"V2X Suisse": V2G at Mobility Car Sharing: 50 vehicles with bidirectional charging offering their flexibility to TSO, DSOs and ZEVs.

Reto Meier[1]
Projectleader | Corporate Development
Direct +41 41 248 22 86
Mobility Genossenschaft
Suurstoffi 16 | CH-6343 Rotkreuz | Switzerland
R.Meier@mobility.ch
www.mobility.ch

Marco Piffaretti[2]
Programleader | Elektro-Offensive
Direct +41 41 248 23 25
Mob. +41 79 620 30 28
Mobility Genossenschaft
Suurstoffi 16 | CH-6343 Rotkreuz | Switzerland
M.Piffaretti@mobility.ch
www.mobility.ch

Executive Summary

Mobility - the Swiss pioneer car-sharer, will electrify all its 3'000 vehicles by latest 2030 and -before doing so- will test the technical feasibility and business-opportunity of V2X with 50 Honda-e and EVTEC bidirectional charging stations (up to +/-20 kW each). The resulting flexibility is offered to TSO, DSOs and ZEVs by a cloud-based platform developed by sun2wheel. Further project partner are tiko and Novatlantis and the whole demonstration project is supported by the Swiss Federal Office of Energy (SFOE). Despite sharing, electric vehicles (EVs) are mostly "standing vehicles". Bidirectional Mobility-EVs therefore offer the opportunity to be used in large numbers as mobile batteries for V2X services. If the whole fleet would be bidirectional operated, we see a potential of up to 60 MW flexibility. Mobility will test this potential -together with several partners by means of a P&D project named "V2X Suisse".

---

1. The first successful car-sharing company – worldwide!

Mobility was founded in 1997 with the merger of the two Swiss carsharing cooperatives AutoTeilet-Genossenschaft (ATG) and ShareCom. These predecessor companies were both founded in 1987, ATG in Stans and ShareCom in Zurich. The two began cooperating as early on as 1991, each enabling their members to use the other's vehicles. Today, the Mobility Cooperative provides its 245'000 customers with some +3'000 vehicles in different vehicle categories at 1'540 stations throughout Switzerland round-the-clock. The main customer argument in favour of using the Mobility fleet is the convenient self-service, the central and non-central stations, the efficiency of the combined mobility and the option to use the vehicles round-the-clock at short notice and for short periods of time. The Mobility Cooperative currently employs a workforce of 221 that share 199 full-time

jobs generates a turnover of about 80 Million Swiss Francs and a net profit of about 1 Million Swiss Francs per year.

Sustainability is deeply rooted in Mobility's DNA: people prefer to share cars rather than own them, use resources efficiently and seek to protect the environment. According to statistics provided by Interface, car sharing reduces the number of privately owned cars on Swiss roads by 35'500 (each Mobility shared car replaces 11 private cars).

2. Mobility switches entirely to electric cars to achieve carbon neutrality

Mobility is now taking major steps in the area of sustainability: it aims to convert all of its +3'000 vehicles to emission-free pure battery electric drive (no PHEVs and no FCEV) by 2030 at the latest, and by 2040 the entire company will be carbon neutral. Today (only) 150 vehicles, or 5% of the entire Mobility-fleet, are electric.

3. The challenge of the charging infrastructure

The biggest obstacle for Mobility to overcome is the charging infrastructure for supplying its e-cars with electricity from renewable sources. It is expensive and complex to build. The main problem is that Mobiliy only rent the parking spaces – Mobility don't own them. This means Mobility can only achieve electrification in collaboration with the site-owners.

4. Carbon neutrality by 2040

While Mobility aims to be emission-free (well-to-wheel) by 2030, the goal for 2040 is carbon neutrality (life cycle assessment): this not only includes how the vehicles are powered but covers the entire range of emissions generated by the cooperative and the products it uses. Examples include commuting by employees, suppliers' carbon footprint, and the grey energy generated in the manufacture of vehicles and their batteries. After 2040, the company even has the vision of retroactively offsetting emissions generated in the past (negative emissions). This could be achieved thanks to new technologies, like V2X.

5. Additional opportunity of electric vehicles: V2X

According the specific study "Coupling transport and electricity: how can vehicle-to-grid boost the attractiveness of carsharing?" by Christine Gschwendtner and Konstantin Kraus of the Group for Sustainability and Technology (SusTec) of ETH-Zürich, Department of Management, Technology and Economics, there are four main potential benefits of V2G-carsharing:

1. First, carsharing operators can gain additional revenue by providing V2G services to the electricity system when the cars are not booked, including at night.
2. Second, V2G could increase the attractiveness of carsharing as it has already been shown that E-carsharing is more popular than conventional carsharing

      a. These first two benefits could counteract financial difficulties for carsharing operators, particularly higher investment costs for E-carsharing.

