9 – 16 Dec 2021

TODAY

9 December 2021

15:00 - 22:00 ● Naaldwijk

13 December 2021

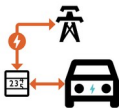
12:30 - 18:00 ● Amsterdam

16 December 2021



User experience (😊)

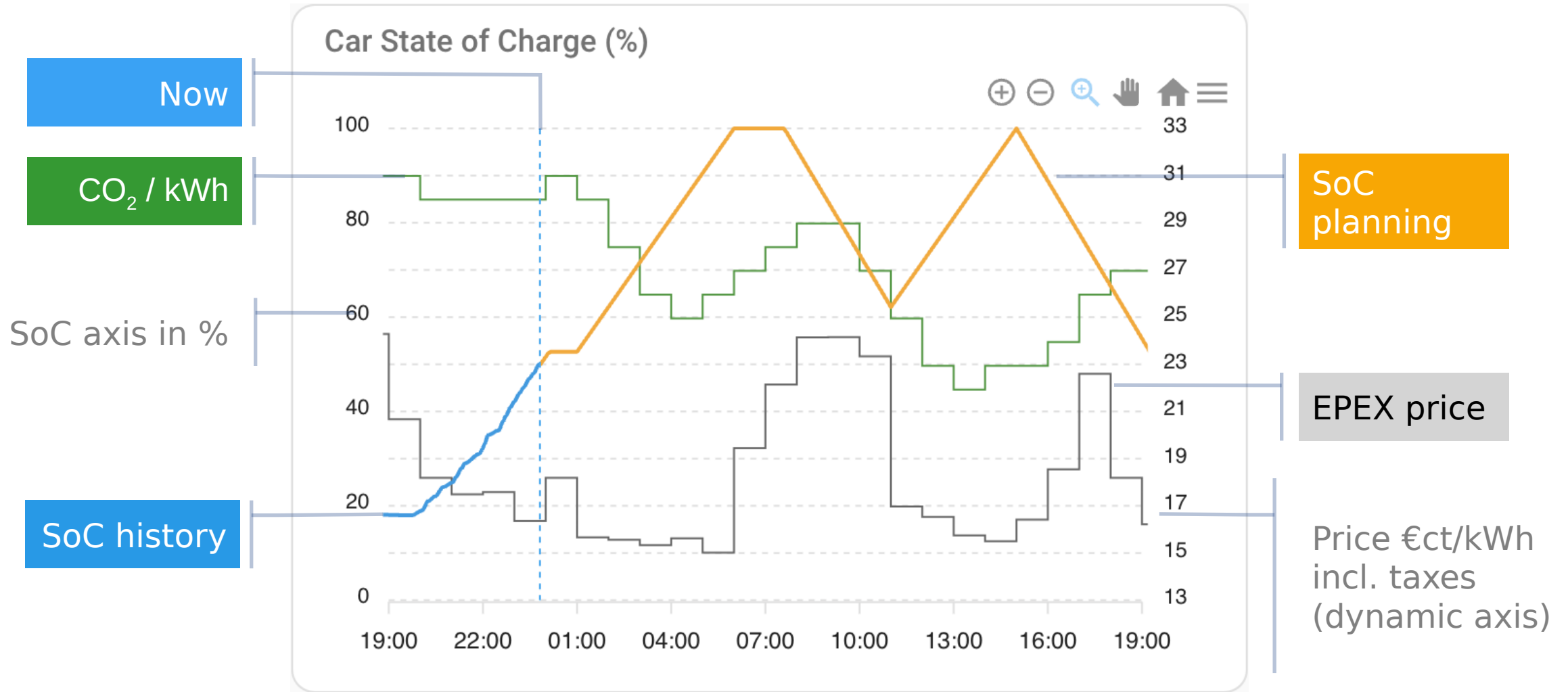
- Should not ask constant attention
 - Automation, user in control
- I'm always ready to ride
- I can trust the system
- It's helping the climate
- It's cost-saving
 - Optimize (dis) charging
 - Protect the battery



V2G research has shown that drivers accept low minimum SoC as long as they can easily overwrite the automated system.

