*EVS30 Symposium*
*Stuttgart, Germany, October 9 - 11, 2017*

# ‘’ How local storage of renewables accelerates e-car sharing utilization and market adoption. ‘’

Harm Weken[1], Flip Oude Weernink[2]

[1] *Managing Partner FIER Automotive, harmweken@fier.net*

[2] *Manager New Mobility, FIER Automotive, foudeweernink@fier.net*

## Executive Summary

The EU has targeted a 20% - 40% reduction in CO2 emissions and a 20% - 27% increase in renewables and energy efficiency from 2020 to 2030. Countries and cities in NWE have set ambitious CO2 reduction targets in line with the EU. Hence the investment in generating renewable energy is increasing. In parallel the uptake of e-mobility is also growing. Although the market position of Battery Electric Vehicles (BEV’s) is still low, the growth rate is accelerating rapidly.

The fast-growing fleet of shared electric vehicles requires a substantial and growing energy supply. With smart charging technologies, the even growing supply of renewables can be used to charge shared cars scheduled at the right moment: when there is a demand for mobility and when there is wind (during the night) and/or when the sun shines.

Applying smart charging for shared electric mobility results in a higher utilization of shared electric cars, new business cases for electric mobility, more efficient use of renewables, and avoiding the need to do large investments in the grid. BEV’s will be the enabler of renewable energy storage and for new business cases and CO2 reduction. This paper describes how a consortium in the Netherlands aims to prove this in practice.

## 1. Background

Mobility causes approximately 25% of the total GHG emissions in The Netherlands. Shared Electric mobility is ‘zero emission’ and is an important contributor to a low-carbon economy and improved air quality. Though shared electric vehicles are still competing with fossil fueled vehicles and nowadays they are still more expensive due to high energy prices and because of low mileages driven due to limited range capacity and long charging time/turnaround time.

On the other hand, the supply of renewables is growing rapidly but the efficiency is lacking behind as a decent solution to store is still not broadly available. Storage makes renewables available during evening and nighttime hence enabling electric vehicles to charge cheap renewable energy at any moment.

Through economies of scale, high utilization of the shared electric vehicles and a low price per kWh, shared electric vehicles are expected to be capable to compete with fossil fueled vehicles. This project intents to show the feasibility of the technology, economy and accelerate the adoption of shared electric mobility with new business models.

## 2. Market Development

Sharing economy is a global trend in which partially unused resources are used in a shared manner. The rise of the sharing economy is a major trend worldwide. Examples of the sharing economy which grew in a very short time span are AirBnB, SnapGoods, Uber. These kind of initiatives disrupted the old economy of selling and buying goods and services. Also in the mobility sector sharing economy has become increasingly popular with the rise of car sharing, bike sharing, ride sharing etc. These kind of initiatives can also be a response to new mobility needs where car ownership becomes less relevant and efficient multi-modal mobility gets more accepted in densely populated areas where parking and traffic are problematic.

Instead of every user owning and driving it's own mostly underutilized car, more and more initiatives can be found were they collectively use a pool of cars which increases the cars' utilization leading to reduced total costs for the operator and eventually the individual user. Mobility as a Service (MaaS) is the term for all kinds of initiatives and innovative new mobility services such as ride-sharing, bike-sharing programs, car-sharing services as well as on-demand "pop-up" bus services. Mobility as a Service leads to better utilization of the vehicles and less costs per kilometer because of this intensive use. This is a crucial cornerstone for e-cars as their higher initial purchase costs can only be offset by the lower operating costs when the utilization is high thus lowering the "e-mobility threshold". Therefore e-MaaS is the newest part of the sharing economy market developments with all kinds of electric vehicles (mobility services) to be combined within a shared system.

