

Executive Summary

Enabling non-discriminatory bidirectional charging

Recommendations for action by the National Centre for Charging Infrastructure Advisory Board for the implementation of Measure 47 of the Charging Infrastructure Masterplan II

Key messages

- Bidirectional charging is a promising additional offer for users of electric vehicles in the future and should be made accessible to them in a simple, safe and non-discriminatory manner.
 - Bidirectional charging can also contribute to sector coupling by offering additional flexibility. Opinions differ with regard to its future contribution towards the energy transition and its economic benefits.
 - Among the various use cases, V2H will initially establish itself on the market; in the medium term, V2G will develop via aggregators / service providers on the market.
 - The members of the National Centre for Charging Infrastructure's Advisory Board have the common goal of enabling all use cases (V2H, V2G, V2B) in a non-discriminatory and competitive manner.
 - The number of bidirectional vehicles and charging facilities available on the market is increasing.
 - The systems already available, however, still differ in terms of the use cases supported and, due to a lack of standardised system standards, have so far only operated on a proprietary basis.
 - The Advisory Board expects a significant increase in the number of bidirectional vehicles and charging facilities available on the market.
 - The goal is to achieve plug & play solutions. This requires a standardised, interoperable and barrier-free system in which the customer can connect various vehicles with different charging facilities and easily network them with the domestic energy management system.
 - In the next two years, proprietary systems will increasingly develop on the market, with interoperable systems expected from 2027/2028.
 - Significant legal and technical hurdles still need to be clarified for all use cases.
 - Industry and politics must therefore work together to adapt and further develop the international, European and national legal regulations in a timely manner.
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Executive summary

Bidirectional charging is a promising and attractive additional product for users of electric vehicles at the interface between the mobility and energy sectors.

In the context of vehicle-to-home (V2H) and vehicle-to-building (V2B) applications, the use of the vehicle battery as buffer storage enables a higher level of self-consumption/self-sufficiency through lower or deferred electricity consumption from the grid and possible cost savings in the domestic system in the home. With vehicle-to-grid (V2G) applications, flexibility can be provided for the energy system with the appropriate price signals, thereby opening up further revenue potential for customers.

In addition, bidirectional charging can contribute to sector coupling by providing additional flexibility. However, opinions differ on the future contribution towards the energy transition and its economic benefits.

From the perspective of the Advisory Board members from the automotive industry, bidirectional charging can make a significant contribution to using renewable energies more efficiently in the future, thereby reducing the economic costs of the energy system and CO₂ emissions. As part of grid and system services, bidirectional charging can also contribute to stabilising the electricity grids in the future.

For the energy and charging industry, bidirectional charging is a building block for the energy transition, together with other options for flexibility. The extent of the flexibility potential depends on a sufficient supply of flexibility from electric vehicles that is competitive with other flexibility solutions.