3. Third, V2G can support the electricity system in integrating more intermittent renewable electricity, which is also beneficial for the decarbonization of the transport system.
      a. Using EVs as mobile batteries in the system can save investment costs in stationary battery storage for the electricity system

4. Fourth, V2G uptake could be accelerated as customers do not own the EVs and hence, do not worry about battery degradation, which is one of the main social barriers for V2G uptake.

In the planned P&D project, technical, organizational and economic solutions are being developed to operate 50 EVs in a grid-friendly manner, without restricting mobility operations and the quality of service for customers, and at the same time offering significant flexibility (10kW or even 20kW per car) to the Swiss TSO (trough an aggregator), several representative (for urban-, mixed- and periferic-grids) DSO's and ZEV-communities.
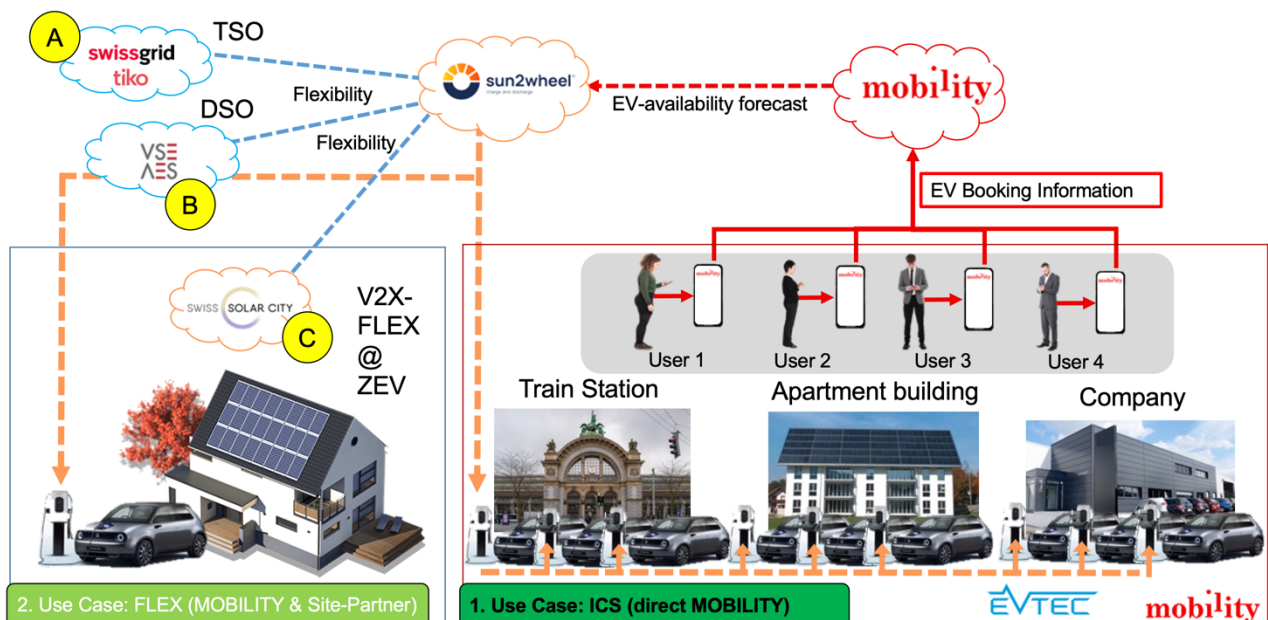

Fig.1

"V2X Suisse" is setting itself a high benchmark until the project is completed at the end of 2023: firstly, it will be exploring how this technology can help stabilise the electricity grid and how charging points with photovoltaic arrays can optimise their self consumption. Secondly, it will be aiming to investigate the business potential of bidirectional charging electric vehicles in Switzerland. And thirdly, it will test the competition between the potential flexibility buyers (Swissgrid, distribution grid operators, and self-consumption associations).