## 3. Project Challenges

The overall challenge is to lower the TCO for shared electric vehicles. In this paper we will especially describe the challenges of electric cars in a shared mobility system within the project. A positive business case of electric car sharing, requires high utilization and daily mileage, short turn-around time. The only way to achieve this is due to (simultaneous) fast charging of the shared vehicles, which requires heavy and expensive grid connection and high yearly fees. The current smart charging solutions of peek shaving and night time charging with lower prices also have its limitations, but they also are not fit for electric cars that have to drive in a shared system with as short charging times as possible.

The challenge to succeed during the project is to intensify capacity utilization (24/7), shorten turn-around times and reduce idle time, enable more and longer trips with the shared electric vehicles, attract more (shared) users and on top, create extra sources of income. 'We will proof this approach by utilizing the fleet of shared electric vehicles for smart charging, local storage technologies (and future V2G)''

## 4. Succeed challenges through local storage

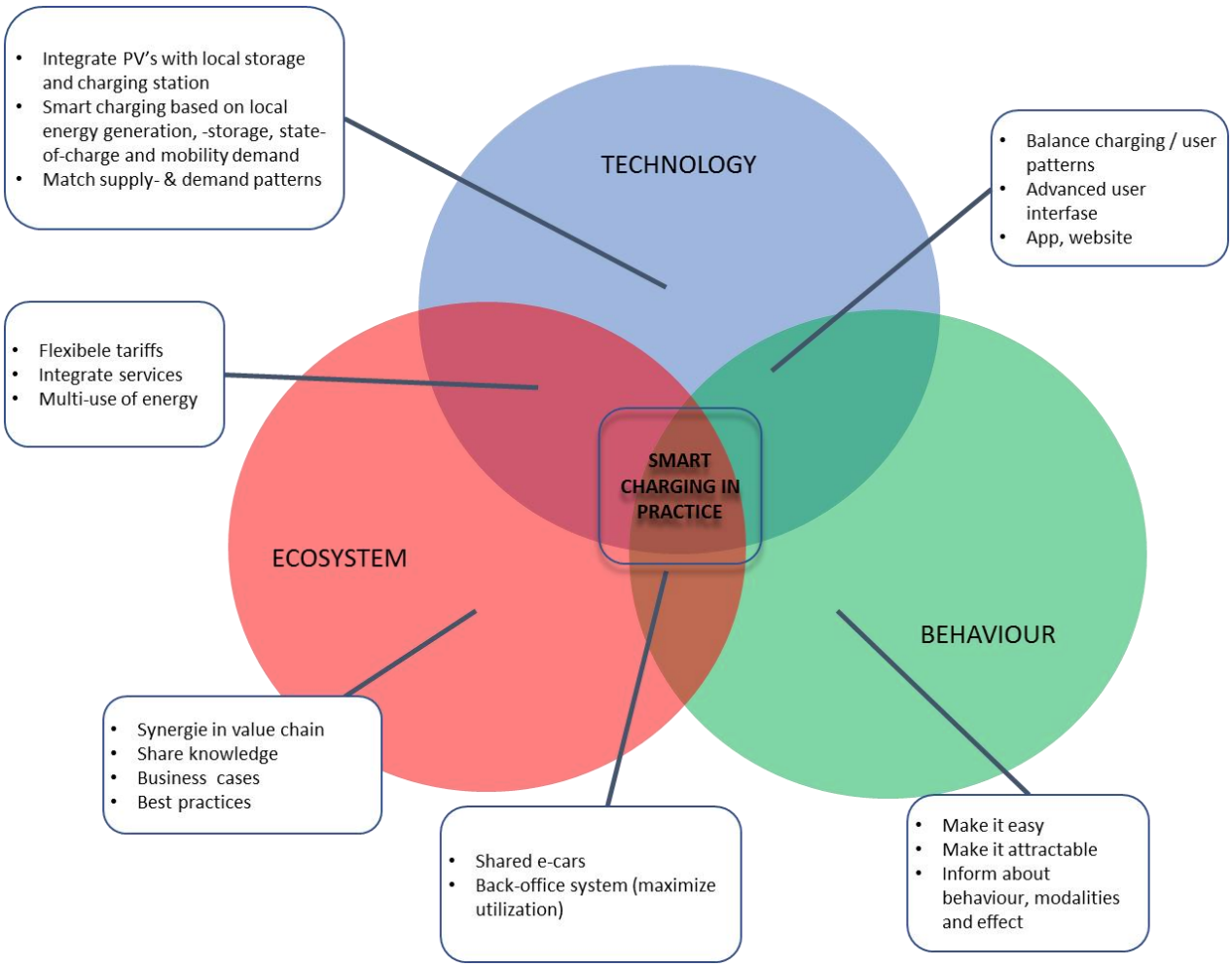
A consortium existing of a charging station manufacturer, a grid operator (DSO), an electric vehicle sharing platform, a PV project agency and an e-mobility cluster organization developed a project called 'Smart charging in practice'. The goal of the project is to proof the synergy between sustainable energy and (shared) electric mobility in practice via a combination of local renewable energy generation, smart charging, vehicle sharing and influencing user behavior.