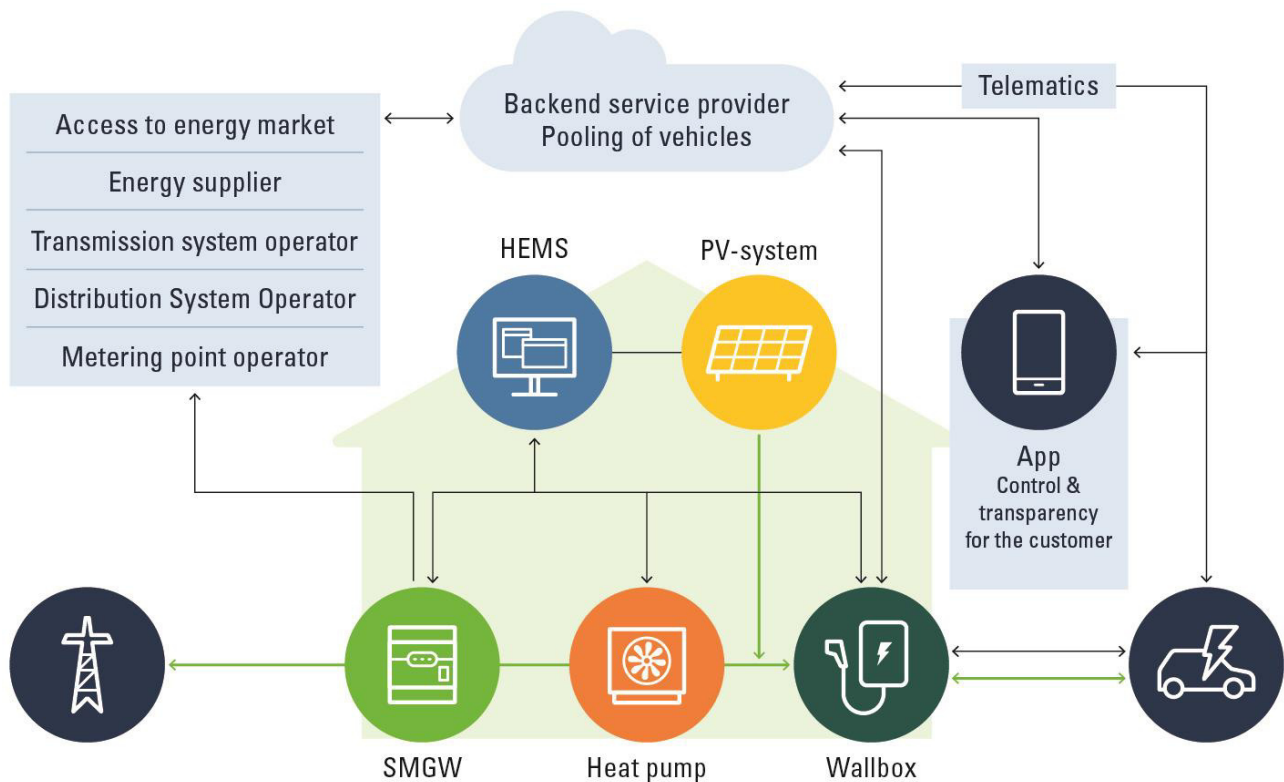


Figure 1: Simplified depiction of bidirectional charging. Source: Based on BDL information.

The potential contribution towards reducing (local) CO₂ emissions and increasing the share of renewable energies, on the other hand, is modest due to the increasing share of renewable electricity in the energy system (80% in 2030). With regard to the distribution grids, it can be assumed that there will be a need for additional grid expansion if bidirectional charging is used intensively.

The members of the National Centre for Charging Infrastructure Advisory Board have the common goal of enabling non-discriminatory bidirectional charging and tapping into the above-mentioned potential, particularly for the users themselves as well as for the energy system.

Corresponding business models are currently being developed, trialled and will be launched on the market in the coming years.

Among the various use cases, V2H/V2B will initially establish itself on the market; in the medium term, V2G will also develop on the market via aggregators and service providers.

It can therefore be assumed that V2H and V2B use cases such as increasing self-consumption, tariff-optimised charging and discharging of electric vehicles or load management for commercial users will be the first use cases to be represented on the market in the coming years. V2G use cases such as participation in electricity markets (intraday, day-ahead) and the provision of ancillary services (balancing energy, re-dispatch) will gradually establish themselves on the market.

The Advisory Board members agree that all use cases must be implemented in a non-discriminatory, standardised and competitive environment.

The availability of suitable bidirectional vehicles and charging facilities as well as their interoperability – from the vehicle to the charging facility and on to the grid connection point – are key to the successful nationwide introduction of bidirectional charging.

The increasing digitalisation of grids, including the spread of smart metering systems and pragmatic metering concepts, as well as improved mobile phone coverage, also play a key role in this.

Overall, the number of bidirectional vehicles and charging systems available on the market is increasing. However, the systems already available still differ in terms of the use cases they support and, due to a lack of standardised system norms, have so far only operated on a proprietary basis.

In the coming years, the Advisory Board anticipates a significant increase in the number of bidirectional vehicles and charging systems available on the market. The goal is plug & play solutions, i.e. standardised, interoperable and barrier-free systems in which the customer can connect various vehicles with different charging facilities and easily network them with the domestic energy management system in the home.

With increasing market penetration, bidirectional charging in the distribution grids is leading to changes in load and feed-in curves. How this affects the utilisation of the respective electricity grid depends, among other things, on which bidirectional use cases are offered and actually used by customers.

Nevertheless, the Advisory Board members from the energy industry assume that bidirectional charging, when used intensively as an option for flexibility in the electricity system (i.e. energy and balancing energy market), is accompanied by an additional need for grid expansion in the distribution grid. Only the application of Section 14a of the German Energy Industry Act (EnWG) can temporarily reduce the need for grid expansion independently of bidirectional charging.

The automotive industry is of the opinion that V2H (optimisation of self-consumption) and the market-oriented use cases of V2G (participation in electricity markets) offer the greatest benefits for users and the energy system. In addition to the position of the energy industry, the automotive industry points out that the grids must be comprehensively expanded and digitalised due to the electrification of heating and mobility.

With a realistic mix of use cases and the right framework conditions (time-variable grid charges, Section 14c EnWG), bidirectional charging may have a positive impact on the need to expand the grid, for example in comparison to scenarios with high proportions of price-controlled unidirectional charging applications.