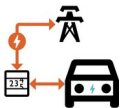
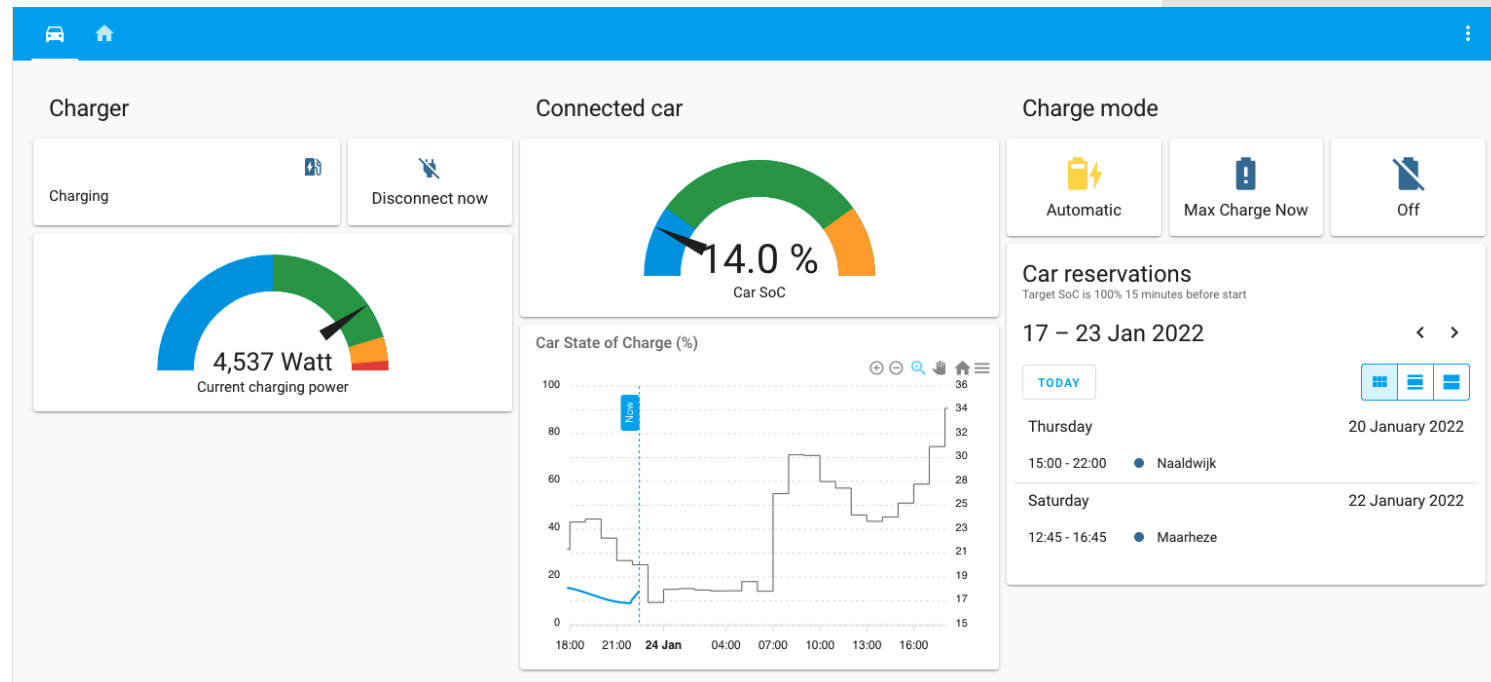