Through local storage and Smart Charging, sustainable energy can be used as efficient as possible to charge shared electric vehicles. The result is increased charging speed and lowering the energy costs component as the required energy will not only be made available when the sun shines, but also during evening and overnight. This enables a better employment of the shared cars as waiting/charging time will be reduced to a minimum. A minimum charging time means a maximum employability. The more the shared car is used

in terms of driven kilometers, the less the costs of the shared car per kilometer. A lower Total Cost of Ownership (TCO) will contribute to make shared e-cars directly competing with small, fossil fuelled cars.

Because e-cars and charging are inextricably linked to each other, we will not treat them separately, but as a holistic and open system. We are aware that the e-mobility ecosystem already has many isolated solutions throughout the value chain and therefore all aspects influencing the future, large scale uptake of (shared) electric mobility and renewables will be considered in one project. Therefore we consider the identified elements of the system: technology, ecosystem & behavior. In the figure 1 below we give an overview of this system which is the back ground of the project Smart Charging in Practice.

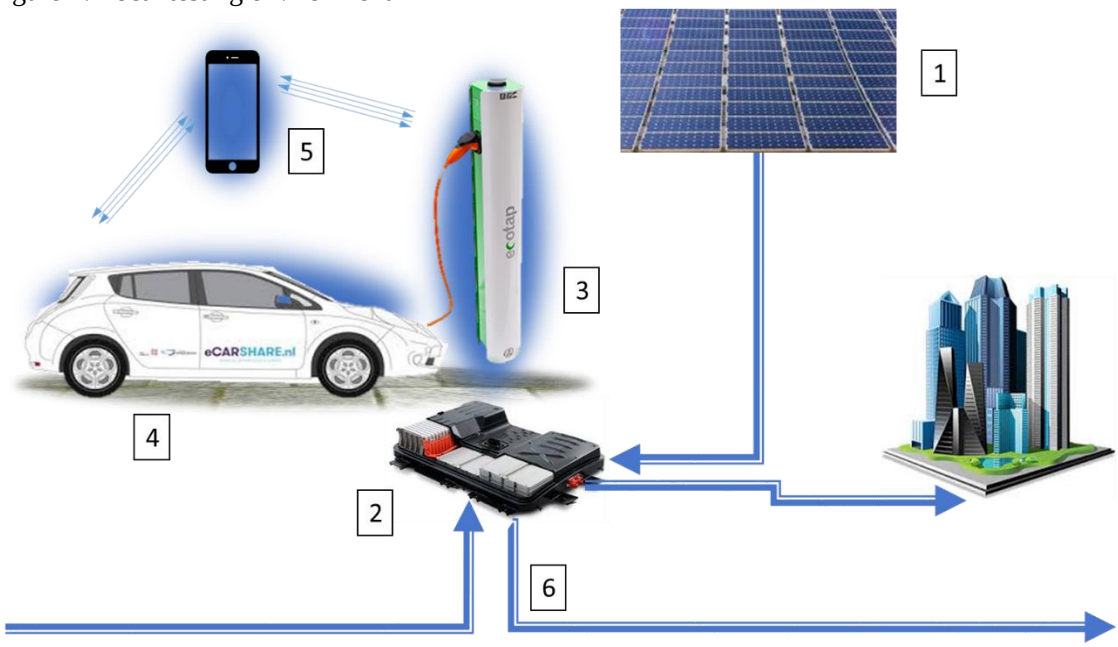
Figure 1: elements of Smart Charging in Practice