In order to implement bidirectional charging, a suitable technical and regulatory framework must be created for all use cases.

To enable bidirectional charging to establish itself on the mass market, the Advisory Board believes that the following technical and regulatory measures in particular are required.

Setting the technical course:

From a technical perspective, internationally applicable and interoperable plug & play solutions are the goal and key success factor for a nationwide market launch in Germany.

In the following relevant standardisation areas, far-reaching enhancements are required for bidirectional charging:

Electrical safety: Adjustment or expansion of the existing safety parameters for the electrical connection between the charging device and the vehicle.

Grid connection: Adjustment of the parameters for connecting alternating mobile storage (e-vehicles) to different grid connection points (in contrast to purely stationary applications such as home storage).

Digital communication: Transfer of the now established and almost fully developed standards for linking the individual components of the overall system “vehicle – charging facility – backend” to the application phase.

Measurement, control, digitalisation: Necessary sets of rules for linking the digital communication “vehicle – charging facility – backend” to measurement and control applications.

Standardisation in the field of bidirectional charging is largely based on projects at ISO and IEC level. The international orientation of these standardisation projects ensures that largely uniform requirements are placed on the overall system worldwide.

The expansion of the various international standards for the use of all applications has been initiated and is to be largely implemented in the years 2025 to 2027.

ISO 15118-20 is essential for standardised communication between the vehicle and the charging system. According to statements made by vehicle manufacturers in the NLL’s Cleanroom¹ Talks, the standard will be implemented by all manufacturers surveyed from 2025..

Setting the regulatory course:

In order to tap into the potential of bidirectional charging for all use cases (V2G and V2H), the existing obstacles or disadvantages for electricity storage or electricity fed back into the grid under the current legal framework with regard to the obligation to pay fees, charges and levies must be removed in their entirety. This must be provided for regardless of the type of storage facility. An overarching legal framework must be created for this in the near future.

In addition, there is currently a lack of standardised regulations across Europe on how the user can access the data and make it available to aggregators and service providers, particularly with regard to data availability from the vehicle.

The following points in particular must be promptly adjusted by the federal government in the legal framework:

¹ Most of the participants in the 2023 update of the Cleanroom Talks were German and European manufacturers, whose market share in the passenger car sector is just under 80 %

- The current classification of intermediate storage of kilowatt hours drawn from the grid as “final consumption” with regard to the obligation to pay grid charges, levies and surcharges systematically penalises electricity storage, as the electricity stored temporarily is charged with ancillary electricity costs both in the context of intermediate storage and in the actual final consumption – and thus twice.
- In order to prevent this kind of double burden, electricity storage must not incur any grid charges, levies or surcharges. This does not constitute preferential treatment, as it merely avoids the imposition of a double burden. All grid fees, levies and surcharges are ultimately paid at the time of final consumption.
- Intermediately stored “green” electricity must retain its designated status and continue to be supported and marketed as green electricity under the EEG, even if it is temporarily stored in a storage facility that also contains grey electricity from the grid. The storage-related exclusivity principle in accordance with Sections 3 No. 1, HS 2, 19 (3) EEG must therefore be adapted.
- In principle, bidirectional charging requires a pragmatic and practicable metering concept that allows for the differentiation of temporarily stored grey and green electricity as well as the quantities of electricity fed back into the public grid.
- The implementation and revision of the relevant European regulations is essential so that the user can access the data required for bidirectional charging from the vehicle or transfer it to third parties for further services. The European requirements on the energy and power data from the vehicle required for

bidirectional charging (e.g. usable energy quantity, charging and discharging power), for example in Article 20a, paragraph 3 of RED III, must therefore be incorporated into national law. It is important to ensure that data access is automated and standardised.

Based on existing preliminary work (BDEW paper PG Data, VDA paper PG Charging), the automotive and energy industries, together with the responsible authorities, ADAC and consumer associations, are setting up an expert dialogue on the energy and power data required for bidirectional charging and its exchange, and are developing a list of the necessary data points for digital communication. The Advisory Board is defining a clear and comprehensive roadmap to pave the way for the widespread introduction of bidirectional charging. According to this, marketable – still proprietary – vehicle-to-home applications can be expected from 2025, with the first proprietary V2G solutions likely to enter the market with a short time lag.

From 2027/2028, there may be a ramp-up of interoperable, standardised solutions for V2H and V2G, which will facilitate the most important use cases once the corresponding standards are in place. The necessary regulatory and technical foundations should have been laid by then. Legislators must therefore take action at European and national level as soon as possible. At the same time, the internationally applicable technical standards must be successively developed further.

