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On-Board Metering

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The demand for infrastructure is closely linked to the diffusion of electric vehicles, because this often represents a bottleneck when implementing new drive concepts. However, this only partially applies to electric mobility since private power connections are widespread, and hybrid vehicles offer the flexibility to choose between two energy sources. Despite this, infrastructure will be necessary in the long term which enables intelligent control, in order to avoid peak loads and to integrate fluctuating renewable energies. Two different principles are being discussed to realize this control, which distinguish between a stationary (off-board metering) and a mobile (on-board metering) metering point.

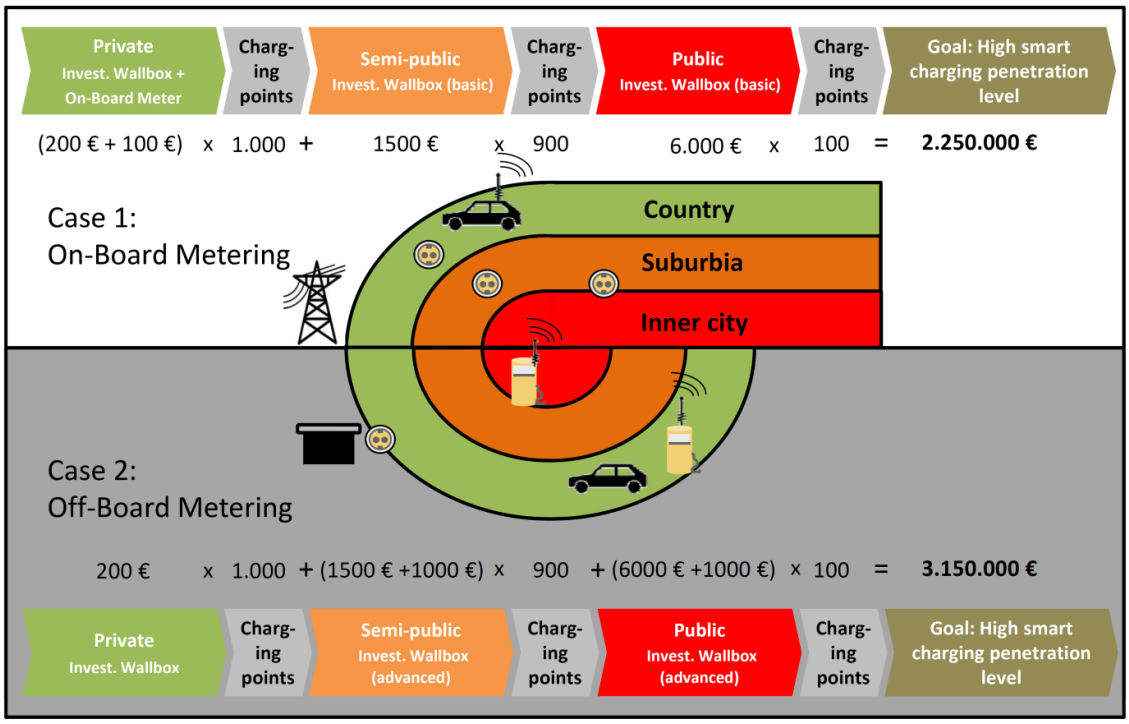
Stationary meters are the basis for today's conventional billing of electricity and are well suited to traditional domestic applications. With a view to electric mobility applications, however, there are several weaknesses related to the infrastructure.

- The supply of each metering point with electricity is regulated by a contract. If a user charges an electric vehicle at home, for example, and at work, then two contractual relationships are necessary. In the case of smart charging at a third party's charging point, a regulation is needed in addition to this on how to distribute any possible profits, which are admittedly still very small at present.
- The construction of public infrastructure is uneconomical because experiences so far have shown that the amount of electricity sold is very small and price increases are very difficult to implement. After a first phase of euphoria, therefore, in which energy suppliers tried to stake out their territories, there is currently a certain degree of disillusionment concerning infrastructure development. Usually, smart control and invoicing are dispensed with because of the high costs involved.
- The data needed for smart charging are present in the vehicle. The battery status and user preferences are important parameters for determining the charging plan. Exchanging this information is sensitive with regard to data security. In research projects therefore, vehicle producers are already partially backing the decentralized optimization of the charging process in the vehicle. An on-board metering system has been developed, for example, by VW, E.ON and Fraunhofer in the Electric Mobility Fleet Test.
- There have hardly been any holistic approaches developed so far, except for systems like "Park & Charge", in which the users of electric vehicles provide each other with charging infrastructure at no cost. If public charge points are

exclusively used as distribution channels as far as possible, roaming threatens to become a cost trap. This could curb acceptance of the public infrastructure and limit electric mobility as a whole.

At first sight, on-board metering seems more complex than simply transferring the established system to electric mobility, because it increases complexity in the vehicle. However, when looking at the realization of nation-wide smart metering, which enables the high penetration of grid-coupled vehicles and the integration of renewable energies, on-board metering is the simpler and above all cheaper concept.

The vehicle has all the main components needed for smart charging. As well as the meter, which so far usually does not comply with metering standards, a communications interface, a user interface and hardware which allows optimized charging will be integrated into future vehicles. Several manufacturers have already announced plans for a 4G communications interface in vehicles for using the internet. Set against this background, the investments needed for on-board meters are less than 100 €. Additionally equipping the charge points with communication interfaces, processors and displays therefore seems superfluous and too costly. The illustrated example for 1,000 vehicles, which compares the two concepts, confirms the lower investments for on-board metering.



Source: own illustration and assumptions

Furthermore, lower operating costs are expected for on-board meters due to the simple charging infrastructure. On top of this, using systems present in the vehicle results in a faster renewal rate since the vehicle's life span of 12 years on average is substantially lower than the life span of the network infrastructure.

One drawback of on-board metering is that data are measured twice. Alongside the measurement in the vehicle, data are also recorded at the next stationary meter. The power used for driving therefore has to be subtracted from the normal electricity consumption. Looking at the system as a whole, however, this can also be advantageous, because it makes an individual electricity tariff possible as well as separate taxation of the driving power. Variable electricity tariffs often have an acceptance problem because these apply not only to flexible consumers, but to all the other consumers in a household. Using on-board metering makes it possible to separate this, which could lead to lower electricity prices and a higher diffusion of variable tariffs in general.

The flexible charging and drive concepts of electric mobility mean that infrastructure could be expanded gradually. On-board metering offers a system which is also open to other solutions. Based on the cost efficiency of developing a nationwide system for smart charging and the related promotion of the grid integration of renewable energies, on-board metering should be given higher priority by automobile producers when planning their strategies, especially as they interact with customers on the demand side of the power market and are therefore natural competitors of the energy utilities.

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