V2GLiberty: 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.
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)
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
V2G Liberty

The software (HEMS)
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
- IKEA
FlexMeasures

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

FM’s goal is to answer this question: “What are the best times to run flexible assets, like batteries, heat pumps or industry processes?”
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
- 4,562 Watt
  - Current charging power
- 18.0%
  - Car SoC

Charge mode
- Automatic
- Max Charge Now
- Off

Car reservations
- Target SoC is 100% 15 minutes before start
- 9 – 16 Dec 2021
- 9 December 2021
  - 15:00 - 22:00
  - Naaldwijk
- 13 December 2021
  - 12:30 - 18:00
  - Amsterdam
- 16 December 2021
  - 10:00 - 10:00
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

Car State of Charge (%)

- Now
- CO₂ / kWh
- SoC axis in %
- SoC history

EPEX price

Price €ct/kWh incl. taxes (dynamic axis)

SoC planning
Auto returns with SoC < 20%

- Directly charge maximum speed
- Healthy SoC: 20 – 80%
- Minimum SoC of 20% ≈ 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 > € 10 per day
- EV energy costs € 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

<table>
<thead>
<tr>
<th>Energy</th>
<th>Costs</th>
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</thead>
<tbody>
<tr>
<td>charge</td>
<td>8.921 kWh</td>
</tr>
<tr>
<td>discharge</td>
<td>5.607 kWh</td>
</tr>
<tr>
<td>netto</td>
<td>3.314 kWh</td>
</tr>
</tbody>
</table>

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
Questions?