V2G Liberty Dashboard

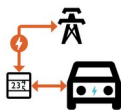
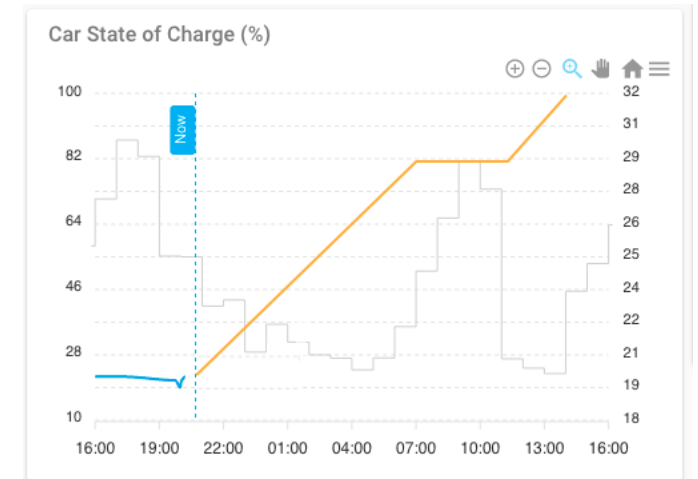
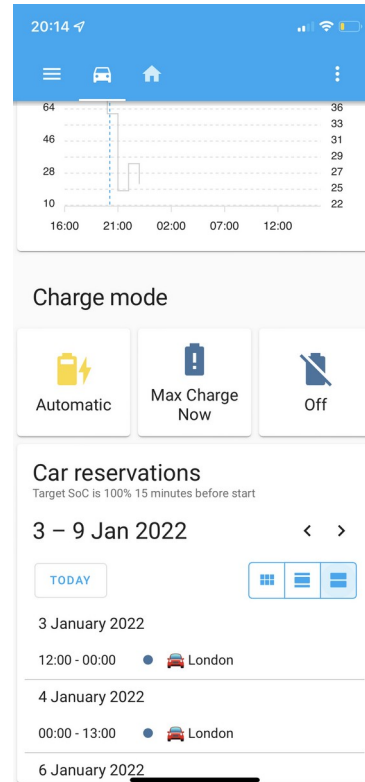
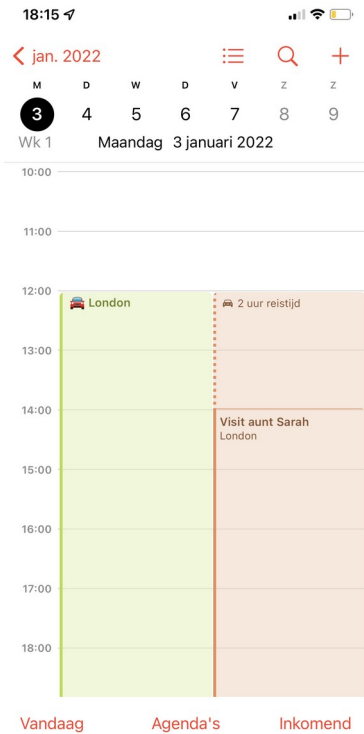


Auto returns with SoC < 20%

- Directly charge maximum speed
- Healthy SoC: 20 - 80%
- Minimum SoC of 20% \approx 60 - 80km



Car reservation → 100% SoC



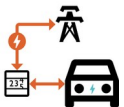
State

- Installation effort could be lower
Needs technical skills
- If it works, it works
(monitoring can be improved)
- Users are happy, now 5 installations
- Earnings up to $> \text{€ } 10$ per day
- EV energy costs $\text{€ } 0,06$ per km

With 20.000 km/year

For 95% of EV drivers the EV is their main car, 40% do not own an IEC (anymore).

Despite many options for car sharing, it seldom is a reason not to (also) own a car.



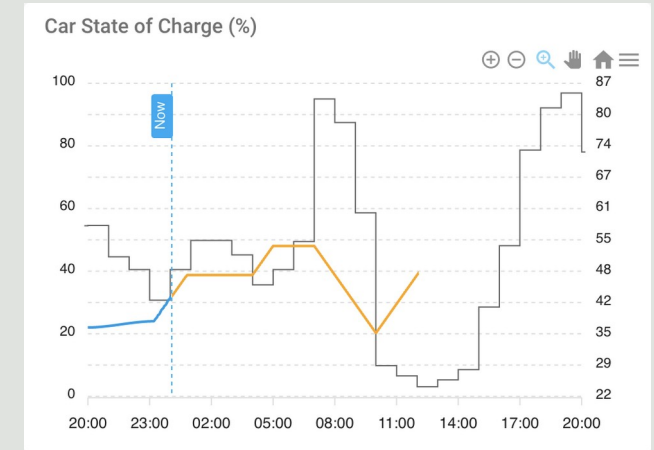
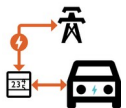
Business case

20000 km driven in 10 months (used for work and vacation), ~ €0,06/km

| | Energy | Costs |
|-----------|-----------|-------------|
| charge | 8.921 kWh | € 2.640,45 |
| discharge | 5.607 kWh | € -2.448,80 |
| netto | 3.314 kWh | € 191,65 |

Compare this to no smart operation at fixed costs (€ 640) or dynamic tariff (€ 1440). Recall that spreads are increasing.

Note: Investment for V2G Charger = x 4 normal charger.



