Brussels, 14 September 2011

ACEA position and recommendations for the standardisation of the charging of electrically- chargeable vehicles

Following previous commitments and the subsequently updated ACEA position from 2 March 2011 (http://www.acea.be/news/news_detail/acea_members_address_the_challenge_of_standardising_the_charging_of_electri/) ACEA members are continuing to contribute to the on-going debate within EU institutions on standards for electrically chargeable vehicles.

Having recognised the progress made over the last few months, namely in the CEN/CENELEC Focus Group and progress made in TEC (Trans-Atlantic Economic Cooperation), ACEA members present their final and joint recommendations on the interface between cars and the relevant infrastructure.

ACEA members express the urgent need to reach European agreement for standard AC charging and present their vision for common agreement on quick charging that also creates room for a global solution and for simplification.

Quick progress and EU-wide agreement for standard charging is a pre-requisite for quicker market uptake of electric vehicles and higher investment into a quick charging network. The recommendations and solutions presented by ACEA will have positive effects for all stakeholders:

- Consumers will find a unique EU-wide solution, at reduced cost and fulfilling all safety requirements;
- Infrastructure providers are provided a clear indication about future developments and investment planning;
- OEMs will be able to reduce costs and progress more quickly on the market uptake of electrically chargeable vehicles.

However, **it is important to note, that the current joint position and recommendation is based on today's best knowledge of the current situation and state of technical development.** This applies both for connectors/modes and communication. Certain technical solutions may still need to be validated in detail, as the technical specifications have not yet been finalised in the different International Standardization Groups. Also, insights and outcomes of demonstration projects and testing could eventually result in a set of different recommendations.

ACEA members call upon the European Commission, relevant standardisation bodies, and other stakeholders to support its recommendations and use them as a basis for the development of common European standards. In the global context, ACEA strongly supports the IEC standardisation process for a global solution. In this framework, ACEA recommends one defined "envelope"[1] for the vehicle inlet supporting single phase AC, three-phase AC and DC charging, including safety requirements. ACEA members will fully respect global solutions agreed in the future if found.

[1] See Annex III of the position

ANNEX I: ACEA position and recommendations on connector types (IEC 62196), charge modes (IEC 61851) and communication standards for the charging of electrically-chargeable vehicles (passenger cars and light-commercial vehicles)

Executive summary:

- ACEA continues to stress the need to divide the upcoming timeframe into two fundamental phases – An ongoing period till approval of relevant standards (Phase 1) and (Phase 2) the period following approval of relevant standards granting sufficient lead-time for implementation.
- The present agreement covers Phase 1 as well as Phase 2, applies to passenger and light-commercial vehicles, and addresses only AC and DC charging.
- **Phase 1 reflects the current situation** and should be seen as a preparatory step for a broader introduction of electrically chargeable vehicles in the EU. Public authorities are invited to consider the agreement reached by the industry. Pilot projects in urban areas should be streamlined on the infrastructure side accordingly.
- **Phase 2 foresees a uniform EU solution that enables the application of global charging standards, hence** reducing the variety of solutions in the market.
- Harmonised rules for phase 2 should apply to new vehicle types starting as of 2017, providing the industry with needed lead time to implement these new solutions in their vehicle development programs and to make necessary adaptations to the infrastructure.
- In line with the joint EU-US TEC discussions ACEA presents a definition of the global vehicle inlet "envelope" as a key step for global solution, enabling a simple switch between US and EU standards (see annex III).
- Concerning the connector types/modes and vehicle/grid communication, ACEA agrees on following key principles and recommendations:

  i) As for the proposed uniform EU solution (Phase 2 starting in 2017 for all new vehicle types on the vehicle side), ACEA suggest the **Type 2/Type 2 Combo to be used in the EU** as the standard for AC/DC charging both on the side of the vehicle and the public charging infrastructure, as long as it meets the required national safety requirements.

  ii) Standardisation of the joint "envelope" profile paves the way towards a real global solution. A single, simple solution cannot work between US and EU, in light of different operational conditions (namely differences between grids and electricity power on the grids), The proposed **joint "envelope" profile** facilitates the exchange of Combo 1/Combo 2 solutions and will lead to significant simplification of charging mechanisms for consumers, as well as cost reductions for the industry.

