Charging stations: a practical, Europe-wide approach to legal metrology

Demand for electric cars has risen sharply in recent years. From a metrological point of view, a number of questions remain unanswered, such as how electricity meters in charging stations should be harmonised in practice throughout Europe. The project consortium LegalEVcharge advocates harmonised regulations to avoid trade barriers and additional costs for operators.

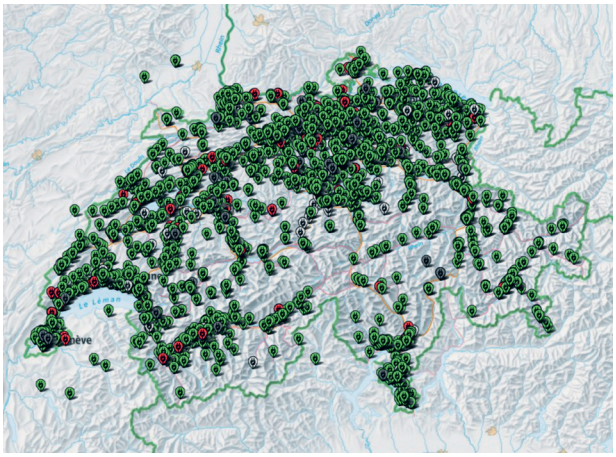
Christian Mester

Electric cars' market share is growing at an ever faster rate across Europe. Electric cars need charging stations to charge their batteries. The availability of public charging stations is one of the most important success factors for the acceptance of electric cars. Nevertheless, electricity meters at charging stations for electric vehicles are not subject to metrology law in many European countries, including Switzerland [1]. The reason for this is that only a few charging stations were in operation at the time these laws were passed, and it was still unclear which technical solutions would prove particularly practical.

The public interest in giving the market a great deal of freedom to try out different solutions has therefore outweighed the public interest in a regulation covering metrology law. This approach has enabled solutions to prevail on the market that are now being used on a large scale. Traditionally, new provisions are introduced as quickly as possible to allow manufacturers to develop appropriate products. At the same time, a corresponding transitional phase also allows the commissioning of non-compliant devices for a reasonable period of time. In addition, measuring instruments that have already been installed can traditionally continue to be legally used on a transitional basis. The principle of proportionality is an essential principle of state action, for example in Switzerland. This also applies when issuing ordinances, including transitional provisions.

In the European Union, metrology law is the responsibility of the individual member states. However, the provisions for certain measuring instruments are harmonised by the EU's Measuring Instruments Directive (MID) [2]. Countries prescribing the use of these instruments must adopt the pro-

1: The Electromobility Data Infrastructure (DIEMO) harmonises and aggregates charging station data in Switzerland. It is not yet clear how e-meters are to be regulated under metrology law. The map below shows the locations of charging stations.



visions of the MID. Deviations are not permitted. This Directive thereby removes barriers to trade on the Union market. It applies to measuring instruments placed on the market or put into service for the first time. Manufacturers must choose a notified body such as METAS-Cert to carry out the mandatory conformity assessment.

Metrology has long had experience with the approval of household meters, whose market is pan-European only for new electricity meters; after installation, harmonisation is less crucial. The situation is different when it comes to charging stations for electric vehicles. Most operators are active across Europe. The same applies to consumers, who travel all over Europe in their electric vehicles. In addition, electricity meters are often purchased externally by charging station manufacturers and then installed in the finished product. The complete charging station is then sold to an operator across borders. There is therefore a pan-European market for individual electricity meters as well as electricity meters that have already been installed.

This situation poses the risk that non-harmonised regulations, which only take effect after products have already been placed on the market, will create new barriers to trade and additional costs for manufacturers and operators of charging stations. To prevent such trade barriers arising and make better use of synergies, EURAMET-TC EM-Project No. 1539 *LegalEVcharge – Practical legal metrology framework for electric vehicle charging stations* was launched.

