TECHNICAL AND LEGAL REQUIREMENTS

D1.3: Technical and legal requirements for USER-CHI solutions

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Author(s): **José Mercado, Anne Freiberger, Felix Nowack, Julia Schmidt, Hermann Blümel**
Co-author(s): **María del Carmén Tomas, Antonio Martín**

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Author(s)	Organisation
José Mercado	IKEM
Anne Freiberger	IKEM
Felix Nowack	IKEM
Julia Schmidt	IKEM
Hermann Blümel	IKEM
María del Carmen Tomás	ETRA
Antonio Martín	ETRA

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Abstract

This report presents the technical and legal requirements, which need to be considered for the development and integration of 8 USER-CHI products in up to 7 European cities. Regarding the technical requirements, the international, European, and national approaches to standardisation of electromobility are described as well as the legal requirements that derive from both the European as well as the national or regional legal framework. By this the similarities and differences with which the developers, installers and users of charging infrastructure are confronted become recognizable.

Keywords

Technical requirements, legal requirements, technical products, Volere, demo sites, CLICK, SMAC, INDUCAR, INSOC, INCAR, eMoBest, INFRA, standards, proprietary, interoperability, legal framework, law, EV, charging, infrastructure.

Copyright statement

Executive summary

This report has the function of a reference book for the USER-CHI consortium on matters regarding technical and legal issues, which should be considered for the development and integration of the 8 technical and non-technical USER-CHI products.

Regarding the technical requirements, the international, European, and national approaches to standardisation of electromobility are presented. On the other hand, the legal requirements for the technical and non-technical products are based on the European legal framework and its national implementation laws, as well as additional national and regional laws.

The methodology is characterised by an integrated approach: general standards and requirements obtained from a literature review and the responses of experts collected with questionnaires are analysed and summarized. Together they form a framework within which the specific requirements that USER-CHI products must accomplish are based. They have been obtained from the product leaders, technical experts, and pilot sites of the consortium using the Volere tool. This combined approach reflects the manifold “ecosystem” of different sectors, disciplines, stakeholders, and technologies that are involved in developing and implementing innovative and user-friendly solutions for EV charging.

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1. Introduction

1.1 Purpose of the document

The aim of USER-CHI is to unlock the potential of transnational and inter-regional electromobility in Europe. Therefore, different charging technologies and the processes to use them will be integrated to achieve interoperability for users. This process includes the development and integration of various innovative solutions, for example, charging technologies, e-roaming, billing, authentication, and reservations of parking slots in front of charging infrastructure.

Moreover, the synergies between electromobility and smart grids will be fostered. The developed technological tools, processes to use them, and business models will be put into practice and demonstrated in five areas: Barcelona metropolitan area (Spain), Rome (Italy), Berlin (Germany), Budapest (Hungary), and Turku (Finland). Besides, replication cities have been included: Murcia (Spain) and Florence (Italy).

This document – Deliverable 1.3 – provides an overview of existing standards/requirements and normative restrictions collected that USER-CHI solutions must accomplish at all five partner countries and a set of at least five other relevant EU countries.[1] Therefore, both technical and legal standards/requirements have been collected, respectively.

Each of the mentioned demo sites will focus on the implementation of a different set of technical products. At this stage of the project (M12), the demo sites plan to implement/demonstrate the following technical USER-CHI products:

Table 1: USER-CHI Environment

Country	Demo Sites	CLICK	SMAC	INSOC	INDUCAR	INCAR
Spain	Barcelona	X	X	X	X	X
Germany	Berlin	X	X			X
Hungary	Budapest	X	X	X		X
Italy	Rom	X	X	X		X
Finland	Turku	X	X	X		X

Accordingly, the development of the technical USER-CHI products is a key element of the project. This document will assist the USER-CHI consortium during the development process of and

[1] see USER-CHI Grant Agreement, Annex 1, Part A, pp.11.

during the implementation phase by providing an overview of the technical and legal requirements for the five technical USER-CHI products, which need to be considered. The analysis includes legal and technical requirements for the five demo sites, as well as five additional countries.

1.2 Scope of the document

This document will provide an overview of the technical and legal requirements, which could influence the development process of the five technical USER-CHI products, namely CLICK (Charging Location and Holistic Planning Kit), INCAR (Interoperability, Charging and Parking Platform), SMAC (Smart Charging Tool), INDUCAR (Inductive Charging for e-Cars), and INSOC (Integrated Solar-DC charging for LEVs).

There is a focus on the technical products in this report, because for the USER-CHI non-technical products, such as e-Mobility Replication and Best Practices Cluster (eMoBest) and "Station of the Future" Handbook, technical and legal requirements as such do not fall into the scope of the products.

The USER-CHI product eMoBest focuses on the transferability potential, as well as the social, economic, and environmental impact of the tested models. Moreover, the "Station of the Future" Handbook is the outcome of WP1, which focuses on the users' needs and desires in regard of EVSE (electric vehicle supply equipment). Therefore, the handbook will provide guidelines for the design and development of EVSE and charging solutions, which take the users' needs sufficiently into account.

Regarding the technical requirements this includes standards on the topics of energy supply for EVs charging infrastructure, parking, and charging, communication, booking and billing, and planning.

Moreover, the legal requirements, which influence the expansion of charging infrastructure for EVs derive from European, national, and regional law. The areas of law include planning and construction law, road traffic law (reservation of parking spots in public spaces), energy law (energy supply to charging point, grid connection, requirements for network operator about network stability), calibration law (billing models, roaming platforms) as well as data protection law (authentication processes / handling of personal data).

1.3 Structure of the document

The document compromises 6 chapters and annexes. Following the introduction, the second chapter gives a short overview of the 8 USER-CHI products, 6 are technical ones, 2 are non-technical. The following third chapter describes the integrated methodological approach how the general technical and legal framework was collected, analysed, and summarized, divided into the identification and definition of general technical and legal requirements and the identification and definition of specific requirements with the use of the VOLERE tool, describing the specific requirements that USER-CHI products must accomplish. Furthermore, the fourth chapter summarizes in a first step the cross-cutting technical and legal requirements for the technical

USER-CHI products and within the following step USER-CHI product specific general requirements. In addition, the fifth chapter provides specific requirements for two USER-CHI products. The final chapter 6 summarizes the technical and legal requirements.

1.4 Connection to other tasks

There are several tasks and products of other work packages – such as WP2, WP3, WP4 and WP5 – that are directly or indirectly related to T1.3. The inventory of technical and legal requirements contributes to all 8 technical and non-technical USER-CHI products. In addition, T1.3 incorporates results from the requirements management tool Volere used by the project consortium for all products (technical and non-technical).

2. USER-CHI products

USER-CHI combines technical, regulatory, and business elements, under a user-centric and smart city perspective, to produce a set of solutions that cover all aspects of a massive deployment of electric vehicles. These user-centric solutions are packaged in the form of 8 products (P) to guarantee the technical performance within the project, and the sustainability and market transferability after the project completion.

2.1 CLICK - Charging Infrastructure location and holistic planning kit

CLICK focuses on the design and test of an easy-to-use question-and-answer online tool. This tool supports location planning for charging infrastructure in cities and is based on a step-by-step top-down process. Its purpose is to optimize the location and planning of new charging infrastructure in cities. The process matches users' needs, preferences and habits, the existing charging technologies, and typologies available in the market, the location, the course and the capacity of the electric grid, parking regulation and other aspects.

The results generated by CLICK addresses proposed locations, preferred technologies as well as the number of charging points needed, amongst other factors. Moreover, CLICK enables a post-planning monitoring process by offering interfaces to be fed with actual utilization of data of electric vehicle supply equipment (EVSE). This triggers the demand-oriented expansion of the charging infrastructure network.

2.2 Station of the Future' Handbook

This handbook embodies the key results of the users' analysis conducted in USER-CHI in the form of short-and mid-term recommendations addressed to CPOs, EMSPs and other private stakeholders of the electromobility field. The Handbook redefines how charging stations are understood, developing the concept of 'Station of the Future', and providing guidelines and added-value insights for the design strategies of user centric EVSEs and charging solutions. It defines the characteristics of the 'perfect' charging station: typology of the charging points, power, connectors, and cables (if any), access and authentication methods, payment and billing features, electricity origin, associated services offered in the stations, etc.

The Handbook also includes the analysis of innovative business models that can overcome legal barriers and that can offer positive returns of investment.

2.3 eMoBest –e-Mobility Replication and Best Practices Cluster

The eMoBest cluster is a collaboration platform that facilitates the transferability of best practices among the 5 demonstration cities, the 2 replication cities and the 5 interested cities in USER-CHI. It makes use of the experience gained through all USER-CHI actions and demonstration activities, and provides technical, legal, and economic feasibility analysis of USER-CHI business models. Thus, eMoBest is enhancing results' replication after the project completion. It helps stakeholders like local governments, urban planners, mobility departments and transport authorities to replicate solutions and learn from the experience of other cities.

And more: eMoBest cluster includes policy recommendations for action on European and national levels for a more harmonized take-up on the internal European market, standardization recommendations, transferability assessment (intra-city, inter-city), analysis of the EU regulatory and standard framework.

2.4 INFRA – Interoperability Framework

INFRA focuses on the design and the specification of interoperability and roaming services and contains the definitions of both INFRA and INCAR. Thus, INFRA elaborates a set of rules, guidelines, and recommendations to support highly interoperable processes among the electromobility stakeholders along the two TEN-T corridors, addressing the organisational, legal, technical, and semantic dimension.

2.5 INCAR – Interoperability, Charging and Parking Platform

The INCAR Platform offers innovative integrated EV-related services such as (i) interoperability and roaming, (ii) park & charge booking features, avoiding waiting times and increasing EVSE usage, (iii) real-time information about publicly accessible EVSEs, (iv) searching and routing to EVSEs, and (v) integration with route planning of e-fleets. These services are customised to different end users' profiles and market segments to enrich the customer proposition. Regarding interoperability, the platform gives technical support to the INFRA –Interoperability Framework. It provides an operator and service provider independent platform to enable an easy, non-discriminatory, convenient, and barrier-free access to EVSE by end users.

2.6 SMAC - Smart charging tool

SMAC provides smart grid integration services for slow, medium, fast, and ultrafast charging, with the objective of minimising the grid impact associated to the implementation of charging infrastructure. SMAC provides high-value services to EV drivers, such as minimum charging

prices and maximum RES electricity supply. EV users' preferences and requirements are considered for the definition and customisation of the services. In addition, SMAC offers flexibility and stabilisation benefits to the DSOs: reduction of the grid impact of new charging infrastructure through demand management, possibility to use EVs as dynamic distributed st**o**rage devices, feeding electricity stored in their batteries back into the local electric grid when needed (V2G supply) and flexibility services to the requests of the grid.

2.7 INSOC - Integrated Solar-DC charging for LEVs

The INSOC system addresses charging needs of LEVs in urban areas. INSOC consists of a standardized and replicable low-power DC-charging solution with on-site produced renewable energy and the antitheft-proof parking. It also integrates payment and billing services, making it especially convenient for new urban mobility modes, such as e-bike and e-scooter sharing services. The standardised solution allows a reduction of the price for final users and facilitates market acceptance due to the integration of all services: vehicle sharing, charging, parking, paying and clean energy usage.

2.8 INDUCAR - Inductive charging for e-cars

INDUCAR provides sets of vehicle-side components for 3 kW and 20 kW wireless automated power transfer, and corresponding charging stations. The hardware components are supplemented by software for the wireless charging systems and the adaptation of the different vehicle types selected. The targeted vehicles are retrofitted and apply reasonable standards.

INDUCAR applies to latest state of knowledge and attempt to reflect applicable states of ongoing discussion on standardisation. The design reflects the character of the project and its frame conditions. Wireless charging is implemented together with M2M communication technologies, providing automated and transparent identification, payment and charging features.

3. Methodology

3.1 Approach

The methodology is characterised by an integrated approach (Figure 1): general standards and requirements obtained from a literature review and the responses of experts collected with a questionnaire are analysed and summarised. Both general standards and requirements "form a cloak" under which the specific requirements obtained from the product leaders, technical experts, and pilot sites of the consortium through the Volere tool may be implemented.

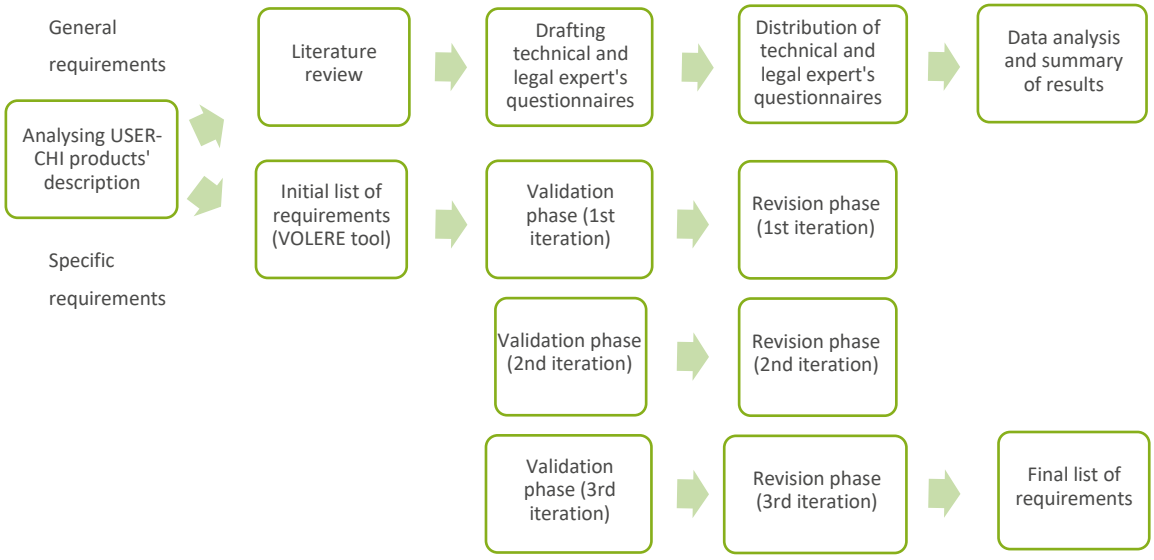


Figure 1. Methodological approach

The identification of **general requirements** comprises of identifying general technical and legal requirements effective at the European, national, regional, and local level. General technical requirements for hardware components for charging infrastructure (e.g., charging stations, charging plugs) and communication platforms have been reviewed at the European and national level, only. Relevant effective legislation for EVSE has been reviewed at the European, national, regional, and local level. These requirements serve as the general framework determining the overall system boundaries of the specific requirements.

The identification of the **specific requirements** comprises of a broader set of requirements to be considered within the development process of the USER-CHI products. For coordinating the definition of requirements by the partners from the USER-CHI consortium, the Volere

methodology has been used[2]. Volere provides a conceptual framework for organising and structuring the definition of requirements, as well as some templates for their formalisation and some procedural rules and pattern for the work.

Applying this approach allowed for the collection of relevant information in a horizontal and vertical manner. The following subsections provide a detailed overview of the applied approach.

3.2 The Identification and Definition of General Technical and Legal Requirements

This section describes the steps carried out to identify effective general technical and legal requirements that need to be considered for the development and implementation of USER-CHI products. After analysing the USER-CHI products, the main steps that have been carried out comprised of a literature review, developing a draft for a technical and legal expert questionnaire, its distribution and analysis (Figure 1).

3.2.1 Literature Review of Technical Requirements

In a first step, a literature review has been carried out. The aim of the literature review was to identify and cluster relevant technical standards for hardware components, communication technologies/interfaces, services, and grid connection for EVSE as well as charging technologies for EVs (e.g., AC, DC conductive; inductive charging; connection methods; charging plug components).

The starting point for identifying national technical standards and requirements for hardware components, communication technologies/interfaces and grid connection for EVSE was the review of available literature in the German context, such as technical norms, guidelines, and standards (such as ISO and DIN standards). Accordingly, analysing the state of the art in the German literature during the past 10 years was the starting point from where the research regarding the technical standard for USER-CHI technical products started. Table 2 provides an overview of the main literature reviewed.

Table 2: Technical requirements literature review - relevant documents considered

Year	Author(s)	Title
2020	Has2be GmbH	Value chain in charging infrastructure operation with has.to.be. in the context of efficient design of complex roaming relationships
2020	Wagner, L.	The technical guide to the charging infrastructure for electric mobility - Version 3

[2] Volere methodology, n.d.

2018	Ferwerda et al.	Advancing E-Roaming in Europe: Towards a Single "Language" for the European Charging Infrastructure
2017	Hall & Lutsey	Emerging best practices for electric vehicle charging infrastructure
2017	Nationale Plattform Elektromobilität (NPE)	The German Standardization Roadmap Electromobility 2020
2014	NPE	The German Standardization Roadmap for Electromobility - Version 3.0. AG 4 - Standardization and Certification
2013	Varro, W.	Technical specifications as annex to the invitation to tender for the construction of charging infrastructure for EVs in the city of Berlin
2012	NPE	The German Electromobility Standardization Roadmap - Version 2
2012	Teichmann et al.	Electric mobility - standards get the future moving

3.2.2 Literature Review on Legislation and Regulation

The aim of the literature review on legislation and regulation was to gain an overview of the European and German legal framework to identify relevant fields of law that must be considered during the development and for the implementation of the five technical and three non-technical USER-CHI products in the demonstration sites (see Figure 2).

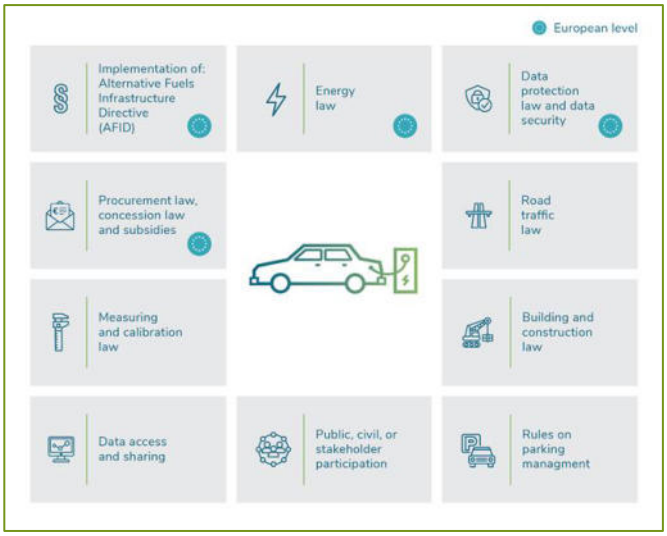


Figure 2: Overview - Legal Framework

3.2.2.1 European Legislation and Regulation

In Table 3 an overview of the relevant EU legislation and regulation that is being implemented through national laws is presented.

Table 3 European Legislation and Regulation relevant for USER-CHI products

No	Regulation	Fokus	Relevance for USER-CHI products
1	Directive 2014/94/EU - Deployment of Alternative Fuels Infrastructure (AFID)	The AFID creates a uniform European framework for the deployment of infrastructure for alternative fuels. This includes the charging point infrastructure for EVs (Art. 1 AFID). Its goal is to implement a strategic and European-wide infrastructure for alternative fuels. According to the AFID, alternative fuels are electricity, hydrogen, liquid gas (LPG) and others. Core regulations include the installation of an appropriate number of public charging points until 31 of December 2020, mandatory technical interoperability standards for charging plugs, as well as the description of roles and duties for charge point operators (CPOs), electromobility service providers (EMSPs), and distribution system operators (DSOs). Non-discriminatory access for users to different types of charging points is mandatory, as well as for the relation between service and electricity providers. Therefore, the implementation laws on the AFID are essential for national legal requirements on the charging infrastructure, which will be developed and implemented in USER-CHI in INSOC, INDUCAR, SMAC.	INSOC, INDUCAR, SMAC
2	Directive 2014/23/EU - Awarding of Concessions Contracts	The regulation addresses the European framework for the awarding of concession contracts to ensure, fair and non-discriminatory market access and to enable EU-wide competition; thus, promoting public investment in infrastructure and strategic services for citizens. The topic of concession law is relevant for the USER-CHI products CLICK, INSOC, INDUCAR, SMAC as the deployment of charging infrastructure by companies could include concession processes. Regarding these processes the implementation laws of the European Directive on the awarding of concession contracts needs to be considered.	CLICK, INSOC, INDUCAR, SMAC
3	Directive 2014/24/EU - Public Procurements and Concessions	The directive 2014/24/EU regulates the public procurement and concessions. The aim of this directive is to provide a simplified and more flexible procurement procedure to ensure benefits for both businesses and	CLICK, INSOC, INDUCAR, SMAC

		public purchasers. Additionally, this directive shall enable better transparency and competition for money for public purchases. The topic of public procurements and concessions law is relevant for the USER-CHI products CLICK, INSOC, INDUCAR, SMAC as the deployment of charging infrastructure could include concession or procurement processes by local public authorities. Regarding these processes the implementation laws of the European directive on public procurements and concessions needs to be taken into account. Accordingly, for public contracts above a certain threshold, which is laid out in the directive, specific national procurement procedures need to be complied with.	
4	Directive 2014/25/EU - Procurement by Entities Operating in the Water, Energy, Transport and Postal Services Sector	The directive addresses the harmonization of procurement activities by entities operating in the water, energy, transport, and postal services sector and complements the directives 2014/23/EU and 2014/24/EU. The goal of this directive is to ensure the opening to competition of procurement by such entities. The coordination is needed to ensure the effect of the principles of the Treaty on the Functioning of the European Union (TFEU). The topic of procurement for the transport sector is relevant for the USER-CHI products CLICK, INSOC, INDUCAR, SMAC as the deployment of charging infrastructure could include procurement processes by local public authorities.	CLICK, INSOC, INDUCAR, SMAC
5	Directive 2014/32/EU -Measuring Instruments Directive (MID)	This directive provides the legal framework for harmonising the laws of the member states concerning the availability of measuring instruments on the market. It establishes requirements that need to be satisfied by measuring instruments to be deployed to the market. The directive and the related national implementation laws are relevant for the USER-CHI project, since charging infrastructure needs to use measuring instruments, which are approved under the MID. Measuring instruments used in charging points fall under the category of electrical energy meters (MI-003) in accordance to Art. 4 (1) and Art. 2 (1) of the MID.	all
6	Directive 2016/679/EU General Data Protection Regulation (GDPR)	The EU General Data Protection Regulation (GDPR) grants the right for EU citizens/natural persons to better control and protect their personal data. Therefore, it regulates the processing of personal data and	all

		provides rules regarding free movement of personal data. While aiming for protecting the fundamental rights and freedom of natural persons, it harmonizes and unifies regulations in the EU, aiming at the reduction of bureaucracy and enhancing trust of consumers. The legal requirements deriving out of the GDPR are relevant for USER-CHI since personal data is generated using charging infrastructure by EV drivers. Personal data is thereby generated through the link of the charging point and measurement data with the user's identity. This link leads to a multitude of potential personal data, such as names, addresses or banking information.	
7	Directive 2018/844/EU - Energy Performance of Buildings (EPBD)	The EPBD provides a legal foundation for the energy performance of buildings and is an amendment of the directive 2010/31/EU and 2012/27/EU. The aim of the EPBD is to improve energy efficiency concerning buildings in the EU. Accordingly, it includes measures, e.g., long-term renovation strategies, smart readiness for buildings, the promotion of smart technologies, as well as the support of e-mobility to reach more energy efficient systems in the building sector. The EPBD is relevant for the deployment of charging infrastructure and therefore relevant for USER-CHI, as it establishes the need for either the installation of charging points or the requirement to provide the infrastructure needed to install charging points at a later point for certain types of buildings. Specific requirements derive out of the EPBD for new residential and non-residential buildings, as well as residential buildings and non-residential buildings, which are undergoing major renovation.	all
8	Directive 2019/944/EU - Common rules for the internal market for electricity	This directive introduces additional requirements for the harmonisation of the EU market for electricity. It considers that consumers have an essential role in achieving the flexibility necessary to adapt the electricity system to variable and distributed renewable electricity generation. The directive provides relevant regulation on the topic of smart grid services, and non-discriminatory access for CPOs to the grid. Therefore, it is particularly relevant for the USER_CHI products SMAC, INDUCAR and INSOC.	SMAC, INDUCAR, INSOC.

3.2.2.2 National Legislation and Regulation

The **starting point** for identifying national legislation and regulation was to **review the German legal framework** of electromobility, charging infrastructure and related fields of law, which influence the deployment of charging infrastructure for EVs. [3]

The legal requirements vary in accordance with different types of charging infrastructure and business models by means of its deployment or installation in public, semi-public, or private spaces. The link between technical standards and the legal framework arises through references within the applicable legal texts. In general, technical standards are not legally binding and are applied by parties on a voluntary basis or contractual obligation under private law.[4] However, in cases where European or national regulations explicitly refer to technical standards, they become legally binding.[5]

An overview of the legal fields and corresponding legislation and regulation identified is provided in Table 4 to Table 13.

[4] BGH, Decision of 14.05.1998, Az. VII ZR 184–97.
[5] Scientific Services of the German Bundestag, Standards and legislation WD 7 - 3000 - 198/19, December 2019, p.5, https://www.bundestag.de/resource/blob/677848/f35cfe3e47845c4c9ae2b6839a9e6a2c/WD-7-198-19-pdf-data.pdf.

Table 4: National implementation of the AFID in Germany

National implementation of the AFID
The implementation of the AFI-Directive (2014/94/EU) into the national legal framework fosters interoperability and the goal of non-discriminatory access to public charging infrastructure for EVs in Europe. However, the detailed implementation of the goals of the AFID into the national legal framework is up to the member states. Therefore, the implementation laws on the AFID are essential for national legal requirements on charging infrastructure.
German (implementation) legislation of the AFID
• **The Charging Pole Decree (LSV)** is a federal ordinance that defines technical standards for public charging points and serves as a basis for the implementation of technical requirements.
• **The Electromobility law (EmoG)** allows privileges for EVs within the framework of road traffic law to promote electromobility.
• **The Amendment of the Energy Industry Law (EnWG)** was established to categorise charging points as final users.
• **The Metering Point Operation Act (MsbG)** regulates the use of electricity consumption recording systems.

Table 5: Building and construction law in Germany

Building and construction law
Building and construction law plays a relevant role for the planning and building phase of infrastructure for EVs, because permits based on building and construction law might be needed for the installation of charging infrastructure.
German legislation on the topic: BauO-Bln, GEIG.
• **The Berlin Building Code (BauO Bln)** is the local building code applicable for charging points
• **The Building and Electric Mobility Infrastructure Act (GEIG)** is the German law implementing the EPB-Directive.

Table 6: Energy law in Germany

Energy law
The topic of energy law raises various legal requirements, such as the connection to the electricity grid and its stability, which are both mandatory for charging infrastructure.
German legislation on the topic: EnWG, EEG, StromStG, NAV
• The **Energy Industry Act (EnWG)** is the federal law, which regulates the energy economy in Germany.
• The **Renewable Energy Sources Act (EEG)** regulates the use of renewable energy on the federal level.
• The **Energy tax law (StromStG)** regulates the taxation on the use of electricity.
• The **Low Voltage Connection Ordinance is applicable (NAV)** regulates the general terms and conditions for the connection to the grid and its use for the supply of electricity at low voltage.

Table 7: Measuring and calibration law in Germany

Measuring and calibration law
The field of measuring and calibration law is important for the technical products of USER-CHI because it can raise legal requirements for the design of charging point technology.
German legislation on the topic: MessEG, PangV.
• The **Measuring and Calibration Act (MessEG)** is the federal law, which regulates the use of measuring instruments.
• The **Price Quotation Ordinance (PangV)** is German consumer protection law, which regulates the sale of electricity amongst othet things.

Table 8: Procurement law, concession law and subsidies in Germany

Procurement law, concession law and subsidies
The topic of procurement and concession law is relevant for the topic of charging infrastructure for EVs, as the implementation of charging infrastructure by companies could include the procurement or concession processes. Moreover, the development of charging infrastructure is often subsidized.
German legislation on the topic: GWB, VGV, SektVO, KonzVGV.
• The **Law against restraints of competition (GWB)** is the central norm of German cartel and competition law.
• The **Public Procurement Ordinance (VGV)** is the ordinance regulating the procurement of public orders.
• The **Sectors Ordinance (SektVO)** regulates the awarding of contracts in the areas of transport, drinking water supply and energy supply.
• The **Award of Concessions Ordinance (KonzVGV)** regulates the procedure for the award of concessions through a concession grantor.

Table 9: Public, civil, or stakeholder participation in Germany

Public, civil, or stakeholder participation
The topic of public, civil, or stakeholder participation can play an important role in the planning process of charging infrastructure.
German legislation on the topic: None on the topic of deployment of charging infrastructure.

Table 10: Road traffic law in Germany

Road traffic law
The regulatory framework for road use could determine the necessity of permits for charging infrastructure in public spaces.
German legislation on the topic: BerlStrG.
• The **Berlin Street Law (BerlStrG)** is the local law on the regulation of road use in Berlin.

Table 11: Parking management in Germany

Parking management
To enable the booking feature of parking spots for EV drivers, all national legal requirements as well as possible specific legal privileges given to EV drivers should be considered.
German legislation on the topic: Local fee regulations.

Table 12: Data access and sharing law in Germany

Data access and sharing
The topic of data access and sharing is relevant as the regulatory framework may implement rights and duties for CPOs in regard of the data generated using their charging infrastructure.
German legislation on the topic: LSV, local administrative practices.
• The **Charging Pole Decree (LSV)** is a federal ordinance that defines technical standards for public charging points and serves as a basis for the implementation of technical requirements.
• Local administrative practices might determine special requirements on the topic of data access and sharing.

Table 13: Data protection law in Germany

Data protection law
The topic of data protection and security is important for the technical USER-CHI products as personal data might be generated by using charging infrastructure and thereby saved.
German legislation on the topic: GDPR, BDSchG, MsbG.
• The **General Data Protection Regulation (GDPR)** harmonizes the protection of personal data in Europe.
• The **Federal Data Protection Act (BDSchG)** is the federal law German law on the topic of protection of personal data.

- The **Metering Point Operation Act (MsbG)** regulates the use of electricity consumption recording systems.

Table 14 Legal requirements literature review - relevant documents reviewed

Year	Author(s)	Title
/	Federal Ministry of Transport and Digital Infrastructure (BMVI)	Electromobility begins in the municipalities - Checklist for municipal representatives for setting up charging infrastructure.
/	Schmidt, T.	Legally binding standards
2017	Federal Ministry for Economic Affairs and Energy (BMWi)	Innovations in electric mobility - ICT for electric mobility III: Integration of commercial EVs in logistics, energy, and mobility infrastructures
2017	Electric mobility showcase	Cornerstones for the legal framework of electromobility - overview and considerations for action in impact research for the Electromobility Showcase Program
2018	Mühe, S. Dr. De Wyl, C.	Legal framework for billing the charging of EVs
2018	VDE /DKE	Legal challenges of electric mobility - an overview of current problems and possible solutions
2018	Ferwerda, Roland et al	Advancing E-Roaming in Europe: Towards a Single “Language” for the European Charging Infrastructure
2019	Scientific Services of the German Bundestag	Standards and legislation
2020	Dr. Preiß, S.	Electric mobility, charging infrastructure and the grid: Current developments
2020	Köller, C.	What is the status quo with bidirectional charging?
2014	Senate Department for Urban Development and the Environment	Electromobility in Berlin - Guidelines for the expansion of charging infrastructure

3.2.3 Drafting technical and legal questionnaires

The second step of the approach was to draft both technical and legal expert questionnaires based on the results of the literature research. During the drafting process it has been distinguished between technical and legal aspects. As a result, two distinctive expert questionnaires have been established.