  iii) **No direct communication between vehicle and grid is foreseen for the moment**

  iv) Preference **PLC communication** between EV and EVSE shall be ISO/IEC 15 118 compliant.

  v) If, in the future, direct communication between EV and the grid is established, it shall follow an international standard (to be defined, but it should be compliant at least with ISO/IE C 15118)

  vi) **International standards** ISO/ IEC 15 118 and IEC 61851-23/-24 shall cover the needs of communication for most modes of charging.

  vii) As for the communication technology, ACEA decided to **concentrate all efforts on IEEE 1901 Profile Green PHY on CPLT/PE, with a demand for further tests to confirm this direction.**

  viii) For wireless communication, the industry decided to select a PLC technology. **Wireless solutions should be developed further in the future and will,** for the moment, reflect additional company specific extensions and business cases.

Justification:

- Concerning the vehicle inlet: electrically chargeable vehicles are entering the market and there is no opportunity to implement uniform vehicle inlets at the moment. But considering the need to have a standardised solution, European manufactures are committed to accepting one "envelope" solution for vehicle inlet once it is set by legislation or standard (with sufficient lead time).
- The proposed Type 2/Type 2 Combo provides the opportunity for a unified solution for different AC and DC charging powers and enables compatibility among solutions.
- Both for the vehicle inlet and public infrastructure side, Type 2/Type 2 Combo is the only solution for the moment in Europe that can combine standard AC and fast AC and DC charging in the near future.
- Type 2 fulfils all ISO/IEC safety requirements and can be equipped with shutters as well.
- Therefore, Type 2/Type 2 Combo, is the only solution that can be used both on the vehicle and public infrastructure sides and is ready for all kinds of charging and can ensure interoperability EU-wide.
- Type 2 Combo offers an opportunity for a global solution and fits in the proposed "envelope" profile as well.
- The proposed "envelope" profile creates a solution that streamlines EU and US charging systems.
- Type 2 is also open for future development and global harmonisation of charging standards.

A. BASIC CHARGING

(covers "basic AC charging" up to 3,7kW)

Phase 1:

ACEA agreement for the vehicle inlet:

No restrictions on the type of vehicle inlet as vehicles with different types are already on the market or in a late development phase. Manufactures will provide at least one cable with Type 2 plug (Mode 3) or standard domestic plug (Mode 2) to connect to infrastructure.

ACEA recommendation for public charging (infrastructure side):

Type 2 (Mode 3)

ACEA recommendation for home charging (infrastructure side):

Type 2 (Mode 3), standard home socket outlet (Mode 2) or industrial socket (IEC 60309-2 - Mode 2).

Remarks:

Remark 1: Industrial sockets (IEC 60309-2 – Mode 2) should be allowed for this transitional period.

Remark 2: As vehicles from Phase 1 product launches will be equipped with different kinds of vehicle inlets, it is important that all public charge spots which use attached cables have an additional Type 2 infrastructure socket outlet (Type 3 where nationally required). If the vehicle inlet is of a different type than the connector on the fixed cable, the customer must be able to use its own cable delivered with the vehicle. (Any adaptors on the vehicle side are forbidden by IEC 61851 due to safety concerns).

Remark 3: Standard home sockets (mode 1) are widely available and well known to customers making them easy to use; therefore they should remain a valid solution for the market uptake. However, a third party certification of the household electricity grid should be conducted before the electrically chargeable vehicle is first charged.

Phase 2:

To achieve a harmonised solution, ACEA strongly recommends unifying national regulations for socket outlet types without shutters. Proposed solutions should fit with the global solution, ensuring different ways of charging (single and three phase AC). Harmonised rules for phase 2 will apply to new vehicle types starting 2017.

ACEA agreement on the vehicle inlet and connector:
The Type 2 (Mode 3) uniforms EU solution in a global "envelope", if opted for by the manufacturer. Manufacturers should provide at least one cable with Type 2 plug (Mode 3) to connect to infrastructure.

ACEA recommendation for public charging (infrastructure side):
The Type 2 (Mode 3) uniform EU solution.

