Recommendations for the management of metering data for billing electric vehicle recharge

The management of electric vehicle charging metering data, from their generation, their display, their use for billing to their archiving, are important elements to ensure the sincerity of users' bills and thus their confidence in the use of charging.

Numerous regulatory texts exist on this subject, peculiarly the European MID directive or the texts defining the rules of trade. However, most of these texts were written in contexts very different from that of electric vehicle charging.

For several years now, there have been many initiatives in Europe to complete and clarify these regulations. The WELMEC organization (legal metrology) is working on instrument control methods, particularly for DC, a ministerial decision of March 2022 specifies the rules applicable to DC charging in France (in general, fast charging), Germany has legislated in this area with the EichRecht law, and European standardization has begun normative work on the management of metering data...

Faced with such an abundance of information and given the associated economic, industrial and regulatory issues, AFIREV and AVERE have mandated a working group with GIMELEC to study the subject in order to make recommendations to the authorities and electromobility players.

The mandate given to the group was to analyze the current situation (applicable requirements and their implementation), to formulate the principles and outline the solutions that should guide this management of metering data and to make recommendations on the approach to be followed both for French regulations and in terms of solutions to be promoted, for the short and medium term, with a clear objective of European convergence.

For the short term, the group focused particularly on normal AC recharging, since DC recharging was the subject of a Ministerial Decision in March 2022 that defines the rules and that the group was not mandated to question. However, the WG identified a strong need to clarify the precise obligations that this Decision creates for each actor as well as how compliance checks will be verified.

The WG met from March to September 2022. This document is a summary of its work and recommendations.

These recommendations are either short term (as soon as possible depending on operational constraints) or medium term, within the timeframe of the standards being prepared. They apply to any public charging point.

1. The regulatory and normative context

The management of electric vehicle charging metering data, from their generation, display, use for billing to their archiving, are important elements to ensure the sincerity of users' bills and thus their confidence in the use of charging.

The main regulatory or normative bodies and texts:

- The European MID (Measuring Instruments Directive): The Measuring Instruments Directive 2014/32/EU harmonizes many aspects of legal metrology in the EU. It defines the rules in Europe for all types of metering that enter into a commercial transaction: technical requirements, display requirements, certification requirements, requirement on data retention and access for the consumer. This Directive concerns the measuring instrument and its implementation conditions, not the complete product such as the charging station.

Important notice: a charging station whose metering is not MID certified cannot charge per kWh.

- OIML (International Organization of Legal Metrology)
- WELMEC (Western European Legal Metrology Cooperation) on the application of the directive and its interpretation, and on the methods of control of these instruments. Its members are national officials of the legal metrology authorities of the Member States of the European Union and the European Free Trade Association. It

issues guides that can be taken as reference in regulations (see Ministerial Decision DC in France). In particular: Welmec guide 7.2:2020, clause 6 (Extension L: Long-term Storage of Measurement Data)

- Standards:

EN 50470 (part 4 for DC in finalization)

A new European standard is under preparation at Cenelec CLC/TC13/WG03: Electric mobility - Measurement systems for distribution equipment. This new standard aims to complete the MID as defined by its terms of reference:

> This standard defines the minimum metering and system requirements for devices that measure energy and time for stationary conductive DC and AC power equipment, such as those complying with IEC 61851, in the power supply of non-stationary electrical equipment, e.g. electric vehicles.
>
> This standard specifies terms and definitions, configuration and requirements. It contains minimum requirements and evaluation criteria for measuring systems. The objective of the standard is to detail the requirements for measurement systems for stationary power equipment in support of the MID (Directive 2014/32/EU)

IEC 62052-11:2020, and its finalized European version EN IEC 62052-11:2021/A11:2022:

> - It serves as the basis for the new 2022 edition of EN 50470-3 (which governs AC meters vs MID) and the future EN 50470-4 (which will govern DC meters vs MID), replacing EN 50470-1 which will become obsolete.
>
> - It should be harmonized with the MID and EMC directives, as far as its scope is concerned (the complement for MID being brought by EN 50470-3 or -4)
>
> - This standard is amply cited in the ministerial decision of March 2022 for DC metering in France