3.2.3.1 Drafting Technical questionnaires

The process of drafting the technical questionnaires resulted in the elaboration of a **set of five distinctive sub-questionnaires, whereas each of the five sub-questionnaires focused on one USER-CHI product (CLICK, SMAC, INSOC, INDUCAR and INCAR)**. Each of the questionnaire consists of product-specific questions as well as cross-cutting questions about EVSE. Table 15 provides an overview of the main topics addressed by each questionnaire and the total number of questions in each questionnaire.

Table 15: Technical questionnaires - main topics covered

Main topics	CLICK	SMAC	INSOC	INDUCAR	INCAR
Energy supply for EV charging		X	X		
Parking & Charging	X	X	X	X	X
Communication	X				
Booking & Billing				X	X
Planning	X	X			X
Total Number of Questions	**35**	**50**	**59**	**36**	**51**

3.2.3.2 Drafting Legal questionnaires

The process of drafting the legal questionnaires resulted in the **elaboration of one questionnaire divided into five sub-sections each addressing one of the five technical USER-CHI products.** A variety of answers will provide relevant information for more than one of the products. However, they are only included once in the questionnaire when similar answers are anticipated to prevent repetitions.

The questions are sorted regarding the different fields of law they refer to. Short introductions are inserted at the beginning of each subdivision to illustrate the link between the technical products and the different fields of law. Table 16 provides an overview of the main legal topics covered by the questionnaire and the total number of questions addressed in each subdivision.

Table 16: Legal questionnaire - main topics covered

Covered legal topics – and predicted relevance for specific products at drafting stage of the legal questionnaire	CLICK	SMAC	INSOC	INDUCAR	INCAR
Alternative Fuels Infrastructure Directive	X	X	X	X	
Energy Law	X	X	X	X	
Measuring and calibration law		X	X	X	X
Tender and procurement law	X				
Building and construction Law	X	X	X	X	
Public, civil, or stakeholder participation	X				
Road traffic law					X
Rules on parking management					X
Data access and sharing	X	X	X	X	X
Data protection law	X	X	X	X	X
Total Number of Questions	**30**	**20**	**3**	**7**	**5**

3.2.4 Distribution of the technical and legal expert questionnaires

The questionnaires were distributed to the USER-CHI partners and to external experts beginning on 14.10.2020. The technical questionnaires were distributed primarily to the product leaders of the five technical USER-CHI products (see Table 17) as well as external technical experts (see Table 19). The legal questionnaires were distributed to the five USER-CHI city partners and replication cities beginning on the same day, as well as external experts from public city administrations (see Table 18).

Table 17: Distribution of technical questionnaires to USER-CHI partners – overview

	CLICK	SMAC	INSOC	INDUCAR	INCAR
USER-CHI Product Leaders	VMZ	ETRA I+D, Enel-X, ENEA, QWE	DSI, Enel-X	IPT	ETRA I+D, VMZ, QWE

Table 18: Distribution of legal questionnaires to USER-CHI partners – overview

	Finland	Germany	Hungary	Italy	Spain

USER-CHI City Partners	TUR	IKEM (for Berlin)	BUD	RSM, FLO	AMB, MUR

Table 19: Distribution of legal and technical questionnaires to external partners – overview (1)

Austria	Switzerland	Poland	Germany
City of Graz, Energie Graz GmbH & Co KG	Canton of Basel (Office for Environment and Nature Conservation)	Electric Vehicle Promotion Foundation (FPPE)	E.ON Solutions GmbH
City of Vienna	Verband Swiss eMobility (Association)		Has2be GmbH

Table 20: Distribution of legal and technical questionnaires to external partners - overview (2)

France	Norway	The Netherlands	Latvia
City of Paris	SINTEF, Norsk elbilforening (Norwegian Electric Mobility Association)	City of Rotterdam, EV Box	Riga City Council (Department Riga Energy Agency), Etago/ emi EV Charging Solutions

3.2.5 Analysis and summary of the general requirements (technical and legal requirements)

To summarise and compare the information provided from both USER-CHI partners and external experts, an Excel-matrix document has been established to identify similarities and considerate differences with respect to the five technical USER-CHI products.

To sum up the legal requirements for the five technical USER-CHI products the information provided by the USER-CHI partners and external partners were summarised in a table-matrix for each country/city. The legal requirements are categorized by the relevant fields of law and the questions, which were addressed in the legal questionnaire. The legal requirements are divided into cross-cutting requirements and other requirements, which are only relevant for specific technical products developed within USER-CHI.

In cases where the respondents of the questionnaire were not able to provide information the relevant national requirements are not included. However, in cases where specific legal requirements only apply in some of the analysed national legal frameworks and are not established in others, this is specifically stated as part of the legal analysis.

The national legal framework of Austria, Switzerland and Sweden is partially included to provide information on other relevant countries for the deployment of charging infrastructure in Europe,

other than the countries of the USER-CHI city partners and replication cities in Italy, Finland, Germany, Hungary, and Spain.

3.3 The Identification and Definition of Specific Requirements

To define the specific technical and legal requirements necessary for the development of each of the USER-CHI products and based on the research work carried out and the information from the questionnaires carried out to the experts, explained in the previous sections, the Volere methodology has been followed.

This methodology has been proven successful in previous H2020 projects such as DORA, MEISTER, X-FLEX, NOBEL GRID[6], WISEGRID[7], or CROSSBOW[8], where it was used mainly because of its simplicity. It helped project partners to describe, discuss, formalise, and track the project requirements in an explicit and collaborative manner. Besides being successfully realised in the above-mentioned previous projects, the Volere methodology was selected for the following three reasons:

1. It requires simple steps to identify and formalise the requirements in an unambiguous manner.
2. It provides an easy process to track and evaluate the progress of the project.
3. Several project partners have already experience using the Volere methodology.

The application of the Volere methodology is not only useful in the initial phases of the project for specifying requirements, but it is also helpful in specifying a reference point for the later stages. For example, it is useful for use case analysis to ensure that all important aspects of the requirements are covered by the different defined use cases. But also, during the implementation and management, it can be used to track and evaluate the progress of the individual work packages and the overall project.

Besides being efficient and easy to use, the Volere methodology provides a mechanism for all partners to specify the requirements in a standard format. Thereby, specifying additional context of a requirement such as the rationale and the acceptance criteria for every requirement helps to build a common understanding of the overall system. Furthermore, defining priorities helps to clarify the focus of the project.

[6] NobelGrid project, n.d.
[7] WiseGRID project, n.d.
[8] Crossbow project, n.d.

3.3.1 Requirement prioritisation

In order to prioritize requirements, the project consortium has introduced five different classes of priorities. These classes range from one (lowest priority) to five (highest priority) and the consortium has defined them as follows:

- **5 - High**: Requirements in this class are either realizing a key innovation of the project or they are needed to realize it. These requirements are necessary to achieve the goals of the project.
- **4 - 3 Medium**: Requirements in this class are not necessary to realize a key innovation but they are necessary or very helpful to realize the application prototypes. These requirements are important to the application developer.
- **2 - 1 Low**: Requirements in this class are necessary neither for realizing a key innovation nor for the application of the prototypes. However, in a broader context possibly beyond the scope of the project, they may be important.

As a consequence, for the success of the project, it is essential to fulfil the requirements with high priority. With respect to providing thorough support for product developers, it is important to realize the requirements with medium priority as well. The requirements with low priority, however, does not have immediate relevance to the project. However, if they are taken into account may provide additional features or benefits for applications or users.

3.3.2 Volere tool

Aiming at defining an optimum and complete list of requirements, a web-based application based on the Volere methodology has been used for gathering the requirements in USER-CHI. This web tool incorporates the concepts in the data model, the templates within its user interface and the procedural patterns in the application business rules. Some USER-CHI partners have already participated in a similar requirement gathering process within the MEISTER project and their experience using Volere methodology for this purpose was satisfactory. This specific tool facilitates the collaborative and interactive work between partners in an iterative and progressive manner.

For the USER-CHI requirements gathering, WP1 partners agreed to classify the requirements into categories, one for each of group of developments that constitutes the USER-CHI products. In general, there was created one group for each product however, for INCAR and SMAC it was agreed to split the whole product in two separate groups of requirements. Each requirement is therefore associated to the product (or the specific part of the product) that has to accomplish it, as it is shown in Figure 3.

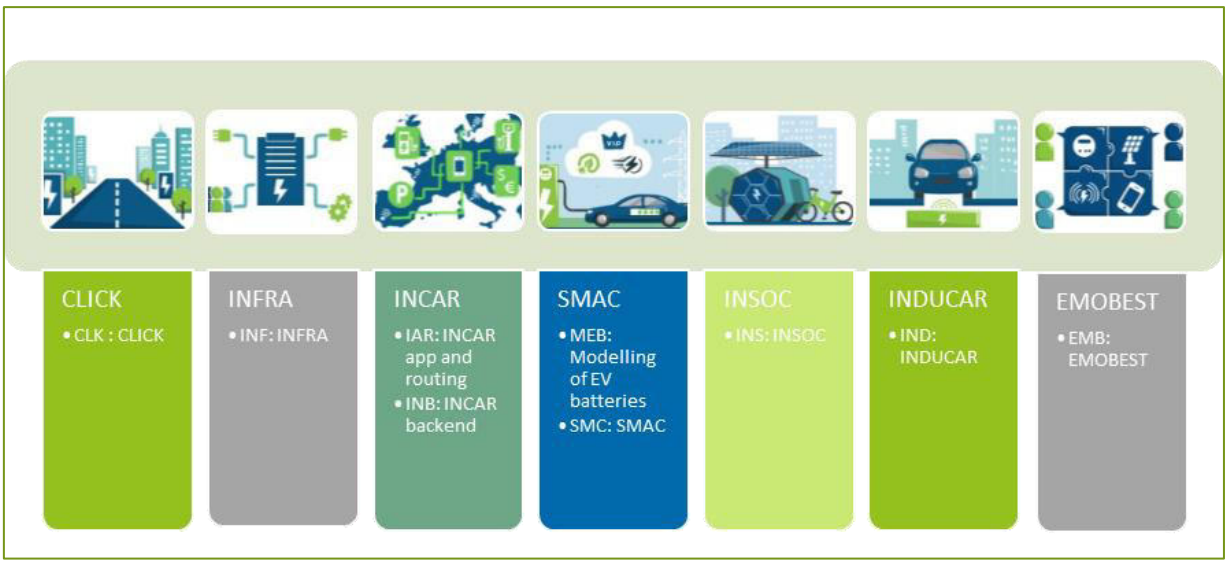


Figure 3: Groups of requirements defined for the USER-CHI products

For each group of requirements, one person was named as leader and 3-5 partners, depending on each group, were involved as collaborators. Therefore, multidisciplinary groups were created, formed by technical experts, pilot site leaders and product development responsible to define, discuss and agree the requirements for each product. The overall process of Volere as supported by the web tool is specified, revised, and solved by the original author of the requirement. Iteratively, this process is repeated for each set of new requirements that are included in the tool. Once all issues are closed and no more requirements expected, the result constitutes the final list of requirements. The following sub-sections briefly outline the individual steps.

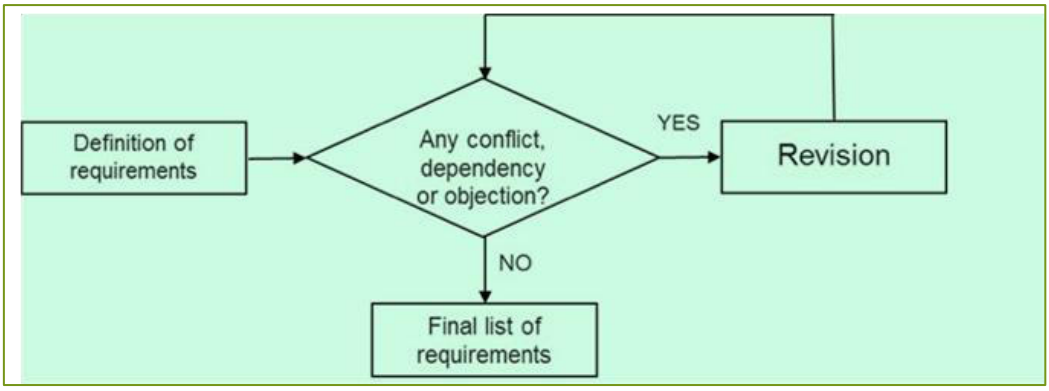


Figure 4: Requirement specification process diagram

3.3.3 Requirement definition

In this first stage, a complete list of the requirements of the USER-CHI solutions that are needed to accomplish the project objectives should be defined.

This initial list of requirements will be refined and expended in future iterations. In this stage, 243 requirements were initially included in the Volere web tool over the course of 5 weeks, from mid-September to mid-October 2020.

The most useful information and the main functionalities of this stage are available at the main page, which could be seen in Figure 5:

- **List of requirements:** The list of requirements with some additional options.
    - Filtering options: The list of requirements filtered per id., type and/or filtered per author.
    - Expand table: Show/hide some columns, displaying more or less information about the requirement.
- **Requirements management:** Modification options for requirements.
    - View a requirement.
    - Edit a requirement (only available for the author).
    - Delete a requirement (only available for the author).
- **Requirements tracing**: After the first validation, a new service is made available for keeping track of all the requirements history.

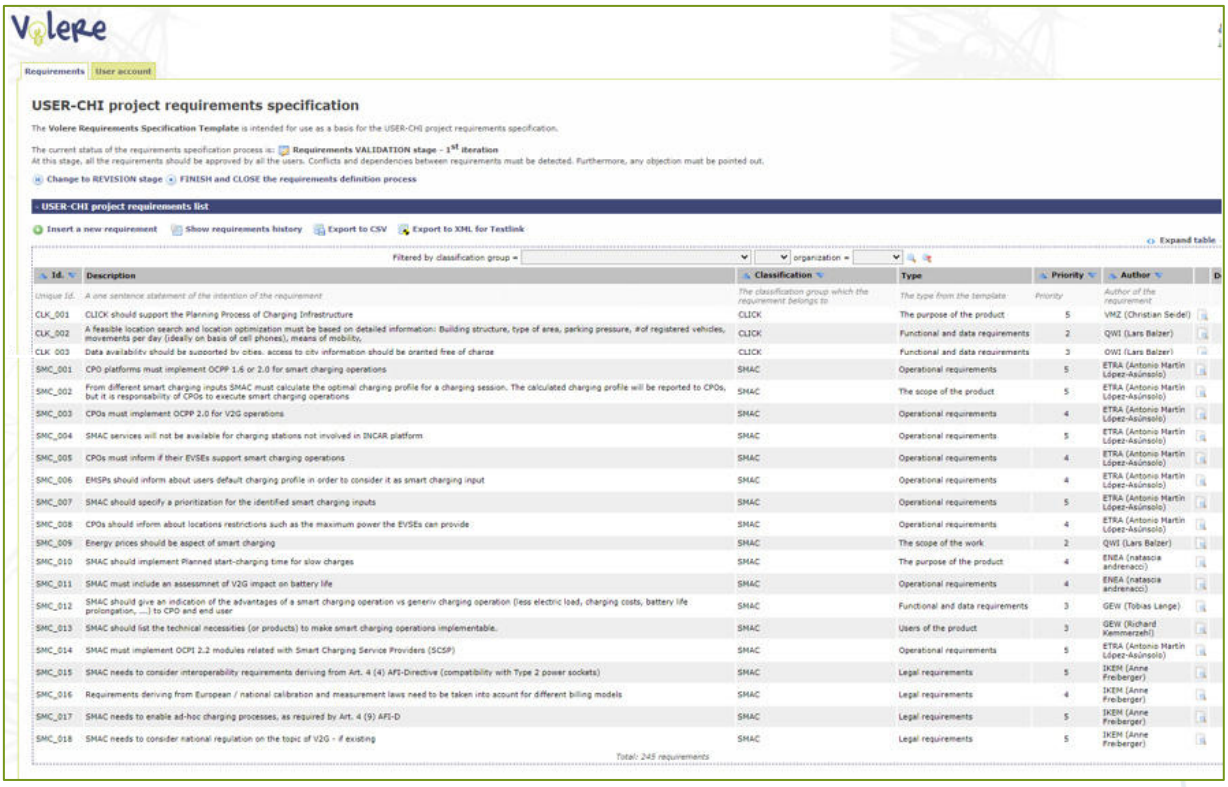


Figure 5: Volere main page

- **Insert a new requirement**: Opens a new window (
- Figure 6) to allow adding a new requirement. All the fields are required except for the "Comments" field which is optional. The required fields are:
    - ID: The scope of this requirement. Appended by an automatically generated sequential number, this ID uniquely identifies each requirement. This ID will be generated after the requirement has been added. (see Figure 7).
    - Classification: The group of requirements which the requirement belongs to.
    - Description: A one sentence statement which describes the intention of the requirement.
    - Type: The type of the requirement as defined by Volere.
    - Rationale: A justification of the requirement.
    - Acceptance criteria: A measurement of the requirement for further verification that the solution matches the original requirement.
    - Priority: The importance for the customer of successfully implementing the requirement

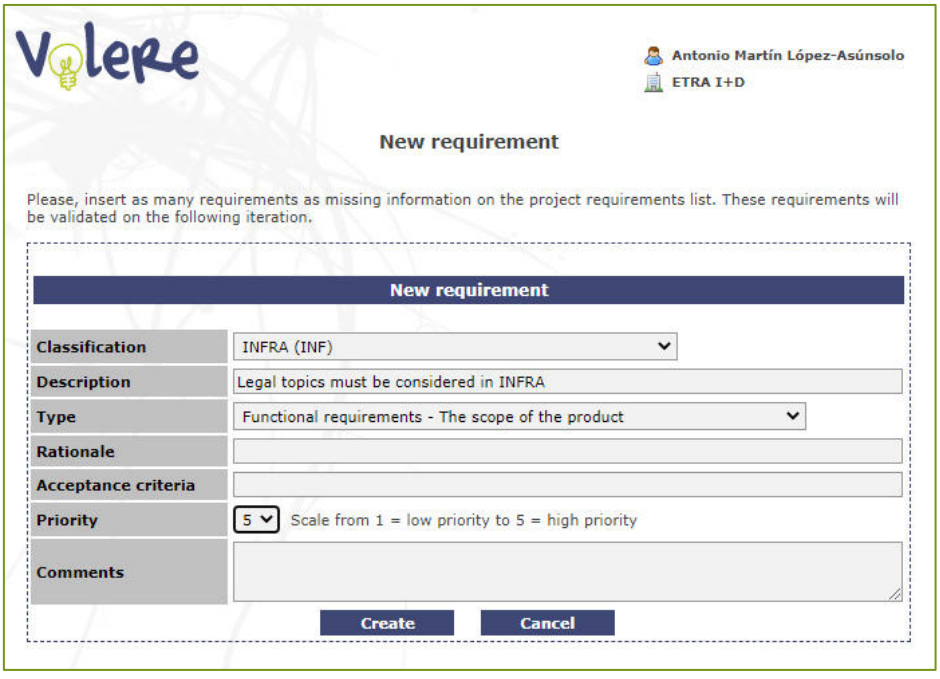


Figure 6: Window to insert a new requirement in Volere tool

Figure 7: USER-CHI project requirement details

3.3.4 Requirement Validation

After the initial definition of requirements, the validation process begins. All the requirements should be approved by all the users. At this stage, conflicts and dependencies between requirements must be detected. Furthermore, any objection must be pointed out:

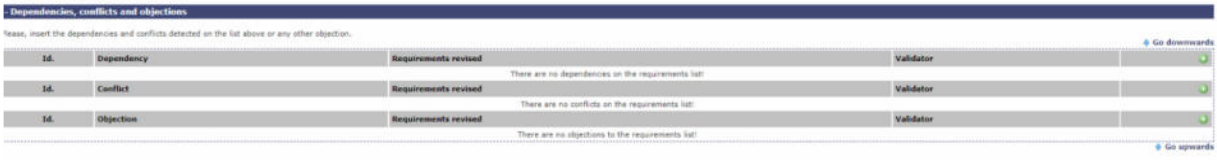
- **Objection**: A reason or argument due to disagreement, opposition, refusal or disapproval of the requirement.
- **Dependency**: Requirements that have some dependency on other requirements.
- **Conflict:** Requirements that cannot be implemented if another requirement is implemented or there is a conflict due to an insufficient definition of the requirement.

How to insert an objection

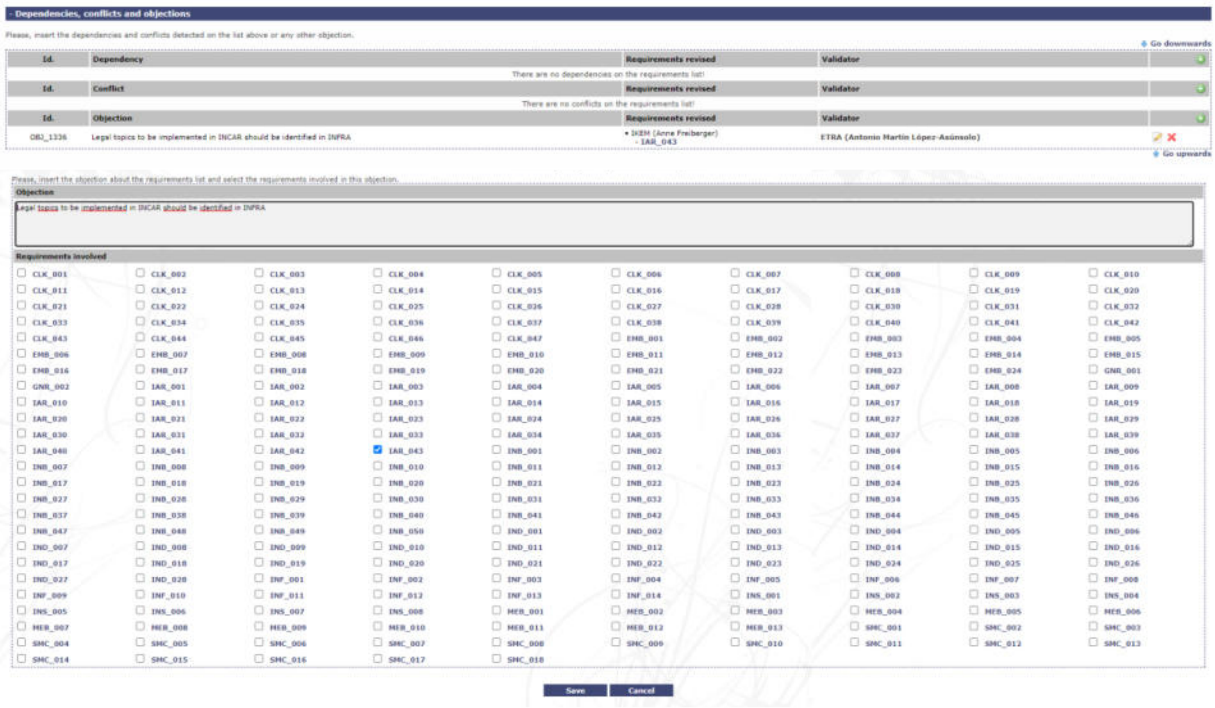
An **Objection** is a reason or argument offered in disagreement, opposition, refusal, or disapproval of the requirement. To introduce an objection in VOLERE, the procedure is as follows:

- Identify the Requirement number on which we want to make the objection.

- Press  icon to add a new Objection.



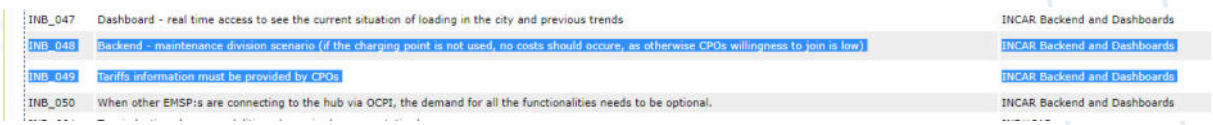
- Select the requirement number on which we want to make the objection and write the description of the Objection
- The new objection has been created and the Validator and Revisor for that requirement has been assigned. The Validator is the person who has introduced the objection and the Revisor is the person who generated the requirement.



How to insert a conflict

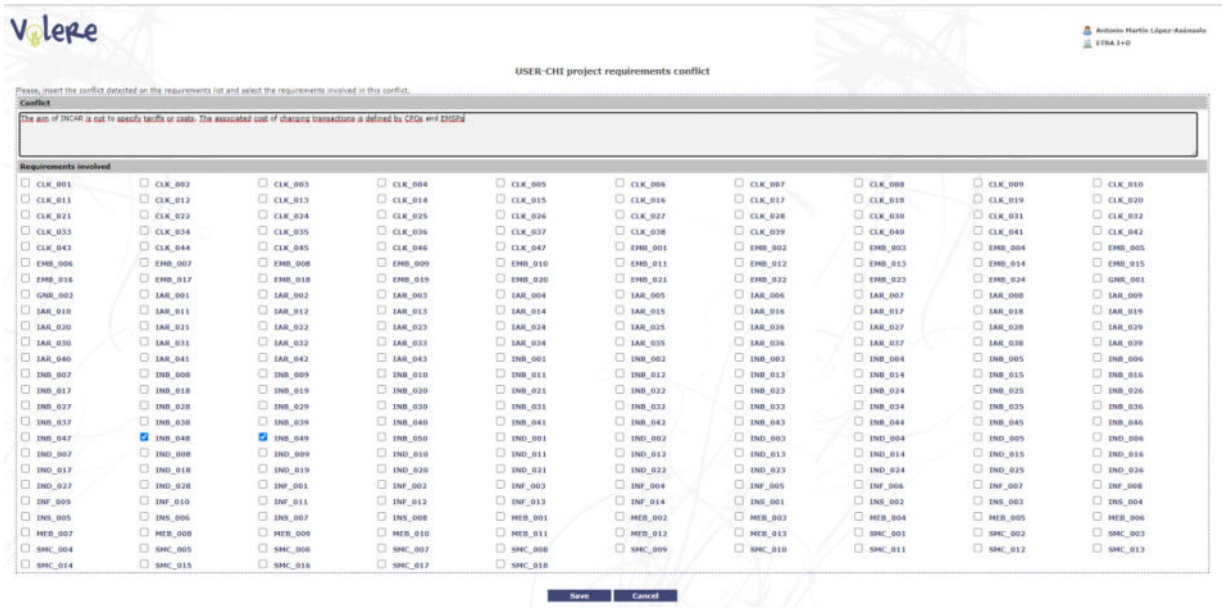
Two or more requirements are in **Conflict** if those requirements cannot be implemented if another requirement is implemented. To introduce a conflictin VOLERE, the procedure is as follows:

- Identify the Requirements number on which we want to make the conflict.



- Press  icon to add a new Conflict.

- Select the requirement numbers on which we want to make the objection and write the description of the Conflict

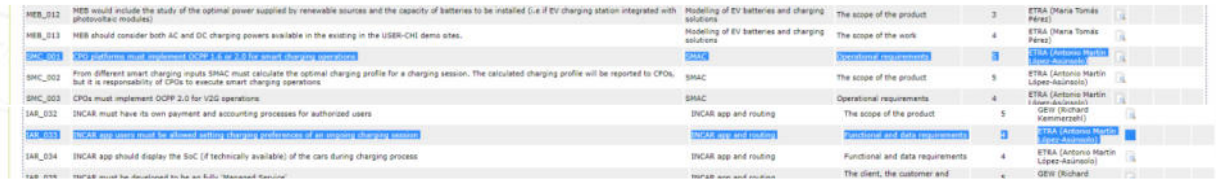


- The new conflict has been created and the Validator and Revisor for that requirement has been assigned. The Validator is the person who has introduced the objection and the Revisors are the people who generated the requirement.

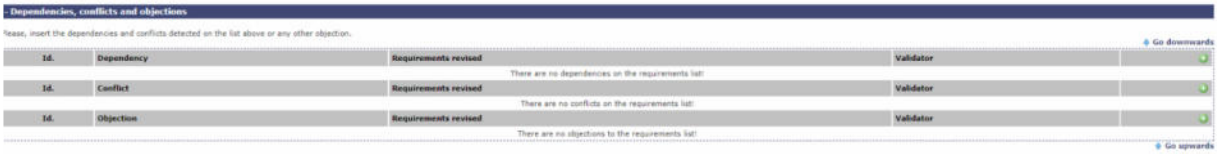
How to insert a dependency

Two or more requirements are **Dependent** if their fulfilment depend on the partial or total implementation of other requirements. To introduce a dependency on VOLERE, the procedure is as follows:

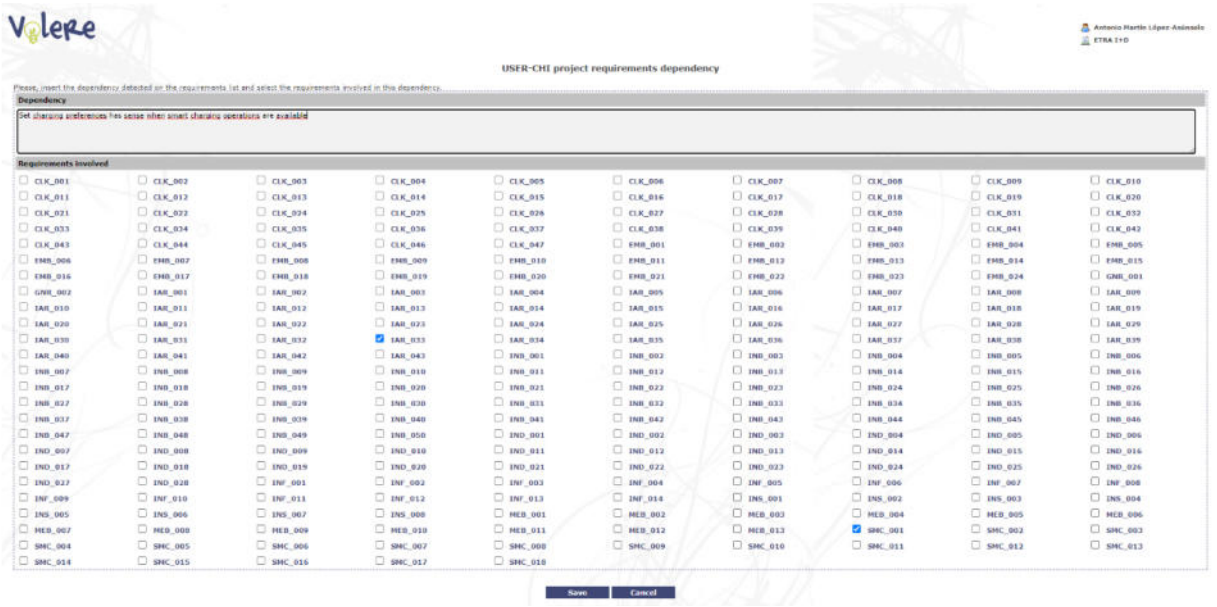
- Identify the Requirements number on which we want to make the dependency.



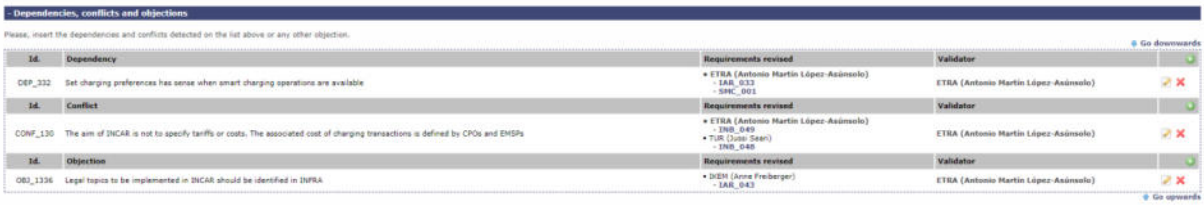
- Press  icon to add a new Dependency.