Note: In case of charging spots with a fixed cable with only a Type2 vehicle connector, ACEA recommends that those charging points are during the transitional period also equipped with standard Type2 outlet (Type3 socket outlet if national differences still remain). Standard home charging should be still allowed as in phase 1.

B. FAST CHARGING

(Including "fast AC charging" above 3,7kW up to 43kW, "fast DC charging" up to 43kW and "ultra fast DC charging" above 43kW)

General remark: ACEA strongly recommends this type of infrastructure/charging points be equipped with a fixed attached cable in line with existing standards. ACEA also see this network as a charging "safety net".

ACEA recommendation for the vehicle inlet:
The Type 2 or Combo2 in a global "envelope" as defined in Annex III

ACEA recommendation for public and fleet charging:
Charging points equipped with fixed cables with a Type 2 or Combo2 connector.

ACEA recommendation for home charging:
Charging points equipped with fixed cables with a Type 2 or Combo2 connector.

Remark: The development of public infrastructure shall not ban vehicles already equipped with other existing DC charging devices (e.g. CHAdeMO) and backward compatibility solutions for those vehicles should be considered.

C. COMMUNICATION PROTOCOLS FOR FAST AC/DC CHARGING

Communication is essential for charging electric vehicles. Once integrated into the smart grid, the vehicle–to-grid communication should enable the reaching of particular objectives:

- Controlling the charging procedure by infrastructure and vehicle
- Providing convenient charging for all customers, e.g. to achieve reliable charging in the absence of the driver
- Enabling certified payment and billing systems
- Maintaining high-voltage safety and personal privacy
- Ensuring the interoperability of certified value-adding vehicle-to-grid accessories.

The communication must maintain the personal privacy of the user and communication technology must be generally available and future proof. The PLC communication interface shall be established via the charging connector.

If a unique communication paradigm guaranteeing low latency in DC mode and sufficient specifications for the AC high-end communication arises, it shall be applied to all existing charging connectors which support all modes of AC and DC charging. If such a solution cannot be strongly proven to work properly, then 2 different ways of communication, one for DC and one for AC, shall be proposed.

A large number of communication options are being discussed and implemented for in-home communication and "smart home" functions. This includes several wireless and PLC systems. These solutions are expected to rapidly evolve and change over time. To provide a stable interface for EVs, work on the ISO/IEC15118 standard for EV charging communication and parallel activities which focus on DC charging communication in IEC61851-24 is closely followed by the automotive industry.

Specific issues:

i) Direct V2G communication (without EVSE)

As far as long-term future options are concerned, the vehicle battery may be used to feed energy back into the grid whenever the price for control energy or balancing energy is particularly high. Many technological, safety and legal issues still have to be resolved (e.g. negative effects on the durability of the battery, the power grid and consumer convenience) until then. Therefore, no communication between vehicle and grid is foreseen for the first stage. The charging has to be in-line with all safety standards, through harmonised hardware.

ACEA agreement: No communication between vehicle and grid is foreseen for the moment.

Options available for the advanced stage:
If future use requires direct EV-to-grid communication without an EVSE, the ISO/IEC15118 charge communication provides a flexible base for adaptations to future infrastructures due to the usage of common TCP/IP communication in a layered architecture. This allows a wide range of topology for the charging infrastructure, from a local centralised controlling instance within an EVSE up to a distributed system with a decentralised controlling instance on the internet.

ACEA agreement: If future use cases require direct EV-to-grid communication without an EVSE, specific and agreed international ISO/IEC standard shall be applied allowing both wire and wireless solutions (ISO/IEC 15118 should be included at least).

ii) V2G communication using EVSE

Options available:
The standard for charging communication, ISO/IEC15118, is the baseline for V2G communication with EVSE. The standard is currently being developed by an international cooperation, with the strong support of the automotive industry. IEC61851-24 extends ISO/IEC15118 by additional messages for DC charging. Both standards are comprehensive and sufficient for the definition of V2G communication using an EVSE.

ACEA agreement: The standard for charging communication ISO/IEC15118 together with IEC61851-23/24 defining additional messages for both AC and DC charging shall be applied.

iii) Communication technology (data link layer) and physical layer

Options available are represented by two major technologies:

- G3-PLC (with frequencies below 500 kHz) and
- IEEE P1901.2 HomePlug Green PHY (with frequencies between 2 and 30 MHz).