In France, several regulatory texts govern the field

- Transposition of the MID: Decree 2016-769 of 9 June 2016 on measuring instruments & Order 9.6.2016

  https://www.entreprises.gouv.fr/files/files/directions_services/metrologie/reglemen/textes/dir-2014-32.pdf
- Decree n°2001-387 of 3 May 2001 - relating to the control of measuring instruments (amended by Decree 2016-769 of 9 June 2016)
- Order of August 1, 2013 on active electrical energy meters (amended by Order of November 2, 2016, by Amended by Order of August 26, 2020)
- Ministerial Decision No. 22.00.570.001.1 of March 1, 2022 on direct current electrical energy meters

In Europe, some countries have their own legal provisions:

In Germany, the EichRecht has precisely defined the requirements for electric vehicle charging metering data.

2. Mandate of the WG

The Working Group was mandated by AFIREV and AVERE to study options to meet known and future requirements for the processing of metering data for charging. The WG was asked to analyze the options chosen by Eichrecht in Germany, to see how the requirements considered in Eichrecht could be met.

The deliverable ordered is a report that clarifies the situation in France and makes proposals for future developments.

The WG, led by GIMELEC, met 6 times, from March 2022 to September 2022. The minutes of each meeting were submitted to AFIREV.

The composition of the group is given in annex.

3. Recommendations

Recommendations #1 through #3 are general. Recommendations #4 through #7 address specific requirements for the Short Term (ST). Recommendation #8 addresses the Medium Term (MT).

On general approach

#1: Be pragmatic for the ST and prepare the MT in a European context.

The changes that are identified for the charging stations or for the complete system may require product adaptations (hardware and software). We strongly recommend considering industrial constraints and avoiding to impose too short-term modifications that would render entire ranges of charging points in production non-compliant and therefore obsolete, whilst those modifications could also be called into question by future normative or regulatory developments.

→ Do not impose retrofits of charging points in operation, which would lead to a form of programmed obsolescence, at a time when the industry is facing supply constraints for very critical components, and counterproductive for the very deployment of charging infrastructures.

→ If a new obligation requires an adaptation of equipment, sufficient time should thus be given to manufacturers and operators.

→ In the short term, give priority to incentives rather than obligations: recommendations for specifications, conditions for granting aid, etc.

→ In the medium term, changes should be made within the framework of European standardization: work undertaken at Cenelec CLC/TC13/WG03.

#2: Treat AC and DC consistently but independently

The issues of normal AC and fast DC charging points are different:

- in the amounts charged to users
- in the usage (parking time at the station of about 20' to 30' in DC, more than 2 hours, or 4 hours or more in AC)
- in the price of the stations, much more constrained in AC
- in the volume of the park concerned (x 10 in AC compared to DC)
- in the regulatory framework of metering which has just been set by ministerial decision in March 2022 for DC.

What is required today for DC should not be applied as is and immediately for AC, due to the industrial and economic constraints mentioned in #1.

Note: For DC, we recommend clarifying, via practical sheets, for each stakeholder of a recharging service, which obligations are incumbent on him and how they will be verified by the certification.

In the medium term, the orientation should be to unify the standards for metering between AC and DC. This is the work started in mid 2022 by the European standardization at Cenelec CLC/TC13/WG03.

#3: Consider the various imprecisions or interpretations in the application of the MID to electro-mobility.

The electrical MID (which deals only with AC metering to date, notably in France, and is in fact aimed at the distribution and sale of electricity within the framework of the energy codes) has been written in a context of distribution metering, without considering the specificities of electro-mobility. The MID, and therefore the certification of conformity, relates to the meter in the charging point, not to the charging station itself nor to the charging infrastructure as a whole.

Note: In DC, the Ministerial Decision has set the regulatory requirements for charging infrastructure in France, which clarifies the regulatory framework. MID certification of a DC meter would therefore not be sufficient; the certification defined in the Ministerial Decision remains necessary. The 50470-4 standard currently being drafted aims to precisely define the MID requirements for DC.

This has led to very different interpretations by manufacturers or operators of MID requirements at the level of the charging stations or the complete system. The recent publication of interpretation guides (WELMEC in particular) is an illustration of these difficulties in understanding the requirements.

This leads us to recommend a pragmatic approach to deal with the AC case in the next few years while waiting for the conclusion of the normative work.