- Select the requirement numbers on which we want to make the objection and write the description of the Dependency



The new dependency has been created and the Validator and Revisor for that requirement has been assigned. The Validator is the person who has introduced the objection and the Revisors are the people who generated the requirement.



3.3.5 Requirement Revision

After the validation, the revision process begins. The dependencies, conflicts and objections highlighted by the experts during the Validation stage must be revised and solved by the requirement's author. However, if the authors do not agree with the validator's comments, they can include their own viewpoint in the "Revisor's comments" section for explanations and requirement clarifications. In this stage, the authors of the requirements pointed to be revised are able to add comments to the dependency, conflict or objection.

Step 1: Check the requirements with issues

Each partner should **identify** each one of the requirements that have been **impacted by an objection, conflict or dependency,** by checking the Requirement revised column in the Dependencies, conflicts and objections section.

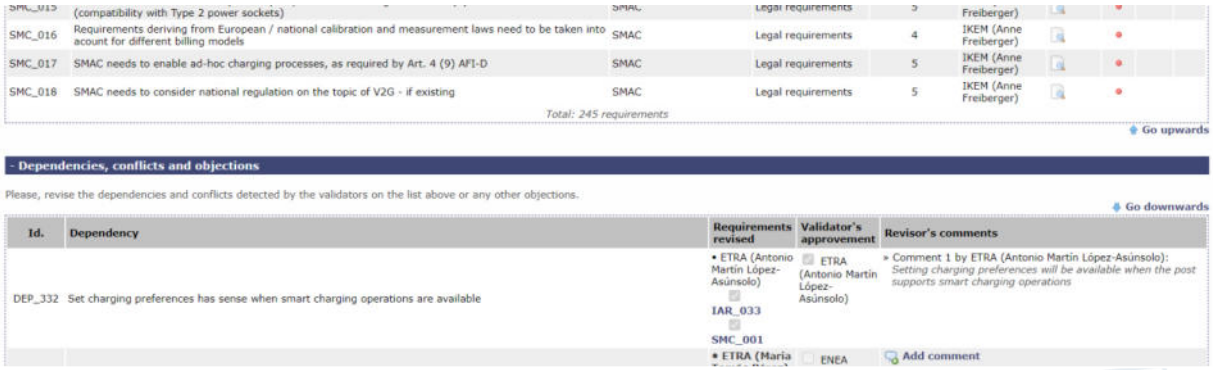


Figure 8: Dependencies, conflicts and objections section

Step 2: Add comments in the issues

The requirements impacted with an objection, conflict or dependency have the "Add comment" button enabled. The revisor(s) (the partner who introduced the requirement) are the people in charge to start writing comments (see Figure 9)

The comments could be oriented to explain that the requirement:

- Is **confirmed as described** (could be a misunderstanding or maybe the requirement description was confusing).
- The revisor notice that the requirement should be **edited.**

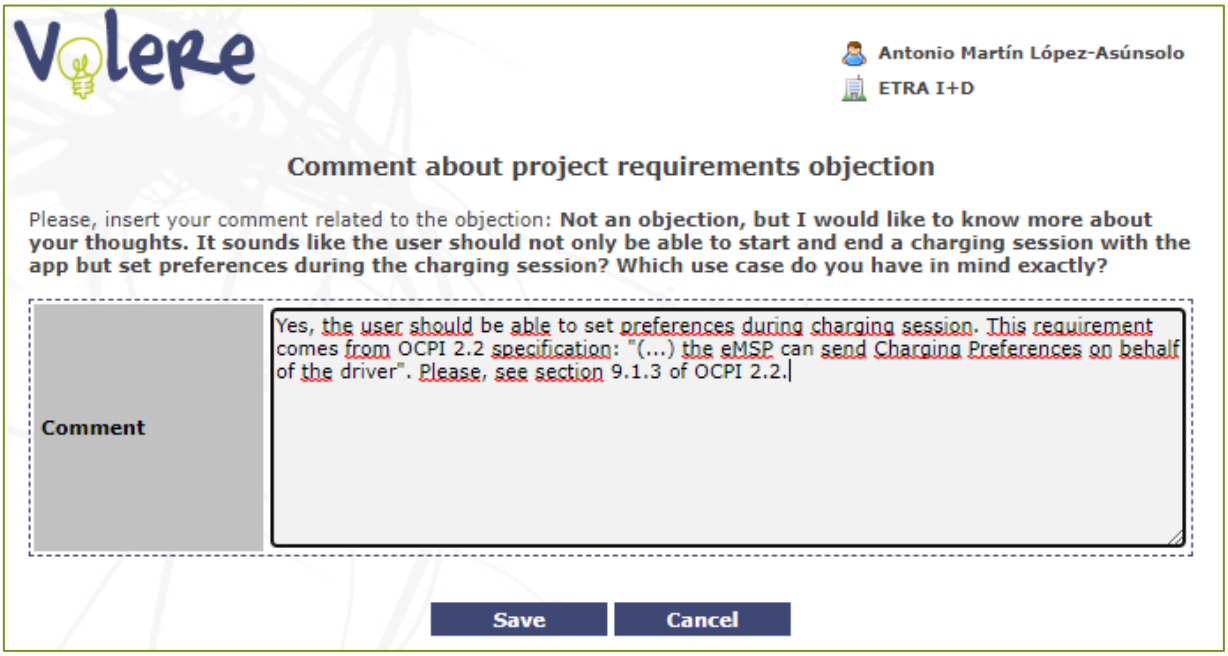


Figure 9: Example of a comment of a project requirement objection (1)

After saving the comment introduced, the comment appears in the mentioned objection, as it is shown in Figure 10.

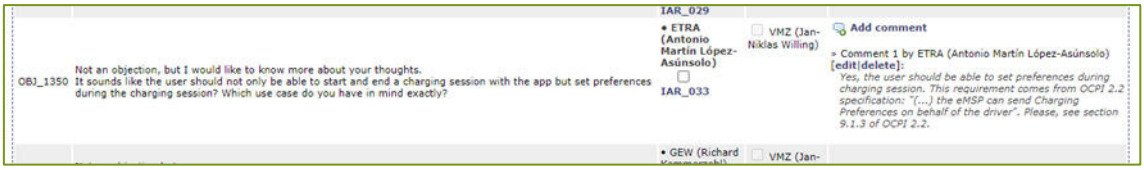


Figure 10: Example of a comment of a project requirement objection (2)

In this case, the revisor has detected that the Requirement needs extra information. Therefore, after write the comment, the requirement should be edited, as it is shown in Figure 11 and Figure 12.

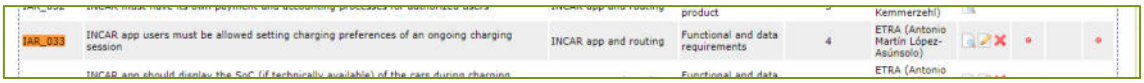


Figure 11: Editing a requirement during the revision phase (1)

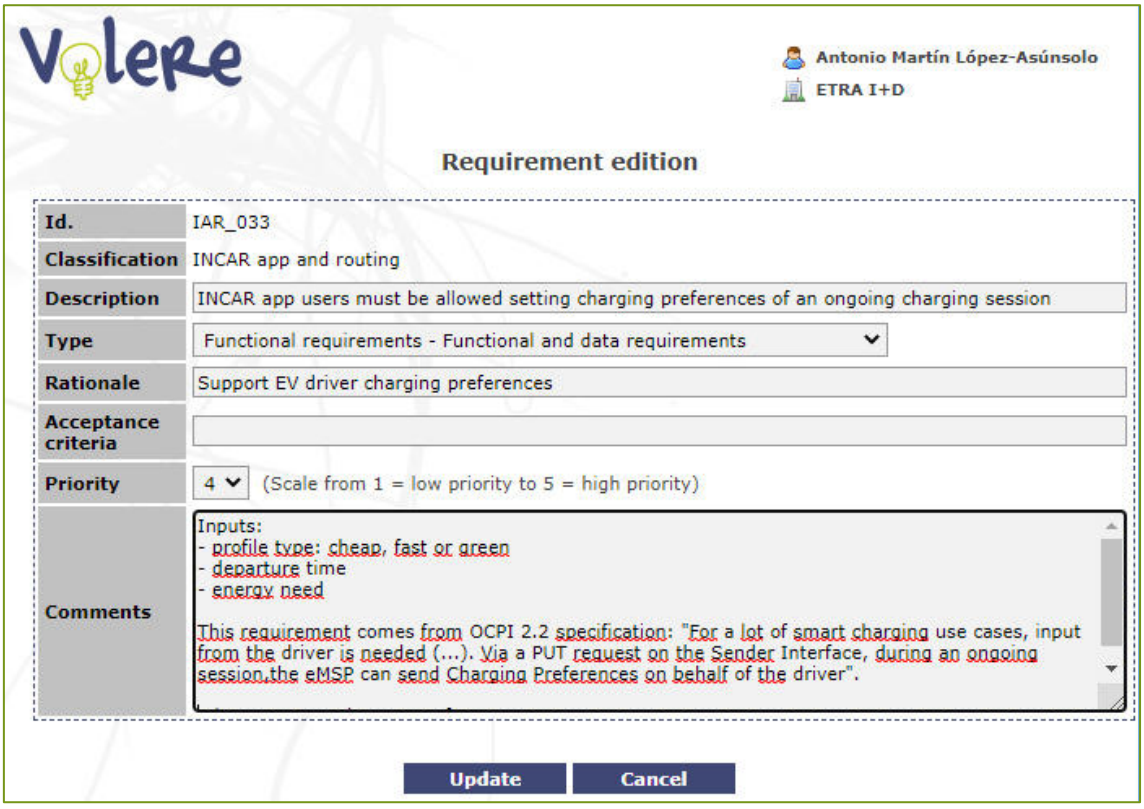


Figure 12: Editing a requirement during the revision phase (2)

Step 3: Mark the objection, conflict or dependency as revised

The person who wrote the requirement, should **mark the issue as revised** they have written the comments and edited the requirement (if necessary). (Figure 13)

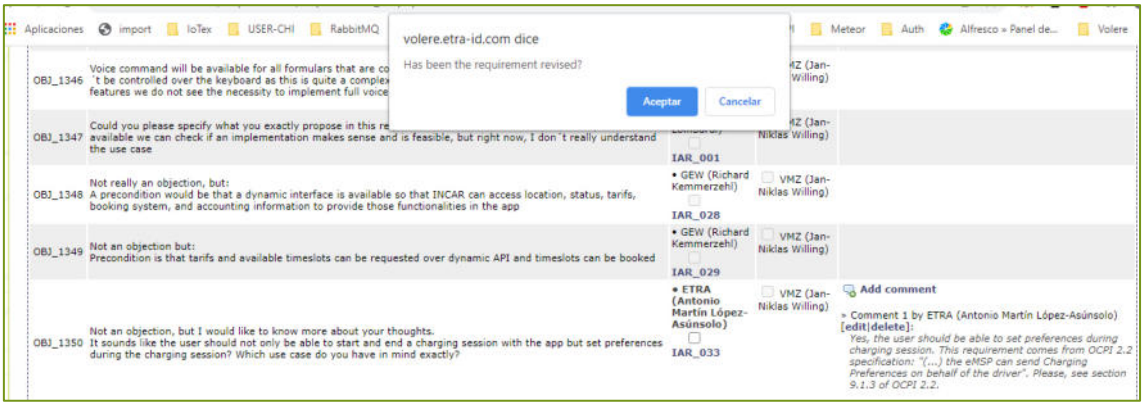


Figure 13: Mark the requirement objection as revised

Step 4: Mark the objection, conflict or dependency as validated

The person who detected the conflict / dependency / objection should check the changes and comments made. If agrees, should mark the requirement as **validated**. If not, he or she should **argue the reason why.** (Figure 14)

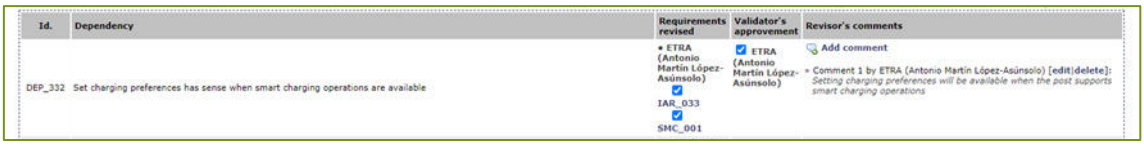


Figure 14: Mark the requirement objection as validated

3.3.6 Iterations and final results

The previously explained process is repeated several times in order to include newly defined requirements, as shown in Figure 15.

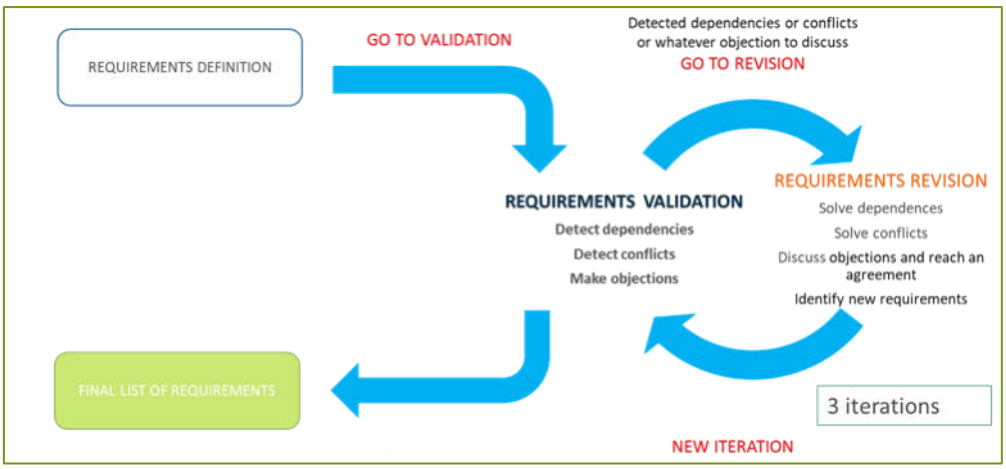


Figure 15: Volere iterative process

Once the final iteration is finished, all issues have been closed, and no more requirements are expected, the final list of requirements is available. The Volere web tool not only provides this final list, but also allows to access the history of each requirement and its associated issues, so any consultant can keep track of the path that leads to the definition of each requirement.

In the case of USER-CHI, three iterations have been performed. The first one lasted one month each (two weeks for the validation stage and two for the revision), while the last two iterations took two weeks each (one per stage). This process successfully completed with a total list of 259 requirements.

During the iterative process, several dependencies, conflicts, and objections among the requirements were detected and solved by the consortium, for each one of the USER-CHI products. Those issues are presented and described in Sections 5.1.2 (CLICK), 5.2.2 (INCAR), 5.3.2 (SMAC), 5.4.2 (INSOC), 5.5.2 (INDUCAR), 5.6.2 (INFRA), 5.7.2 (EMOBEST).

4. General Technical and Legal Requirements

This chapter presents the results of the identification and definition of general requirements. The cross-cutting requirements for USER-CHI products are presented in 4.1. USER-CHI product specific general technical and legal requirements are presented in 4.2.

4.1 Cross-cutting technical and legal requirements for the technical USER-CHI products

4.1.1 Cross-cutting technical requirements for CLICK, INCAR, SMAC, INDUCAR

This section provides an overview of the general cross-cutting technical requirements that must be met on a national level of the USER-CHI countries and five other countries for the implementation of the USER-CHI products. The results are presented as tabular formats. The overview covers the following information received from the countries/cities tagged. The residual information is pending.

Table 21 Technical requirements – feedback results from USER-CHI and external partners

	Finland (TUR)	Germany (IKEM, QWI, IPT, VMZ, E.ON)	Hungary (BUD)	Italy (ENEA, Enel-X, DSI)	Spain (AMB, MUR, ETRA)
USER-CHI Countries	✓	✓		✓	✓
	Austria (City of Graz, Energie Graz)	France (City of Paris)	The Netherlands (City of Rotterdam, EV Box)	Latvia (City of Riga, Etago/emi EV Charging Solutions)	Switzerland (Canton of Basel, Verband Swiss eMobility)
Other Countries	✓				(✓)

Given the nature of the electric mobility system and the specific requirements of the charging infrastructure for EVs, a set of technical requirements that are transversal to all USER-CHI technical products dealing with EVs´ implementation have been identified. However, the USER-CHI technical product INSOC focuses on the implementation of lightweight electric vehicles (LEV), such as e-bikes and e-scooters, and therefore complies mainly with a different set of technical and legal requirements that are described in chapter 4.6. Figure 16 illustrates this relation of crosscutting technical requirements to the USER-CHI technical products, respectively.

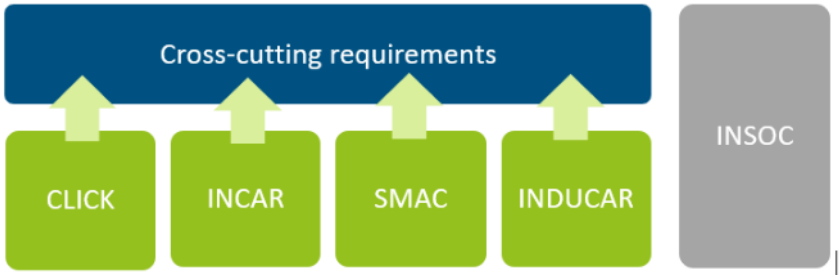


Figure 16 Cross-cutting technical requirements for USER-CHI technical products.

Table: 22 outlines the cross-cutting general technical requirements for electromobility.

Table: 22 General technical requirements for electromobility.[9]

Requirements	Standard	Description
Vehicle-side charging point	ISO 17409:2020[10]	Electrically propelled road vehicles — Conductive power transfer — Safety requirements
Charging infrastructure and charging point	IEC 61851-1:2017[11]	Electric vehicle conductive charging system - Part 1: General requirements
	IEC 62196-1:2014[12]	Plugs, socket-outlets, vehicle connectors and vehicle inlets - Conductive charging of EVs - Part 1: General requirements
	IEC 60364-7-722:2018[13]	Low-voltage electrical installations - Part 7-722: Requirements for special installations or locations - Supplies for EVs

[9] NPE 2017

[10] Available at: https://www.iso.org/standard/72880.html

[11] Available at: https://www.vde-verlag.de/iec-normen/224263/iec-61851-1-2017.html

[12] Available at: https://webstore.iec.ch/publication/6582

[13] Available at: https://webstore.iec.ch/publication/63898

Electro-magnetic compatibility (EMC)	IEC 61851-21-1:2017[14]		Electric vehicle conductive charging system - Part 21-1 Electric vehicle on-board charger EMC requirements for conductive connection to AC/DC supply
	IEC 61851-21-2:2018[15]		Electric vehicle conductive charging system - Part 21-2: Electric vehicle requirements for conductive connection to an AC/DC supply - EMC requirements for off board electric vehicle charging systems

The literature findings showed that technical standardisation in the field of electromobility is characterised by several features distinguishing it from previous standardisation processes[16]. The main challenge for USER-CHI technical products lies in coordinating and integrating diverse activities in different sectors to effectively meet local demands at each USER-CHI demo site within the EU.

Table 23 presents the structure of the standardisation landscape at the international, European, and national levels. Moreover, it shows the standardisation committees involved in the definition of technical standards in relevant domains for electromobility, such as automotive technology, electrical technology, and telecommunications, and the relationship between the various standards organisations, together with their regulatory bodies. International electrotechnical standardisation is carried out at IEC, while these activities in the automotive sector and the telecommunication sectors are carried out at ISO and ITU, respectively. Before electromobility can be seamlessly introduced, work amongst these organizations needs to be harmonized.

Table 23: Structure of the standardisation landscape

	General	Automotive technology	Electrical technology	Telecommunications
International Standardisation	International Organization for Standardization (**ISO**)	Electrically propelled vehicles **ISO / TC 22 / SC 37**	International Electrotechnical Commission (**IEC**) **SC 23H**[17]	International Telecommunication Union (**ITU**)

[14] Available at: https://webstore.iec.ch/publication/32045

[15] Available at: https://webstore.iec.ch/publication/31282

[16] NPE 2014; NPE 2017; Werner 2020

[17] Sub Committee (SC) for Plugs, socket-outlets, couplers for industrial and similar applications, and for EVs.

European Standardisation	European Committee for Standardization (**CEN**) / Technical Committees (**TC**)	European Committee for Standardization (**CEN**) / TC 301 - Road vehicles	European Committee for Electrotechnical Standardization (**CENELEC**)	European Telecommunications Standards Institute (**ETSI**)
National Standardisation	**German** Institute for Standardization[18] (**DIN**)	National Committees Electric Road Vehicles[19] **NA 052-00-37 AA**	German Commission for Electrical, Electronic & Information Technologies[20] (**DKE**) **DKE/UK 542.4**[21]	German Commission for Electrical, Electronic & Information Technologies (**DKE**) **DKE/K 724 & K 731**[22]
	Asociación **Española** de Normalización (UNE)		Asociación **Española** de Normalización (UNE)	
	Ente **Italiano** di Normazione (UNI)		Comitato Elettrotecnico **Italiano** (CEI)	
	Suomen Standardisoimisliitto r.y. (SFS)		**Finnish** Electrotechnical Standards Association (SESKO)	
	Hungarian Standards Institution (MSZT)		**Hungarian** Standards Institution (MSZT)	

In the European context, the importance given to seeking the integration of the different standardisation domains and its contribution to achieving climate protection targets has been highlighted. Through the EU mandate M/468, herein referred to as 'the mandate', the European

[18] Deutsches Institut Für Normung

[19] Nationale Gremien Elektrische Straßenfahrzeuge

[20] Deutsche Kommission Elektrotechnik Elektronik Informationstechnik

[21] Industrial plugs and sockets

[22] Telecommunication systems & Radio technology, respectively

Commission aims at ensuring uniform charging methods for EVs across the EU, avoiding isolated solutions by individual European member states. The mandate not only covers passenger cars, but also other vehicle categories, namely electric-scooters and electric-bicycles. It must therefore be considered when implementing all technical USER-CHI products. Nevertheless, for the issues of interoperability, the priority should be for the four-wheel EVs[23].

4.1.1.1 Supply of electric energy for EV's charging infrastructure

Within the USER-CHI consortium, the supply of electric energy for EVs charging infrastructure is mainly provided by the general power supply network (DSO). Moreover, the USER-CHI partners reported that in some USER-CHI countries, namely Italy and Germany, there are both public charging points (connected to the public distribution grid), and private charging points (connected to the public distribution grid or isolated connected to PV systems and batteries for storage) within a decentralized energy supply concept. Amongst the private charging points, there are some charging infrastructures for "public use" (e.g., service stations, supermarkets, etc.). In Germany, the availability of charging infrastructure in the semi-public space was also reported.

According to the NPE the international requirements for the connection of charging stations to grid are specified in **IEC 60364-7-722** "Erection of low voltage installations"[24]. This international standard, which is important for the safe connection of charging stations, was published in a first edition as early as 2014 and has been incorporated into the German standard **DIN VDE 0100-722**.

- GRID CONNECTION

For charging stations with a capacity of more than 12 kVA, according to the German Low Voltage Connection Ordinance (Niederspannungsanschlussverordnung or NAV) and VDE AR N 4100 as well as the Technical Connection Conditions (Technische Anschlussbedingungen or TAB), an approval by the network operator is required and a data sheet of the charging device as well as a commissioning notification is necessary.

Moreover, a control interface (see VDE AR N 4100) must be provided from 12 kVA upwards. Charging devices with an output of less than 12 kVA must be registered with the main operator. In addition, **VDE AR N 4100** requires compliance with the symmetry requirement (asymmetrical load <4.6 kVA). Both for the direct connection of charging stations to the public distribution grid and in residential and commercial areas, the requirements of VDE application rule VDE-AR-N 4100 must be considered in the low-voltage grid. Depending on the connected load of the charging equipment to be installed and the planned use, measures must be taken regarding the power supply. The registration of changes in the grid connection is to be carried out by the qualified electrician or company carrying out the work[25].

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[23] See mandate M/468

[24] NPE 2017

[25] Wagner 2020

- CHARGING SPEEDS

The so-called charging power, which determines the time required to charge an EV, can vary by orders of magnitude across charge points, as shown in Table 24 below. A small household outlet may charge as slowly as 1.2 kW, while the most advanced fast charging stations can charge at up to 350 kW. The charging infrastructure could be broadly broken into three categories based on the charging speed: alternating current (AC) Level 1 (120V AC, 1.2 – 1.8 kW) and Level 2 (200 – 240V AC, 3,6 – 22 kW), and direct current (DC) fast charging (400V DC, 50 kW or more) sometimes referred to as Level 3[26].

In the EU, normal and fast charging are defined in the EU Directive 2014/ 94/EU Development of the infrastructure for alternative fuels[27] and result only from the charging performance applied during the charging process. For example, all charging processes with a charging capacity of up to 22kW are classified as normal charging, charging processes with higher capacities are called quick charging. In addition to the classic DC charging stations with lines from 50kW upwards, smaller DC wall boxes with outputs between 10 and 20kW are increasingly being considered across the EU[28].

Table 24 illustrates how the charging infrastructure is implemented either as AC – one or three-Phases – or DC charging infrastructure in German, Spanish and Italian USER-CHI cities. The main voltage (V) and amperage (A) are also reported in each case and varies from 230V – 16A to 500V – 125A, as shown in the table below.

In the Italian case, it is important to note that DC grid connection for High Power Charging (HPC) is made to medium voltage (MV) grids, since in Italy the voltage varies from region to region.

Table 24: EV charging - AC and DC current values for BEVs and PHEVs

Charging Technology	Charging capacity (kW) Up to			Charging current (A) Up to			Grid connection charging infrastructure		
USER-CHI Countries	**DE**	**IT**	**ES**	**DE**	**IT**	**ES**	**DE**	**IT**	**ES**
AC – 1 Phase	3.7	3.7	3.7	16	16	16	230V, 16A	230V, 16A	230V, 16A
AC – 3 Phases	22 (2x11)	43	44	32	63	63	400V, 3x32A	400V, 3x63A	400V, 63A
DC	350	350	350	200	500	500	400V, 3x125A	400V, 3x125A	500V, 3x125A

[26] Hall and Lutsey 2017

[27] Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014L0094

[28] Wagner 2020

- AC CHARGING

The energy transfer between the AC network and the EV can be wired or wireless – often referred to as conductive and inductive - (i.e., inductive charging, see USER-CHI product INDUCAR). In most cases, the EV is connected to the AC grid via a suitable power supply device, e.g., an AC charging station or AC wallbox[29]. Figure 17 provides an overview of the available options for AC charging stations and their corresponding international technical requirements.

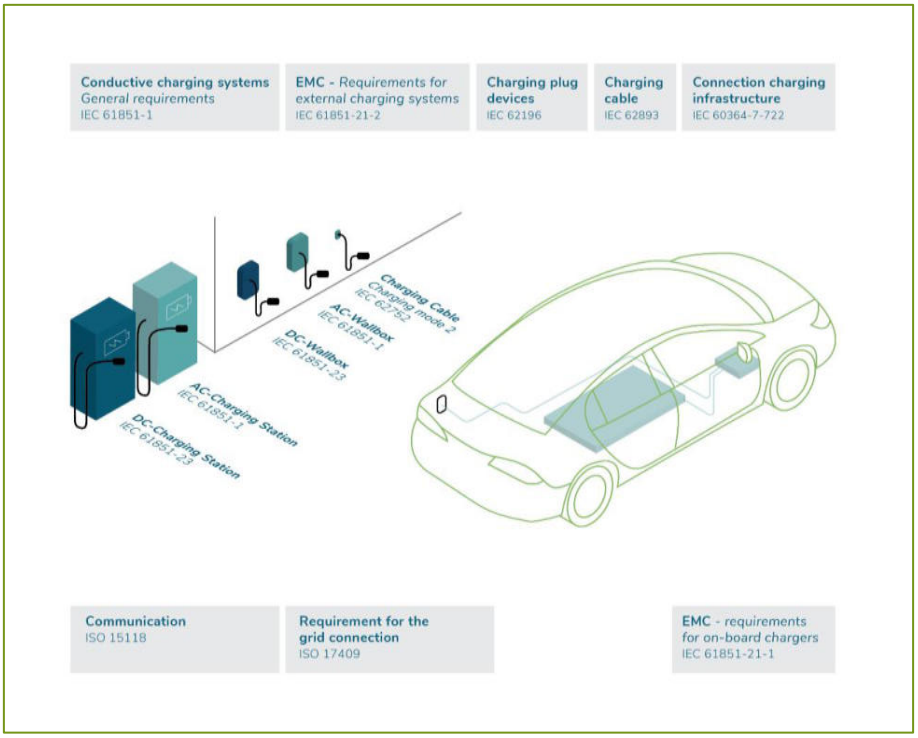

Figure 17: Conductive charging of EVs[30]

Italian and **German** USER-CHI partners reported the international standard **IEC 61851-1** "Electric vehicle conductive charging system – Part 1: General requirements" and LV-EMC directives as the most relevant technical standards for AC charging technologies (see Figure 17). Moreover, the **CEI-021 and CEI-016** standards were reported as the technical standards for AC grid integration in **Italy**, whereas the **DIN VDE 0100-100 VDE 0100-100:2009-06, DIN VDE V 0124-100:2020-06, DIN EN 61851-1 VDE 0122-1:2012-01, DIN EN 50341-1 VDE 0210-1:2013-11, DIN VDE V 0124-100:2020-06, and VDE V 0124-100:2020-06 standards in Germany.**

[29] Wagner 2020

[30] NPE 2017

- DC CHARGING

Charging with direct current requires the vehicle to be connected to the charging station via a charging cable, with the charger integrated in the charging station. DC charging is controlled via a communication interface between the vehicle and the charging station [31]. The Figure 18 below provides an overview of the available options for DC charging stations and their corresponding international technical requirements.

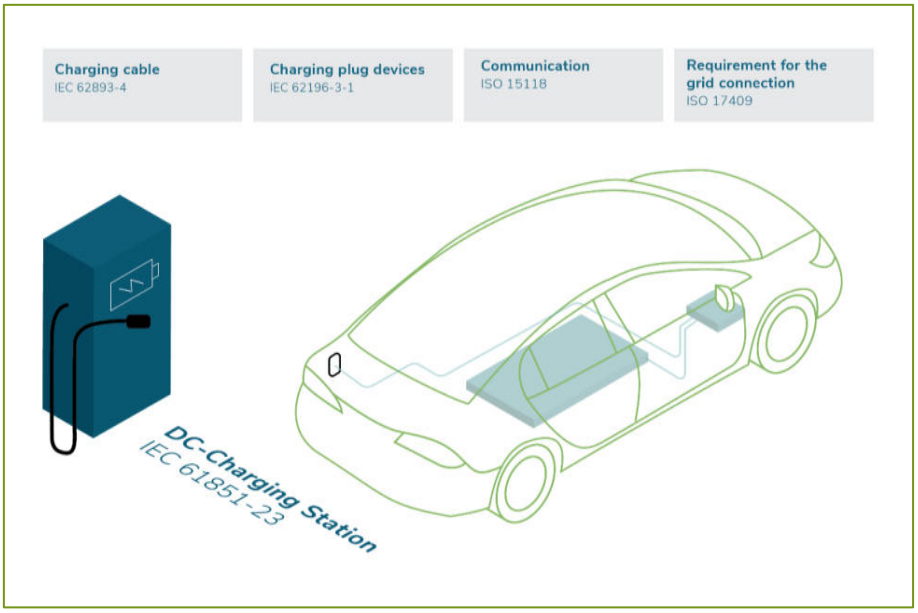

Figure 18: Conductive charging with higher charging capacity[32]

Table 25 highlights the international standardisation activities in the field of EV charging with higher charging capacities (DC charging) and in the field of communication between EVs and charging infrastructure.

