Brussels, 4 May 2012

ACEA position and recommendations for the standardization of the charging of electrically chargeable vehicles

Following the previous commitments made and 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 during last months, namely in the CEN/CENELEC Focus Group and progress made in TEC (Trans-Atlantic Economic Cooperation), ACEA members present final agreement and joint recommendations on interface between cars and relevant infrastructure.

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

From the perspective of the automotive industry, presented agreement and solutions will have positive effects for the consumers (having unique EU wide solution, cost reduction for all stakeholders and fulfilling all safety requirements), for the infrastructure providers to have clear indication about the future development and for the OEMs to reduce costs and progress more quickly on the market uptake of electrically chargeable vehicles. Quick progress and EU-wide agreement for standard charging is a pre-requisite for quicker market uptake of electric vehicles and higher investment into quick charging network.

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.** That 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 finalized in the different International Standardization Groups. Also learnings and outcomes of demonstration projects and testings could eventually result in a set of different recommendations.

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

Considering the ACEA common position regarding charging connectors and its communication, we, automotive industry, will make further efforts in promoting e-mobility solutions and services. We believe that such is only possible based on co-operation with utilities, infrastructure companies, and the automotive industry, supported by the governments. ACEA also urges the need to implement ACEA recommendations and encourages all stakeholders involved in standards setting mentioned below.

[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 and stresses the need to divide the timeframe into two fundamental phases - Ongoing period till approval of relevant standards (Phase 1) and approval of relevant standards with sufficient lead-time for implementation (Phase 2).
- Current agreement covers both Phase 1 and Phase 2 for passenger and light-commercial vehicles only for AC and DC charging.
- **Phase 1 reflects current situation** and should be seen as a preparatory step for a broader introduction of electrically chargeable vehicles in the EU. Public authorities are welcomed to consider the voluntary agreement made by the industry and pilot projects in urban areas should be streamlined on the infrastructure side accordingly.
- **Phase 2 suggests an uniform EU solution enabling global charging standards to be applied** that reduces the variety of solutions in the market.
- Harmonized rules for phase 2 should apply for new vehicle types starting 2017, providing the industry with needed lead time to implement these new solutions in their vehicle development programs and to make necessary adaptation in the infrastructure.
- In line with the joint EU-US TEC discussions ACEA presents a definition of global vehicle inlet "envelope" as a key step for global solution, enabling simple switch between US and EU standards (see annex III).
- Concerning the connector types/modes and communication, ACEA agrees on following key principles and recommendations:

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

  ii) Standardisation of joint "envelope" profile paves the wave to real global solution. Having in mind too different operational conditions (namely from the side of grid and electricity power in grids), simple single solution cannot work between US and EU. **Joint "envelope" profile** facilitates the exchange of Combo 1/Combo 2 solutions and will lead to significant simplification of charging mechanisms for consumers and 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 communication between EV directly to the grid will be 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 of IEEE 1901 Profile Green PHY on CPLT/PE.**

  viii) For the wireless communication, industry decided to select a PLC technology for the communication, **wireless solutions should be developed in the future**

or for the moment will represent additional company specific extensions and business cases

Justification:

- Concerning vehicle inlet, electrically chargeable vehicles are entering the market and there is no possibility to have unified vehicle inlets for the moment. But having in mind the need to have standardized solution, European manufactures are committed to accept one "envelope" solution for vehicle inlet once it is set by legislation or standard (with sufficient lead time).
- Proposed Type 2/Type 2 Combo provides background for 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 short future.
- Type 2 fulfills all safety requirements of ISO/IEC and can be equipped with shutters as well.
- Therefore from the perspective of automotive industry, Type 2/Type 2 Combo, is the only solution that can be used both on vehicle and public infrastructure side and is ready for all kinds of charging and can ensure interoperability EU-wide.
- Type 2 Combo give as opportunity for global solution and fits to proposed "envelope" profile as well.
- 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 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 (Type3 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:

As for harmonized solution, ACEA strongly recommends to unify national regulations concerning socket outlet Types without shutter. Proposed solutions should fit to the global solution ensuring different ways of charging (single and three phase AC). Harmonized rules for phase 2 will apply for new vehicle types starting 2017.