The collective preparations will run until September 2022, after which 50 Honda e EVs will be deployed for a year at around 40 Mobility stations across Switzerland. This will be the first time that bidirectional EV charging is used across the board in people's everyday mobility, allowing it to be tested in different settings, from rural to urban. The prospects look promising: a Mobility EV plugged into a bidirectional charging station can feed up to 20

kilowatts of power back into the grid. This would amount to 60 MW across Mobility's entire car-sharing fleet – more than the Peccia pumped-storage power plant in Ticino, for example. This electrical regulating power will help stabilise the grid, minimise bottlenecks in the distribution grid, and avoid, reduce or delay the need for expensive grid expansions. "V2X Suisse" will be setting a worldwide first by deploying the CCS combined charging system, the international plug standard for direct current (also used for fast charging). "V2X Suisse" will operate across Switzerland and thus under different conditions. Around 40 charging points allowing up to 20 kW to flow bidirectionally are to receive a total of 50 Honda e EVs operated by Mobility. Two types of charging scenarios will be trialled: dual bidirectional DC charging points developed specifically for this project by EVTEC featuring CCS combined charging plugs, and single bidirectional Honda Power Manager DC charging points, also with CCS plugs. Both are equipped with ripple control receivers for the distribution grid operators as well as a digital interface. This requires the development of a cloud-to-cloud IT platform to manage the available power for each Mobility EV in quarter-hour cycles; this will offer, allocate, release, directly regulate if necessary and calculate (for billing purposes) the flow of electricity. This cloud-to-cloud solution developed by sun2wheel connects the availability inputs of Mobility bookings with the tiko aggregator relevant for Swissgrid.

The plan is to test the 50 bidirectional vehicles during normal car sharing operations for 1 year starting in September 2022. The V2X benefit will be concretized on three grid-levels and the achieved compensation for flexibility will show possible new business models. Additional research projects have been launched around the topic data-security, battery-life and predictive demand forecast.
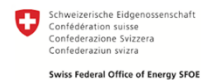
6. Frame conditions for V2X

With the adoption of the "Long-Term Climate Strategy for Switzerland", the Swiss energy industry is facing a paradigm shift. Within the next 30 years, Switzerland aims to increase power generated by photovoltaics by 1700 % to 34 TWh and the number of battery electric vehicles (EVs) by 8295 % to 3.6 million. A Swiss case study indicates that the grid can handle 16% electric vehicle (EV) penetration without coordination, and levels beyond 50% would overload substations even with optimal charging [2]. Conversely, EVs represent an opportunity for the grid. Internationally, ENTSO-E has positioned EVs as a powerful resource for flexibility in the electricity system, with environmental, economic and electricity system benefits being possible from the effective implementation of vehicle to grid (V2G) technology [3]. EDSO includes V2G services in its list of technical requirements for large scale roll-out of electric vehicles [4].

Because car-sharing and V2G play complementary roles in increasing the asset use of cars, their integration will facilitate the development of both innovations. Car-sharing decarbonizes individualized road transport by allowing the shared use of vehicles and reducing the number of individually-owned cars. The combination of car-sharing and V2G enables shared EVs to participate in the V2G process when the car is not booked for mobility use. This will increase grid stability and revenue for the car-sharing operator. Meanwhile, the car-sharing operators can accelerate the implementation of V2X by providing the necessary V2X infrastructure and a centralized management platform.

7. Partner of "V2X-Suisse"

The "V2X Suisse" project is looking to find solutions through resource pooling. Mobility providers (Mobility), car provider (Honda R&D Europe and Honda Motor Europe), soft-ware developers (sun2wheel), charging point developers (EVTEC), aggregators (tiko), flexibility buyers and the scientific community (novatlantis in cooperation with ETH) are working hand-in-hand. The project is supported by the pilot and demonstration programme of the Swiss Federal Office of Energy (SFOE).

Powered by:

Figures

Fig.1: schematic illustration of the "V2X-Suisse Project" including the 3 possible beneficiaries of the flexibility: TSO (A), several DSOs (B) and several ZEVs - energy communities (C).

References

[1] Christine Gschwendtner and Konstantin Kraus: "Coupling transport and electricity: How can vehicle-to-grid boost the attractiveness of carsharing?" (https://www.sciencedirect.com/science/article/pii/S1361920922000906)
[2] Salah, Florian, et al. "Impact of EV on distribution substations: A Swiss case study.
[3] Electric Vehicle Integration into Power Grids, ENTSO-E, accessed online 25/05/2021
[4] European Distribution System Operators for Smart Grids, EDSO, accessed online 25/05/2021

Presenter Biographies

Reto Meier has studied Business Innovation at the University of St. Gallen. After working as a Business Consultant he joint Mobility in 2020 as a project Leader in Corporate Development. There he is responsible for the electrification of the Mobility-Fleet and the way to climate neutrality.

Marco Piffaretti has studied Car-Design at the "Scuola d'Arte Applicata & Design of Torino" and the "Art Center College Europe". In 1984 he started developing solar race cars and has since then founded or co-founded several EV-related companies like Protoscar, Alpiq E-Mobility, EVTEC, GOFAST and sun2wheel. Today Marco is a freelance EV-consultant working mainly for MOBILITY CarSharing. More information: https://www.linkedin.com/in/marco-piffaretti-39a723/