Table 25 Wired charging with higher charging capacity[33]

	Technical Requirements
DC charging station	**IEC 61851-23** Conductive charging systems for EVs – DC charging stations for EVs

[31] Wagner 2020; Hall and Lutsey 2017; NPE 2012, 2014, 2017

[32] NPE 2017

[33] NPE 2017

DC charging cables	**IEC 62893-4**[34] Charging cables for EVs – DC charging cable
DC charging connector	**IEC 62196-3-1** Connectors for charging EVs – Requirements and main dimensions for DC charging connectors
Vehicle requirements	**ISO 17409** Electrically powered road vehicles – Connection to an external power supply – Safety requirements
Communication	**ISO 15118-2** Communication interface between vehicle and charging station – Network and application protocol requirements

The standard **IEC 61851-23** introduces the terms standard operating conditions' and 'special operating conditions' for describing the technical requirements for charging with cooled charging cables and cooled plugs and sockets in a normative way. In addition, the behaviour of the charging station when critical temperatures are reached is also defined.

The standard **IEC 62893-4** defines the technical requirements for charging cables for DC charging including those for use for higher charging power. The application of higher currents to the connector leads to increased heat generation, so that reliable temperature management, including the associated measurement methodology and corresponding tests, is also introduced into the standard **IEC 62196-3-1** for charging with higher charging capacities. Requirements for the description of the contact coating, contact surface, and the corresponding tests are also included in this standard.

The following technical standards go beyond the requirements on the charging infrastructure side. According to the **ISO 17409** standard, the conditions for temperature monitoring on the vehicle side must be introduced and technical adjustments must be made accordingly. Moreover, the **ISO 15118-2** standard deals with the communication interface between vehicle and charging station. The communication must ensure that the charging process with the higher charging power is only started if the vehicle and charging station have the necessary temperature monitor and can safely monitor the process.

Italian USER-CHI partners reported the **IEC 61851-1** standard, LV-EMC directives, and **CEI EN 61851-23** Electric vehicle conductive charging system - Part 23: DC electric vehicle charging

[34] According to the VDE, the standard **IEC 62893-4-1:2020** (Charging cables for EVs of rated voltages up to and including 0,6/1 kV - Part 4-1: Cables for DC charging according to mode 4 of IEC 61851-1 - DC charging without use of a thermal management system) applies to cables for DC charging according to mode 4 of IEC 61851-1. These cables are not intended to be used with a thermal management system such as that specified in IEC 61851-23. Charging cables specified in IEC 62893 (all parts) are intended to be used for electrical appliances of class II equipment.

station, as relevant standards for DC charging technologies. German USER-CHI partners reported the **DIN EN 61851-1 VDE 0122-1:2012-01** standards to be implemented in Germany.

Furthermore, the **CEI EN 61851-23** Electric vehicle conductive charging system - Part 23: DC electric vehicle charging station, and the CEI-021, CEI-016 standards were reported as the Italian standards for DC grid integration, although the connection to the DSO in AC was noted, since there are no DC grids in Italy. The German **DIN VDE 0100-100:2009-06** and **DIN VDE V 0124-100:2020-06** were reported as current standards for DC grid integration in Germany.

- VEHICLE TO GRID (V2G) TECHNOLOGIES

The Italian and German USER-CHI partners are currently testing and demonstrating V2G technologies in their countries. **Italy** refers to the **ISO 15118** family "Road vehicles - Vehicles to grid communication interface" as the international standard for V2G, the Italian partners reported. Moreover, the Italian Ministerial Decree "Criteria and modalities to favour the diffusion of the integration technology between EVs and the electricity grid, called vehicle to grid", published on 30 January 2020, supports V2G implementation in Italy. **Germany** refers to **IEC 60870-5-104** as the international standard considered for the connection to V2G chargers OCCP 1.6 with extensions. The Italian and German USER-CHI partners reported that V2G technologies are being tested with CHAdeMO connectors.

- DEMAND SIDE MANAGEMENT (DSM)

DSM strategies aim at improving the flexibility of the energy system on the consumer side by encouraging final users to be more energy efficient. The Italian and German USER-CHI partners reported that they are currently testing and demonstrating DSM strategies in their countries.

The Italian Transmission Operator (Terna) began around two years ago some pilot projects with the aim to test the flexibility connected to distributed resources also including the possibility to apply Demand Response (DR) strategies. In Germany, the chargers are "aggregated" on a virtual power plant (VPP) and respond to service requests, namely: load reduction, power reduction in the LV based on local injection, local renewable energy source consumption, reactive power Injection, and harmonics filtering. No specific technical requirements for implementing DSM strategies were reported.

4.1.1.2 Technical Requirements of the grid operator and metering device operator

- GRID CONNECTION

Technical requirements for the grid connection were reported by Italian and German USER-CHI partners. The **CEI-021 and CEI-016** standards are Italian national standards in the field. Moreover, the Italian Grid Code, approved by the Regulatory Authority for Energy, Networks and Environment (ARERA) with resolutions no. 79/05 and 49/06, and by the Ministry of Productive

Activities, is subject to continuous updating according to the procedures defined within the document[35].

German USER-CHI partners reported the Technical Connection Conditions (Technische *Anschlussbedingungen* or TAB) and the Technical Connection Rules for Low Voltage (Technische *Anschlussregeln Niederspannung* or TAR) as the main technical standards for the grid connection in Germany.

- ELECTRICITY METER LOCATION

Technical requirements for electricity meter location were reported by the USER-CHI Italian partners. The **CEI-021 and CEI-016** standards were reported as relevant national standards in **Italy** for the grid connection. Moreover, the Italian Regulatory Authority for Energy, Networks and Environment (ARERA) defined technical requirements to connect second generation of smart meters (2G) on March 2016[36].

- GRID OPERATOR REQUIREMENTS

Requirements on the part of the network operator regarding symmetrical load conditions and impermissible network perturbations are reported by Varro (2013) within the German context.

From the grid operator's point of view, charging stations for EVs are electrical appliances within the meaning of Section 10 of the **TAB NS Nord 2012**. There shall be no inadmissible system perturbations and voltage shifts due to asymmetrical loads. The standards for grid connection, meter location and circuit distributor used in the **TAB NS Nord 2012** shall be considered. This applies to the connection of several single-phase charging points with 16 A or higher.

4.1.1.3 Technical connection rules (TCR)

According to Wagner (2020) and the German Association for Electrical, Electronic & Information Technologies (VDE[37]), the TCR for low voltage (Technische Anschlussregeln Niederspannung or TAR-NS) are summarized in the standard **VDE-AR-N-4100** which specifically regulates the technical requirements for electromobility. The TAR-NS sets the TCR that must be observed during the planning, construction, connection, and operation of electrical installations to the low voltage (LV) grid of the grid operator. The TAR-NS applies to reference installations and - in connection with the application rule Generation Installations on the Low Voltage Grid (**VDE-AR-N 4105**).

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[35] The Italian Grid Code and annexes are available at: https://www.terna.it/en/electric-system/grid-codes/italian-grid-code.

[36] See ARERA Luca lo Schiavo "Innovation in the electricity sector in the framework of cooperation between energy and telecom regulators in Italy", AEEGSI 2017.

[37] Verband der Elektrotechnik Elektronik und Informationstechnik e.V., German Association for Electrical, Electronic & Information Technologies, or VDE.

With the entry into force of the VDE Application Regulations, the following requirements have been replaced and repealed:

- Requirements for low-voltage meter stations (**VDE-AR-N 4101**), 2015
- Outdoor connection cabinets (**VDE-AR-N 4102**), 2012
- VDN guideline emergency for power generators, 2004
- Technical requirements for access to low voltage networks of the Distribution Code 2007
- **DIN VDE 0100-732 (VDE 0100-732)** House connections in public cable networks
- VDN guideline surge protection devices type 1
- **VDEW-Material M-38/97** Requirements for seal closures, edition 1997
- Technical connection conditions for connection to the low-voltage grid, TAB 2007 (Federal sample wording)

Italian USER-CHI partners reported the following TCR for LV grid:

- **CEI-021:2014-09**
- **CEI-016**

Moreover, the Italian USER-CHI partners reported the technical connection conditions **CEI-50160** and **CEI-021**, **CEI-016** should be considered from DSO side and CPO side, respectively.

4.1.1.4 Charging plug components for electromobility

As EV charging technology continues to advance in the EU context and world-wide, several standards and guidelines have become widely accepted across the industry. To provide a technical background for the implementation of technical USER-CHI products, this subsection gives an overview of charging plug components for wired charging for EVs.

As mentioned in section 4.1.1, the so-called charging power determines the time required to charge an EV and could vary by orders of magnitude across charge points. The charging infrastructure is implemented either as alternating current (AC) one and three-Phases or direct current (DC) charging infrastructure in the USER-CHI cities (see Table 24).

Moreover, the IEC 62196-1:2014 international standard is applicable to plugs, socket-outlets, vehicle connectors, vehicle inlets and cable assemblies for EVs, intended for use in conductive charging systems which incorporate control means, with a rated operating voltage not exceeding: 1) 690V AC 50 Hz to 60 Hz, at a rated current not exceeding 250A; and 2) 1 500V DC at a rated current not exceeding 400A.

- CHARGING PLUG STANDARDS

The type of plug and socket used for EV's charging may vary depending on region and speed of charging. The USER-CHI partners reported using the following Plug and socket configurations

for AC and DC charging, namely: CCS, CHAdeMO, Mennekes, and Schuko, as illustrated in Table 26 below. Moreover, the charging speeds and the corresponding international standards for type are also detailed.

Italian USER-CHI partners mentioned using Type 3A (LEV) for AC charging. Moreover, it was also pointed out that CHAdeMO chargers are not required but Enel X installs it in most of its DC charging stations, so CHAdeMO is still present in the DC charging stations and Tesla Superchargers for Tesla EVs.

Regarding the Schuko plugs and sockets, no common EU standards were found. The following types are used in the USER-CHI countries: Type F, CEE 7/4 plug, CEE 7/7 plug for Germany Spain, Hungary, and Finland; and CEI 23-50 for Italy.[38]

Table 26 Plug and socket configurations for AC and DC charging. Source: Wagner 2020[39]

	CCS (Combo)					CHAdeMO					Mennekes (Type 2)					Schuko				
International Standards	IEC 62196-3 DIN SPEC 70121					ISO/IEC 61851-23 ISO/IEC 61851-24 IEC 62196					IEC 62196-2					No common EU standard				
AC 1-3 Phases	X										X					X				
DC	X					X					X									
																				
Communication Standard	ISO 15118																			
USER-CHI Countries	ES	DE	HU	IT	FI	ES	DE	HU	IT	FI	ES	DE	HU	IT	FI	ES	DE	HU	IT	FI
				X					X		X	X		X		X				

For DC fast charging, connector types vary by automaker and region. Furthermore, the following standards for vehicle connectors and vehicle plugs are in force in Germany:

- DIN EN 62196-1 (VDE 0623-5). Plugs, socket-outlets, vehicle plugs and vehicle connectors - Charging of EVs - Part 1: Conducted charging of EVs up to 250 A (AC) and 400 A (DC) (IEC 62196-1); German version EN 62196-1
- DIN IEC 62196-2 (VDE 0623-5-2). Plugs, socket-outlets, vehicle mounted plugs and socket-outlets - Conductive charging of EVs - Part 2: Requirements and main

[38] available at: https://ec.europa.eu/info/sites/info/files/xii24a_plugs_and_sockets.pdf

[39] available at: www.electromovilidad.net

dimensions for compatibility and interchangeability of pin and socket-outlets for alternating current (IEV 62196-2:2011); German version EN 62196-2:2012

The Draft standard DIN EN 62196-3; VDE 0623-5-3 covers plugs, socket-outlets and vehicle plug and socket devices - Conductive Charging of EVs - Part 3: Requirements and main dimensions for pins and sockets for interchangeability of vehicle plug-and-socket components for dedicated charging with direct current and as a combined version for charging with alternating current / direct current Understandably, a regulatory requirement to comply with this draft does not yet exist. However, compliance is recommended.[40]

4.1.1.5 Product standards and electrical safety

The focus in electromobility product standards (hardware) is on electrical safety. The EV safety requirements for connection to an external power supply are defined in the international standard ISO 17409. To adapt the standard to the technical innovations after its publication in 2015, further development was already planned, and should take place continuously until 2020. This standard is also being continuously adapted to technological innovations[41].

- EQUIPMENT AND CONDUCTIVE CHARGING SYSTEMS

The ISO 17409 standard was reported to be implemented by Italian USER-CHI partners as the technical standard for equipment and conductive charging systems for EVs. Beyond this standard, in the Italian normative framework aiming to protect public against established adverse health effects that may result because of exposure to electro-magnetic fields (0 Hz - 300 GHz), follows the Council Recommendation 1999/519/EC and IEC TS 62764-1, according to USER-CHI Italian partners.

German USER-CHI partners reported the standard DIN EN 62752 (VDE 0666-10):2017-04[42] for charging line integrated control and protection device for charging mode 2 of electric road vehicles (IC-CPD) (IEC 62752:2016) (German version EN 62752:2016) about existing standards for equipment and conductive charging systems for EVs.

Furthermore, according to Wagner (2020) the system standards DIN EN 61851-1:2013-04 and VDE 0122-1:2013-04 for cable-bound charging, consider the development of the separate product international standard IEC 62752 for the charging cable set for charging mode 2 (IC-CPD) as well as the product standard IEC/TS 61439-7 (VDE V 0660-600-7), which defines the housing requirements (DIN EN 60529) for charging stations depending on the installation location and intended use in Germany.

- LOCATION OF FIRE EXTINGUISHERS AND FIRE ALARM SYSTEMS

[40] Varro 2013

[41] NPE 2017

[42] available at: https://www.dke.de/de/normen-standards/dokument?id=7085182&type=dke%7Cdokument

Technical standards for the location of fire extinguishers and fire alarm systems were only reported by Italian USER-CHI partners. In Italy, the Circular no. 2/2018 of the Ministry of the Interior, Department of Fire, Public aid and Civil Defence of the Central Direction for Prevention and Technical Safety published the "Guidelines for the installation of infrastructure for charging EVs".

- SAFETY INSPECTIONS OF CHARGING STATIONS

Technical standards for safety inspections of charging stations were reported by Italian and German USER-CHI partners. In Italy, the Circular no. 2/2018 of the Ministry of the Interior, Department of Fire, Public Aid and Civil Defence, Central Direction for Prevention and Technical Safety issued the "Guidelines for the installation of infrastructure for charging EVs". In Germany, on the other hand, the DIN VDE 0100-600 VDE 0100-600:2017-06[43] standard for Erection of low-voltage installations was reported.

- DATA SECURITY REGARDING CHARGING INFRASTRUCTURE

German USER-CHI partners reported the IEEE 802.11-2016[44] - IEEE Standard for Information technology--Telecommunications and information exchange between systems Local and metropolitan area networks--Specific requirements, as the reference for data security regarding charging infrastructure.

- FUNCTIONAL SAFETY

Technical standards for functional safety were reported by Italian and German USER-CHI partners. In Italy, the IEC 61851-1:2017 standard for Electric vehicle conductive charging system - Part 1: General requirements was reported as the international standard in place. Moreover, The Circular no. 2/2018 of the Ministry of the Interior, Department of Fire, Public Aid and Civil Defence, Central Direction for Prevention and Technical Safety issued the "Guidelines for the installation of infrastructure for charging EVs" was reported as the Italian national standard in this field.

In Germany, two certifications, the VDE calibration[45] and CE certification, and two standards should be considered regarding functional safety, namely ISO 26262 (that replaces IEC 61508 for the automotive industry as the standard for the functional safety of road vehicles[46]) and IEC 62061:2005[47] (Safety of machinery - Functional safety of safety-related electrical, electronic, and programmable electronic control systems).

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[43] available at: https://www.vde-verlag.de/normen/0100382/din-vde-0100-600-vde-0100-600-2017-06.html

[44] available at: https://standards.ieee.org/standard/802_11-2016.html

[45] Also known in Germany as “VDE-Eichrechts certification”

[46] available at: https://www.elektronikpraxis.vogel.de/iso-26262-ueberblick-zur-norm-zur-funktionalen-sicherheit-von-strassenfahrzeugen-a-771930/

[47] available at: https://webstore.iec.ch/publication/6426

4.1.1.6 Hardware requirements for installed charging points

Due to the integration of the charging stations into an existing authentication system or the connection to an IT backend system, modifications of standard charging stations in which other IT systems or GSM components are usually installed as hardware may occur. In this case, the electrical safety of the entire system must be verified (if necessary, by means of inspection) and, if necessary, the replacement of components must be notified to the issuer of the certificate or the test documents for CE conformity. The following sections present sets of technical requirements in specific areas that are considered amongst the Italian and German USER-CHI partners.

- ELECTRONIC EQUIPMENT IN CHARGING STATIONS

The Italian USER-CHI partners reported **IEC 61851-1:2017** Electric vehicle conductive charging system - Part 1: General requirements[48]; **EN 61851-21-1:2017** Electric vehicle conductive charging system - Part 21-1: Electric vehicle on-board charger EMC requirements for conductive connection to an AC/DC supply[49]; and CEI EN 61851-23 Electric vehicle conductive charging system Part 23: D.C. electric vehicle charging station[50]; as the technical standards for electronic equipment in place in the Italian context. In Germany, on the other hand, the USER-CHI partners reported that electronic equipment, such as components for charging stations should be CE conform and reported the **DIN VDE 0100-100 VDE 0100-100:2009-06**[51] standard for Low-voltage electrical installations as the technical standard in place.

- SWITCHGEAR

In Italy, the USER-CHI partners reported that when implementing switchgear equipment, such as low voltage switchgear, load-break switches, dis-connectors, switch-dis-connectors, and switch-fuse units, the following standards must be observed: **IEC 61851-1, CEI EN 61851-21**, and **CEI EN 61851-23**, USER-CHI partners reported. In Germany, on the other hand, it was reported that switchgear for charging stations should be CE conform and reported the **DIN VDE 0100-100 VDE 0100-100:2009-06**[52] standard for low-voltage electrical installations as the technical standard in place.

- COMMUNICATION UNIT

The Italian USER-CHI partners reported the **IEC 61851-24:2014** Electric vehicle conductive charging system - Part 24: Digital communication between a DC electric vehicle charging station

[48] available at: https://www.vde-verlag.de/iec-normen/224263/iec-61851-1-2017.html

[49] available at: https://standards.iteh.ai/catalog/standards/clc/8d80f635-8691-4602-b632-a7c3d73f79b0/en-61851-21-1-2017

[50] available at: https://standards.globalspec.com/std/13240828/EN 61851-23/EC

[51] available at: https://www.vde-verlag.de/standards/0100131/din-vde-0100-100-vde-0100-100-2009-06.html

[52] available at: https://www.vde-verlag.de/standards/0100131/din-vde-0100-100-vde-0100-100-2009-06.html

and an electric vehicle for control of DC charging[53], as the standards for communication units, such as modem or radio interfaces.

In Germany, the USER-CHI partners reported the **SAE J2954-Standards**, Norm **SAE J2847/6** and the **E DIN EN IEC 61980-1 VDE 0122-10-1:2020-11** Electric vehicle wireless power transfer (WPT) systems[54] should be considered as the standards for communication units, such as 3G modems.

- ELECTRO-MAGNETIC TOLERANCE (EMT)

In Italy, the USER-CHI partners reported that when considering the EMT in EV charging stations, the following standards should be observed: **IEC 61851-21-2; CEI EN 61980**; and **IEC TS 62764-1:2019**[55]. Measurement procedures of magnetic field levels generated by electronic and electrical equipment in the automotive environment with respect to human exposure - Part 1: Low frequency magnetic fields. In Germany, the USER-CHI partners reported the **SAE J2954-Standards, Norm SAE J2847/6** and the **E DIN EN IEC 61980-1 VDE 0122-10-1:2020-11** Electric vehicle wireless power transfer (WPT) systems[56]; should be considered.

- INSTALLATION, PROTECTION REQUIREMENTS, AND PROTECTION MEASURES

The Italian USER-CHI partners reported the **IEC 61851-1; CEI-EN 61851-1; CEI-EN 61851-23;** and **ISO 17409:2015** Electrically propelled road vehicles — Connection to an external electric power supply — Safety requirements[57], as the international standards for installation, protection requirements, and protection measures.

The German USER-CHI partners reported the **DIN VDE 0100-100 VDE 0100-100:2009-06**[58] standard for Low-voltage electrical installations as the technical standard in place for installation, protection requirements, and protection measures.

- IT SECURITY

In Italy, the USER-CHI partners reported that when considering how to ensure that the communication between the charging infrastructure and the back end it is secured, the international standard **IEC 63119-1:2019** Information exchange for electric vehicle charging roaming service - Part 1: General[59] must be considered. German USER-CHI partners, on the other hand, reported that VPN channel, SSL, closed cabinets, locked USBs, and the following standards should be observed: **ISO/IEC 27001** Information Security Management Systems standard[60]; **SAE**

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[53] available at: https://www.vde-verlag.de/iec-normen/220664/iec-61851-24-2014.html
[54] available at: https://www.vde-verlag.de/standards/1100638/e-din-en-iec-61980-1-vde-0122-10-1-2020-11.html
[55] available at: https://www.vde-verlag.de/iec-normen/247993/iec-ts-62764-1-2019.html
[56] available at: https://www.vde-verlag.de/standards/1100638/e-din-en-iec-61980-1-vde-0122-10-1-2020-11.html
[57] available at: https://www.iso.org/standard/68491.html
[58] available at: https://www.vde-verlag.de/standards/0100131/din-vde-0100-100-vde-0100-100-2009-06.html
[59] Italian standard CEI-EN 63119-1 (CEI 69-18)
[60] available at: https://www.icertworks.com/iso-27001-certification.php?gclid=EAIaIQobChMIiYXMyqnV7QIVAeztCh2sNA03EAAYASAAEgIWqPD_BwE

J2954-Standards, Norm SAE J2847/6 and the **E DIN EN IEC 61980-1 VDE 0122-10-1:2020-11** Electric vehicle wireless power transfer (WPT) systems[61].

4.1.1.7 Testing of hardware/charging infrastructure

The testing of hardware under environmental influences (such as rain, storm, heat and cold; damage caused by negligence or force) is particularly relevant for its operational safety and reliability. One of the essential ideas in this context is to ensure safe operation for the user. The influences of the environment are tested based on the standards in Table 27.

Table 27: Standards for testing the influences of the environment. Source: Varro 2013 and USER-CHI German partners

Test	International	Germany
Environmental influences - Part 2-14: Test methods - Test N: Temperature Change	IEC 60068-2-14 IEC 61851-1	DIN EN 60068-2-14 (VDE 0468-2-14)
Ambient conditions - Part 2-30: Test methods - Test Db: Humid heat, cyclic (12 + 12 hours)	IEC 60068-2-30 IEC 61851-1	DIN EN 60068-2-30
Environmental testing - Part 2-75: Tests - Test Eh: Hammer tests	IEC 60068-2-75 IEC 61851-1	DIN EN 60068-2-75
Environmental testing - Part 2-78: Tests - Test Cab: Humid heat, constant	IEC 60068-2-78 IEC 61851-1	DIN EN 60068-2-78
Flood Resilience	IEC 60529:1989/A2:2013/COR1:2019	EN 60529:1991/A2:2013/AC:2019-02

USER-CHI partners reported that **IEC 61851-1**, an international standard for EV's conductive charging systems, which presents the requirements for temperature change, humid heat (cyclic and constant), hammer-test, and precipitation, as shown in the Table 27 above. Requirements for flood storm were not reported in the technical questionnaires.

[61] available at: https://www.vde-verlag.de/standards/1100638/e-din-en-iec-61980-1-vde-0122-10-1-2020-11.html

4.1.1.8 Safety and standard-compliant design of the mounting system

As mentioned in the section 4.1.1.2, the grid operator is responsible for providing, commissioning, and operating the grid connection. The metering point operator is responsible for the metering point. The sub-distribution and remaining installation shall be carried out in connection with the erection of the charging point considering the following standards.

In Italy, the following alternative mounting system exist: Boxes: wall-mounted; Pole: reinforced plint; and Multi-standard: reinforced plint.

In Germany, the standard E DIN EN IEC 62196-1 VDE 0623-5-1:2020-12 for Plugs, sockets, vehicle connectors and vehicle plugs - Conductive charging of EVs[62] should be considered as reference for safety and standard-compliant design of the mounting system. Moreover, the charging stations implemented in the City of Berlin must follow design guidelines by the Senate of Berlin regarding colour, stickers, height; they should also comply with historic preservation guidelines.

4.1.1.9 Technical records and documentation

The **ISO 15489**[63] standard establishes the core concepts and principles for the creation, capture, and management of records. It is the core of several international standards and technical reports that provide further guidance and instruction on the concepts, techniques, and practices for creating, capturing, and managing records. The standardisation ensures that appropriate attention and protection is given to all records, and that the evidence and information they contain can be retrieved more efficiently and effectively, using standard practices and procedures. ISO 15489 consists of the following parts, under the general title Information and documentation – Records management, namely Part 1: Concepts and principles; and Part 2: Guidelines (Technical Report). The Technical Report **(ISO/TR 15489-2**) provides further explanation and implementation options for achieving the outcomes of **ISO 15489**.

In the German context, Varro (2013) reported that technical documentation must meet the requirements of the standards described in the Table 28 below.

Table 28: Standards for technical records and documentation

Technical Standards	Realm/contents
ISO 15489	Information and documentation — Records management
ISO/IEC GUIDE 37	Instructions for use of products of consumer interest
DIN EN 82079	Preparation of instructions for use; namely: Structure, content, and presentation
VDI 4500-1	Technical documentation - User information

[62] Available at: https://www.vde-verlag.de/normen/1600349/e-din-en-iec-62196-1-vde-0623-5-1-2020-12.html
[63] Available at: https://www.iso.org/obp/ui/#iso:std:iso:15489:-1:ed-2:v1:en

Complying with CE marking requirements was noted by USER-CHI partners as a further requirement that cities should meet regarding technical records and documentation within the EU. The technical documentation provides information on the design, manufacture, and operation of a product and must contain all the details necessary to demonstrate the product conforms to the applicable requirements. Moreover, this documentation is required to prove the USER-CHI technical product meet the essential requirements and therefore justify and support an EU declaration of conformity. This documentation is needed to affix the CE marking to the product[64]. Graphic symbols are used for, among other purposes, the user interface, human machine interaction and safety labelling.

Graphical symbols are standardised by various committees. For the vehicle side and at the international level, **ISO/TC 22/SC 13 with WG 5** is particularly noteworthy. The IEC also maintains various committees for the standardisation of electrical engineering symbols. In Germany, this work is mirrored by the DKE and the DIN Automotive Standards Committee. At the European level, the European Commission issued mandate **M/533 to CEN and CENELEC** for the labelling of charging stations. **CEN/TC 301** will work in close cooperation with the international level in the coming years.[65]

Moreover, German USER-CHI partners reported the **ISO 9001**, that sets out the criteria for a quality management system, as the reference standard to be considered for technical documentation.

Finally, Italian, and German USER-CHI partners reported that for charging stations funded by EU projects documentation must be available at least 5 years after the end of the project. On the other hand, when complying with CE marking the technical documentation should be kept for 10 years from the date the product is placed on the market (unless explicitly specified otherwise). It is therefore suggested to keep all records and documentation for at least 10 years.

4.1.2 Cross-cutting legal requirements

This section provides an overview of the general cross-cutting legal requirements that must be met on a national level of the USER-CHI countries and five other countries for the implementation of the USER-CHI products. The results are presented as tabular formats. The overview covers the following information received from the countries/cities tagged (see Table 29). The residual information is pending.

Table 29: Legal requirements – feedback results from USER-CHI and external partners

	Finland (TUR)	Germany (IKEM/BER)	Hungary (BUD)	Italy (FLO, RSM)	Spain (AMB, MUR)

[64] available at:https://europa.eu/youreurope/business/product-requirements/compliance/technical-documentation-conformity/index_en.htm
[65] NPE 2017

USER-CHI Countries	✓	✓			✓
	Austria (City of Graz)	France (City of Paris)	The Netherlands (City of Rotterdam)	Latvia (City of Riga)	Switzerland (Canton of Basel)
Other Countries	✓				

The information presented is based on the information provided through the questionnaires as well as desk research where possible/applicable.

4.1.2.1 National Implementation of the Alternative fuels Infrastructure (AFID) (2014/94/EU) (SMAC, INDUCAR, INSOC, CLICK)

- **NATIONAL IMPLEMENTATION OF THE AFID (2014/94/EU)**

Table 30 Overview of national measures implementing the AFID (2014/94/EU)

Barcelona	Berlin	Graz	Murcia	Turku
The Royal Decree 639/2016, establishing a "framework of measures for the implementation of an infrastructure for alternative fuels" is the national law for the implementation of the AFID[66]. Moreover, the Spanish government issued a technical report on November 2019 to address the fulfilment of the Art.10 of AFID (2014/94/EU) [67].	The Charging Pole Decree (LSV) which defines technical standards for public charging points, e.g., "interoperability" or "selective charging" accordingly implementing the technical requirements of Annex II to AFID (see question No. 12 for more details). In accordance with the Electricity Market Act (StrommarktG)[68], an amending law to several energy and energy industry related legal provisions, charging points are qualified as "final users" within the German Energy industry Law (EnWG)[69] -. This categorisation is a privilege for CPOs, because it exempts them from certain duties, which would otherwise arise for commercial electricity providers in accordance with the EnWG. Moreover, the EnWG was adapted to implement definitions and specifications for	Information not yet reported	Same as Barcelona	Information not yet reported

[66] Real Decreto 639/2016, de 9 de diciembre, por el que se establece un marco de medidas para la implantación de una infraestructura para los combustibles alternativos, (available at: https://www.boe.es/diario_boe/txt.php?id=BOE-A-2016-11738, last accessed: 04.01.2021).
[67] Informe sobre la aplicación del marco de acción nacional de energías alternativas en el transporte, (available at: https://industria.gob.es/es-ES/Servicios/Documents/aplicacion-marco-energias-alternativas.pdf, last accessed: 04.01.2021
[68] Available at: https://www.bgbl.de/xaver/bgbl/start.xav?startbk=Bundesanzeiger_BGBl&start=//*%5B@attr_id=%2527bgbl116s1786.pdf%2527%5D#__bgbl__%2F%2F*%5B%40attr_id%3D%27bgbl116s1786.pdf%27%5D__1609770779438, last accessed 04.01.2021
[69] available at: https://www.gesetze-im-internet.de/enwg_2005/, last accessed 04.01.2021

Barcelona	Berlin	Graz	Murcia	Turku
	charging points.[70] In addition, the Metering Point Operation (MsbG) Act[71] was implemented for the specifications for consumption recording systems according to AFID Art.4(7).[72] Furthermore, the Electromobility law (EmoG)[73] allows privileges for EVs within the framework of road traffic law in order to promote electromobility e.g. the possibility of free parking spaces or the use of the bus lane.			