These technologies appear to be convenient and available sufficiently soon. The two possible communication links are

- Power wires between EV and EVSE (called “mains” link),
- The pilot line (CPLT) / Protective Earth (PE).

Decision on both layers need to be taken together because they will influence each other. Preliminary theoretical analysis, simulation and physical tests show that HP GP on the pilot line is seen as the most promising technology. This technology provides a high level of robustness for a reliable communication, together with future oriented high data rate.

ACEA agreement: Concentrate all efforts on of IEEE 1901 Profile Green PHY on CPLT/PE to be operational as soon as possible with a demand for further tests needed to confirm this direction.

Note: No such communication should be mandatory to enable charging. Indeed, it is important to enable AC charging as soon as the vehicle is compliant with IEC 61851-1 standard, notably in terms of pilot line, in all countries and places.

iv) Wireless communication for conductive charging

For launching the market, the OEMs have decided to select a PLC technology for the EV/EVSE communication. Thorough further investigation is required in into the use of wireless communication.

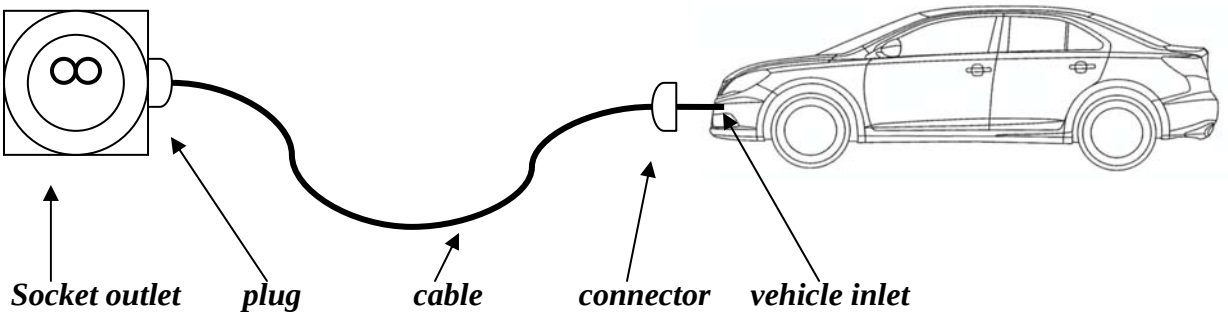
Wireless communication may be a solution for the future (e.g. for inductive charging) or for company specific extensions and business cases, so it should be left to the competitive area of additional services on offer by each OEM. It could also involve existing technology that may be carried over from conventional vehicles.

As a complement of conductive charging, the wireless communication does not cover the charge and control mechanism, neither in AC (61851-1) nor in DC (61851-23/24). Nevertheless, according to the current state of the art, the PLC communication is seen as the main path of the EV/EVSE communication, when equipped.

ACEA agreement: Keeping PLC technology for main vehicle-EVSE communication.

ANNEX II: Vocabulary and abbreviations

To ensure clear communication, ACEA advocates the use of common language with the following terminology:



Explanatory notes:

AC – alternating current (movement of electric charge that periodically reverses direction).

DC – direct current (movement of electric charge in one direction).

ISO/IEC15118 – international standard for EV charging communication protocol between electric vehicle and grid, focusing on providing a solution for a link between the EV and the charge spot.

IEC61851-24 - international standard which focuses on DC control communication protocol between off-board DC charger and electric vehicle.

IEC 61851-1 – IEC standard on general requirements for electric vehicle conductive charging systems.

V2G – vehicle-to-grid.

PLC – Power Line Communication.

EVSE – Electric Vehicle Supply Equipment - conductors, including the phase, neutral and protective earth conductors, the EV couplers, attachment plugs, and all other accessories, devices, power outlets or apparatuses installed specifically for the purpose of delivering energy from the premises wiring to the EV and allowing communication between them if required (according to ISO/IEC 61851-1 standard).

"G3" and **"HP GP- Home Plug Green PHY"**- two different power line communication technologies.

CPLT – Control PiLoT line used for control and safety signals.

PE – Protective Earth.

ANNEX III: Definition of a global envelope profile

Global technical specification on "envelope" – vehicle inlet – for global solution