Specific short-term requirements

We have identified (peculiarly in the laws or regulations of certain countries, such as EichRecht in Germany), major requirements, because of the application of the MID, which can impact stations or complete systems. They will of course be part of the context to be considered in the construction of standards and rules for the medium term. They have also been considered to define the short-term recommendations, with the objective of progressive European convergence.

These recommendations apply to metering for public AC charging points. The rules for DC have just been defined by the Ministerial Decision.

These recommendation apply to charging points publicly accessible.

Note that for each point, as expressed in recommendation #1 above, there should be no retrofit obligation.

#4. Obligations of Display on the station

The MID requires, for any type of measurement:

> 10.1 Indication of the result shall be by means of a display or hard copy.
>
> 10.2 The indication of any result shall be clear and unambiguous and accompanied by such marks and inscriptions necessary to inform the user of the significance of the result. Easy reading of the presented result shall be permitted under normal conditions of use. Additional indications may be shown provided they cannot be confused with the metrologically controlled indications.

These requirements concern the meter itself, not the station. But the requirement that the counting result be visible to the user must be met. Many technical possibilities exist, from positioning the meter in external visibility, installing a remote display, or making the meter display visible.

To limit the necessary modifications, we recommend that the possibility of making the indication on the meter visible through a window on any side of the station be recognized as fulfilling the requirement. This is the short-term solution adopted by some manufacturers in Germany to comply with this requirement. It is also what the OIML recommends in its Guide G22 (2022):

> 4.3 Access to data
>
> 4.3.1 Readability of the result
>
> An EVSE shall make the legally relevant transaction data accessible to the end user through the client interface. This shall be done in accordance with 4.3.1.1 and/or 4.3.1.2. Both options may be implemented.
>
> 4.3.1.1 The EVSE is provided with an indicating device that is locally visible from the outside of the EVSE and that is capable of showing the legally relevant transaction data as indicated in 2.3.38, with a minimum character height of 4 mm.
>
> 4.3.1.2 The EVSE is provided with a non-local client interface to provide the end user access to the data […]

We also recommend specifying what should be displayed:

- The cumulative kWh of the meter (no reset at the beginning or end of the session),

- With a precision of at least 1 digit after the decimal point (100 Wh correspond to less than 10 c€). ex: 1234.5 kWh.

- No obligation to display the multi-rate indexes on the meter or station on tariff change during a session (this will be done in the invoice, not on the meter).

Note that the customer can be informed by his operator on its mobile phone on the kWh delivered and on the pricing terms, beyond the information listed above.

#5 Display certification

A MID certified meter is certified with its integrated display.

In the medium term, if this display is remote or displayed on a screen, the meter must be certified with its remote display.

The MID limits this requirement to utilities, which is not the case for a recharge service:

> 10.5 Whether or not ameasuring instrument **intended for utility measurement purposes** can be remotely read it shall in any case be fitted with a metrologically controlled display accessible without tools to the consumer. The reading of this display is the measurement result that serves as the basis for the price to pay.

We therefore recommend, for the short term, that no certification beyond that required for the MID meter itself be required.

#6 Metering Data Archiving

The Welmec guides require metering data archiving. This provision applies to DC via the Ministerial Decision.

In AC, the MID states:

> 11. Further processing of data for the conclusion of the business transaction
>
> 11.1. A measuring instrument other than a measuring instrument used in utility services shall record by a durable means the result of the measurement together with information identifying the transaction in question when:

(a) the measurement is not repeatable; and

(b) the measuring instrument is normally intended for use in the absence of one of the parties to the transaction.

11.2 In addition, a durable record of the measurement result and the information to identify the transaction shall be available upon request at the time the measurement is completed.

We therefore recommend:

a. to apply the general obligations of trade as defined by the trading authorities

b. to allow the proof to be a dematerialized message sent to the user

c. that the actor who receives the payment from the customer keeps this data, with identification of the transaction, until the payment is completed.

#7 To not require in ST to certify data storage

The certification requirement and the conditions of this certification remain unclear to this day. This is why we recommend that efforts be made to specify this within the framework of the European work, and not to create new requirements (beyond what is already enacted by the trading authority).

d. not to require at this stage certification of the data retention system by the operator and to proceed by *a posteriori* control. The standards in progress will specify these requirements. The Welmec Extension L: Long-term Storage of Measurement Data guide provides direction.

e. Allow user verification by accessing the archived data at the payment processor.