ACEA agreement for the vehicle inlet and connector:
Type 2 (Mode 3) uniform EU solution in global "envelope" if opted by 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):
Type 2 (Mode 3) uniform EU solution.

Note: In case of charging spots with fixed cable with Type2 vehicle connector only, ACEA recommends that those charging points are for 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 and "fast DC charging")

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

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

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

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

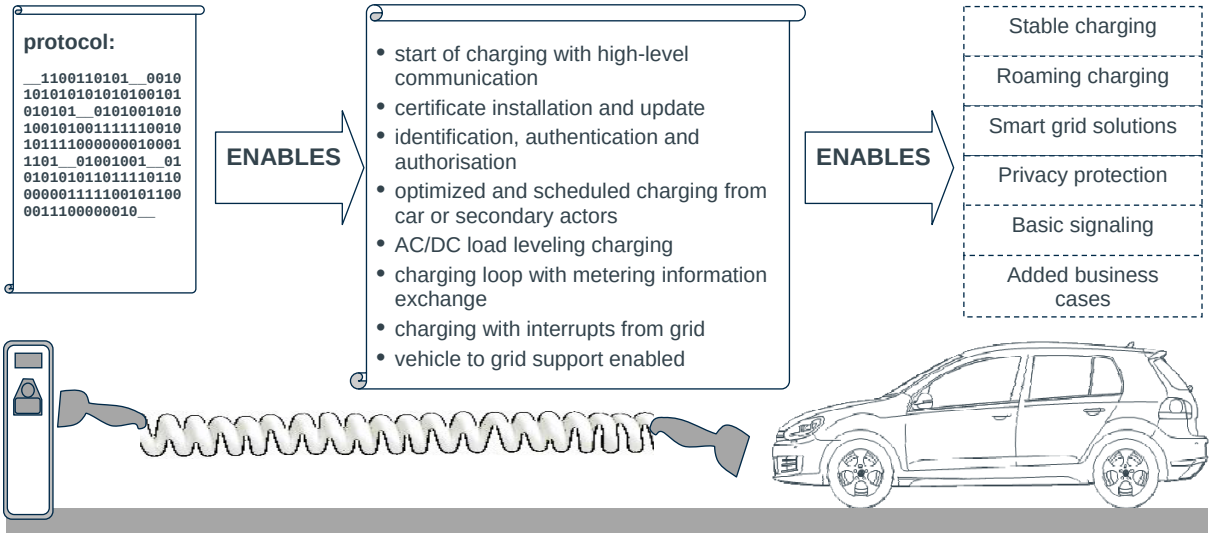
Remark: The development of public infrastructure shall not ban vehicles already equipped with other existing DC charging devices (e.g. CHAdeMO) and backward compatibility solutions for those vehicles should be considered.

C. Communication protocols for AC/DC charging

Communication is essential for charging electric vehicles. Basic communication for AC mode 3 should be in line with IEC 61851-1 standard that has to be applied on all charging points. The detailed specification of ISO/IEC 15118 enables reliable charging in different use

cases like smart grid integration, roaming for charging abroad and also guarantees customer privacy, authentication and identification purposes.

ISO/IEC 15118 describes communication between the car and the infrastructure (charging point) using **IEEE 1901 Profile Green PHY on CPLT/PE**. ISO/IEC 15118 does not include and describe any further details for enabling the infrastructure behind the charging point for smart grid solutions, for roaming services and so on, and it also does not include any details of the internal process of handling the data of this ISO/IEC 15118 protocol inside the car and the Control Units being part of the car.



The ISO/IEC 15118 protocol aims to propose non-exclusive list of solutions that enable different services as shown.