## 5. Solutions to be tested

One of the aims of the project “Smart charging in Practice” is to proof this approach and test this new business case through 14 shared Battery Electric Vehicles (BEVs) in 5 local testing environments at stakeholder locations. For each shared electric vehicle, 30 solar panels will be installed combined with a local storage unit. The smart charging station communicates with the storage unit based on the reservation system of the shared vehicles, so the vehicles will be fully charged when someone has booked the vehicle or when there is an overflow. This will serve two goals: generating solar power which will be available against low rates to the shared vehicles and to contribute to the low carbon economy. Both visible and available for public. In figure 2 below a visual of the local testing environments that will be installed at 5 locations.

Figure 2: Local testing environment




1. Installation of 420PV’s / 113.400wP and development of enhanced back office

2. Optimized storage system specs with 60-100kwh storage capacity. Test in practice the technical feasibility and optimize the system specifications and dimensions. Stationary storage enables axtra income / cost to be reduced by optimizing charging according to APX spot prices

3. Development & test of 2x 10kw AC smart charger with storage capacity (2) underneath (EcoTap® patent). Charging tailored to shared e-cars: ‘on demand’ (planning & reservation), Slow when possible, fast when needed, always available

4. 14 shared Nissan Leaf’s at organizations for shared use. Business trips during working hours and private use during evening and weekends. The impact of the usability of the grid will be tested. The vehicles come with:

5. Integrated platform / app to make trip reservations, open / close the car with a digital key, monitor and stimulate user behavior, manage energy supply & demand based on reservations and storage capacity

6. Validate protocols from technology point of view, validate the concept from regulation point of view and monitoring of grid impact

## 6. Foreseen results and future perspective

Local storage and smart charging enables shared electric mobility concepts to be suitable for mass market take up removing barriers to adoption by creating economies of scale, addressing range & charging challenges and increasing the familiarity with EVs. This will fulfill the charging needs for shared e-cars (fast, simultaneous, short turn-around).

On longer term the concept will reduce energy costs due to the use of PV, in The Netherlands for particular households and SME's. Due to the limited required grid connections, the investments and fees for the (micro) grid will be lowered. On top of this, storage enables (future) additional income and lowered cost by using APX pricing opportunities and trade-off with additional investments in storage

This scalable business case makes the TCO for electric shared vehicles competing with fossil fuelled vehicles, enabling e.g. SME's and in a later phase private users to adopt electric mobility in an earlier stage as well. Moreover, this project will contribute to and generate consumer awareness and changing behaviour when it comes to electric mobility.

The first measurable results of the project are expected late 2018. After the project, fleet managers, companies, utilities and private-public institutes (like hospitals and social housing institutes) will adopt e-car sharing as a main modality powered by local stored renewable energy.

## Authors

Harm Weken is since 1995 managing Partner of FIER Automotive, a business development company in the international automotive sector, with a focus on electric mobility. Harm is also chairman of the board of Foundation Limburg Electric and member of the Council of Advisors at Drive Oregon. From 2007 till 2015 he has been Board-Director of EASN ltd, a European platform for automotive clusters and starting-point of various EU-projects.

Flip Oude Weernink is since 2010 responsible for new mobility at FIER Automotive, a business development company in the international automotive sector, with a focus on electric mobility. Flip has a focus on sharing programmes and concepts and the further development of 'e-mobility as a service' (eMaaS). In his work, he balances the interests of governments, companies, institutions and end-users to initiate, develop and introduce sustainable mobility services.