General recommendations for the medium term to be pushed into the European standard and possible European regulations or directives.

Recommendations here below are intended for the French representatives in Cenelec CLC/TC13/WG03. We recommend waiting for the conclusions of their work before defining possible new regulatory requirements in France.

#8 Guidelines for the medium term

Keep the use of new payment technologies and usages open (such as dematerialized payment)

Implement a PKI (Public Key Infrastructure) for electro-mobility (including Plug & Charge), not specific to metering and metrology. This is the subject of a specific workstream of the STF of DG MOVE.

Communication to user of session kWh (difference or with RaZ at the beginning or end of the session), with a precision of at least 2 digits after the decimal point (10 Wh correspond to less than 1 c€; ex: 1234.56 kWh), but without requiring display of metering by tariff period.

Certification: in the case of a remote display not supplied with the meter and in the absence of another visible display integrated to the meter - and thus certified -, certification should be required.

Data archiving: Minimum duration guaranteeing the conservation until the transaction is completed. Archiving of a cryptographically signed copy at the operator (2 years for example).

Operator certification: Not necessary for archiving: the archived data are kept signed, under the responsibility of the operator. Control a posteriori

Verification by the user by checking the signature of the archived transaction data (verification software could be available on interoperability platforms such as GIREVE or HUBJECT). This should allow the display of fare information on a user station, without requiring a dedicated station on the station.

Appendix 1: Composition of the WG

Many thanks to the members of the WG for their time and rich contributions.

Members

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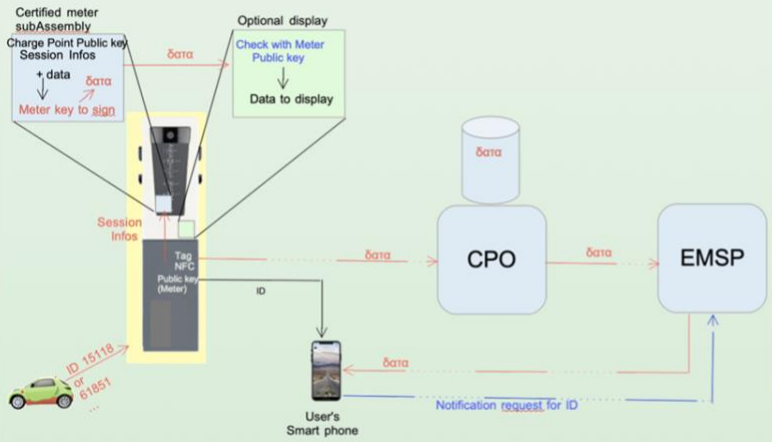
Appendix 2: Reference Architecture

Architecture principles

The metering data produced by a certified meter sub assembly are signed by the meter itself from its private key to which ONLY it has access. This key (as well as its "public sister") is produced by the meter itself during its installation. The public key is the subject of a certificate produced in the framework of a Public Key Infrastructure (PKI).
Only this signed data is communicated by the meter: once produced, it is impossible to create new "false authentic" data. The data is inherently secure.
This data is transmitted to the CPO and eMSP, authenticated by the signature of the terminal (PKI terminal) by the terminal's private key.



- data is the raw count data
- δατα is the secured data: contains a signature to authenticate it if needed
- δατα contains the count information, time-stamped, by tariff period, with session identifiers communicated to it encrypted or signed by the charging point, allowing to identify the vehicle or the associated contract.
- The counter subset contains the public key of the charging point to decrypt or check.
- The use of a signature to authenticate allows data to be used in clear, without having to perform an encryption operation. Authenticity of data can be verified with the signature.
- CPO and EMSP will have to verify the authenticity of the data.
- For the information of the user on the spot, the direct use of the raw data can be sufficient (without the need to verify the signature).

With this architecture:
- it is impossible to tamper the data downstream meter or to recreate an authentic data for this meter
- the data are archived with their signature (δατα) possibly in encrypted form by the EMSP.
- If a user wants to verify his data, he receives the signed data and verifies with the counter's public key.
- The complexity is confined to the counter. This makes it possible to use the user's laptop without the need for a display terminal on the terminal.