NATIONALE
PLATTFORM
ELEKTROMOBILITÄT

WG 4 – Benchmark paper

Standardization and Certification

Benchmark paper on the main requirements for the development of electromobility on a European and international scale

Working Group 4 "Standardization and Certification" of the National Platform for Electromobility set up by the German Federal Government has developed a "German Standardization Roadmap for Electromobility" on the basis of cross-sectoral cooperation within German industry. This roadmap provides an overview of existing structures and decisions made within the standardization landscape and addresses essential requirements and recommendations for action needed for e-mobility to see a breakthrough in Europe and the rest of the world. This benchmark paper summarizes the central demands put forward in the standardization roadmap. It identifies the framework conditions required for standardization, defines specific recommendations for action, and points out what further action is needed.

I. Framework conditions

Political action is needed at European and international level
The close networking of research and development, and of regulatory and legislative frameworks with standardization is necessary. National standardization and regulation carried out by certain countries must not impede harmonization at an international level.

Standardization must be quick and international
At present, national and international standardization concepts compete with one another. However, since road vehicle markets are international, efforts must aim towards developing international standards right from the start. The same applies to interfaces between e-vehicles and infrastructure. Standardization at national or European level alone is considered to be inadequate. It is therefore essential that national standards proposals be processed quickly and that German results be transferred to international standardization as soon as possible.

Coordination and focus are absolutely essential
Because e-mobility involves so many actors and sectors, collaboration among all relevant bodies, and coordination by DIN's Electromobility Office and the steering committee EMOBILITY (DKE/NA Automobil) are important to avoid duplication of work. New bodies should not be created; instead, the existing committees within DIN and DKE are to be strengthened.

Standards must be clear and unambiguous
To encourage innovation, standards should be function-related and should avoid the definition of specific technical solutions (i.e. they should be performance-based rather than descriptive).

Nevertheless, some technical solutions need to be defined in interface standards to ensure interoperability (e.g. between vehicles and the network infrastructure).

A uniform worldwide charging infrastructure is necessary (interoperability)
It must be possible to charge electric vehicles "everywhere, at all times": interoperability of vehicles of different makes with the infrastructure provided by various operators must be ensured. The standardization of charging techniques and billing / payment systems must ensure the development of a user-oriented, uniform, safe and easy-to-operate charging interface. User interests must have priority over the interests of individual companies.

Existing standards must be used and further developed without delay
There are already a number of necessary standards in the established sectors "automotive technology" and "electrical engineering". These must be appropriately utilized and made known. Providing information on these standardization activities and their status are a vital part of this standardization roadmap.

Moreover, the necessary work should focus less on initiating new standards projects than on expanding/adapting existing standards and specifications to the needs of e-mobility. Cross-sectoral cooperation at international level is required particularly for the standardization of interfaces.

Participation in European and international standardization is essential
In order to achieve our aims – and to ensure we have have active influence - a greater participation at national and international level is needed. This means that German companies must play a greater part in German, European and international standards work.

Standards work is to be seen as an integral component of R&D projects and thus eligible for funding.

II. Specific recommendations for action

German industry makes the following recommendations for action for the implementation of electromobility at European and international level:

Recommendation	Explanation
Use of type 2 AC charging accessories as specified in IEC 62196-2	The charging accessories system must ensure interoperability and connectivity between the vehicle and the infrastructure using a uniform, easy-to-use and universal solution. The concept of the IEC 62196-2 configuration type 2 charging accessories offers the most flexible and most mature solution with a view to the necessary harmonization in Europe. For this reason, German industry demands that the charging accessory of configuration type 2 as specified in IEC 62196-2 be used.
The use of shutters for charging accessories is questionable	The use of shutters (as in IEC 62196-2, type 3) is not considered necessary to ensure the safety of charging accessories. Furthermore, there are strong misgivings about the safety and functional reliability of charging accessories with shutters, since experts are of the opinion that there is insufficient experience on the probability of failure due to wear and contamination in long-term outdoor use.
Use of charging modes 1 to 3	Recommendations on charging modes (mode 1, 2 and 3 in accordance with IEC 61851-1): ■ Mode 1 as in IEC 61851 requires the provision of a residual current device (RCD) in the infrastructure. However, energy suppliers and grid operators do not recommend its use because it cannot always be ensured that a protective earth conductor and RCD are provided in installations, and the consumer cannot check this in every case. ■ It is recommended that mode 2 be used for existing installations. ■ Mode 3 is recommended for new installations. Technically, mode 3 offers the option of direct load management via the charging interface, including feeding energy back into the grid, and thus meets the conditions for linking electric vehicles to the smart grid.
Promoting conductive (direct, wired) charging and demand-compliant specification of inductive charging modes	German industry sets the following priorities for the rapid introduction of an interoperable charging infrastructure: ■ German industry's top priority is conductive charging. AC charging (modes 1 to 3) with up to 63 A (44 kW) three-phase (mode 3); DC charging: more than 50 kW). ■ Currently several basic technical framework conditions for the inductive charging of electric vehicles are being developed in various projects. At present, well-founded standards proposals can only be drawn up once the results of these projects are available. ■ In the opinion of German industry, battery-switching systems are not of high priority at present. In view of the amount of research still required, the same applies to redox flow systems.
Standardization of battery geometry only at cell level	The standardization of the external geometry of batteries is rejected as this would lead to restrictions placed on vehicle design which would have a negative effect on competition. The standardization of cell dimensions and the location of connections in the battery system should be encouraged.
Cooperation between the standards organizations ISO and IEC must be ensured	It remains to be seen whether or not the Memorandum of Understanding between ISO and IEC which is currently in the process of being adopted is implemented to the extent necessary. Concerted efforts within the Joint Working Groups under mode 5 are needed to strengthen international consensus-building between ISO and IEC. This applies especially to the subjects involving interfaces named in this paper.
Involving SAE in ISO/IEC work	Standardization is to be carried out in the established international organizations ISO and IEC. Consortia, particularly SAE, must be called upon to participate in standards work at ISO and IEC instead of developing their own additional specifications. Germany must work towards achieving this.
Cooperation with China	German standards setters and the German Chinese Joint Committee of Industry and Trade should actively work towards ensuring that China is involved in international standardization to a greater extent.

III. Further necessary standardization activities

German industry sees a need for the following standardization activities in the electromobility sector.

Activities needed	Activities needed
Electrical safety of the charging station	The future standard IEC 60364-7-722: “Low voltage electrical installations: Part 7-722: Requirements for special installations or locations –Supply of Electrical Vehicle” is currently being prepared. This work should be completed as soon as possible.
Electrical safety of the high-voltage on-board system	Essential safety requirements for the electric vehicle, its rechargeable energy storage system, the operational safety of electrical systems and personal protection are covered in the ISO 6469 series. Work on ISO 6469-3 is to be completed without delay.
Cables for road vehicles	Cables for voltages over 600 V are not covered at present. ISO 6722 and ISO 14572 are to be expanded to include cables for voltages up to 1000 V and 1500 V.
Electrical, chemical and mechanical safety of battery systems	The safety of battery systems is an area in which uniform standards are to be given high priority. Work on current projects (ISO 12405) in this area is to be completed as soon as possible. Current test methods need to be further developed and continually adapted to meet international demands.
Electromagnetic compatibility of vehicles	To ensure electromagnetic compatibility (EMC) at the drive system and overall system levels, tests have to be conducted under defined load conditions, and the requirements concerning immunity and field strengths must be adjusted in keeping with technological progress. In this context, the EMC standards being dealt with in cooperation with the CISPR should be taken into account. Some of these standards should be amended by adding new parts to the series. Attention should be paid to special needs for the various vehicle categories, e.g. for category M3.
Compatibility with smart grid communication methods	Compatibility with smart grid communication methods must be ensured. This means that it will be necessary to provide seamless communication between the vehicle charging station and the charging station infrastructure, taking into consideration current activities in connection with ISO/IEC 15118 “Road vehicles – Communication protocol between electric vehicle and grid”. Requirements arising from electromobility developments must be taken into consideration when the smart grid is being set up. Work on ISO/IEC 15118 is to be completed as soon as possible under German leadership.
Load management – with low and high temporal dynamics	Suitable application and communication protocols need to be defined for load management in smart grids, taking into account all relevant factors (predictability of energy availability, pricing flexibility etc.).
Restart after power failures (reboot grid)	After power failures, the time at which the electric grid is switched back on is a critical issue. To avoid grid instability due to a large number of vehicles having to be charged at the same time, suitable mechanisms for a controlled restart of charging procedures need to be defined and standardized.
Interfaces for vehicle diagnostics	Vehicle diagnosis is defined in the relevant ECE regulations. The extent to which the data exchange protocols for these interfaces defined in various ISO Standards can be modified or augmented to meet the special needs of electric vehicles is to be investigated.
External interfaces – DC plugs	DC plugs are being standardized in IEC 62196-3 which is being developed by IEC/SC 23H. Germany has proposed that the type 2 AC accessory be expanded to allow for DC charging. It is to be ensured that this proposal be included in the IEC standard.
External interfaces – charging stations	Charging stations – including charging modes – are being dealt with by IEC/TC 69 in the IEC 61851 series “Electric vehicle conductive charging systems”. It is to be ensured that IEC 61851 be developed so that it remains open to new technologies. Part 21 of this series describes electric vehicle requirements and is to be harmonized with ISO 6469-3 accordingly – preferably in a mode 5 JWG.
Charging station user interface	The use of graphic symbols is recommended for the charging station user interface so as to ensure intuitive and safe operation by a wide range of users. The extent to which graphic symbols can be used for man-machine-interaction and safety marking, and the necessity of further standardization remain to be investigated, as should the need for standardization as regards accessibility.

