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»Flexibility provided by E-Mobility«

Cost-efficient and customer-friendly ways of increasing the flexibility potential of E-Mobility

October 2019. With an increasing number of electric vehicles, E-Mobility offers considerable potential for flexibility for the energy industry: With an appropriate regulatory framework in place, electric vehicles can help to integrate more renewable energies into the energy system and make better use of existing grid capacities. That way, the costs of energy system transformation could be significantly reduced. The German Association of Energy Market Innovators (Bundesverband Neue Energiewirtschaft e.V.) (bne) maps out the key conditions needed for implementing the flexibility potential of E-Mobility.

E-Mobility offers great potential for flexibility

E-Mobility offers an important opportunity both to integrate more renewable energies into the energy system and to avoid overloading the networks. Starting point is the long period of time that cars – on average – are not used during the day. They spend the greater part of the day as "standing vehicle" in the parking lot of the employer, in front of the supermarket or at home and thus, as electric vehicles (EVs) could offer significant flexibility potential to the energy system. During this idle period, the charging process can be adjusted according to various parameters such as electricity supply and grid utilization. The EV could, for example, charge preferentially during a period of high feed-in of photovoltaic and wind power and thus make efficient use of an oversupply of renewable electricity. In addition, charging could be carried out at times of low grid utilization in particular, so that the utilization rate of existing grid capacities would be increased and the need for additional grid expansion would be reduced.

A smart integration of E-Mobility into the existing energy system is particularly important with regard to the rapidly growing number of EVs: In the medium term, a considerable additional demand of several gigawatt hours can be expected from

EVs.[1] An uncontrolled integration of these into the energy system would require enormous investments to cover the additional electricity and grid capacity needs. Currently, there is a real danger that end consumers are charging especially when the demand for electricity is already particularly high. Therefore an incentive system should be created which incorporates the system costs into the end consumer's calculation and thus brings about a change in the consumer's behavior. The resulting cost advantages for the system should at least partially benefit the consumer. In this way, the costs of E-Mobility could be reduced for the individual consumer and the attractiveness of using an EV could be increased compared to using a vehicle with an internal combustion engine.

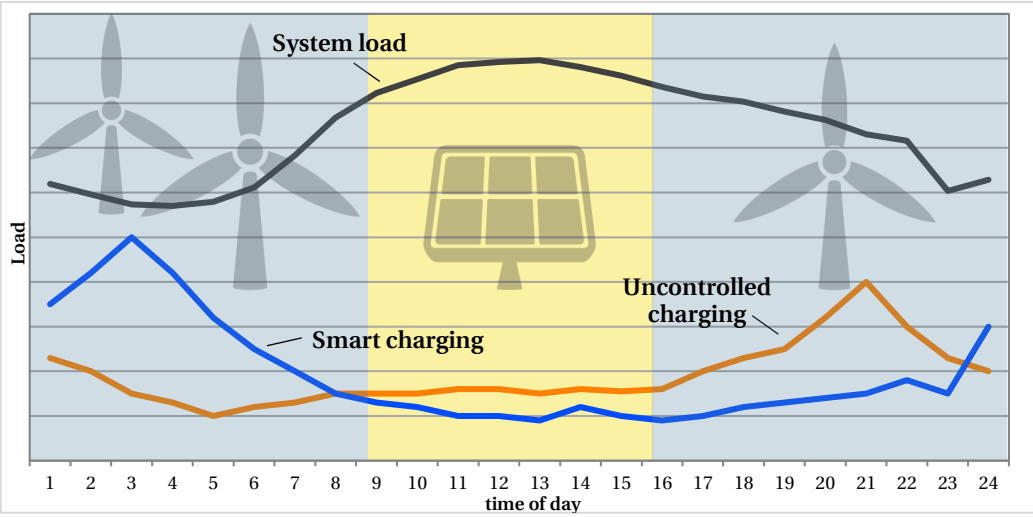

Figure 1: Power consumption with uncontrolled and smart charging[2]

“Smart” charging means to charge the battery of an electric vehicle in consideration of the power generation and/or system load while taking customer requirements into account (see Fig. 1). Currently, however, charging is usually carried out uncontrolled and the flexibility potential of E-Mobility remains largely untapped.

In order to charge "smart" by default, the following conditions are required:
1. A **market-based procurement** of flexibility in the distribution network and
2. **Open access to** the respective **vehicle data** is necessary.

[1] See Agora: „Stromspeicher in der Energiewende“. 2014, page 109.

[2] See Regulatory Assistance Project: “Start with smart”. 2019, page 22 and entsoe.eu. Pictures: rawpixel.com/freepics.