In addition to national metrology institutes, supervisory authorities are also actively involved. The project is coordinated by METAS. The project consortium is preparing a practical framework for legal metrology for meters in charging stations. MID conformity assessments are usually based on harmonised standards. Despite a corresponding mandate from the EU Commission, such standards for DC active energy meters and for meters to be used in charging stations have not yet been developed. The project consortium has therefore published a provisional solution. In the field of legal metrology, the MID's requirements regarding the active energy meter are sufficient in themselves, but must be implemented differently than for household meters. The charging station as a whole will not be subject to legal metrology regulation. The project is also a platform for exchanging experience, for example in defining sensible transition periods. To implement this, the project consortium is developing procedures and equipment for maintaining measurement stability and general inspection purposes. See box below.

Overview of marketing aspects harmonised by the MID and non-harmonised aspects of use:

MID-harmonised	Not harmonised
Placing on the market	
Market surveillance	General inspection
Definition of accuracy classes	Accuracy classes to be used
	Obligations of the user
	Reverification
	Statistical test procedures

Standard for DC active energy meters

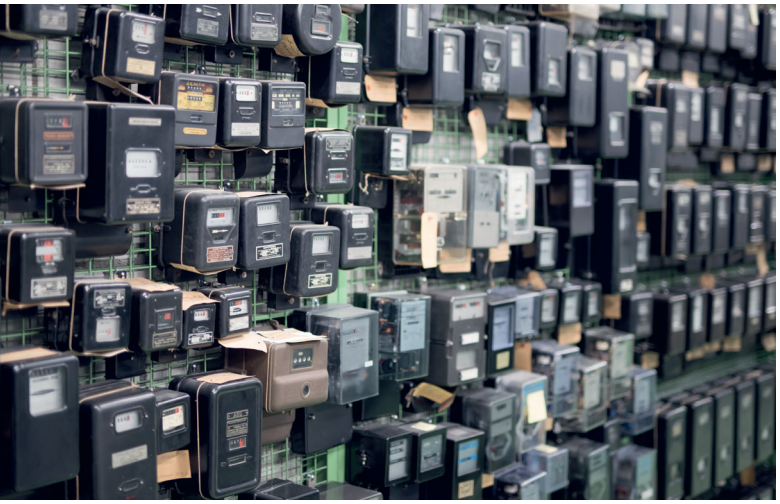
The objective of the MID is to define essential requirements, preferably performance requirements (Recital 25 MID). On the one hand, these should be formulated to achieve the protection objectives – ensuring fair trading and consumer protection – so that those concerned can trust the measurement results (Ingress Annex I MID). On the other hand, technical specifications must not restrict technological progress. This imposes a level of abstraction on the MID, which makes it very difficult to translate it directly into technical products. In order to assess conformity with the requirements of the MID, it is possible to demonstrate conformity with a harmonised standard and to derive conformity with the MID itself from it («presumption of conformity», Article 14 MID).

Corresponding harmonised standards for AC active energy meters have existed since the entry into force of the MID. In 2015, the EU Commission requested European standardisation organisations such as CENELEC to prepare relevant standards for direct current active energy meters by 31 December 2017 [3]. As work on this standard has not yet begun, manufacturers, conformity assessment bodies and market surveillance authorities are obliged to demonstrate the conformity of DC active energy meters with the MID without a harmonised standard.

In order to facilitate this work, the project consortium has published its own standard as a provisional solution on the project website www.metas.ch/legalevcharge. Once CENELEC has adopted the relevant standard, the provisional solution will become redundant. In April 2021, CENELEC TC 13 decided to start work and reserved the designation EN 50470-4 for their standard [4].

Standard for meters for use in charging stations

The solutions selected on the basis of the essential requirements of the MID must take into account the intended use of the instrument (Ingress Annex I MID). Care should therefore be taken when transferring more than one hundred years of experience [5] to electricity meters in charging stations. For example, it is stipulated that both parties to the transaction must have non-discriminatory access to the measurement result, which must be transparent and trustworthy.



2: The "Chasseral" electricity meter was the first electricity meter to be approved in Switzerland in 1917. Since then, requirements and markets have changed dramatically.