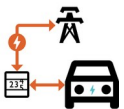
V2G Liberty roadmap

- Easier installation
- Update process automatable (via HA)
- UI upgrades, KPIs
- Learn from users
- Support other chargers, cars, standards (CCS 2? OCPP?)

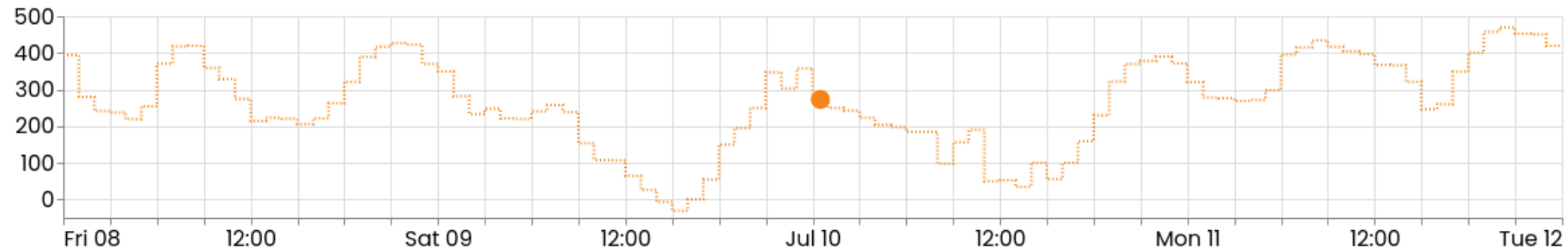


FlexMeasures roadmap

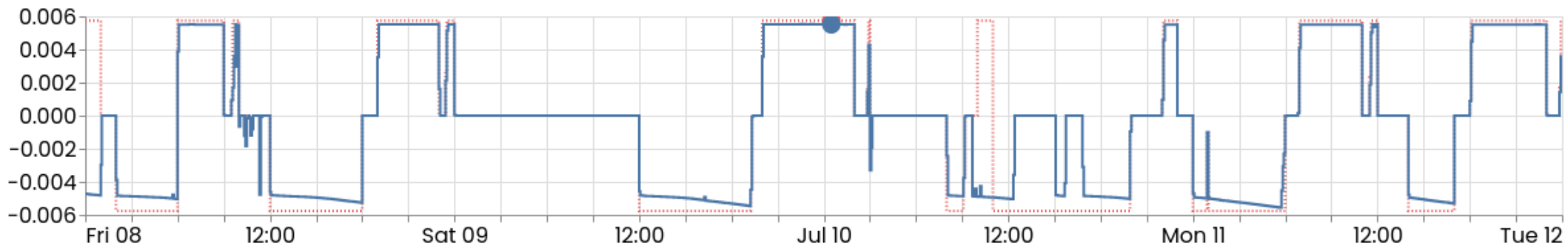
- Optimize heat & e-mobility together
- “Super-accounts” who manage sub-accounts
- Optimizing towards network congestion support



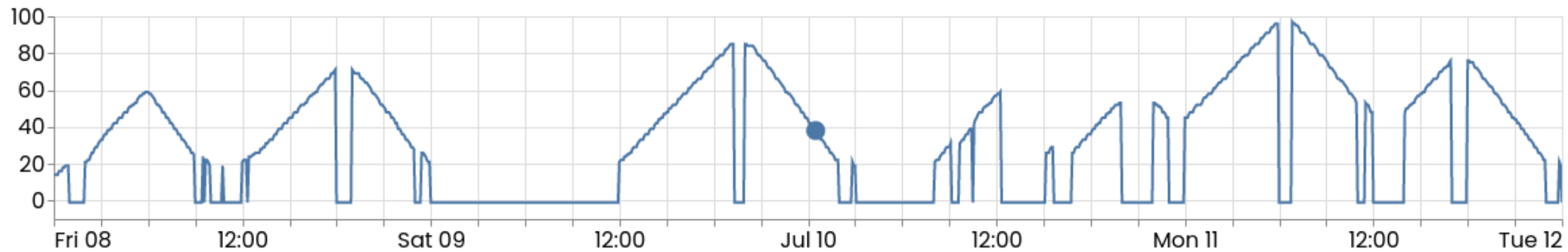
Day-ahead prices (EUR/MWh)



Nissan Leaf Battery (MW)



Nissan Leaf battery state of charge (%)



Questions?



ELF ENERGY

FlexMeasures