The basic functionality of ISO/IEC 15118-controlled charging follows this pathway:

1. Start of charging process (after inserting the plug)
2. Communication setup (basis for ISO/IEC 15118 information exchange)
3. Certificate handling (basic need for identification, etc.)
4. Identification, Authentication and Authorization (Security issues, safety issues)
5. Target setting and charge scheduling (exchange of data, time setting, start charger etc.)
6. Charge controlling and re-scheduling (question of levelling)
7. Use of value-added-services (not defined yet)
8. End of charging process (electrically, and draw plug)

This protocol is not the only protocol that can be used in the future. Once integrated into a smart grid, the vehicle to grid communication technology must be general and future proof and should enable reaching particular objectives:

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

To provide a stable interface for EVs, the 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 automotive industry.

Specific issues:

i) Direct V2G communication (without EVSE)

No communication between vehicle and grid is foreseen, only vehicle charging is considered and this has to be in-line with all safety standards, through harmonized hardware.

ACEA agreement: No direct communication from vehicle to grid is foreseen.

ii) V2G communication using EVSE (including wall-boxes)

Independent of future standards, many technological, safety and legal issues still have to be resolved concerning two-way communication and energy flow between vehicle and grid (negative effects on the durability of the battery, the power grid, consumer convenience, privacy, warranty on the battery etc.). A large number of communication options are being discussed and implemented that also includes several wire and wireless systems. These solutions are expected to rapidly evolve and change over time.

The standard for charging communication ISO/IEC15118 is the baseline for V2G communication with EVSE. The draft standard is currently discussed with strong support by the automotive industry.

ACEA agreement: The standard for charging communication ISO/IEC15118 defining mechanisms for both AC and DC charging shall be applied. If future use cases require a direct EV to grid communication using EVSE, specific and agreed ISO/IEC standard shall be applied allowing both wire and wireless solutions.

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

ISO/IEC 15118 working group has decided to focus all activities on using **IEEE 1901 Profile Green PHY as the physical layer.** This technology appears as convenient and available sufficiently soon. The transmission is via the pilot line (CPLT) / Protective Earth (PE).

ACEA agreement: Concentrate all efforts on of IEEE 1901 Profile Green PHY on CPLT/PE to be operational as soon as possible. First implementations using IEEE 1901 Profile Green PHY are currently under development.

Note: If the vehicles are charged under Mode 1 or Mode 2, no such communication should be mandatory to enable charging.

iv) Wireless communication for conductive charging

For launching the market, the OEMs have decided to select a PLC technology for the EV/EVSE communication. Deeper investigations are required for the future for introducing a wireless communication for this communication.

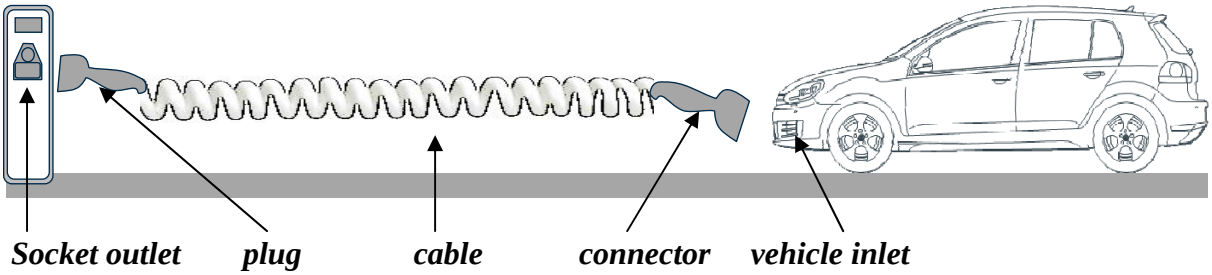
Wireless communication may be a solution for the future (e.g. for inductive charging) or for company specific extensions and business cases, so it should be left to the competitive area of additional services offer by each OEM. It also represents existing technology that may be carried out over from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

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

Annex II: Vocabulary and abbreviations

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



Explanatory notes:

AC – alternating current (movement of electric charge in 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 link between the EV and the charge spot.

IEC61851-24 - international standard which focus 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 system

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).

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