[70] BMVI, First report on the implementation of the national strategic framework in Germany, 2019, p.20.
[71] available at: https://www.gesetze-im-internet.de/messbg/, last accessed 04.01.2021.
[72] BMVI, First report on the implementation of the national strategic framework in Germany, 2019, p.20.
[73] available at: https://www.gesetze-im-internet.de/emog/, last accessed: 04.01.2021.

- NATIONAL IMPLEMENTATION OF THE GOAL OF NON-DISCRIMINATORY ACCESS TO PUBLIC CHARGING INFRASTRUCTURE (FOR USERS AS WELL AS FOR ELECTRICITY SUPPLIERS; SEE ART. 2 NO. 7, ART. 4 NO. 8-11 AFI-DIRECTIVE)[74]

Table 31: National implementation of the goal of non-discriminatory access to public charging infrastructure (Art. 2 No. 7, Art. 4 No. 8-11 AFID)

Barcelona	Berlin	Graz	Murcia	Turku
The Spanish legal framework does not address this goal explicitly. However, even though the national regulation (Royal Decree-Law 15/2018) does not include this goal in the same clear manner than it is included in the AFID, the non-discriminatory access remains a characteristic in the sector (for users and suppliers).	The §3 (1) of the Charging Pole Decree (LSV) requires that each for AC standard charging point shall be equipped at least with sockets or with sockets and vehicle couplings of type 2 in each case in accordance with the standard DIN EN 62196-2, December 2014 edition. Moreover, § 3 (2) LSV requires AC fast charging points to be equipped at least with type 2 couplings in accordance with the DIN EN 62196-2 standard, December 2014 edition. §3 (3) LSV requires normal and fast DC charging points to be equipped at least with couplers of the type Combo 2 in accordance with the standard	The Austrian legal framework links these requirements with national subsidies for infrastructure. However, it is common to offer public charging infrastructure with a non-discriminatory access.	Same as Barcelona	Information not yet reported

[74] USER-CHI Legal Questionnaire Q. No.12

Barcelona	Berlin	Graz	Murcia	Turku
	DIN EN 62196-3, July 2012 edition.			

- RULES IMPLEMENTED IN ORDER TO GUARANTEE THAT EV-DRIVERS ARE ABLE TO CHARGE THEIR VEHICLE WITHOUT PREVIOUSLY HAVING TO CONCLUDE A CONTRACT WITH THE CHARGING POINT OPERATOR (CPO) IN ACCORDANCE TO ART. 4 NO. 9 AFI-DIRECTIVE[75]

Table 32: Rules implemented to guarantee "ad-hoc charging" (Art. 4 No. 9 AFID)

Barcelona	Berlin	Graz	Murcia	Turku
Regarding the Metropolitan Area of Barcelona, the legal basis for the is the transposition law of the AFID into the Spanish legal is the Royal Decree 639/2016, establishing a 'framework of measures for the implementation of an infrastructure for alternative fuels.	§ 4 LSV states that the operator of a charging point must allow users of EVs to recharge without entering a long-term contract. However, technical improvements are still needed in order to ensure the availability of 'ad-hoc charging.' The LSV is currently under revision and expected to be updated in 2021.[76] See also question 28 regarding information about the 'Berlin model'.	In the city of Graz, the major public infrastructure has a non-discriminatory access implemented, even though no certain rules exist.	There is no regulation applicable in Murcia in order to guarantee this. In the case of Murcia in practice users must register as a new user or client at the charging service of the CPO (by the APP or website).	Information not yet reported

[75] USER-CHI Legal Questionnaire Q. No.12
[76] Zweite Verordnung zur Änderung der Ladesäulenverordnung, Referentenentwurf des Bundesministeriums für Wirtschaft und Energie, (available at: https://www.bmwi.de/Redaktion/DE/Artikel/Service/Gesetzesvorhaben/zweite-verordnung-zur-aenderung-der-ladesaeulenverordnung.html, last accessed: 04.01.2021).

- NATIONAL LAWS TO ENSURE INTEROPERABILITY OF CHARGING INFRASTRUCTURE RUN BY DIFFERENT CPOS[77]

Table 33: National laws to ensure interoperability of charging infrastructure run by different CPOs

Barcelona	Berlin	Graz	Murcia	Turku
The Spanish legal framework does not imply such laws. Currently, both the regulations regarding the requirements for the provision of the energy recharging service, as well as the Order of the Minister for the Ecological Transition and the Demographic Challenge where the information that the owners of the recharging points must send and the terms to ensure the Interoperability among different CPOs, which are a pending development.	Regarding the city of Berlin and the German aspects of interoperability standardized communication interfaces are not required by the LSV. However, the current draft bill of the amendment of the LSV includes § 3 (4), which states that 'when setting up charging points, for reasons of interoperability, it must be ensured that an interface is available that can be used to transmit authorisation and billing data as well as dynamic data.'[78]	The Austrian national government has offered subsidies to implement this aspect of interoperability in the past. As a result, various aspects of interoperability have been widely ensured by now.	The Spanish legal framework does not imply such laws. Currently, both the regulations regarding the requirements for the provision of the energy recharging service, as well as the Order of the Minister for the Ecological Transition and the Demographic Challenge where the information that the owners of the recharging points must send and the terms to ensure the Interoperability among different CPOs, which are a pending development.	No national laws ensure this aspect of interoperability.

[77] USER-CHI Legal Questionnaire Q.No. 15
[78] Available at: https://www.bmwi.de/Redaktion/DE/Downloads/J-L/konsolidierter-text-lsv-novelle.pdf?__blob=publicationFile&v=10.

4.1.2.2 National implementation of the EPBD (2018/844/EU) and national building and construction law (SMAC, INDUCAR, CLICK)[79]

- NATIONAL LAWS TO IMPLEMENTING ART. 8 (2) OF THE EPB-DIRECTIVE (2018/844/EU)[80]

Table 34: National laws implementing Art. 8 (2) of the EPBD (2018/844/EU)

Barcelona	Berlin	Graz	Murcia	Turku
The requirements deriving out of the EPB-Directive (2018/844/EU) are included in the ITC-BT 52.	The Building and Electric Mobility Infrastructure Act (GEIG) needs to be considered (§§7, 11 GEIG).	Information not yet reported	The relevant modification of the Spanish Technical Building Code (CTE) was announced in September 2020. Accordingly, the minimum conditions necessary for the installation of charging points for EVs in car parks are established.	National legal measures in accordance to are Art. 8 (2) of the EPBD-Directive (2018/844/EU) not yet implemented.

[79] This subchapter addresses the legal requirements in different European cities which derive out of national building and construction laws, as well as the European Energy Performance of Buildings Directive (2018/844/EU).
[80] USER-CHI Legal Questionnaire Q. No.7

- NATIONAL LAWS TO IMPLEMENTING ART. 8 (3) OF THE EPB-DIRECTIVE (2018/844/EU)[81]

Table 35: National laws implementing Art. 8 (3) of the EPBD (2018/844/EU)

Barcelona	Berlin	Graz	Murcia	Turku
The obligations in accordance with the EPBD are implemented in ITC-BT 52. Moreover, the national "Law on Climate Change and Energy Transition", which is under discussion before the stage of approval, will update the requirements as well.	The German GEIG needs to be considered. In accordance to § 10 GEIG from January 1, 2025 onwards, every non-residential building with more than twenty parking spaces must be equipped with at least one charging point. Exceptions include non-residential buildings owned and predominantly used by small and medium-sized enterprises, or existing buildings if the cost of charging and wiring infrastructure exceeds seven percent of the total cost of a major renovation.	Information not yet reported	The national implementation law establishes the obligation that all buildings for other use than private residential purposes, that have more than 20 assigned parking spaces, meet the same requirements in terms of the minimum number of charging stations before January 1, 2023.	The legal requirements for new installed parking spots imply that 50 % need to provide charging infrastructure. Moreover, regarding parking spots with a size of 11-50 spots, there is a requirement for one charging station. For parking spots with a size of 51-100 parking spots there need to be two charging points offered. For parking spots with a size bigger than 101 spots three charging points are required.

[81] USER-CHI Legal Questionnaire Q. No.9

- NATIONAL LAWS IMPLEMENTING ART. 8 (5) OF THE EPB-DIRECTIVE (2018/844/EU)[82]

Table 36: National laws implementing Art. 8 (5) of the EPBD (2018/844/EU)

Barcelona	Berlin	Graz	Murcia	Turku
The obligations in accordance with EPBD are implemented in ITC-BT 52. Moreover, the national "Law on Climate Change and Energy Transition", which is under discussion before the stage of approval, will update the requirements as well.	The German national implementation law GEIG needs to be considered (§§ 6, 8 GEIG).	The law which will implement the European target provided by Art. 8 (5) EPBD is under revision. It is expected that with the national implementation law unanimous approval by other owners in public parking areas of the buildings are not required anymore.	The national implementation laws establish the obligation for new construction buildings and those that undergo major intervention to have a preinstallation for 100% of the car park spaces, in the case of private residential buildings, and for 20% of the car park spaces in the rest of the buildings. Additionally, the latter with more than 10 car park spaces, must have recharging station for every 40 car park spaces. The requirement is stricter for buildings, which belong to the General State Administration, demanding one station for every 20 car park spaces.	The national Finnish laws applicable provide higher standards then the requirements set out in Art. 8 (5) EPBD. Therefore, no additional national laws are implemented in order to meet the European targets.

[82] USER-CHI Legal Questionnaire Q. No. 8

- **BUILDING PERMITS NEEDED FOR CP INSTALLATION IN PUBLIC SPACE**

Table 37: Building permits needed for the installation of charging points in public space

Barcelona	Berlin	Graz	Murcia	Turku
Permits for necessary civil works are needed, as well as permits from the town hall to do the civil works.	A building permit is usually not needed to set up charging points in Berlin. (§ 61 (1) No. 15 d) BauO Bln)	Permits from the city road department and city traffic planning are needed to build charging infrastructure in public spaces.	A municipal building permit is needed to set up charging infrastructure in public spaces. Moreover, the installation project will have to be presented and registered in the correspondent public administration department.	A building permit is needed to build charging infrastructure for EVs.

- INVOLVEMENT OF PUBLIC AUTHORITIES AND PUBLIC BODIES[83]

Table 38: Involvement of public authorities and public bodies

Barcelona	Berlin	Graz	Murcia	Turku
The local administration (municipalities) issues the installation and construction permits for the charging infrastructure. The regional administration provides technical controls, and collect the technical information about the charging points	The road construction authority is involved in deciding upon the special use permit needed for the construction of charging infrastructure in public spaces due to road traffic law.	The city road department is responsible for the management of public space in general and therefore involved in the installation process of charging infrastructure on public ground.	The city council has the competences to grant permissions or licenses to install charging points in the public space. Regional administrations oversee legalizing the electric works and related installations.	The building permit unit is part of the local city authority. Moreover, the involved transport planning unit is also a part of the local city authority. The energy grid provider, which is involved in the installation process of charging points is not embedded in the internal administration structure.

[83] USER-CHI Legal Questionnaire Q. No.2

- **DIFFERENT STEPS OF ADMINISTRATIVE APPROVAL**[84]

Table 39: Different steps of administrative approval

Barcelona	Berlin	Graz	Murcia	Turku
1) Elaboration of a technical project for a charging point (or a plan for a network of charging points), 2) Present the project or the plan to the municipality and ask for a permission to operate the charging points in the street, 4) Present the project to the DSO and ask to plan the grid connections to the charging points, 5) Ask municipality for permission to do civil works in the street, 6) Installation of charging points in the street, 7) Connection of charging points to the grid by electric distribution company, 8) Registration of the charging point installed in the regional administration.	1) CPO applies for special use permit for the installation of charging points at the civil engineering office offering a location plan. 2) CPO applies to the road traffic authority for an order for the desired location with a plan for the necessary licence plates and marks. 3) CPO applies to the network operator for a network connection for the desired location providing a conduit plan.	1) Request to use public space at city road department, 2) Approval by the committee of the historic centre, 3) Request for approval for construction.	1) Request of a new electric supply - The exact location of the planned e-charging stations, must be specified, 2) Elaboration of the technical documentation to legalize the e-charging point (technical report of project), 3) Request for works license to the city council. 4) The city will assess the documentation and grant the license 5) Promotor can initiate the works after receiving the necessary permits 6) Presentation of technical documentation 7) Communication to DSO that civil works are done	A building/planning permission and the registration of a grid connection is necessary for the administrative approval.

[84] USER-CHI Legal Questionnaire Q. No.3

- REGULATION FOR THE INSTALLATION AND OPERATION OF CHARGING INFRASTRUCTURE[85]

Table 40: National regulations for the installation and operation of charging infrastructure

Barcelona	Berlin	Graz	Murcia	Turku
The ITC-BT 52[86] of the Electrotechnical Regulation for low voltage, approved by Royal Decree 842/2002, of 2 August, and other complementary technical instructions are modified" is applicable at the national level. The ITC-BT 52 is a technical guideline, which addresses the charging point installation in Spain. The ITC-BT 52 is a compulsory document like a law.	The German national Charging Point Decree (LSV) only addresses questions of interoperability regarding plugs (§3 (1), (2), (3) LSV). A revision of the LSV is planned. All public charging points must be displayed and registered at the Federal Network Agency (BNetzA) according to § 4 and § 5 LSV. CPOs must meet additional technical requirements defined by local authorities in Berlin in order to receive charging points installation permits for public spaces.	The federal construction law (§ 92a Stmk BauG) needs to be considered.	The ITC BT-52 (see Barcelona) is also applicable in the city of Murcia.	Information not yet reported

[85] USER-CHI Legal Questionnaire Q. No.4
[86] Royal Decree 1053/2014 of 12 December, approving a Complementary Technical Instruction (ITC) BT 52 "Special purpose installations. Infrastructure for the recharging of EVs" or ITC-BT 52

- FIRE PROTECTION PROVISIONS FOR CHARGING POINTS[87]

Table 41: Fire protection provisions for charging points

Barcelona	Berlin	Graz	Murcia	Turku
The ITC-BT 52 includes the requirements on fire protection. Most of this provision refers to the protection of switches, as well as the needed protection equipment based on EN standards.	Special fire protection measures may be necessary in commercial and industrial areas and in garages. No highly flammable materials may be stored in the immediate surrounding of the charging points.	Information not yet reported	The ITC-BT 52 also needs to be considered in regard of the general prescriptions stablished for general purposes in electric facilities.	The fire protection provisions need to be considered in dependence on the power of the charging point.

[87] USER-CHI Legal Questionnaire Q. No.5

- LOCAL PROVISIONS FOR THE PRESERVATION OF HISTORICAL MONUMENTS AFFECTING THE CONSTRUCTION OF CHARGING POINTS[88]

Table 42: Local provisions for the preservation of historical monuments affecting the construction of charging points

Barcelona	Berlin	Graz	Murcia	Turku
Specific requirements on the protection of historical monument need to be followed around historical monuments, building, or archaeological sites. However, since charging points are rather small object the problem could be minimized	The Law for the protection of historic monuments in Berlin (DSchG Bln) should be considered § 10 (1) DSchG Bln. These requirements might influence appearance conditions for charging infrastructure.	Public infrastructure, which is installed in areas downtown, needs the additional approval by the committee of the historic centre.	Information not yet reported	The location of charging infrastructure needs to be approved by scenery and history boards, which take the specific requirements for charging points in the area of historical buildings into account.

[88] USER-CHI Legal Questionnaire Q. No.6

4.1.2.3 Public procurement and concession law and subsidies (CLICK, INSOC, INDUCAR, SMAC)

- IMPLEMENTATION LAWS OF DIRECTIVE 2014/23/EU (AWARDING OF CONCESSION CONTRACTS) INTO THE NATIONAL LEGAL FRAMEWORK[89]

Table 43: National laws implementing Directive 2014/23/EU

Barcelona	Berlin	Graz	Murcia	Turku
The Directive 2014/23/EU has been implemented by the law 9/2017 and the Royal Decree-Law 3/2020.	The Act against Restraints of Competition (GWB) was issued in 2016, which is implementing: Directive 2014/23/EU, as well as Directive 2014/24/EU and Directive 2014/25/EU. Moreover, the Award of Concessions Ordinance (KonzVgV)[90] a new concession ordinance, was implemented.	Information not reported	The same information already referred to in Q. No. 16 applies	Information not reported

[89] USER-CHI Legal Questionnaire Q.No. 18
[90] available at: https://www.gesetze-im-internet.de/konzvgv/BJNR068300016.html, last accessed: 04.01.2021.

- IMPLEMENTATION LAWS OF DIRECTIVE 2014/24/EU (PUBLIC PROCUREMENT) INTO THE NATIONAL LEGAL FRAMEWORK[91]
- Obligation to publish an announcement of contract modification and the allegations and reports collected, in addition the possibility of terminating contracts during their validity is introduced when the legally established requirements that allow their modification are not met.

Table 44: National laws implementing Directive 2014/24/EU

Barcelona	Berlin	Graz	Murcia	Turku
The applicable legal framework the implementation of Directive 2014/24/EU has been done by the Law 9/2017, of 8 November, on 'Public Sector Contract', which has transposed the Directive partially.[92]	The Act against Restraints of Competition (GWB) was issued in 2016[93], which is implementing: Directive 2014/25/EU, as well as Directive 2014/23/EU and Directive 2014/24/EU. In addition, the Directive was implemented by modifying the Public Procurement Ordinance (VgV)[94]	Information not yet reported	The Directive 2014/24/EU (Public procurement) has been incorporated in the Spanish legal framework by Royal Decree-Law 3/2020, of February 4, on urgent measures. Various directives of the European Union have been incorporated into the Spanish legal system in the field of public procurement in certain sectors; private insurance; of pension plans	Information not yet reported

[91] USER-CHI Legal Questionnaire Q.No. 16
[92] Ley 9/2017, de 8 de noviembre, de Contratos del Sector Público, por la que se transponen al ordenamiento jurídico español las Directivas del Parlamento Europeo y del Consejo 2014/23/UE y 2014/24/UE, de 26 de febrero de 2014, (available at: https://www.boe.es/buscar/act.php?id=BOE-A-2017-12902, last accessed: 04.01.2021).
[93] available at: https://www.gesetze-im-internet.de/gwb/, last accessed: 04.01.2021.
[94] available at: https://www.gesetze-im-internet.de/vgv_2016/, last accessed: 04.01.2021.

Barcelona	Berlin	Graz	Murcia	Turku
			and funds; of the tax area and tax litigation.	

- IMPLEMENTATION LAWS OF DIRECTIVE 2014/25/EU (ON PROCUREMENT BY ENTITIES OPERATING IN THE WATER, ENERGY, TRANSPORT AND POSTAL SERVICES SECTOR)[95]

Table 45: National laws implementing Directive 2014/25/EU

Barcelona	Berlin	Graz	Murcia	Turku
The applicable legal framework Directive 2014/25/UE has been transposed to the national legislation by the Royal Law-Decree 3/2020. This law has also completed the implantation of Directive 2014/23/UE.[96]	The GWB was issued in 2016, which is implementing: Directive 2014/25/EU, as well as Directive 2014/23/EU and Directive 2014/24/EU. Moreover, the directive has been transposed into the Sectors Ordinance (SektVO)[97] which is a federal state decree. The SektVO only applies to public contracts that exceed the threshold value in § 2 VgV.	Information not yet reported	The same information already referred to in Q. No. 16 applies.	Information not yet reported

[95] USER-CHI Legal Questionnaire Q.No. 17

[96] Ley 9/2017, de 8 de noviembre, de Contratos del Sector Público, por la que se transponen al ordenamiento jurídico español las Directivas del Parlamento Europeo y del Consejo 2014/23/UE y 2014/24/UE, de 26 de febrero de 2014, (available at: https://www.boe.es/buscar/act.php?id=BOE-A-2017-12902, last accessed: 04.01.2021).

[97] available at: https://www.gesetze-im-internet.de/sektvo_2016/, last accessed: 04.01.2021.

- PUBLIC SUBSIDY DIRECTIVES TO PROMOTE CHARGING INFRASTRUCTURE, E.G. BY NATIONAL OR LOCAL AUTHORITIES[98]

Table 46: Public subsidy directives to promote charging infrastructure (e.g., by national or local authorities)

Barcelona	Berlin	Graz	Murcia	Turku
The national and the regional administrations offer subsidies to promote the deployment of charging infrastructure. There is an annual plan (Plan MOVES), approved by the national administration and managed by the regional administration, which regulate the subsidies for charging infrastructure as a financial aid. The granting of this subsidies is tied to charging point characteristics, e.g., power, connectors, non-discriminatory access, and location.	On a local level in Berlin the Senate Department for Economic Affairs Energy and Operations (SenWEB) is subsidizing the deployment of charging infrastructure through the funding programme for business-oriented electromobility (WELMO).[99] On the federal level the BMVI aims at funding the construction of at least 15.000 publicly accessible charging stations with a total of 300 million euros by the end of 2020.[100]	Mainly national subsidies are available for the deployment of charging infrastructure. The subsidies are tied to certain requirements e.g., interoperability and free access for consumers.	There are grants and subsidies coming from the national government and in some cases from the regional and local administrations. Some recent examples are the MOVES II Program.	The housing cooperative (ARA) are eligible for financial help for the construction of the charging infrastructure. In case the charging infrastructure operates with electric power higher than 11kWh the total amount of the financial aid is raised. Moreover, the national Energy Authority (Energiavirasto) has its own infrastructure aid regarding public chargers (for high power charging) and for electric bus charging systems.

[98] USER-CHI Legal Questionnaire Q.No. 19
[99] SenWEB, Förderprogramm Wirtschaftsnahe Elektromobilität, Pressemitteilung, 30.09.2020.
[100] BMVI, Förderprogramm Ladeinfrastruktur.

- NATIONAL PUBLIC PROCUREMENT LAW REGULATING THE DEPLOYMENT OF CHARGING INFRASTRUCTURE [101]

Table 47: National public procurement laws regulating the deployment of charging infrastructure

Barcelona	Berlin	Graz	Murcia	Turku
There are no national rules belonging to public procurement law regulating specifically the assignment of constructing charging infrastructure. However, the new 'Law on Climate Change and Energy Transition', will assign some responsibilities to the gas station networks (owned by the main companies in the energy sector) in order to develop the charging points infrastructure.	There is no national German legislation, which deals specifically with the procurement process for charging infrastructure. The VgV is influenced by the European legal framework. However, the procurement landscape on the deployment of public charging infrastructure is influenced by the national subsidy directives („Förderrichtlinie"), which promote the implementation of municipal electromobility concepts amongst other topics in regard to market run-up of electro-mobility.[102]	Information not reported	There are no national rules belonging to public procurement law regulating specifically the assignment of constructing charging infrastructure. However, the new "Law on Climate Change and Energy Transition", will assign some responsibilities to the gas station networks (owned by the main companies in the energy sector) in order to develop the charging points infrastructure.	Information not reported

[101] USER-CHI Legal Questionnaire Q.No. 20
[102] BMVI, Elektromobilität mit Batterie

4.1.2.4 Tender specification (CLICK, INSOC, INDUCAR, SMAC)

- LOCAL TENDER SPECIFICATIONS FOR CHARGING INFRASTRUCTURE DEMANDING STRONGER MINIMUM STANDARDS CONCERNING E.G., INTEROPERABILITY COMPARED TO THE EUROPEAN OR NATIONAL FRAMEWORK[103]

Table 48: Local tender specifications for charging infrastructure demanding minimum standards/requirements (e.g., for interoperability)

Barcelona	Berlin	Graz	Murcia	Turku
The local tender requirements for charging points are in usual the same as in the EU or national legislations.	The "Berlin model" was the first municipal concept for the deployment of public charging infrastructure for EVs in Germany. The requirements integrated in the tender process were already aimed at including the interoperability requirements and a uniform user interface throughout the city laid out by the AFID, even though the implementation of the AFID into the national framework was established later through the LSV - Charging Point Ordinance in 2016 with far fewer requirements.[104]	Information not reported	The city of Murcia did not demand stronger minimum standards on interoperability or safety standards for charging infrastructure compared to the EU context. The city launched a public tender process in 2015 to purchase 6 conventional charging points (7.6 kW) and during the tender process no special requirements for interoperability were included within the specifications.	Information not reported

[103] USER-CHI Legal Questionnaire Q. No. 28

[104] Senatsverwaltung für Stadtentwicklung und Wohnen, Berliner Modell wird Realität: erste Ladesäule für Elektrofahrzeuge mit neuem Konzept geht ans Netz, 2015.

4.1.2.5 Energy law (SMAC, INDUCAR, INSOC)

- SAFETY REGULATIONS FOR THE OPERATION OF CHARGING POINTS FOR EVS[105]

Table 49: Safety regulations for the operation of charging infrastructure for EVs

Barcelona	Berlin	Graz	Murcia	Turku
The electrical safety regulation, applicable to the installation / operation of electric charging infrastructure for vehicles are outlined in detail in the national regulation ITC-BT 52.	The notification requirement Low Voltage Connection Ordinance (NAV)[106] is applicable. This requirement is at least indirectly a safety regulation. Moreover, standards for fire protection need to be considered.	Information not reported	The electrical safety regulation, applicable to the installation / operation of electric charging infrastructure for vehicles are outlined in detail in the national regulation ITC-BT 52.	The following regulation and standards regarding the charging infrastructure for electric cars apply: (66/2009, 707/2011, 478/2017, SFS 5610, SFS 6000, SFS 6000-5-52, SFS 6000-7-722, SFS-EN 50620, SFS-EN 60309, SFS-EN 62196).

[105] USER-CHI Legal Questionnaire Q. No. 23
[106] available at: https://www.gesetze-im-internet.de/nav/, last accessed: 04.01.2021.

- NATIONAL IMPLEMENTATION OF EU LEGISLATION ON THE INTEGRATION OF EVS AND RENEWABLE ENERGY SOURCES (RES) INTO SMART GRID SERVICES (DIRECTIVE 2019/944/EU - ON COMMON RULES FOR THE INTERNAL MARKET FOR ELECTRICITY)[107]

Table 50: National implementation of EU legislation on the integration of EVs and RES into Smart Grid Services (Directive 2019/944/EU)

Barcelona	Berlin	Graz	Murcia	Turku
Within the legal framework of Spain, the Directive 2019/944/EU has only been partially transposed into the Royal Decree-Law 23/2020 approving measures in the field of energy and other areas for economic recovery.[108] The Royal Decree-Law 23/2020 is a partial update of the main national law about the electric market regulation: the Law 24/2013 on the Electricity Sector"[109] The first national legislation on the topic of	The Directive 2019/944/EU has not been fully implemented within the German legal framework yet (Status December 2020). However, the federal council has emphasized the importance of the implementation for the digitalization of the energy transition.[111]	Information not reported	The Directive 2019/944/EU has only been partially transposed into the "Real Decreto-ley 23/2020, de 23 de junio, por el que se aprueban medidas en materia de energía y en otros ámbitos para la reactivación económica".[112] The "Real Decreto-ley 23/2020" is a partial updating of the main national law about the electric market regulation: the "Ley 24/2013, de 2 de diciembre, del Sector	Directive 2019/944/EU has been implemented in the Finnish national legal framework.

[107] USER-CHI Legal Questionnaire Q. No. 46

[108] Real Decreto-ley 23/2020, de 23 de junio, por el que se aprueban medidas en materia de energía y en otros ámbitos para la reactivación económica, (available at: https://www.boe.es/buscar/act.php?id=BOE-A-2020-662, last accessed: 04.012020).

[109] Ley 24/2013, de 26 de diciembre, del Sector Eléctrico, (available at: https://www.boe.es/buscar/act.php?id=BOE-A-2013-13645, last accessed: 04.01.2021).

[111] Beschluss des Bundesrates, Entschließung des Bundesrates - Digitalisierung der Energiewende - Rasche Umsetzung der Strombinnenmarktrichtlinie (RL 2019/944/EU), 03.07.2020.

[112] Real Decreto-ley 23/2020, de 23 de junio, por el que se aprueban medidas en materia de energía y en otros ámbitos para la reactivación económica, (available at: https://www.boe.es/buscar/act.php?id=BOE-A-2020-662, last accessed: 04.012020).

Barcelona	Berlin	Graz	Murcia	Turku
RES and Smart Grid Services was established within two laws: the Royal Decree-Law 15/2018 on urgent measures for energy transition and consumer protection, and the Royal Decree 244/2019, wich regulates the administrative, technical and economic conditions for the self-consumption of electrical energy[110]. Moreover, additional legislation, which will supplement the legislation on economic regulation of RES, such as the new Law on Climate Change and Energy Transition in Spain is currently in progress.			Eléctrico."[113] The first national legislation on the topic of RES and Smart Grid Services was established within two laws: the "Real Decreto-ley 15/2018, de 5 de octubre, de medidas urgentes para la transición energética y la protección de los consumidores" mentioned above, and the "Real Decreto 244/2019, de 5 de abril, por el que se regulan las condiciones administrativas, técnicas y económicas del autoconsumo de energía eléctrica".[114] Same as Barcelona	

[110] Real Decreto 244/2019, de 5 de abril, por el que se regulan las condiciones administrativas, técnicas y económicas del autoconsumo de energía eléctrica, (available at: https://www.boe.es/diario_boe/txt.php?id=BOE-A-2019-5089, last accessed: 04.01.2020).

[113] Ley 24/2013, de 26 de diciembre, del Sector Eléctrico, (available at: https://www.boe.es/buscar/act.php?id=BOE-A-2013-13645, last accessed: 04.01.2021).

[114] Real Decreto 244/2019, de 5 de abril, por el que se regulan las condiciones administrativas, técnicas y económicas del autoconsumo de energía eléctrica, (available at: https://www.boe.es/diario_boe/txt.php?id=BOE-A-2019-5089, last accessed: 04.01.2021).

- NATIONAL IMPLEMENTATION LAWS TO FACILITATE THE CONNECTION OF PUBLICLY ACCESSIBLE AND PRIVATE CHARGING POINTS TO THE DISTRIBUTION NETWORK AND THE PROVISION OF NON-DISCRIMINATORY COOPERATION BETWEEN THE ACTORS INVOLVED (DIRECTIVE 2019/944/EU - ON COMMON RULES FOR THE INTERNAL MARKET FOR ELECTRICITY)[115]

Table 51: National implementation laws to facilitate the connection of charging points to the distribution network (Directive 2019/944/EU)

Barcelona	Berlin	Graz	Murcia	Turku
No regulation is implemented yet. However, the demand for new charging points is currently not higher than the availability of access to the distribution grid. However, the Royal Decree-Law 23/2020 include some measures facilitating the installation of charging points along the national road network.	§ 17 (1) 1 EnWG states that, the operators of energy supply grids (ESCs) are obliged to guarantee conditions that are technically and economically non-discriminatory for the connection of charging points to the grid.	Information not reported	No regulation is implemented yet However, the demand for new charging points is currently not higher than the availability of access to the distribution grid. However, the Royal Decree-Law 23/2020 include some measures facilitating the installation of charging points along the national road network.	Information not reported

- NATIONAL LEGISLATION ON THE COMMISSIONING OF A STUDY TO EVALUATE WHETHER FLEXIBILITY SERVICES ARE ECONOMICALLY EFFICIENT (ART.33 DIRECTIVE 2019/944/EU)[116]

Neither in Spain, nor in Finland, nor in Germany has a study to evaluate whether flexibility services are economically efficient (Art.33 Directive 2019/944/EU) been commissioned yet.