Various charging stations have a vandal-proof window behind which the meter is located. If it is ensured that this window is not obscured – for example due to vandalism – and that it can be read easily, even by elderly or disabled people, at any time, regardless of the position of the sun, then this is a suitable technical implementation. However, technical progress has opened the door to other appropriate technical implementations. Other charging station-specific deviations from previous practice, which can and must be designed to be MID-compatible, relate to permanent proof of the measurement result. Furthermore, losses between the electricity meter and the plug, the ownership boundary between charging station operators and customers must not be included in the energy billed to the consumer. These aspects are also covered by the EU Commission's mandate to European standardisation organisations such as CENELEC to prepare corresponding standards [3]. In this case, too, work has not begun, so the project consortium itself will develop a provisional solution and publish it on www.metas.ch/legalevcharge.

Equipment for procedures for maintaining measurement stability, general inspection

Individual countries are free to prescribe procedures for maintaining measurement stability, such as reverification and statistical test procedures, and to determine the associated deadlines. Since this concerns meters that are in use and the implementation of these procedures is generally considered to be a governmental activity, these rules do not create barriers to trade and coordination is less relevant. However, these procedures must be carried out in practice. Metrological tests are required for this purpose. Within the scope of the project, various methods for these metrological tests will be tested. Depending on the organization of the legal metrology system in the individual countries, tests are generally carried out on the complete charging stations either on site or in a verification laboratory. Other countries generally only require the meter to be tested in a verification laboratory, although the entire charging station is tested if the actual meter cannot be tested individually. It is possible that installed charging stations will be checked at random.

Transitional provisions

The individual states are also free to decide on transitional provisions. It is important for manufacturers to be informed of requirements as early as possible. This allows them to take these into account when developing new products and assess whether and in what time frame it makes sense to retrofit existing products.

The principle of proportionality requires that the state still allows the installation of new meters that had already been developed before the new regulations came into force for a reasonable period. In practice, market pressure is likely to lead to compliant meters replacing non-compliant and therefore soon to be obsolete meters on the market relatively quickly.

Similarly, it appears necessary to allow legally installed meters to be used for a reasonable period, for example until the end of the actual or economic life of the charging station. This may be subject to conditions. Compliance with formal aspects could be dispensed with – for example, a meter installed prior to the entry into force of the regulations cannot principle, bear a conformity mark – while error limits must be complied with. However, these may be extended so generously that only obvious problem cases need to be replaced. In the specific case of meters in charging stations, it is often to be borne in mind that legislators have deliberately not issued any regulations for a number of years in order to give the market freedomto develop suitable solutions. The installation of charging stations has also been demanded and promoted by various bodies, including governmental organisations as part of wider climate change mitigation policies. It would therefore not be in the public interest to now penalise those operators who have already installed charging stations.

Differentiation: Questions outside the scope of legal metrology

In addition to these aspects, there are numerous questions in the field of electromobility that are entirely understandable and interesting, but irrelevant to fair trading and consumer protection regarding individual energy measurements at a charging station. Many project partners are networked within the administration of their respective countries. The project consortium is drawing up a non-exhaustive list of such questions that are outside the scope of legal metrology. This list may help other bodies to identify issues within their remit and to prepare appropriate, co-ordinated responses. Examples are non-metrological requirements for charging stations – security, functionality, availability, user-friendliness, efficiency, billing modalities, means of payment – and pricing.

Literature

[1] Art. 2 (2) (a) EDJP Ordinance of 26 August 2015 on Measuring Equipment for Electrical Energy and Power (EMmV; SR 941.251).

[2] Directive 2014/32/EU of the European Parliament and of the Council of 26 February 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of measuring instruments (recast)

[3] M/541: Commission implementing decision of 15.12.2015 on a standardisation request to the European Committee for Standardisation, to the European Committee for Electrotechnical Standardisation and to the European Telecommunications Standards Institute pursuant to Regulation (EU) No 1025/2012 of the European Parliament and of the Council as regards certain measuring instruments

[4] CENELEC document TC13/Sec0135/RM: Unconfirmed Minutes of the Plenary meeting of CENELEC TC 13 held on April 14th 2021

[5] Implementing Regulation of 9 December 1916 on the official inspection and stamping of electricity consumption meters