The introduction of bidirectional charging should be flanked by comprehensive and transparent consumer information measures throughout the entire process. The companies involved, consumer advocacy centres and automobile clubs have a particular responsibility in this regard. The National Centre for Charging Infrastructure’s Advisory Board will continue to provide ongoing constructive support for the process in the future.

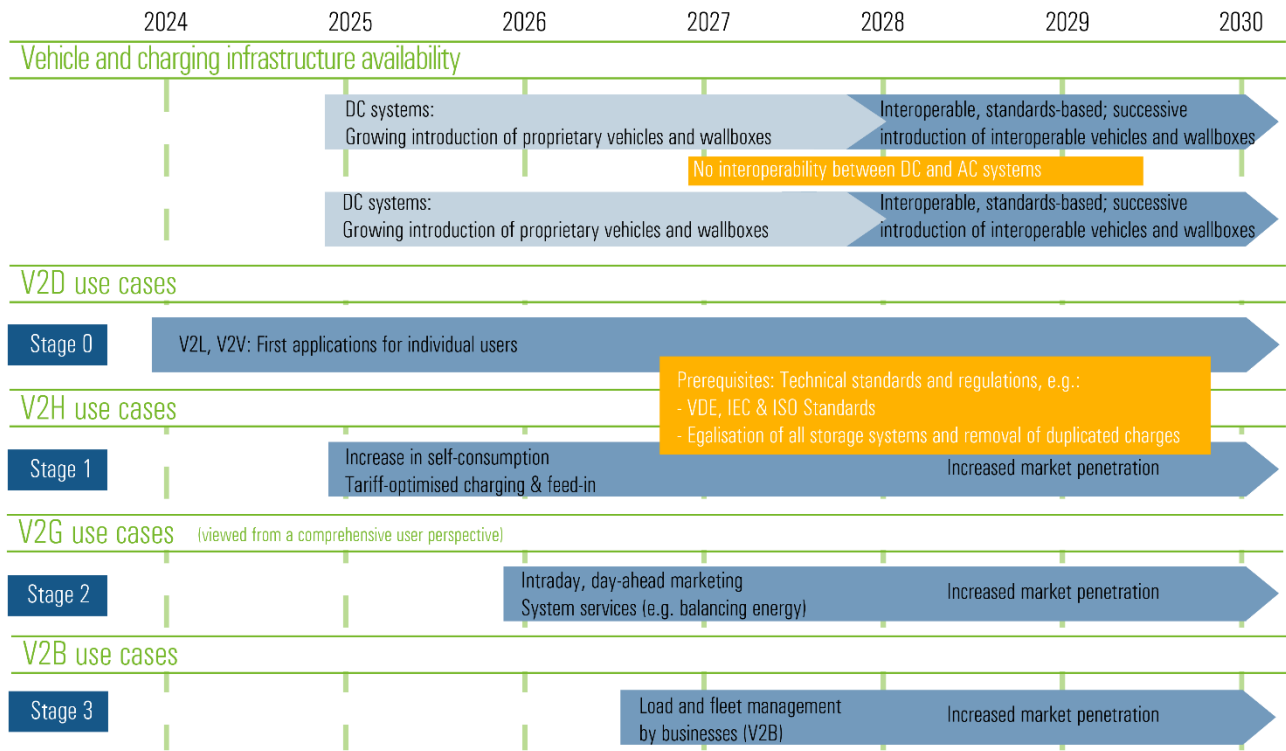


Figure 2: Bidirectional charging roadmap; Source: Own depiction

MAIN AUTHORS

ADAC:
Dr. Sören Trümper
Stefan Gerwens

BDEW:
Dr. Jan Strobel

BMW:
Claas Bracklo

Elli:
Maximilian Wilshaus

EnBW:
Stephan Wunnerlich
Elisabeth Kolb
Claus Fest

EWE GO:
Werner Harms

Mercedes Benz:
Sina Marek

National Centre for
Charging Infrastructure:
Dr. Jens Hinrich Prause

P3 on behalf of the VDA:
Michael Scholz
Markus Hackmann

VDA:
Loïc Geipel

Corporate and policy consulting E-Mobility –
Energy – Sustainability on behalf of the VDA:
Xaver Pfab

The position paper of the Advisory Board of the National Centre for Charging Infrastructure reflects the views of the members of this Advisory Board.

Further information on the Advisory Board can be found here:
[Networking | National Centre for Charging Infrastructure
\(nationale-leitstelle.de/en/vernetzen/\)](https://www.nationale-leitstelle.de/en/vernetzen/)