[115] USER-CHI Legal Questionnaire Q. No. 47
[116] USER-CHI Legal Questionnaire Q. No. 48

- DSOs RIGHT TO ADJUST CONSUMER'S DEMAND FROM CONTROLLABLE LOADS[117]

Table 52: DSOs right to adjust consumer's demand from controllable loads

Barcelona	Berlin	Graz	Murcia	Turku
The right of DSOs to adjust consumer's demand depends on the charging point location on the distribution network. There are no general restriction criteria applicable to this right.	§ 14 a EnWG enables DSOs to actively control the charging of EVs in exchange for discounted network charges for EV charging. A concretizing regulation provided for by § 14 a EnWG has not been issued yet.[118]	Information not reported	The right of DSOs to adjust consumer's demand depends on the charging point location on the distribution network. There are no general restriction criteria applicable to this right.	DSOs do not have the right to adjust consumer's demand, except for the situation of electricity shortage. In these cases, Fingrid will contact the local network operators to take necessary action to restrict loads according to the plans prepared beforehand.

[117] USER-CHI Legal Questionnaire Q. No. 49
[118] Status: January 2021.

- NATIONAL LAWS REGULATING THE PHYSICAL ELECTRICITY GRID REGARDING OPERATION, MAINTENANCE, INTERACTION REGARDING RELEVANT STAKEHOLDERS[119]

Table 53: National laws regulating the physical electricity grid regarding operation, maintenance, interaction with stakeholders

Barcelona	Berlin	Graz	Murcia	Turku
The topics of transport and distribution remain regulated activities by the national administration, whereas the power generation and commercialization in the electricity market are liberalized. The national administration and the regional administrations establish the Plan for the Development of the Electricity Transmission Network. This plan is the basis for the evolution of the physical electricity grid on a national level. This process is also linked to the pan-European electricity infrastructure development plan (ENTSO-E's 10-	The Energy Industry Act (EnWG) seeks ensuring the most secure supply of electricity and gas to the general public, which is increasingly based on renewable energies. Part 6 of the EnWG regulates in §§ 49 – 53b) the provisions on the security and reliability of the energy supply.	Information not reported	The operation and maintenance of the electricity grid at Spanish national level is assigned by law ("Ley 24/2013") a public-private company called "Red Eléctrica de España (REE)", which manages the national electricity grid.[120] At regional level, the operation and maintenance of the distribution network. as well as the function of manager of the electricity grid transport, is assigned to a private company.Operation and maintenance of the Spanish electricity grid is assigned by the Law 24/2013 to the Spanish Electricity Network.[121] At regional	Information not reported

[119] USER-CHI Legal Questionnaire Q. No. 50

[120] RED, Eléctrica de Espana, (available at: www.ree.es, last accessed: 04.01.2021).

[121] RED, Eléctrica de Espana, (available at: www.ree.es, last accessed: 04.01.2021).

Barcelona	Berlin	Graz	Murcia	Turku
year network development plan: TYNDP).			level, distribution network's operation and maintenance and the management of the electricity grid transport, is assigned to a private company. Other specific regulations are: P.O.2.5 Production unit maintenance plans[122]; P.O.3.4 Programming the transmission network maintenance[123]; P.O. 3.5 Maintenance programming of the distribution network affecting the operation of the electricity system.[124]	

[122] available at: https://www.ree.es/sites/default/files/01_ACTIVIDADES/Documentos/ProcedimientosOperacion/PO_resol_17mar2004_correc_c.pdf, last accessed: 04.01.2020.
[123] available at: https://www.ree.es/sites/default/files/01_ACTIVIDADES/Documentos/ProcedimientosOperacion/PO_resol_20jul2004.pdf, last accessed: 04.01.2020.
[124] available at: https://www.ree.es/sites/default/files/01_ACTIVIDADES/Documentos/ProcedimientosOperacion/PO_resol_28jul2006.pdf, last accessed: 04.01.2020.

- DEFINITION OF CHARGING POINTS FOR EVS AS FINAL COSTUMERS/USERS OR SUPPLIERS OF ELECTRICITY UNDER THE APPLICABLE NATIONAL REGULATION[125]

Table 54: Definition of charging points for EVs as final costumers/users or suppliers of electricity under the applicable national regulation

Barcelona	Berlin	Graz	Murcia	Turku
In the Spanish national legislation Charging points are defined as electricity suppliers. One of the main difficulties for the installation of EV charging infrastructures for companies in the services and hotel sectors was the legal obligation to include the charging activity management as a corporate purpose. Thanks to the modifications to the Decree Law 15/2018, any company (hotels, car parks, shopping centres, company car parks, etc.) or freelancers can install charging points in their facilities and offer this service, although in any case they must comply with industrial safety regulations.	In accordance to § 3 No. 25 EnWG charging points for EVs are categorised as final users within the meaning of the EnWG and the ordinances based on the Act.	Information not reported	Charging points are defined as suppliers of electricity in the Spanish national legislation. The Royal Decree Law 15/2018 sets a few modifications for overcoming some barriers related to sale of electricity from electric charging points in Spain. Same as Barcelona	Information not reported

[125] USER-CHI Legal Questionnaire Q. No. 55

- NATIONAL ENERGY LAW REGULATIONS CONCERNING REPORTING OBLIGATIONS, WHICH MUST BE OBSERVED BY CPOS[126]

Table 55: National energy law regulations concerning reporting obligations that must be observed by CPOs

Barcelona	Berlin	Graz	Murcia	Turku
The Spanish legal framework Royal Decree-Law 15/2018 for reporting commission and decommissioning, and Royal Decree-Law 23/2020 for the authorization process and grid connection of charging stations up to 250 kW are applicable. The following regulations should be considered: Law 24/2013 on the Electricity Sector (BOE 12/27/2013) which regulates the quality of electricity supply. Moreover, Article 51 e) establishes that the General State Administration will determine the objective service quality indexes, to be met both at the individual user level and for each geographical area served by a sole distributor.	Concerning Germany and the national legal framework, the Renewable Energy Sources Act (EEG)[127] defines charging point operators as suppliers of electricity instead of final users. Therefore, CPOs must fulfil reporting obligations deriving from § 70 EEG. Accordingly, CPOs must report specific basic data to the transmission system operator as well as their used amount of electricity. Regarding the German national legal framework, the notification requirement pursuant to Section 19 (2) of the Low Voltage Connection Ordinance (NAV) of 2019 is applicable.	Concerning the Austrian legal framework reporting obligations arising out of the Electricity Industry and Organisation Act (ELWOG) needs to be considered.	Same as Barcelona	The Finnish national legal framework does not apply reporting obligations, which must be undertaken by charging point operators.

[126] USER-CHI Legal Questionnaire Q. No. 56
[127] available at: https://www.gesetze-im-internet.de/eeg_2014/, last accessed: 04.01.2020.

Barcelona	Berlin	Graz	Murcia	Turku
The Royal Decree 1955/2000 (BOE 12/27/2000) regulates the activities of transport, distribution, marketing, supply and authorization procedures for electric power installations. In addition,The order ECO / 797/2002 (BOE 04/13/2002) by which the procedure for measuring and controlling the continuity of the electricity supply is approved. Moreover, the 12. additional provision of Royal Decree 738/2015 (BOE 08/01/2015) applies.				

4.1.2.6 Legal framework regulating road use (SMAC, INDUCAR, INSOC, CLICK)

- PERMISSIONS NEEDED TO SET UP CHARGING INFRASTRUCTURE IN PUBLIC SPACES BASED ON NATIONAL ROAD USE REGULATION[128]

Table 56: Permissions needed to set up charging infrastructure in public spaces based on national road use regulation

Barcelona	Berlin	Graz	Murcia	Turku
No permissions based on road use regulations are needed for charging infrastructure in public urban spaces. In public spaces along the national or regional roads the permission from the national or regional road administration are the most important (National road regulation: Law 37/2015 of 29 September on Roads129; Regional road regulation: Legislative Decree 2/2009, of 25 August, approving the revised text of the road law130)	In order to set up charging infrastructure in public spaces a special use permit is needed. See question 2 for more information.	Information not reported	The council must grant a permit to use public space for the installation of charging points.	Information not reported

[128] USER-CHI Legal Questionnaire Q. No. 29
[129] Ley 37/2015, de 29 de septiembre, de carreteras, (available at: https://www.boe.es/buscar/act.php?id=BOE-A-2015-10439, last accessed: 04.01.2021).

4.1.2.7 Measuring and calibration laws (SMAC, INDUCAR, INSOC)

- TRANSPOSITION LAWS OF DIRECTIVE 2014/32 (EU) (MEASURING INSTRUMENTS DIRECTIVE) APPLICABLE TO CHARGING POINTS[131]

Table 57: Transposition laws of the Measuring Instruments Directive (2014/32/EU)

Barcelona	Berlin	Graz	Murcia	Turku
The Law 32/2014 of 22 December on Metrology and the Royal Decree 244/2016 of 3 June implementing the Law 32/2014 are applicable.[132] Especially the latter law accomplishes the implementation of Directive 2014/32/EU into the national legislation.	The Directive is implemented through the Act on the placing and making available on the Market of Measuring Instruments, their Use and Calibration (MessEG)- and on as well Pre-packages (MessEG), as well as the Ordinance on the revision of legal metrology and adaptation to European case law (MesswNeuRegV).	Information not reported	Information not reported	Information not reported
Switzerland: The Directive is implemented through the Bundesgsetz über das Messwesen (MessG) - Federal law on metrology, Messmittelverordnung (MessMV) - Measuring Instruments Ordinance and the Verordnung des EJPD über Messmittel für elektrische Energie und Leistung (EMmV) - Ordinance of the EJPD on Measuring Instruments for Electrical Energy and Power.				

[131] USER-CHI Legal Questionnaire Q. No. 36

[132] Real Decreto 244/2016, de 3 de junio, por el que se desarrolla la Ley 32/2014, de 22 de diciembre, de Metrología, (available at: https://www.boe.es/diario_boe/txt.php?id=BOE-A-2016-5530, last accessed: 04.01.2021).

- NATIONAL RULES ON THE REGULATION OF THE CALIBRATION OF MEASURING DEVICES IN CHARGING INFRASTRUCTURE[133]

Table 58: National rules on the regulation of the calibration of measuring devices in charging infrastructure

Barcelona	Berlin	Graz	Murcia	Turku
There is no special regulation covering the topic of calibration of measuring devices in charging infrastructure.	Regarding Berlin the charging infrastructure needs to be in conformity with Measurement and Calibration Act (MessEG), as well as the Measurement and Calibration Ordinance (MessEV), Measuring Station Operation Act (MsbG) and the Price Indication Ordinance (PAngV). See question 42 for more information on price quotation requirements.	There is no special regulation covering the topic of calibration of measuring devices in charging infrastructure.	There is no special regulation covering the topic of calibration of measuring devices in charging infrastructure.	Measuring devices, which are used as billing basis for electricity consumption from EV charging points need to be MID-approved (Measuring Instruments Directive).
Switzerland: The MessMV governs measuring instruments. The ordinance of the EJPD on measuring instruments for electrical energy and power (EMmV) now specifically regulates electricity meters and instrument transformers (Art. 1 EMmV). However, Art. 2 (2) EMmV includes an exemption of electricity meters used by short-term customers at charging stations for EVs[134]. Because of this explicit exception, which is not subject to a time limit, they must not be calibrated.				

[133] USER-CHI Legal Questionnaire Q. No. 38
[134] Verordnung des EJPD über Messmittel für elektrische Energie und Leistung, (available at: https://www.admin.ch/opc/de/classified-compilation/20142068/index.html, last accessed: 04.01.2020).

- LEGAL DUTY TO SAVE DATA OF MEASURED VALUES OF ENERGY WITHIN THE ELECTRICITY METER OF THE CHARGING POINT[135]

Table 59: Legal duty to save data of measured values of energy within the electricity meter of the charging point

Barcelona	Berlin	Graz	Murcia	Turku
In general, for electricity meter: two years (Order TEC/1281/2019, of 19 December, approving the complementary technical instructions to the unified regulation on measuring points in the electrical system[136]; Royal Decree 1110/2007, of 24 August, approving the unified regulation on measuring points in the electricity system.[137]	In accordance to § 33 (3) MessEG the charging point or the system behind it must be able to save the meter readings of all the constantly changing user and assign them to a specific transaction. The customers must still be able to view individual charging processes at the relevant charging stations after they have received the bill.[138]	The legal duty to save data of measured values of energy within the electricity meter of the charging point does not arise within the Austrian legal framework.	The information is requested by regional administration and by the Spanish Ministry of energy on a yearly basis with the aim of monitoring the usage of green infrastructure and estimate the CO2 emissions saved.	The measuring of energy is mandatory for charging infrastructure in the city of Turku.
Switzerland: The legal duty to save data of measured values of energy within the electricity meter of the charging point does not arise (see Q. No. 38).				

[135] USER-CHI Legal Questionnaire Q. No. 39

[136] Orden TEC/1281/2019, de 19 de diciembre, por la que se aprueban las instrucciones técnicas complementarias al Reglamento unificado de puntos de medida del sistema eléctrico, (available at: https://www.boe.es/diario_boe/txt.php?id=BOE-A-2020-2, last accessed: 04.01.2020).

[137] Real Decreto 1110/2007, de 24 de agosto, por el que se aprueba el Reglamento unificado de puntos de medida del sistema eléctrico, (available at: https://www.boe.es/buscar/doc.php?id=BOE-A-2007-16478, last accessed: 04.01.2020).

[138] Eneco – E-mobility Eichrechtskonforme Ladesäulen für eine transparente Abrechnung.

- LEGAL DUTIES TO COMPLY WITH LEGAL METROLOGY FOR USERS OF MEASURED VALUES, LIKE EMSPs[139]

Table 60: Legal duties to comply with legal metrology for users of measured values (e.g., EMSPs)

Barcelona	Berlin	Graz	Murcia	Turku
The legal duty to comply with legal metrology is mostly relevant for CPOs.	The legal duty to comply with legal metrology is mostly relevant for CPOs (as users of measuring instruments) (German legislation: § 31 (2) MessEG). However, within the German legal framework in some situations, it could affect EMSPs, who manage the billing process between CPOs and final users while using the measured values.	There is no applicable legal duty to comply with legal metrology for users of measured values, like EMSPs.	The legal duty to comply with legal metrology is mostly relevant for CPOs.	Information not reported

[139] USER-CHI Legal Questionnaire Q. No. 40

- APPLICABILITY FOR OBLIGATIONS ARISING OF LEGAL METROLOGY REQUIREMENTS FOR BACK END SYSTEMS[140]

Table 61: Applicability for obligations arising out of legal metrology requirements for backend systems

Barcelona	Berlin	Graz	Murcia	Turku
The obligations are only applicable for measuring devices. However, the requirements related to information to be provided, to the administration or to the consumers, could impact back end systems.	Back-end systems could be additional equipment in the meaning of § 3 No. 24 MessEG and thus subject to legal metrology, if they determine additional measured quantities.	Within the Austrian legal framework, the stated obligations are not applicable for back end systems.	Information not yet reported.	Within the Finnish legal framework, the stated obligations are not applicable for back end systems. However, they could possibly be applicable, when the datahub is fully implemented.
Switzerland: According to the current legal situation, an exception applies to the measurement of electricity in charging stations, which is otherwise subject to calibration according to MessG, MessMV and EMmV. Therefore, no legal obligations arise out of legal metrology requirements for back end systems				

[140] USER-CHI Legal Questionnaire Q. No. 41

- NATIONAL RULES REGULATING TARIFF MODELS REGARDING PAYMENT FOR THE USE OF PUBLIC CHARGING INFRASTRUCTURE[141]

Table 62: National rules regulating tariff models regarding the payment for the use of public charging infrastructure

Barcelona	Berlin	Graz	Murcia	Turku
No national rules regulating tariff models regarding payment for use of public charging infrastructure exists.	With regard to the German legal framework the Price Quotation Ordinance needs to be taken into account (PAngV) needs to be considered. The § 3 (PAngV)[142] has been interpreted by the Federal Ministry of Economy and Energy to the effect, that time-based pricing is inadmissible.[143]	A tariff of kilowatt-hour is not approved by Austrian laws so far, but an update on this legal matter is expected.	No national rules regulating tariff models in regard to payment for use of public charging infrastructure exists.	No national rules regulating tariff models in regard to payment for use of public charging infrastructure exists.

[141] USER-CHI Legal Questionnaire Q. No. 42
[142] available at: https://www.gesetze-im-internet.de/pangv/BJNR105800985.html, last accessed: 04.01.2021.
[143] BMWi, Preisangabe für und Abrechnung von Ladestrom für Elektromobile, 2018.

4.1.2.8 Data protection law (CLICK, INCAR, SMAC, INDUCAR, INSOC)

- NATIONAL REGULATIONS ON MANAGEMENT OF DATA MODELS FOR SMART METERING SYSTEMS ALREADY IMPLEMENTED REGARDING THE ISSUE OF CYBERSECURITY AND DATA PROTECTION OF SMART METERING SYSTEMS[144]

Table 63: National regulations on the management of data models for smart metering systems already implemented regarding cybersecurity and data protection of smart metering systems

Barcelona	Berlin	Graz	Murcia	Turku
General data protection legislation from the EU Directives has been transposed to the national Spanish legislation. Spanish national legislation: 'Orden ministerial IET/290/2012"[145] and the "Royal Decree-Law 1/2019"[146].	The Act on the Digitalisation of the Energy Transition (GDEW) created the legal basis for the rollout of modern metering equipment and smart metering systems. In accordance, the Metering Point Operation Act (MsbG) regulates technical requirements, financing and data communication and thus lays the foundations for the	Information not reported	General data protection legislation from the EU Directives has been transposed to the national Spanish legislation. Spanish national legislation: 'Orden ministerial IET/290/2012"[148] and the "Real Decreto-ley 1/2019"[149].	Information not reported

[144] USER-CHI Legal Questionnaire Q. No. 54
[145] Amending Order ITC/3860/2007, of 28 December, revising electricity tariffs from January 1st, 2008 regarding the plan to replace analog meters for smart meters.
[146] Royal Decree-Law 1/2019 of 11 January on urgent measures to adapt the powers of the National Commission for Markets and Competition to the requirements arising from EU law in relation to Directives 2009/72/EC and 2009/73/EC of the European Parliament and of the Council of 13 July 2009 concerning common rules for the internal market in electricity and natural gas.
[148] Amending Order ITC/3860/2007, of 28 December, revising electricity tariffs from January 1st, 2008 regarding the plan to replace analog meters for smart meters.
[149] Royal Decree-Law 1/2019 of 11 January on urgent measures to adapt the powers of the National Commission for Markets and Competition to the requirements arising from EU law in relation to Directives 2009/72/EC and 2009/73/EC of the European Parliament and of the Council of 13 July 2009 concerning common rules for the internal market in electricity and natural gas.

Barcelona	Berlin	Graz	Murcia	Turku
	introduction of smart metering systems.[147]			

[147]BDEW, Smart Metering, (available at https://www.bdew.de/energie/digitalisierung/welche-rolle-spielen-smart-meter-fuer-die-digitalisierung-der-energiewende/, last accessed: 04.01.2021).

- REQUIREMENTS DERIVING OUT OF THE GENERAL DATA PROTECTION REGULATION

All legal frameworks in European Cities imply the requirements deriving out of the General Data Protection Regulation (GDPR) for the personal data generated using charging points by EV users. General information on the legal requirements deriving out of the GDPR is included in USER-CHI D11.2 “Research participants involvement report”, D11.4 “Protection of personal data report”, as well as D12.1 “H - Requirement No.1. “

- REQUIREMENTS DERIVING OUT OF NATIONAL LAWS ON DATA PROTECTION

Moreover, the legal frameworks in European Cities may also imply requirements deriving out national data protection laws. For the USER-CHI city partners an overview of the national data protection regulation is included in USER-CHI D11.2 “Research participants involvement report”, as well as D12.1 “H - Requirement No. 1.”.

4.2 USER-CHI product specific general requirements: CLICK - Charging Location and Holistic Planning Kit

4.2.1 Technical Requirements for CLICK[150]

4.2.1.1 Technical Requirements on the CLICK Platform

The CLICK Platform will be made available online as an internet service. CLICK will consist of a web-frontend for interaction with the urban planner and a backend that runs the calculations and derive the proposals. The frontend must be compatible with the most prevalent web browser (at time of writing this deliverable: Chrome 87.0), while it should be compatible to the top 3 most common web browsers by market share (additionally Mozilla Firefox, Microsoft Edge). The frontend will have a public and a private area, where the publicly accessible area will contain basic information and the access restricted area will contain the planning process.

The main interaction with the user will be via a map interface. The map interface should be implemented by standard solutions and tools (e.g., leaflet based on OpenStreetMap). Data transfer as far as needed should use standard interfaces and protocols.

The focused user of CLICK is the urban planner. Therefore, CLICK frontend is to be designed to be used from within a professional environment with a desktop equipment setup (i. e. big high-resolution display, keyboard, and mouse usage). A design for tablet or smartphone use is not in the focus of CLICK development.

4.2.1.2 Technical Requirements on the CLICK Results

CLICK backend must support the storage of results and inputs. The user must be able to save his planning process and results at specific stages of the process. A reprocessing of calculations should be possible. Therefore, a database should be used.

CLICK results should be made available to the user via the web interface. A provision of the results in file format for export (e.g., csv, xlsx) should be considered, a provision of the result in standard geo exchange formats (e.g., shape format) could be considered. CLICK could offer a monitoring functionality. Usage data of existing charging points should be importable to CLICK

[150] At the time of writing this report, the task for specifying the high-level architecture of CLICK as well as basic requirements (T2.1) had just begun. Therefore, the technical requirements can be stated on a high level at this early stage only. CLICK is an online platform with digital interfaces to the user. Therefore, other than other USER-CHI products, technical requirements are limited. The focus of the technical requirements for CLICK is divided in two directions: the requirements on the CLICK platform itself as well as the requirements on the results.

via a file-based transfer (comma separated csv file). CLICK could implement an interface to INCAR to receive actual usage data and could implement interfaces to other existing platforms (e. g. Hubject).

4.2.2 Legal Requirements for CLICK

4.2.2.1 Public, civil, or stakeholder participation (CLICK)

- PUBLIC PARTICIPATION DURING THE PLANNING PROCEDURE[151]

Table 64 Public participation during the planning procedure

Barcelona	Berlin	Graz	Murcia	Turku
Information not yet reported.	Public participation is undertaken on a merely voluntary basis and not required by law. The communication of planned deployment of charging infrastructure is only recommended.[152]	Public participation during the authorization procedure of charging infrastructure is not mandatory.	Public participation is not mandatory for charging infrastructure projects, but strongly recommended. Therefore, Murcia initiated a public participation process during the planning process of the deployment of charging points in 2016. However, the result of this voluntary public participation process was binding.	Public participation is mandatory in land-use and building law in accordance with § 62 MRL, § 63 MRL. On this basis actions are taken systematically, and the different stakeholders need to be involved during the planning phase of the deployment.

[151] USER-CHI Legal Questionnaire: Q. No.25, No.26, No.27
[152] BMVI, DIFU - NOW, Genehmigungsprozesse der E-Ladeinfrastruktur in Kommunen: Strategische und rechtliche Fragen, 2014, p.7.

4.2.2.2 Data access and sharing (CLICK)

- REQUIREMENT OF CPOS TO PROVIDE REAL-TIME AVAILABILITY DATA OF THEIR CHARGING POINTS TO OTHER STAKEHOLDERS[153]

Table 65 Requirement of CPOs to provide real-time availability data of their charging points to other stakeholders

Barcelona	Berlin	Graz	Murcia	Turku
There is no legal requirement for CPO's to provide real-time location data regarding the availability of their charging points. However, in Catalonia the "Institut Català d'Energia (ICAEN)" has organized a tool, which offers real-time location and availability data concerning charging points in the region.	There is no legal requirement for CPOs to provide real-time availability data. § 5 (1) LSV merely lays down the duty to notify the commissioning as well as the decommissioning of charging points but does not include duties on further data access.	There is a legal requirement for CPO's to provide real-time location data regarding the availability of their charging points.	CPOs might have to provide data regarding the use of their charging points to local authorities in case the city council includes such requirements in the technical specifications and terms of contract.	No such requirement applies towards CPOs.

[153] USER-CHI Legal Questionnaire: Q. No.43

- LEGAL REQUIREMENT OF CPOS TO PROVIDE HISTORIC CONSUMPTION DATA OF THEIR CHARGING POINTS TO LOCAL AUTHORITIES[154]

Table 66 Legal requirement of CPOs to provide historic consumption data of their charging points to local authorities

Barcelona	Berlin	Graz	Murcia	Turku
The national legal framework does not imply the legal requirement of CPOs to provide historic consumption data of their charging points to local authorities.	There is no duty to provide historic consumption data as such to local authorities. However, the duty to provide information on electricity consumption generated by one charging point may arise out of measuring and calibration law regarding consumers. Moreover, reporting requirements may also arise out of § 12 (4) EnWG towards electricity supply network operators.	The national legal framework does not imply the legal requirement of CPOs to provide historic consumption data of their charging points to local authorities.	The national legal framework does not imply the legal requirement of CPOs to provide historic consumption data of their charging points to local authorities. However, regarding the city of Murcia this kind of requirements might arise on the basis of contractual terms established with the city authorities.	The national legal framework does not imply the legal requirement of CPOs to provide historic consumption data of their charging points to local authorities.

[154] USER-CHI Legal Questionnaire: Q. No.44

- PROVISIONS FOR DATA SHARING PROCESSES AMONG CPOS REGARDING MINIMUM STANDARDS AND INTEROPERABILITY[155]

Table 67 Provisions for data sharing processes among CPOs regarding minimum standards and interoperability

Barcelona	Berlin	Graz	Murcia	Turku
There are currently very few data sharing processes among EMSPs or/and CPOs. Some existing agreements between CPOs and EMSPs has been established under the OCPI protocol.	There are currently no provisions for the data sharing processes among providers of charging services regarding minimum standards of interoperability. However according to § 3 (4) Amendment Draft of the LSV the requirement to use standardized communication protocols for charging points operators is included.[156]	Information not yet reported.	Interoperability is a requirement within all public procurement tenders concerning charging infrastructure in Spain. Local administrations require the operators to use the Open Charge Point Protocol (OCPP). This pursues the goal to enable interoperability between different charging points (operators) within the same city.	Information not yet reported.

[155] USER-CHI Legal Questionnaire: Q. No.45
[156] available at: https://www.bmwi.de/Redaktion/DE/Artikel/Service/Gesetzesvorhaben/zweite-verordnung-zur-aenderung-der-ladesaeulenverordnung.html, last accessed: 04.01.2021.

4.3 USER-CHI product specific general requirements: INCAR - Interoperability, Charging and Parking Platform

4.3.1 Technical Requirements for INCAR

4.3.1.1 Location of park & charge services

For supporting the implementation of the INCAR application for finding parking spots and charging stations to increase the usage of existing infrastructure within the USER-CHI cities, there is a need to have an overview on the existing technical standards for the location of park & charge services for electromobility and the navigation to such infrastructure in the USER-CHI cities.

Italian and German USER-CHI project partners reported to be implementing several different standards for routing applications in their respective countries and cities. Italian USER-CHI partners reported they use company-specific standards, namely Enel X standards. German USER-CHI partners, on the other hand, reported that there are no common standards in Berlin where proprietary (worldwide) car routing services such as: google routing, here routing, Inrix routing, or Open Street Map Routing, are currently used. It was also pointed out that VMZ Berlin has its own router for Berlin-Brandenburg area, Public transport routing by the Transport association Berlin Brandenburg (Verkehrsverbund Berlin Brandenburg or VBB).

In a similar manner, Italian and German USER-CHI project partners reported to be implementing several different standards for geographic information systems (GIS) and geomatics in their respective countries and cities. Italian USER-CHI partners reported they use company-specific standards, namely Enel X standards. German USER-CHI partners, on the other hand, reported that there are no common standards for GIS analysis in Berlin. The current standards refer to the mainly to international standards issued by ISO/TC 211 GPS, expecting Galileo. Moreover, the Radio Technical Commission for Maritime Services (RTCM), RTCM 2.3, and RTCM 3.0 are also currently used.

- ROUTING SERVICE (RS)

The RS provided by INCAR aims at guiding the user to the EVSE charging process should be performed. The RS therefore firstly needs to request all charging stations of INCAR over OCPI in its Points of Interest (POI) module and, secondly, cover and support all areas where EVSEs integrated in INCAR are located.

The RS also includes a corresponding grid to perform the routing on. Different modes of transport are supported by the RS such as car, walk, and bike routing[157]. However, the focus of the RS will be car routing as EV drivers are the main target group of INCAR services and applications. The RS can be connected modularly to different local RS, if available, for walk, bike, car, or public transport for specific areas. Moreover, car routing considers current traffic situations based on Floating Car Data (FCD) generated by GPS-enabled mobile devices or on-board computers installed in cars.

4.3.1.2 Communication protocols, eRoaming Platforms/eMobility Service Providers (EMSPs)

Existing standards for the technical communication between charging points and CPOs as well as between CPOs and EMSPs were reported by Spanish and German USER-CHI partners. They include information on the four main charging protocols:

Open Charge Point Protocol (OCPP) were reported as current standards for acquisition of information between charging points and CPOs. Moreover, Open Charge Point Interface (OCPI) were reported as current standard for acquisition of information between EMSPs and CPOs.

Spanish and German USER-CHI project partners reported to be implementing common standards for charging protocols (standards for data sharing processes among providers of charging services) in their respective countries and cities. OCPI – version 2.1.1 (e.g., NKL Nederland); OICP (e.g., Hubject) are used in both countries, while OCHP – version 1.4 (e.g., eClearingNet) and proprietary interfaces (e.g., Berlin Authentication Platform) are also used in Germany.

- INTEROPERABILITY AND ROAMING SERVICES

INCAR should enable the following functionalities related to the recharge of EVs: 1) Provide static information about EVSEs such as geocoordinates, available plug types and amperage; 2) Provide real-time information of EVSEs such as availability or price; 3) Reservation of EVSEs.; 4) Management of the start and the end of transactions and monitoring of their status and evolution; and 5) Control and recording of energy consumption per transaction and in time.

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[157] The routing services can process different input parameters that the end-users can set in the INCAR app. These are departure and destination addresses, departure time, arrival time, modes of transport to be considered, and chosen optimization criteria (duration, costs, CO_2 emissions). Multiple routing results are returned by the service based on chosen parameters and ordered by optimization criteria. A corresponding geocoding subservice translates departure and destination addresses into geocoordinates for the routing or uses current GPS location as a starting point for the route. If the user clicks on one of the suggested routes, he or she will see detailed instructions in a directions list view as well as in the map view of the INCAR app.

With this set of functionalities, EV drivers will have transparent access for using the EV charging infrastructure of CPOs integrated into the platform, regardless of whether the EMSP of the user offers an application with such functionality.

It is important to note that interoperability and roaming issues will be executed by means of the OCPI 2.2 protocol implementation. This protocol version defines how the market role called Hub (in this case INCAR interoperability and roaming services) would act as a communication intermediary between different EMSPs and CPOs. If there was not any platform that could centralise communications between the different actors involved in the charging process, it shall be necessary to manage a high number of connections and develop several end-user applications, as it is shown in the Figure 19 below.