Market-based flexibility procurement in the distribution network provides important incentives for smart charging management

For an effective incentive system, the end consumer's electricity bill must be the most favorable if his EV is charged according to current electricity availability and/or grid utilization. While electricity availability is indicated by the price signals of various markets such as the electricity exchange, a variable price signal that reflects the actual network load is currently lacking. Although the legal basis for this already exists in Germany: According to Section 14a EnWG, network operators must offer a reduced network charge in return for a network-related shift in electricity consumption. So far, however, the regulation set out in the paragraph, which is intended to specify this broad general regulation, is still missing.

A market-based design of Section 14a EnWG is essential here. Currently, end consumers have to transfer complete control over their adjustable consumption device, such as a charging device, to the distribution network operator in order to claim reduced network charges in accordance with Section 14a EnWG. The distribution network operator can then interrupt the power supply according to his own criteria, for example, to charge an electric vehicle. End consumers neither have the opportunity to express their needs nor can they follow other market signals at short notice. In order to ensure the unbundling of grid operation and electricity supply, the distribution network operator's control request should be implemented by market players while taking customer needs into account. In addition, only a market-based provision of flexibility makes it possible to optimize system costs instead of network costs alone. Market players contracted by the customer can manage the end customer's electricity consumption, while taking into account electricity availability and network utilization. If, on the other hand, the distribution network operator has the sole control over the management of adjustable consumption devices, it can be assumed that he is primarily using it for optimizing network operation and does not take market or system needs and opportunities of third parties into account. A market-based design of Section 14a EnWG is also essential with regard to customer orientation and thus with regard to a broad use of the paragraph. Today's state of the art is that the charging process is not automatically continued after the charging device has been switched off – even if only for a short-time – by the distribution network operator. An interruption therefore means that the battery would not be fully charged. Hence, bne proposes a decentralised and market-based flexibility mechanism in which distribution network operators communicate their need for flexibility to participating consumers. If consumers respond to this need, they receive a flexibility bonus payment or a reduction in network charges (bne-proposal regarding a decentralized flexibility mechanism).

For the prompt realization of the great flexibility potential of E-Mobility, a timely adoption of the ordinance according to Section 14a EnWG is necessary: Currently, the more than 800 distribution network operators in Germany handle the application of Section 14a EnWG very differently. Depending on the network area,

for example, different consumers are entitled to use the paragraph, different control technologies must be installed or the amount of the network fee reduction varies. An ordinance pursuant to Section 14a EnWG could create the necessary legal clarity and thereby enable a national scaling of business models with regard to smart charging. In addition, without this regulation, there are no incentives to install smart charging infrastructure. The longer this regulation is missing, the higher will be the number of "stranded investments" in the form of non-controllable charging infrastructure.

Open access to in-vehicle data is necessary for smart charging management

For smart charging management, it must be possible to forecast the charging process with sufficient accuracy. The charging process can only be optimally adapted to the system when the amount of energy required for the charging process and the charging capacity, i.e. the rate at which the electricity from the electric vehicle is charged, are known. This requires various in-vehicle data: The necessary electricity for charging can be calculated from the current state of charge (SoC) and the battery capacity. The maximum and minimum charging capacity of the vehicle battery indicate the range in which the charging capacity can be adjusted for smart charging management.

Currently, this in-vehicle data is usually not transmitted to the charging device and is not available to service providers contracted and authorized by end consumers. As a rule, only the current or past electricity flow can be retrieved via the charging device; the remaining charging parameters are unknown. The end consumer can often view this information via a display in the vehicle or a proprietary app from the vehicle manufacturer, but external service providers cannot access the in-vehicle data technically. Vehicle manufacturers should therefore be obliged to provide a standardized technical interface for data exchange at no extra cost for third-party service providers. Via this interface, service providers commissioned by the end consumer can have direct access to the relevant data or the backend of the vehicle manufacturer. Only with this information can the enormous flexibility potential of E-Mobility be leveraged. Open data access is a prerequisite for strong competition in the field of smart charging management and thus for a market that focuses on the consumer.

Outlook: Vehicle-to-grid (V2G)

In the future, not only smart charging will play an important role for the energy system and new business models, but also the Vehicle-to-grid (V2G) concept: Electricity can be returned back to the electrical grid by using bidirectional charging solutions. Possible applications include for example the provision of system services such as balancing to support frequency control, reactive power, or the use of the EV battery as a home storage device. Various pilot projects have already shown that returning electricity back to the grid releases a significant potential for flexibility. In order to use this flexibility effectively in the future, it is important to take the V2G concept into account when developing the regulatory

framework for E-Mobility. Especially the legal requirements regarding battery storage systems play an important role in this context. Currently, those requirements are a major obstacle to the economical and practical application of storage systems (bne-position on battery storage systems as an integral element of the energy system transformation).

Who we are: Bundesverband Neue Energiewirtschaft e.V. (bne) / Association of Energy Market Innovators – a strong voice for independent energy companies

bne represents the interests of grid-independent energy suppliers and energy service companies in Germany. By combining competition, renewables and innovation members create a new energy industry and unleash the forces of energy system transformation.

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