Inductive charging	Currently several basic technical framework conditions for the contactless charging of electric vehicles are being developed in various funded projects. At present, well-founded standards proposals can only be drawn up when the results of these projects are available. Further course of action with regard to the standards proposal submitted to the IEC (IEC 61980-1; “Electric vehicle inductive charging systems”) is to be voted on without delay. Active and timely participation of German experts at international level as well should be aimed at in order to prevent the premature standardization of technical solutions which would inhibit technical progress and unnecessarily restrict the diversity of good solutions.
Functional safety of charging stations	The development of a standard defining procedures is recommended to ensure the functional safety of charging stations. A risk analysis must first be carried out before this standard can be drafted.
Functional safety of vehicles	IEC 61508 and ISO 26262 are both process-oriented standards that in principle can be used for all electronic systems within vehicles. Energy storage is a complex, extremely sensitive system. Guidelines should be developed on the basis of ISO 26262.
IT security and data protection	This topic is very important, but is not being adequately addressed at present. It is recommended that a Working Group be set up with BSI participation.
Environmental conditions for electrical and electronic systems	The extent to which ISO 16750 “Road vehicles – Environmental conditions and testing for electrical and electronic equipment” can be modified or augmented to meet the special needs of electric vehicles is to be investigated.
Entire vehicle – performance and consumption characteristics	The following standards covering the entire vehicle, including the drivetrain, shall be reviewed to see if any additions are necessary: ISO 23828 Fuel cell road vehicles ISO 23274-1 Hybrid-electric road vehicles ISO 23274-2 Externally chargeable hybrid-electric road vehicles ISO 23274-3 Charging ISO TR 11954 and ISO TR 11955 Charge balance measurement ISO 8715 Road operation characteristics Furthermore, electric vehicle quiescent power consumption values must also be taken into consideration.
Consumption / charging infrastructure	It is recommended that specifications be defined regarding reliable internal consumption in the charging infrastructure, particularly during periods of inactivity.
Entire vehicle after accidents	To ensure safety in case of accidents, there is an urgent need for measures to allow simple and safe identification of the vehicle (HV, Li+, other hazardous substances etc.) The preparation of standards on drafting emergency rescue guidelines (including isolation of voltage sources by rescuers) needs to be commenced in the medium term.
Battery system after accidents (research need)	Studies must be carried out to determine how battery systems can be brought into a safe condition after an accident, and the need for standardization is to be determined on the basis of these studies.
Battery service life (research need)	Currently, the parties involved do not see any immediate need for a standard on methods to determine the remaining service life of a battery by recording the required characteristic values. This may, however, be a subject for research which can be integrated into future standardization activities.
Load spectra (research needs)	As the operation of purely e-vehicles may differ from that of present vehicles with internal combustion engines, research in the field of determining load spectra is considered necessary.
Capacitors (including ultracaps) (research needs)	Research in the field of capacitors for electric vehicle drive is considered necessary.

Verfasser:
Arbeitsgruppe 4 „Normung, Standardisierung und Zertifizierung“
der Nationalen Plattform Elektromobilität (NPE)

Redakteurin:
Geschäftsstelle der Nationalen Plattform Elektromobilität
AG „Normung, Standardisierung und Zertifizierung“ (NPE)
Stephanie Hölk
Audi AG
I/EM-1
85045 Ingolstadt

Herausgeber:
Gemeinsame Geschäftsstelle Elektromobilität
der Bundesregierung (GGEMO)
Scharnhorststraße 34–37
10115 Berlin

Grafik/Design:
Theim Kommunikation GmbH
Carl-Thiersch-Str. 3
91052 Erlangen

Druck:
Bundesministerium für Wirtschaft und Technologie