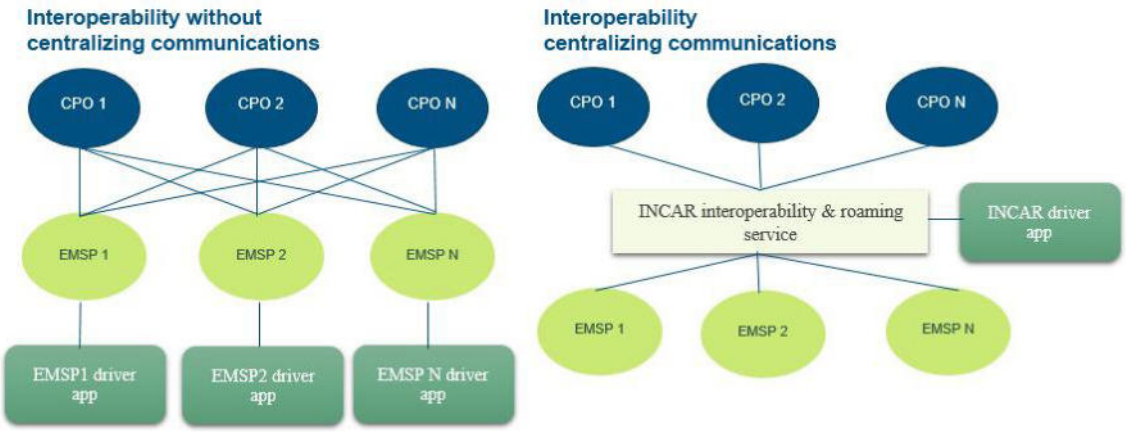

Figure 19 INCAR Platform. Source: Martin et al. 2020

The Hub can be considered the main entity to be developed regarding roaming services as it is specifically conceived to centralise and facilitate connections between EMSPs and CPOs. However, its functionalities are not just limited to solve interoperability issues. All related services such as accounting, routing or electromobility dashboards are based on the information provided and reported to EMSPs and CPOs, therefore the platform Hub is intended to participate as a main actor in the whole set of INCAR services. Besides, it will have an essential role in the smart charging operations. The reason is that a set of smart charging inputs that are needed by the product SMAC to calculate the optimal charging profile will be informed by the Hub, and once this charging profile is defined, it will be reported to CPOs system by the Hub.

- COMMUNICATION PROTOCOLS FOR INCAR

With the implementation of OCPI 2.2 protocol, every time any partner involved in the platform (EMSPs and CPOs) would perform any update in the electromobility elements status, INCAR platform will be notified. Immediately, the interoperability and roaming component, which manages the received information, will store this information in the system database.

From specific data included in the EMSP/CPO request, the interoperability service will be notified about if the requesting system wants to send this updated information to the whole set of platforms involved in INCAR, or just to a single partner, and the backend service will redirect the information according to this data. The EV driver app can be considered the end-user device for this service. Their graphic user interfaces will display the information managed by the roaming component such as the EVSEs data (location, availability, etc.). Beyond offering the electromobility elements information, the driver app will perform any of the operations that are conceived in charging scenarios, like booking charging points, cancel reservations, and start or stop charging transactions. For this set of functionalities offered to the final user, it would be necessary communication between roaming services and mobile app backend.

- ACCOUNTING SERVICES PROVIDED BY INCAR

Since INCAR platform end-users are costumers of the EMPSs, the responsibility of the billing of each charging transaction corresponds to the EMSP, according to tariffs and contractual conditions of the customers. Meanwhile, CPOs shall manage the direct interaction with the EVSEs infrastructure for the charging of the vehicles and shall periodically generate an invoice to the EMPSs with the aggregation of the costs of the charging transactions in the period. INCAR will centralize and redirect information between EMSPs and CPOs, including billing data generated by CPOs. Nevertheless, when the platform would be notified about an end of charging transaction, the relevant accounting data will not just be redirected from CPO to EMSP. It also will be stored by INCAR accounting service safely by means of BigchainDB technology[158]. Although this service will not participate directly in the payment process, any EMSP and CPO will be able to search the billing information of the transactions which their customers have participated (for EMSPs) and which their EVSEs have performed the EV charging (for CPOs).

The accounting services will interact with the EV driver app, the accounting web and the interoperability and roaming services. With the mobile app, each user could get the billing information of their own ended transactions. The accounting web will let the partners who joined to INCAR platform (EMSPs and CPOs) to search the accounting data of the whole set of charging transactions which have performed (for CPOs) or which their customers have participated (for EMSPs). The accounting service will be fed by the charge detail records (CDRs) which is the only

[158] Kumar 2019

billing-relevant object defined in OCPI protocol. Data which conforms CDR objects will be created by CPO and sent to INCAR backend, where will be processed and stored by means of this service in the BigchainDB instance.

- AUTHENTICATION SERVICES

In many cases, EV drivers still need to have a contract with an EMSP if they want to use a charging service. Consequently, end-users of offered services are the customers of EMSPs which are involved in the INCAR platform. Once an EMSP would be registered on the platform, almost all services and processes related to the final user actions would be performed by INCAR instead of EMSP system. Despite, there is a relevant part of functionalities offered to the final user which both, EMSPs and INCAR backend would have to participate: authentication process. A graphic user interface of the mobile app will be a login form, with the aim of identifying the EV driver who will make use of INCAR services. The platform backend will not be able to run this process in an individual way because customers´ information will be stored neither managed by INCAR, as some data is considered confidential. Storage and management tasks will be performed by the EMSP with which the EV driver has a contract. Due to the lack of relevant customers data such as credentials in INCAR systems, there will be necessary an authentication service which could validate and identify the final user while respecting their privacy. Authentication issues will be covered by a Keycloak server instance[159].

The authentication service in INCAR can be separated into two subcomponents: a graphic user interface (GUI) and the backend service. The EMSP operator will be the responsible to interact with the authentication service frontend. He/she will have an administrator account in order to manage their customers information. It will be necessary that, for each EV driver, the operator includes data required for interoperability operations such as the id OCPI token assigned to the user, as well as useful information for the customization of the driver app frontend. Once the information is stored in the authentication service backend, the authentication process could be performed using the EV driver app. A login form will be displayed where the final user will introduce their credentials. The mobile app will communicate with the authentication service backend to validate the username and password. If they are correct the application will show the INCAR app content and the authentication service will inform about relevant data which the EMSP operator introduced previously, such as user full name or OCPI token.

[159] available at: https://www.keycloak.org/docs/latest/server_admin

4.3.2 Legal Requirements for INCAR

4.3.2.1 Parking management (INCAR)

- BOOKING OF PARKING SPOTS ON PUBLIC ROADS FOR EVS FOR THE PURPOSE OF CHARGING[160]

Table 68 Booking of parking spots on public roads for EVs for the purpose of charging

Barcelona	Berlin	Graz	Murcia	Turku
In the Metropolitan Area of Barcelona, the privilege of booking parking spots in public urban spaces is not yet developed.	The booking of public parking spaces in front of charging points before its use is not possible on a local level in Berlin. The only privilege for EVs, is the possibility to park free of charge at charging points during the charging process.	In the city of Graz, the only privilege that exists for EVs is that parking fees can be waived.	The City of Murcia has reserved 50 parking spots for EVs, and the administration is monitoring their usage with sensors embedded in the ground and an app, which shows the occupancy or availability. Likewise, the public charging points of Murcia can be booked through an APP from the vendor (FENIE ENERGIA).	Information not yet reported.

[160] USER-CHI Legal Questionnaire Q. No.31

- EXEMPTIONS FROM OR REDUCTIONS OF PARKING FEES FOR EVS[161]

Table 69 Exemptions from or reductions of parking fees for EVs

Barcelona	Berlin	Graz	Murcia	Turku
In the Metropolitan Area of Barcelona there is a total exemption of parking fees in specific zones ('Zona blava', charging point not available). However, other parking facilities include no reductions or exemptions for EVs.	In accordance to § 3 (4) Nr. 4 - Electromobility Law (EmoG) exemptions for EVs can be made regarding parking fees on public streets or roads. However, EVs are only allowed to park free of charge at charging stations during the charging process, which applies Berlin wide. Other privileges have not been introduced yet.	In the City of Graz, the parking is free for EVs on public spaces for the upcoming two years (Status: December 2020).	In the city of Murcia parking is free for EVs in the controlled parking area of the municipality. Besides there is an agreement between the city council and the association of private car parks in Murcia. Based on this agreement, EV users can park free of charge for the duration of an hour.	In the city of Turku public charging spots are currently freed from parking fees.

[161] USER-CHI Legal Questionnaire Q. No.32

- PRIVILEGES OF EVS WHICH ARE PART OF A CARSHARING FLEET[162]

Table 70 Privileges of EVs which are part of a carsharing fleet

Barcelona	Berlin	Graz	Murcia	Turku
In the Metropolitan Area of Barcelona, the question of granting privileges to vehicles, which are part of a carsharing fleet is under discussion.	Regarding the city of Berlin, the same privileges apply to shared vehicles eligible under the Carsharing Law (CsgG)[163] but in this case they are not limited to EVs.	The city of Graz has not implemented national or local regulations on privileges for carsharing fleets.	In the city of Murcia, currently no carsharing companies are operating.	The city of Turku has implemented not national or local regulations on privileges for carsharing fleets.

[162] USER-CHI Legal Questionnaire Q. No.33
[163] available at: https://www.gesetze-im-internet.de/csgg/BJNR223000017.html, last accessed: 04.01.2021.

- RULES ON ENFORCEMENT OF ADMINISTRATIVE OFFENCES FOR PARKING AFTER CHARGING PROCESS IS FINISHED[164]

Table 71 Rules on enforcement of administrative offences for parking after charging process is finished

Barcelona	Berlin	Graz	Murcia	Turku
In the city of Berlin applicable traffic signs indicate that only EVs are allowed to park on the parking space next to charging points. During the day (8 a.m. and 6 p.m.) the parking period is limited to maximum 4 hours. EV users are asked to use parking discs to indicate when the charging process was started. During the night (6 p.m. – 8 a.m.) there is no time restriction on how long the EVs are allowed to park.[165]	In the city of Berlin if, and how long EVs can park after the charging process is not regulated yet. In some municipalities EV are only allowed to park next to charging points if the charging cable is plugged in.	In the City of Graz, the parking time charging stations in public spaces is generally limited for up to three hours.	In the city of Murcia regulation on the enforcement of overdue parking next to charging infrastructure is not yet implemented. However, it will be included in the new urban mobility ordinance of Murcia soon.	In the City of Turku, the only enforcement measure is time-related and implemented after a certain duration is overdue.

[164] USER-CHI Legal Questionnaire Q. No.34
[165] SenUVK, Beschilderung von Ladestationen, 23.03.2020.

4.3.2.2 Roaming platforms

In neither the German, the Finish, the Spanish nor the Austrian legal frameworks special legal requirements on the topic of roaming platforms exist, which are applicable for the charging process of EVs in Europe. However, European regulation already exists on the topic mobile communication. The framework was established through the Regulation (EU) 2012/531 for roaming on public mobile communication networks within the Union. The Regulation addresses the levying of roaming charges within the European Economic Area. Another Regulation, which has been issued on the topic of roaming, is the Regulation (EU) 2015/2120 of the European Parliament and of the Council of 25 November 2015 laying down measures concerning open internet access.

The topic of roaming regarding public communication networks or open internet access offers similarities to the topic of roaming in regard to charging processes of EVs in Europe. Lessons learned derive from e.g., the need for interoperability between parties, as well as financial barriers, and a culture of open management.[166] It is expected that a running e-roaming system in the EU would foster the deployment of EVs.[167]

4.4 USER-CHI product specific general requirements: SMAC - Smart Charging Tool

4.4.1 Technical Requirements for SMAC

This section and the subsections below describe the technical requirements for the technical USER-CHI product SMAC.

4.4.1.1 Authorization and Authentication Methods

The information provided by the USER-CHI partners regarding the authorization and authentication methods was rather scarce. Nevertheless, the following authorization and authentication methods were reported.

German USER-CHI partners reported the following authentication methods. the 7 Byte UID version was reported as the Radio Frequency Identification (RFID) Card used in Berlin, whereas Bluetooth token authentication in Munich.

No Near-field communication (NFC) or Quick Response-Code (QR-Code) were reported from USER-CHI partners.

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[166] Ferwerda et al, Advancing E-Roaming in Europe: Towards a Single “Language” for the European Charging Infrastructure, World Electric Vehicle Journal, 2018, p.7.
[167] Ferwerda et al, Advancing E-Roaming in Europe: Towards a Single “Language” for the European Charging Infrastructure, World Electric Vehicle Journal, 2018, p.12.

The Ad hoc payment by credit card or debit card was reported to be used by Spanish and German USER-CHI partners.

4.4.2 Legal Requirements for SMAC

4.4.2.1 Legal requirements on the topic of V2G

- NATIONAL LAWS ON THE TOPIC OF V2G AND STATUS OF ITS PRACTICAL IMPLEMENTATION[168]

Table 72 National laws on the topic of V2G and status of its practical implementation

Barcelona	Berlin	Graz	Murcia	Turku
The Spanish legal framework does not include regulations on the topic of V2G so far. However, V2G application could be incorporated in the coming regulation (updating the Law 24/2013).	The German legal framework has established first steps for the national regulatory framework on V2G (§3 No. 25 EnWG defines charging points as 'final users'; § 14 a EnWG includes EVs into the category of controllable consumer devises).	Information not yet reported.	The Spanish legal framework does not include regulations on the topic of V2G so far. However, V2G application could be incorporated in the coming regulation (updating the Law 24/2013). All the activities around the V2G topic are mainly located in the R & D field.	The finish national legal framework does not include legislation regarding the topic of V2G. However, there are on demand side management/demand response markets that are maintained by the DSO (Fingrid). Moreover, technical requirements must be reached to get into the market.

[168] USER-CHI Legal Questionnaire: Q. No. 51, Q. No. 52

- SEPARATION WITHIN THE NATIONAL SCHEME OF ELECTRICITY FED INTO THE GRID AND ELECTRICITY CONSUMED FROM THE GRID[169]

Table 73 Separation within the national scheme of electricity fed into the grid and electricity consumed from the grid

Barcelona	Berlin	Graz	Murcia	Turku
This scheme has been introduced recently in the Spanish national electricity market by the Royal Decree-Law 15/2018 and the Royal Decree-Law 23/2020, especially for domestic photovoltaic production.	§ 18 Ordinance on Charges for Access to Electricity Supply Networks (StromNEV) [170] includes the possibility of charges for the operator of decentralized energy plants, which arise due to the feed-in of electricity and have to be paid by the distribution network operator under certain conditions.	Information not yet reported.	Same as Barcelona	Information not yet reported.

[169] USER-CHI Legal Questionnaire: Q. No. 53
[170] available at: https://www.gesetze-im-internet.de/stromnev/, last accessed: 04.01.2021.

4.5 USER-CHI product specific general requirements: INDUCAR - Inductive charging for e-Cars

4.5.1 Technical Requirements for INDUCAR

This section and the subsections below describe the technical requirements for INDUCAR.

The wireless charging of EVs is a user-centred requirement with the aim of making the use of EVs as comfortable as possible. The challenges for implementation are high. The installation space in the electric vehicle that can be considered for a wireless charging system is limited and the different vehicle types have very different ground clearances, which also depend on the loading condition of the vehicle. The electro-magnetic energy transfer is only reliable and efficient if the two corresponding inductors are optimally located in relation to each other. The Figure 20 shows the sequence specified in the IEC 61980-2 standard from the approach of the vehicle to the fine positioning above the infrastructure-side charging device and the subsequent control of the energy transmission.

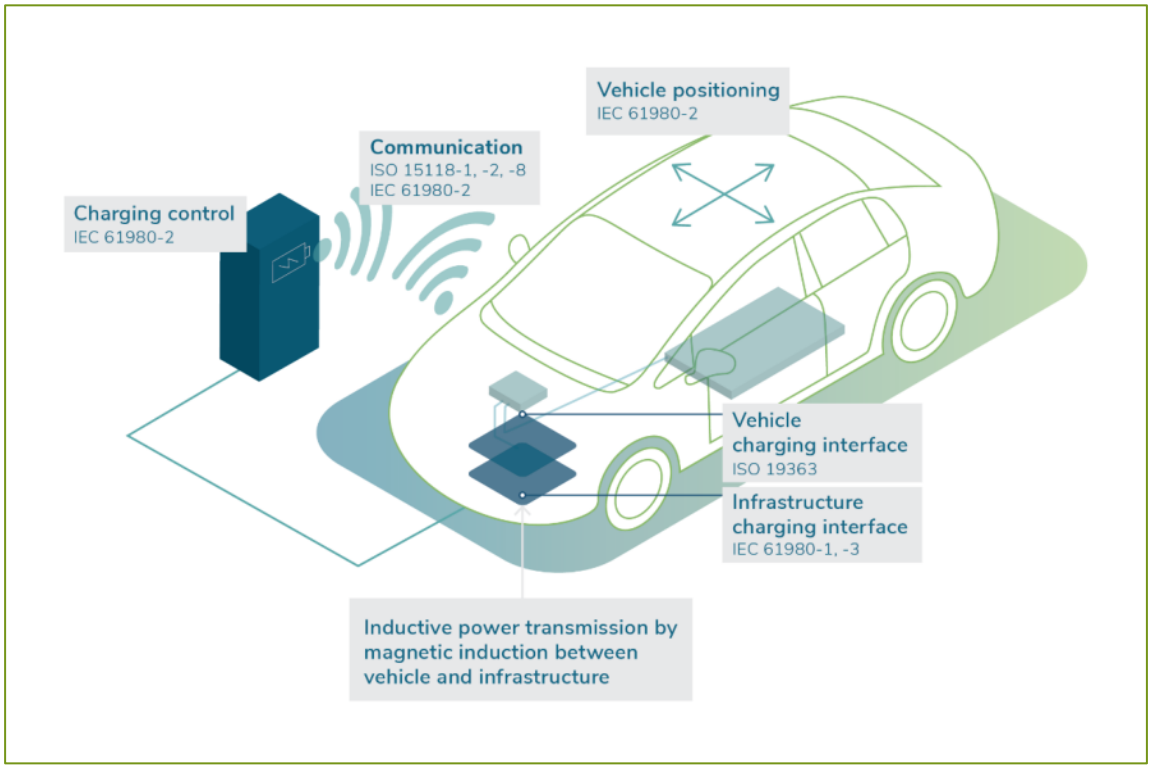


Figure 20 Wireless charging of EVs. Source: NPE 2017: 32

4.5.1.1 Safety and operation for wireless charging, electro-magnetic compatibility (EMC) and magnetic field emissions

Italian and German USER-CHI partners reported technical requirements for safety and operation for wireless charging, electro-magnetic compatibility (EMC) and magnetic field emissions. For this typology of sources, the Italian normative framework aiming to protect the general public against established adverse health effects that may result because of exposure to electro-magnetic fields (0 Hz - 300 GHz), follows the Council Recommendation 1999/519/EC and IEC TS 62764-1[171]. On the other hand, the E DIN EN IEC 61980-1 VDE 0122-10-1:2020-11 Electric vehicle wireless power transfer (WPT) systems[172]; DIN EN 50364:2002-05, VDE 0848-364:2002-05[173]; DIN EN IEC 61000-6-1:2019-11, VDE 0839-6-1:2019-11[174]; and the SAE J2954-Standards, Norm SAE J2847/6[175] should be considered in Germany.

4.5.1.2 Testing of hardware/charging Infrastructure - Electro-magnetic Compatibility (EMC)

The Table 74 below provides an overview on the international standards for EMC. Italian USER-CHI partner reported IEC 61851-21-2:2018 Electric vehicle conductive charging system - Part 21-2: Electric vehicle requirements for conductive connection to an AC/DC supply - EMC requirements for off board electric vehicle charging systems[176], and the Directive 2014/30/EU[177] on the harmonisation of the laws of the Member States relating to EMC as the main requirements in Italy. German USER-CHI partners, on the other hand, reported the DIN EN IEC 61000-6-1 VDE 0839-6-1:2019-11[178] as the main requirement for EMC in Germany.

[171] available at: IEC TS 62764-1:2019 - IEC-Normen - VDE VERLAG (vde-verlag.de)
[172] available at: E DIN EN IEC 61980-1 VDE 0122-10-1:2020-11 - Standards - VDE Publishing House (vde-verlag.de)
[173] available at: DIN EN 50364 VDE 0848-364:2002-05 - Normen - VDE VERLAG (vde-verlag.de)
[174] available at: DIN EN IEC 61000-6-1 (VDE 0839-6-1):2019-11 (dke.de)
[175] available at: Induktive Ladesysteme: Interoperalität und Validierung von SAE TIR J2954 - electrive.net
[176] available at: IEC 61851-21-2:2018 | IEC Webstore
[177] available at: EUR-Lex - 32014L0030 - EN - EUR-Lex (europa.eu)
[178] available at: DIN EN IEC 61000-6-1 VDE 0839-6-1:2019-11 - Standards - VDE Publishing House (vde-verlag.de)

Table 74 EMC requirements. Source: NPE 2017: 16

Requirements	Standard	Description
Electro-magnetic compatibility (EMC)	IEC 61851-21-1:2017[179]	Electric vehicle conductive charging system - Part 21-1 Electric vehicle on-board charger EMC requirements for conductive connection to AC/DC supply
	IEC 61851-21-2:2018[180]	Electric vehicle conductive charging system - Part 21-2: Electric vehicle requirements for conductive connection to an AC/DC supply - EMC requirements for off board electric vehicle charging systems

Moreover, Varro reported further national requirements that charging stations must meet for interference emission in residential areas and interference resistance in commercial areas in Germany[181], namely:

- DIN EN 61000-6-1 (VDE 0839-6-1):2007-10 Electro-magnetic compatibility (EMC) - Part 6-1: Generic standards - Immunity for residential, commercial, and light-industrial environments (IEC 61000-6-1:2005); German version EN 61000-6-1:2007
- DIN EN 61000-6-3 (VDE 0839-6-3) Electro-magnetic compatibility (EMC) - Part 6-3: Generic standards - Emission standard for residential, commercial, and light-industrial environments (IEC 61000-6-3); German version EN 61000-6-3

4.5.2 Legal Requirements for INDUCAR

- NATIONAL REGULATION IMPLEMENTED ON THE TOPIC OF INDUCTIVE CHARGING [182]

In neither the German, the Spanish, the Finnish nor the Austrian legal framework special provision on the topic of inductive charging are yet applied. Within the Spanish legislation framework, the topic of inductive charging is a research and development activity.

[179] available at IEC 61851-21-1:2017 | IEC Webstore
[180] available at: IEC 61851-21-2:2018 | IEC Webstore
[181] Varro 2013
[182] USER-CHI Legal Questionnaire Q. No. 57

4.6 USER-CHI product specific general requirements: INSOC - Integrated Solar DC-Charging for LEVs

4.6.1 Technical Requirements for INSOC

The technical requirements for INSOC consider the following aspects, but are not available yet:

- Energy supply for LEVs charging box – Photovoltaic (PV) systems
- Technical requirements of the grid operator and metering device operator
- Energy Storage
- Location of LEVs charging infrastructure
- Technical connection rules
- Grid connection, provision of the grid connection and commissioning
- Supply of electric energy for electric vehicles (EVs) charging infrastructure
- Product standards and electrical safety
- Charging plug components for LEVs charging
- Hardware requirements for installed LEVs charging box
- Safety and standard-compliant design of the LEVs charging Box (Box envelope, PV Module)
- Testing of the LEV box hardware components
- Booking & Billing
- Communication protocols
- Authorization and authentication methods
- Technical records and documentation

4.6.2 Legal Requirements for INSOC

4.6.2.1 Building and construction law

- PERMISSIONS REQUIRED FOR THE INSTALLATION OF A PHOTOVOLTAIC SYSTEM BY NATIONAL BUILDING AND CONSTRUCTION LAW REGARDING SPECIFIC SIZES OF CONSTRUCTIONS[183]

Table 75 Permissions required for the installation of a PV system by national building and construction law regarding specific sizes of constructions

Barcelona	Berlin	Graz	Murcia	Turku
The photovoltaic installations without grid connection, or with grid connection, with a maximum capacity of 15 kW, do not require permissions in urban areas. Otherwise, the permissions needed are identified in: 'Real Decreto-ley the Royal Decree-Law 15/2018' and in the 'Real DecretoRoyal Decree 244/2019'.2019. The modifications included in the 'Real Decreto-leyRoyal Decree-Law 23/2020' and the former legislation	Building permits are not needed for the installation of photovoltaic systems (PV systems) on top of buildings in the city of Berlin. On the other hand, PV systems which are independent from buildings and taller than 3 meters or longer than 9 meters, need a building permission. ground-mounted systems) with a height of more than 3 meters	Information not yet reported.	Information not yet reported.	A construction permit is requested if the solar panels are not installed on rooftops. Moreover, industrial size plants are subject to other requirements.

[183] USER-CHI Legal Questionnaire: Q. No. 58

Barcelona	Berlin	Graz	Murcia	Turku
'Real Decreto-LeyRoyal Decree-Law 1955/2000' should also be considered.	and a length of more than 9 meters need a building permit.			
Florence: the installation of PV systems is regulated by the landscape protection law, which is a law of the national level, on 60% of its territory. **Florence:** The installation of PV systems is regulated by the landscape protection law, which is a law of the national level. This implies that a permission is required from the Cultural Heritage Superintendence (Sovrintendenza ai Beni Culturali) for the LEV box including the PV systems. At local level, urban plans define different zones of the city, where different regulations are in force. All the above-mentioned rules arise from the local planning regulations of the Municipality of Florence (Regolamento Urbanistico del Comune di Firenze).				

- INSTALLATION OF PV SYSTEMS FOR LEV CHARGING STATIONS IN URBAN AND RURAL AREAS[184]

Table 76 Installation of PV systems for LEV charging stations in urban and rural areas

Barcelona	Berlin	Graz	Murcia	Turku
If the installation takes place in a private space in a within the city of Barcelona, the requirements will be the same as explained in question 57. But if the installation takes place a public space, the previous permission from the Town Hall is mandatory.	The differences regarding the German legal framework on road use arise between installation on public and private space. For the installation in Berlin on public ground a special use permit from the road traffic authority is needed in accordance to §11 (1) Berlin Street Law (BerlStrG). Furthermore, in regard to INSOC a building permit might be needed for the LEV boxes, where the PV systems will be installed on the roof. However, the exemption of § 61 (1) No. 1 b) BauOBln might be applicable for the container-boxes of INSOC. For structural facilities (§ 2 (1) 2 Building Code Berlin (BauOBln) building permits are	Information not yet reported.	Information not yet reported.	Information not yet reported.

[184] USER-CHI Legal Questionnaire: Q. No. 59

Barcelona	Berlin	Graz	Murcia	Turku
	needed in accordance to § (1) 59 BauOBln. However, § 61 (1) No. 1 b) BauOBln states that covered parking spaces for bicycles, each as well as their storage rooms with an average wall height of up to 3 m per wall and a gross floor area of up to 30 m^2, do neither need a building permit nor does an obligation to notify the building authority arise. This exemption might be applicable for the container-boxes of INSOC.			

- REQUIREMENTS FOR THE CONSTRUCTION OF PV SYSTEMS REGARDING FIRE PROTECTION PROVISIONS[185]

Table 77 Requirements for PV systems regarding fire protection provisions

Barcelona	Berlin	Graz	Murcia	Turku
In the Spanish legal framework, the requirements for the installation of PV systems regarding fire protection provisions are set at the national level by the Royal Decree 842/2002 which enacts the Electrotechnical regulation for low voltage (Reglamento electrotécnico para baja tension or REBT[186]). At the local level, the requirements derive from the REBT in the technical regulation ITC-BT 40.	TheRegarding the German legal framework, the requirements for the design of PV systems regarding fire protection provisions depend on the type of buildings or use of special buildings. These requirements are specified within the BauO Bln.	Information not yet reported.	Same as Barcelona.	In the city of Turku, the requirements for the installation of PV systems regarding fire protection provisions are considered as regular electrical requirements. Moreover, breakers and other additional requirements are needed.

[185] USER-CHI Legal Questionnaire: Q. No. 60

[186] Royal decree 842/2002 – Electrotechnical regulation for low voltage (REBT, Reglamento electrotécnico para baja tension), (available at: https://www.hylaw.eu/database/national-legislation/spain/royal-decree-842-2002-electrotechnical-regulation-for-low-voltage-rebt-reglamento-electrotcn, last accessed: 04.01.2021).

4.6.2.2 Energy Law

- RIGHTS AND DUTIES ARISING FOR ELECTRICITY GENERATORS AND SUPPLIERS UNDER THE APPLICABLE NATIONAL ENERGY LAW[187]

Table 78 Rights and duties for electricity generators and suppliers under national energy law

Barcelona	Berlin	Graz	Murcia	Turku
No rights and duties arise if the PV system is not connected to the grid. In case the photovoltaic generator plant is connected to the grid and has a power up to 15 kW, the 'Real Decreto-leyRoyal Decree-Law 15/2018' and 'Real DecretoRoyal Decree 244/2019' should be considered for rights and duties.	The obligations for the operation of PV systems under the German energy law framework are spread across a high number of regulations in the Energy Industry Act (EnWG), Renewable Energy Sources Act (EEG),)[188] and the Electricity Tax Law (StromStG), as well Electricity Tax Ordinance (StromStV). (StromStV)[189] and can be roughly divided into:	Information not yet reported.	Information not yet reported.	Information not yet reported.

[187] USER-CHI Legal Questionnaire: Q. No. 62
[188] available at: https://www.gesetze-im-internet.de/eeg_2014/, last accessed: 04.01.2020.
[189] available at: http://www.gesetze-im-internet.de/stromstv/, last accessed: 04.01.2020.

4.6.2.3 Legal framework regulating road use

- PERMISSIONS WHICH ARE REQUIRED BY NATIONAL ROAD USE LAW IN ORDER TO SET UP A LEV BOX ON PUBLIC GROUND[190]

Table 79 Permissions which are required by national road use law in order to set up a LEV box on public ground

Barcelona	Berlin	Graz	Murcia	Turku
The permission from the national or regional administration would be mandatory, if the set up would take place in rural roads, outside from the urban area. On the other hand, if the set up will take place in urban streets the permission from the local administration (Town Hall) (See question 61) will be needed.	Setting up a LEV box in public spaces falls fall under the category of special use in accordance to § The § 11 (1) Berlin Street Law (BerlStrG). Therefore, a special use permit would be needed from one of the twelve civil engineering offices of the districts of Berlin.	Information not yet reported.	Information not yet reported.	Information not yet reported.

[190] USER-CHI Legal Questionnaire: Q. No. 63

- PRESERVATION OF HISTORICAL MONUMENTS IN FORCE OPPOSING THE CONSTRUCTION OF A "LEV BOX" AND A PHOTOVOLTAIC SYSTEM FOR LEV CHARGING STATIONS [191]

Table 80 Preservation of historical monuments in force opposing the construction of a "LEV box" and a photovoltaic system for LEV charging stations

Barcelona	Berlin	Graz	Murcia	Turku
In the Spanish context, local provisions differ from city to city. In Barcelona there are no provisions in place, which are related to the preservation of historical monuments only. In each municipality, there are several restrictions about visual impact, accessibility, and safety for pedestrian amongst others.	In the German context, § 10 (1) Law for the protection of historic monuments in Berlin (DSchG Bln) needs to be considered. This regulationIn accordance with § 10 (1) DSchG Bln: The immediate surroundings of a monument, as far as they are of formative importance for its appearance, may not be changed in such a way that the character and the appearance of the monument are substantially impaired by the construction or alteration of structural facilities, by the design of undeveloped public and private areas or in any other way. These requirements might influence appearance requirements for LEV boxes on publics pace.	Information not yet reported.	In Murcia there are protected buildings and public spaces where the construction of a "LEV box" and a PV system for LEV charging stations would need a special authorisation. Nevertheless, most of the public urban space should be evaluated to install such facilities.	Information not yet reported.