Contact:
Dr Christian Mester
Co-ordinator EURAMET-TC EM project LegalEVcharge
legalevcharge@metas.ch

The LegalEVcharge project is working on the following topics, the results of which will be published on www.metas.ch/legalevcharge:

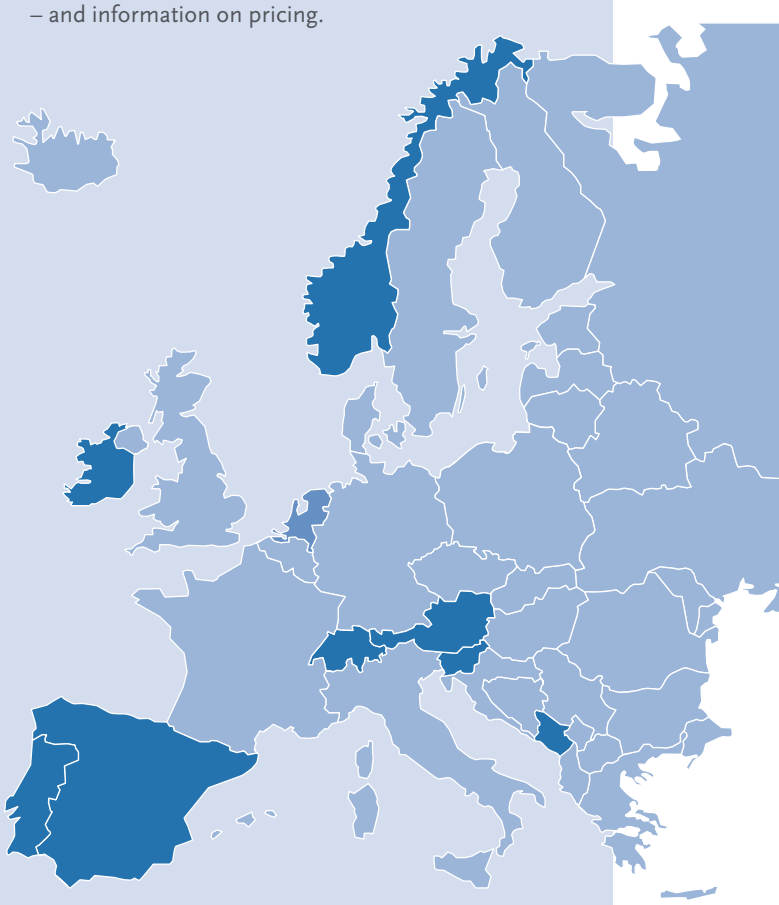
Standard for direct current active energy meters
- In order to ensure that manufacturers, conformity assessment bodies and market surveillance authorities can meet the requirements of the MID sufficiently, easily and uniformly.
- So that those concerned can trust the measurement results, ensuring fair trading and consumer protection.
- Technical specifications must not limit technological progress.

Standard for meters for use in charging stations
- Both parties to the transaction must have non-discriminatory access to a transparent and trustworthy measurement result.
- Permanent proof of the measurement result
- Consideration of losses between the electricity meter and the connector as the ownership boundary between charging station operators and customers

Reverification, general inspection
- Equipment for maintenance of measurement stability (subsequent verification etc.), general inspection
- Testing of various methods for metrological tests. Depending on the organisation of legal metrology in the individual countries, tests are generally either carried out on the dismantled meter or on the entire charging station, either on site or at a verification point.

Transitional provisions
- The individual states are free to establish their own transitional provisions. For manufacturers, it is important to be informed of requirements as early as possible.
- The principle of proportionality requires that the state still allows the installation of new meters that had already been developed before the new regulations came into force for a reasonable period. Similarly, previously lawfully installed meters must be permitted for a reasonable period of time.

Differentiation: Questions outside the scope of legal metrology
- The project consortium is preparing a non-exhaustive list of questions outside the scope of legal metrology, but relevant to other competent organisations. Examples include non-metrological requirements for charging stations – security, function, availability, user-friendliness, efficiency, billing modalities, means of payment – and information on pricing.



Countries participating in the LegalEVcharge project as partners (blue) or observers (light blue).