[191] USER-CHI Legal Questionnaire: Q. No. 64

Barcelona	Berlin	Graz	Murcia	Turku
Florence: A permission is either needed or strongly recommended permission is needed (or when not needed is strongly recommended Protection Authority (Soprintendenza per i beni architettonici e paesaggistici), if the box is located inside an area protected by cultural heritage regulation.				

5. Specific Requirements for USER-CHI solutions

As described in Section 3.3, the requirements have been classified in groups based on the product they refer to; thus, there is one group of requirements for CLICK, INFRA, INSOC, INDUCAR and EMOBEST and two groups of requirements for INCAR and SMAC (see Figure 3).

According to the approach presented in Section 3.1 and the Volere methodology described in Section 3.3.2, the specific requirements for the USER-CHI solutions have been defined. This activity has been performed in a cooperative way among the different members of the consortium. It should also be noted that these specific requirements will serve as an input to define the product Use Cases (UC), while at the same time are inputs for the Usage Scenarios that are described in the deliverable 1.2 of WP1.

The lists of requirements presented in this Section are the result of the three iterations performed following the Volere methodology and built on the foundations of the General defined in Section 4.

5.1 CLICK product

This chapter describes the Specific Requirements for the technical USER-CHI product CLICK introduced by the partners through the Volere tool.

5.1.1 Overview

As stated in the DoA, CLICK is the USER-CHI product for supporting administrators within the process of top-down location planning for charging infrastructure in cities and the TEN-T corridors. CLICK consists of a question-and-answer online tool considering user's needs and habits in regard of charging technologies. The results generated by CLICK will address exact proposed locations, preferred technologies as well as the number of charging points needed, amongst other factors. Moreover, CLICK will enable a post-planning monitoring process by offering interfaces to be fed with actual utilisation of data of electric vehicle supply equipment (EVSE). This will trigger the demand-oriented expansion of the charging infrastructure network.

Figure 21: CLICK product icon

The General Requirements for CLICK have been obtained by the research study and the questionnaires were described in section 4.2. As a summary, the most relevant ones are:

- CLICK must have a web-frontend for interaction with the urban planner. The frontend should incorporate:
  - A map interface implemented by standard solutions (e.g., leaflet based on OpenStreetMap) for the user interaction with the tool.
  - A public and a private area, where the publicly accessible area will contain basic information and the access restricted area will contain the planning process.
  - A specific design to be used from within a professional environment, with a desktop equipment setup.
- CLICK must have backend that runs the calculations for the planning process and derive the recommendations for their charging infrastructure development.
  - CLICK backend must support the storage of results and inputs. The user must be able to save his planning process and results at specific stages of the process. A reprocessing of calculations should be possible. Therefore, a database should be used.
  - CLICK results should be made available to the user via the web interface. A provision of the results in file format for export (e.g., csv, xlsx) should be considered, a provision of the result in standard geo exchange formats (e.g., shape format) could be considered.

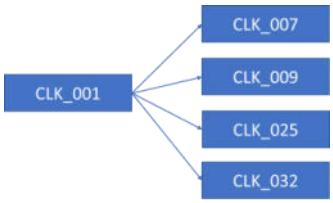
- CLICK could offer a monitoring functionality. Usage data of existing charging points should be importable to CLICK via a file-based transfer (comma separated csv file). CLICK could implement an interface to INCAR to receive actual usage data and could implement interfaces to other existing platforms (e. g. Hubject).

5.1.2 Figures of the Validation and Revision process

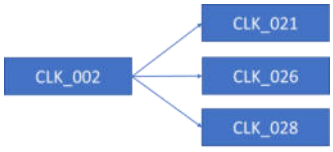
5.1.2.1 Dependencies

During the three iterations of the Volere methodology carried out in USER-CHI, a total of 12 dependencies among the CLICK requirements were identified by the validators.

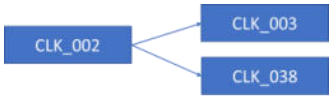
Most of them helped to identify different requirements that were referred to the same content and, in addition, to identify if some of them could be merged. The dependencies and main comments provided by the validators are shown in the Figure 22.



"Five requirements are related to the scope of the product, the facilities which are related to and the main outputs"

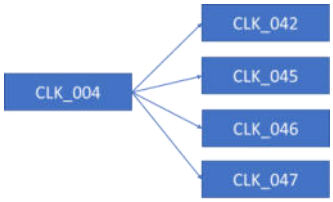


"All these requirements are related to the need of accurate information about movement patterns hour to hour"

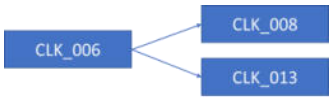


"Data basis for CLICK product must be based on various type of inputs (mobile GPS, building information, open data from maps of city...)"

"CLK 27 has a high dependency on information provided by the grid operators"

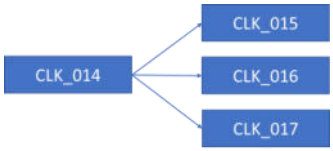


"All of them are related to the legal constraints for installing charging points at different levels: European, national, regional and local"

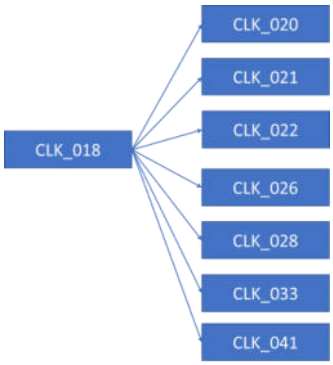


"These requirements could be merged in only one about the usability and humanity performance for CLICK tool"

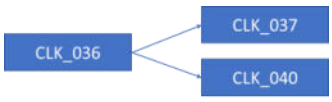
"These requirements could be merged in only one about the usability and humanity performance for CLICK tool"



"This set of requirements propose several functional steps for CLICK, and are related to urban data."



"As CLK_020 explain, a detailed description of CLICK output (maps and tables) is required: location, power, demand (present and future), demand components (private, commercial...), cost of installation, formats... per charging point and in global (network). The eight requirements could be merged in two or three related to the CLICK output."



"Consider to merge these three requirements about forecast"

"Both requirements are related to include estimations of future population change"

"Both requirements are related to consider the already existing plans of the city"

Figure 22: CLICK Product. Dependencies identified during the requirement definition process.

5.1.2.2 Conflicts

With regards to CLICK products, only one conflict was detected during the requirement definition process, as it is shown in .

Figure 23: CLICK Product. Conflict identified during the requirement definition process

The conflict between CLK_039 and CLK_043 was raised because it was not clear if the word "plans" in both requirements referred to the same concept. It was solved pointing the difference between plans for charging infrastructure development and SUMPs.

5.1.2.3 Objections

During this process, also four Objections were raised regarding to the CLICK product, as it is shown in Figure 24.

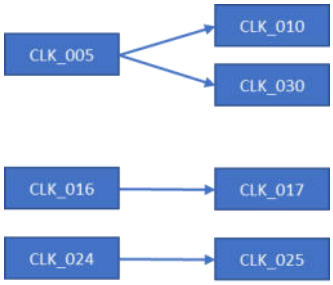


Figure 24 CLICK Product. Objections identified during the requirement definition process

"To make interfaces with some private CPO or EMSP can be difficult for CLICK. I suggest to declare data from the existing charging points as a second level input for CLICK."

"Other data must be also included: legal, existing charging points, new plans, grid availability…"

"It will depend on the information the cities are providing, however cities could be reluctant to share the information with external companies such as housing companies or CPOs"

"Some aspects such as monumental protection of historic buildings could help planners to choose between locations"

"Other data must be also included: legal, existing charging points, new plans, grid availability…"

"It will depend on the information the cities are providing, however cities could be reluctant to share the information with external companies such as housing companies or CPOs"

5.1.1 Final list of requirements

After the three iterations of identifying and solving issues from the preliminary requirement list introduced in Volere Tool, the final list of requirements have been obtained. An overview of all CLICK requirements provided by the consortium can be found in Table 81:

Table 81: Summary of CLICK specific requirements

ID	Description	Type
CLK_001	CLICK should support the Planning Process of Charging Infrastructure	The purpose of the product
CLK_002	A feasible location search and location optimization must be based on detailed information: Building structure, type of area, parking pressure, #of registered vehicles, movements per day (ideally on basis of cell phones), means of mobility,	Functional and data requirements
CLK_003	Data availability should be supported by cities, access to city information should be granted free of charge	Functional and data requirements
CLK_004	National regulations should be included	Functional and data requirements
CLK_005	AI learning integration: Lessons learned on certain locations (type of area, type of street, traffic, etc.) should be shared and an AI function should make best guess based on those learnings	Functional and data requirements
CLK_006	CLICK should be a question-and-answer online tool that current usability requirements to guide the user through the planning process.	Look and feel requirements
CLK_007	The focused user of CLICK should be an urban planner.	Users of the product
CLK_009	CLICK must follow a top-down-approach.	The scope of the product
CLK_010	CLICK could implement interfaces to charging station backends in order to retrieve usage data for monitoring functionalities	Functional and data requirements
CLK_011	CLICK must have a multi-step planning functionality	Functional and data requirements
CLK_012	CLICK could have a Monitoring functionality	Functional and data requirements

CLK_014	CLICK should gather information about the goals and targets of the cities in the first step	Functional and data requirements
CLK_015	CLICK should gather basic information about the city (e.g. population, size etc.) in the second step	Functional and data requirements
CLK_016	CLICK should gather information about the city structure in the third step	Functional and data requirements
CLK_017	CLICK should gather city structure information in the fourth step	Functional and data requirements
CLK_018	CLICK should give a recommendation on charging station placement within areas after completion of data input	Functional and data requirements
CLK_019	CLICK should provide an option to change inputs and recalculate the recommendation	Functional and data requirements
CLK_020	CLICK results should be provided as a map and a basic data table	Functional and data requirements
CLK_021	CLICK must provide location-based forecasts of charging demands	The purpose of the product
CLK_022	CLICK should produce reliable statements for the business model of charging infrastructure	The scope of the work
CLK_024	CLICK should be designed to support housing companies in the planning process of charging infrastructure	Users of the product
CLK_025	CLICK should be designed to support charging operators in the planning process of charging infrastructure	Users of the product
CLK_026	CLICK should forecast how many charging processes per day can be expected at a certain location in the city	Performance requirements
CLK_027	Click should provide information on the availability of electrical power in the local grid	Functional and data requirements
CLK_028	CLICK should evaluate the frequency of site visits	Functional and data requirements
CLK_030	CLICK must display all charging points already in place	The scope of the product
CLK_031	CLICK should provide advice for dimensioning new charging stations (quantity vs power)	The scope of the product
CLK_032	CLICK should categorize the attractiveness of a planned charging infrastructure location based on the collected data	The scope of the product
CLK_033	CLICK could give a prospect of charging infrastructure demand for a certain time period ahead	The scope of the product

CLK_034	CLICK could support information on time spent on hotspots (shops, work), so information can be used to decide power of the charger	Functional and data requirements
CLK_035	CLICK should interconnect all forms of travel (busses, bikes, walking…)	Functional and data requirements
CLK_036	Should support estimations of future EV population and calculate needed charging infrastructure	Functional and data requirements
CLK_037	Should support estimations of future population change	Functional and data requirements
CLK_038	Easily use open access data	Functional and data requirements
CLK_039	Ability to add already existing/set future plans into CLICK	Functional and data requirements
CLK_040	Should support different simulation of predicting future population	Functional and data requirements
CLK_041	Click could differentiate between demand created by different users (private/commercial: fleet, freight transportation).	The scope of the product
CLK_042	CLICK should take into account the permits needed for building infrastructure in public spaces	Legal requirements
CLK_043	CLICK should take into account SUMP (Sustainable Urban Mobility Plans) of cities - if available	Cultural and political requirements
CLK_046	CLICK should consider requirements of public / stakeholder participation in regard to infrastructure planning - if mandatory / existing	Legal requirements
CLK_047	CLICK should consider requirements deriving from national laws on preservation of historical monuments	Legal requirements
CLK_048	Click could provide information on the availability of fibre network	Functional and data requirements
CLK_049	CLICK could use "Connection Time" or "Grid Connection Time" as one dimension instead of or in combination with "charging time".	Functional and data requirements
CLK_050	CLICK should have a public and a private section, where the public contains general information and the private (user restricted) holds the actual planning process	Functional and data requirements
CLK_051	CLICK should use standard tools and components (e.g., leaflet)	Functional and data requirements

CLK_052	CLICK should have a storage functionality in order to pause and resume the process	Functional and data requirements
CLK_053	CLICK could consider other data as legal requirements, data from existing charging points, data about new plans, grid availability, fibre network availability	Functional and data requirements
CLK_054	CLICK could consider special user groups as e-taxi drivers, carsharing operators, commuters.	Functional and data requirements
CLK_055	CLICK should consider the suitability of the distribution grid for potential charging infrastructure locations as well as potential grid-side effects.	The scope of the product

5.2 INCAR product

5.2.1 Overview

INCAR is the USER-CHI product that allows barrier-free access to electric vehicle charging points along the TEN-T corridors and integrates innovative services for electric vehicle drivers.

INCAR is a user-centred roaming platform with integrated services for both operators and drivers of electric vehicles. INCAR will offer automated, transparent, and flexible payment and identification services to ensure barrier-free and operator-independent access to ultra-fast and slow charging for end users, while also offering services to maximize availability and accessibility to the EVSE, providing real-time information, reservation and routing services for electric vehicle drivers that will enhance their seamless experience with electric vehicle charging and daily parking activities. This will reduce the "charging anxiety" of the electric vehicle driver, one of the three main barriers for drivers to buy an electric car and improve the satisfaction level of electric vehicle drivers in relation to the charging process due to the elimination of current accessibility barriers. and the new services provided.

Figure 25 INCAR product icon

The General Requirements for INCAR have been obtained by the research study and the questionnaires were described in section 4.3. As a summary, the most relevant ones are:

- INCAR must have a mobile application for interaction with the end user (EV drivers). It should incorporate
  - A map interface for the user interaction with the app when finding or booking a charging station.
  - A wallet to allow the payment of the charging by the end-user.

- Routing services to guide the end-user to the selected charging point.
- Real-time information of the charging points status.

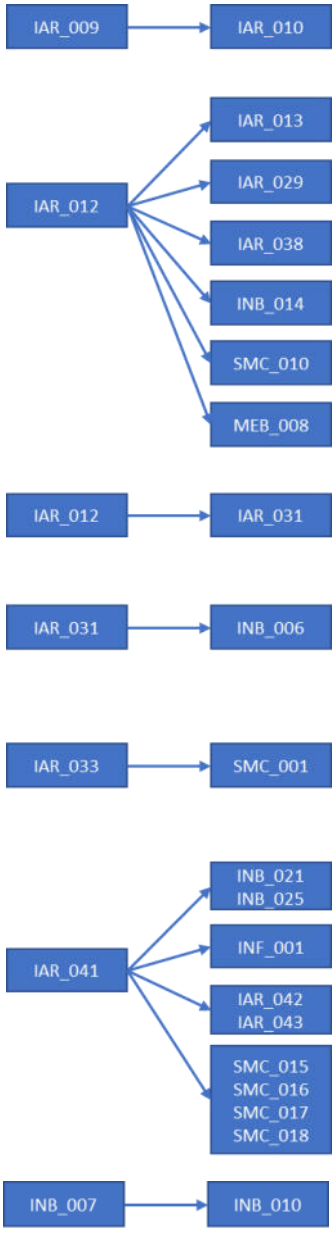
- INCAR must have a web frontend for interaction with charging point operator (CPO). It should incorporate
  - An interface to introduce a new CPO or EMSP into the INCAR platform.
  - An interface to allow the CPO to have access to their Charging Data Record (CDR) and payments.
- A backend that contains all the services provided by the INCAR platform, both for end-users and professionals. The INCAR backend should accomplish with the follow General Requirements:
  - INCAR backend must support the storage CDRs in a transparent and a secure way. The CPOs and EMSPs should have access to this information.
  - INCAR should manage the payments between the CPO and EMSP in an integrated and automatic way. The interaction and the information provided by the platform should be user friendly for the CPOs and EMSPs.
  - INCAR should be able to manage reservations through the INCAR app.
  - INCAR should be able to provide value added information to city planners.
  - INCAR should be able to manage the start and end of a charging session through the INCAR app.

5.2.2 Figures of the Validation and Revision process

5.2.2.1 Dependencies

During the three iterations of the Volere methodology carried out in USER-CHI, 5 dependencies were identified among the INCAR requirements and 3 more dependencies were identified by the validators among other USER-CHI products, INFRA and SMAC.

In the case of INCAR, most of the dependencies helped to identify links among the requirements that should be considered for different reasons. The main comments provided by the validators as well as the list of dependencies are shown in the Figure 26.



"Listing the nearest available EVSEs is only possible if the user gives permission to access GPS"

"To implement V2G it is necessary to have a planned time of arrival & departure for EV who are able to perform V2G. We should know in advance the available "time for charging. There is a strong dependency with INCAR backend and SMAC".

"INCAR can only provide information about whether a parking spot with charging infrastructure is free or occupied if authorized users are able to reserve/book an EVSE"

"INCAR could inform about availability if this information is reported from CPO to INCAR. If there is relevant information not covered in OCPI, it should be studied how could be reported to INCAR."

"Set charging preferences has sense when smart charging operations are available, in other words only if the charging point supports Smart Charging operations"

"This list of requirements depends on requirement INF_001 as legal and contractual aspects should be studied in INFRA".

"When a CPO creates a CDR or updates EVSEs status, CPO must send this information to INCAR/EMSPs. This is the general workflow"

Figure 26: INCAR Product. Dependencies identified during the requirements definition process

5.2.2.2 Conflicts

With regards to INCAR product, only one conflict was detected during the requirement definition process, as it is shown in Figure 27.

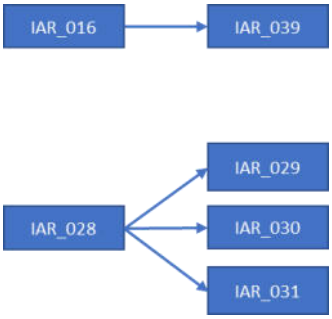
"The aim of INCAR is not to specify tariffs or costs. The associated cost of charging transactions is defined by CPOs and EMSPs"

Figure 27: INCAR Product. Conflict identified during the requirements definition process

The conflict between INB_048 and INB_049 was raised because it was not clear if the charging tariffs was decided by INCAR or by the CPOs. It was solved clarifying that INCAR will not take decisions about costs, which will be set by the different CPOs of the platform.

5.2.2.3 Objections

During this process, also four Objections were raised regarding to the CLICK product, as it is shown in Figure 28.



"We should define beforehand in which language(s) the app should be. (Suggestion: Language spoken in the demonstration city + English)"

"INCAR will communicate with charging points operators by means of standard OCPI. If there is a parking operator which requires communications with the INCAR platform that are not covered in OCPI, a proposal from the parking operator will be necessary"

Figure 28: INCAR Product. Objections identified during the requirements definition process

5.2.3 Final list of requirements

After the three iterations of identifying and solving issues from the preliminary requirement list introduced in Volere Tool, the final list of requirements have been obtained. An overview of all INCAR requirements provided by the consortium can be found in Table 82:

Table 82: Summary of INCAR specific requirements

ID	**Description**	**Type**
IAR_001	INCAR should include information/connection to services provider dedicated to the EV users during the charging time	Usability and humanity requirements
IAR_002	Voice command of app	Functional and data requirements
IAR_003	INCAR app must be able to run under Android and iOS operating systems	Operational requirements
IAR_004	INCAR should allow users to give their instant feedback regarding specific charging experiences and the usage of the application itself.	Functional and data requirements
IAR_005	INCAR app must offer certain features and functionalities to authenticated users only	Security requirements
IAR_006	Personal data must not be stored in mobile application storage	Legal requirements
IAR_007	INCAR app users should be informed about application updates	Operational requirements
IAR_008	INCAR app must show INCAR EVSEs located in a map view	Functional and data requirements
IAR_009	INCAR app should list the nearest available EVSEs regarding the current position of the user	Functional and data requirements
IAR_010	INCAR app must ask users to grant permission to access mobile device GPS	Legal requirements
IAR_011	Current availability status of EVSEs should be represented in map view	Look and feel requirements
IAR_012	Authorized users must be able to reserve/book an EVSE	Functional and data requirements
IAR_013	Authorized users should be able to cancel an existing reservation of an EVSE	Functional and data requirements
IAR_014	EVSE information must include types of connector	Functional and data requirements
IAR_015	INCAR app should use project styles, fonts and colors	Look and feel requirements

IAR_016	INCAR app must be available in English	Usability and humanity requirements
IAR_017	INCAR app should show charging tariffs for EVSE	Functional and data requirements
IAR_018	INCAR app must be connected to the internet	Mandated constraints
IAR_019	INCAR app must support the start and stop of a charging session	Functional and data requirements
IAR_020	INCAR app supports a European wide modal car routing	Functional and data requirements
IAR_021	INCAR app could support a multimodal routing for integrated pilot sites	Functional and data requirements
IAR_022	INCAR app could show charging transaction history in a list view	Functional and data requirements
IAR_023	INCAR app should be available 24/7 during pilot demonstration with a 96% availability	Operational requirements
IAR_024	INCAR app should allow to display different Points of Interest (POI) in map view	Functional and data requirements
IAR_025	INCAR app backend must implement OCPI 2.2 in order to communicate with INCAR backend	Functional and data requirements
IAR_026	INCAR app must have access to Identity and Access Management (IAM) system to confirm eMSP user credentials for authentication	Functional and data requirements
IAR_027	INCAR app should facilitate an end-user to interact with INCAR functionalities	The purpose of the product
IAR_028	INCAR must have an interface to parking facilities and must enable the reservation and digital payment of parking	The purpose of the product
IAR_029	INCAR should enable digital booking for long-term and short-term parking	The scope of the product
IAR_030	INCAR should provide geographic information about parking spots with charging infrastructure	Functional and data requirements
IAR_031	INCAR should provide information of whether a parking spot with charging infrastructure is free or occupied	Functional and data requirements
IAR_032	INCAR must have its own payment and accounting processes for authorized users	The scope of the product

IAR_033	INCAR app users must be allowed setting charging preferences of an ongoing charging session	Functional and data requirements
IAR_034	INCAR app should display the SoC (if technically available) of the cars during charging process	Functional and data requirements
IAR_035	INCAR must be developed to be a fully 'Managed Service'	The client, the customer and other stakeholders
IAR_036	Application should show estimated price and time for charging to specific charge	Functional and data requirements
IAR_037	Application should have high demand warning, when charging power is lowered due high demand	Functional and data requirements
IAR_038	Customer should be able to set estimated time of the charge, so power can be adjusted. (like overnight stay)	Functional and data requirements
IAR_039	Incar app must be multilingual	Usability and humanity requirements
IAR_040	Should show information of falsely blocked charging point to end user.	Functional and data requirements
IAR_041	INCAR should consider legal privileges for parking of EVs in cities - if available	Legal requirements
IAR_042	INCAR must take into account the concept of privacy by design based on the GDPR	Legal requirements
IAR_043	INCAR needs to consider national data protection laws	Legal requirements
IAR_045	INCAR should support car sharing	Operational requirements
IAR_046	INCAR should allow the users plan long range trips	The scope of the product
IAR_047	The app should show the user a step by step onboarding (introduction of features and usage).	Usability and humanity requirements
IAR_048	INCAR app should display settings to the user.	Functional and data requirements
INB_001	INCAR must implement OCPI 2.2 version	Operational requirements
INB_002	INCAR must manage, store and redirect charging transactions information	Functional and data requirements

INB_003	Due to legal restrictions, INCAR must not store customer personal information	Legal requirements
INB_004	INCAR backend must be able to interface with charging point operators (CPOs)	Operational requirements
INB_005	INCAR backend must be able to interface with e-mobility service providers (EMSPs)	Operational requirements
INB_006	EVSEs information (location, status, connector type, etc.) must be provided by CPOs to INCAR backend	Operational requirements
INB_007	At the end of each charging session, the CPO must send the charging detail information to INCAR. The platform backend will redirect the data to the EMSP. This information contains all relevant data about the charging session	Operational requirements
INB_008	The E-Mobility Dashboard must offer a map with the location and status of the elements of the electromobility in the city	Functional and data requirements
INB_009	When the user clicks the representation of an element in the E-Mobility Dashboard, characteristics details and status of that element must be displayed	Functional and data requirements
INB_010	CPOs must provide real-time information about EVSEs status to INCAR backend, which will offer this information to final users by means of driver app	Operational requirements
INB_011	EMSPs must register their customers information in the platform identity provider	Operational requirements
INB_012	CPOs platforms must implement OCPI 2.2 protocol version	Operational requirements
INB_013	EMSPs platforms must implement OCPI 2.2 protocol version	Operational requirements
INB_014	INCAR should provide information if the CPO is equipped for V2G service and at which condition	The client, the customer and other stakeholders
INB_015	Tariff based on kWh and time	Functional and data requirements
INB_016	Reservation function on location level with multiple CPs	The scope of the product
INB_017	Blocking/ false parker information	The scope of the product
INB_018	Reservation switch to another pole at same location or next location	The scope of the product

INB_019	INCAR backend must be able to interface with INCAR app backend	Functional and data requirements
INB_020	INCAR should include digital management of access authorizations	The scope of the product
INB_021	INCAR should follow the guidelines published by the Alliance for Parking Data Standards (APDS) to facilitate seamless integration for potential users	The client, the customer and other stakeholders
INB_022	The INCAR dashboards should show statistical information of the recharge operations	Functional and data requirements
INB_023	INCAR should be able to communicate with administration software such as SAP ERP and SAP IDP	Functional and data requirements
INB_024	INCAR must have its own payment and accounting processes for authorized users	The scope of the product
INB_025	It must be clear who holds the contracts with CPO/EMSP joining the INCAR platform	Open issues
INB_026	There must be a clear benefit for CPO/EMSP to be part of the INCAR platform	The purpose of the product
INB_027	Employing app utilities without subscription	Users of the product
INB_028	Two basic payment modalities: subscription and credit card	Users of the product
INB_029	User profile should include several cars description and several drivers&riders description	Users of the product
INB_030	Booking procedure must be reliable and include users' preferences (such as charging, planning, routing, …)	Users of the product
INB_031	User must be able to manage its charge even in the case of failure in its connection to the internet. INCAR should consider the possibility that Internet connection falls down during the charging process	Users of the product
INB_032	The app could manage charging at home (in a private charger or public)	Users of the product
INB_033	App should include monitoring in real time utilities	Users of the product
INB_034	App could include a social network utility	Users of the product
INB_035	EMSPs-CPOs-DSOs should access to aggregated information to improve their services	The client, the customer and other stakeholders
INB_036	App could include booking options for additional services while charging	Users of the product
INB_037	App must route-book-pay	Users of the product

INB_038	App to communicate sustainability	Users of the product
INB_039	App could provide customised information according to personal driving profile (autonomy, charges per week, charging time, kWh per km, ...)	Users of the product
INB_040	App should filter the CPs available according to the route and the user's preferences	Users of the product
INB_041	Wireless technology authenticates user when getting to the CP	Users of the product
INB_042	INCAR backend should be able to interface with parking detection sensors	Operational requirements
INB_043	Should support variable pricing, high and low demand times	Functional and data requirements
INB_044	Time reated payment. Charging can be kWh based, but after some time payment by minute starts. This should be allowed by the back end. (some places might have free parking on charging points, but we dont want that cars are occupying spots indefiniely)	Functional and data requirements
INB_045	Should have added value for existing similar back ends	The client, the customer and other stakeholders
INB_046	Possibility to charge parking and e-charging separately based and time and volume	Functional and data requirements
INB_047	Dashboard - real time access to see the current situation of loading in the city and previous trends	Functional and data requirements
INB_048	Backend - maintenance division scenario (if the charging point is not used, no costs should occur, as otherwise CPOs willingness to join is low)	The client, the customer and other stakeholders
INB_049	Tariffs information must be provided by CPOs	Operational requirements
INB_050	When other EMSPs are connecting to the hub via OCPI, the demand for all the functionalities needs to be optional.	Operational requirements
INB_051	INCAR Backend Must provide an interface to CLICK to provide Online and Historic usage data of charging points.	Functional and data requirements

5.3 SMAC product

5.3.1 Overview

As stated in the DoA, SMAC will provide smart grid integration services for slow, medium, fast and ultrafast charging, by allowing the dynamic management of the charging infrastructure. SMAC will allow minimising the grid impact associated to the implementation of charging infrastructure, optimising the power supplied to the EVSE while providing high-value services for citizens and cities, such as minimum charging prices and maximum RES electricity supply. In addition, SMAC will provide flexibility and stabilisation benefits to the DSOs, such as reduction of the grid impact of new charging infrastructure through demand management and the possibility to use EVs as dynamic distributed storage devices, by means of the V2G.

Prior to the development of SMAC tool, a detailed EV charging infrastructure models are being created to define the flexibility, control, and response capabilities to be integrated in the smart grid. Modelling activities will tackle all necessary components and will incorporate capacity and flexibility parameters for local grid optimization. On the other hand, this task will deliver algorithms and models for profiling of EV batteries and charging infrastructure for optimal charging and discharging actions.

When defining SMAC requirements, two groups have been defined, to also consider the requirements associated with modelling of EV batteries and charging solutions. The list of requirements and main figures of the process related to both groups are presented in this Section.

Figure 29: SMAC product icon

The General Requirements for SMAC have been obtained by the research study and the questionnaires were described in section 0. As a summary, the most relevant ones are:

- A web-frontend for interaction with the CPOs, in order to define the different inputs regarding the level of service and boundaries for performing the smart charging operations.
- A backend that runs the algorithms that calculate the optimal charging profile considering the boundary conditions and be able to be in constant communication with the charging point to send this data.

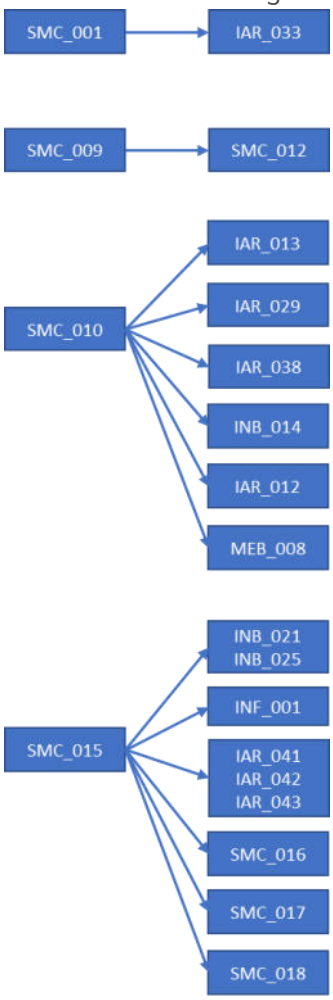
5.3.2 Figures of the Validation and Revision process

5.3.2.1 Dependencies

During the three iterations of the Volere methodology carried out in USER-CHI, a total of 8 dependencies were identified by the validators, 4 of them directly related to the SMAC tool and the other 4 linked to the task of modelling of EV batteries and charging solutions (MEB).

In the case of SMAC, some of the dependencies helped to point out links with the information provided by the EV drivers such as the “time available for charging”, or technical requirements of the charging points for supporting Smart Charging operations. Others helped to identify dependencies with legal requirements or real data required to create the due models.

An overview of the main comments provided by the validators as well as the list of dependencies are shown in the Figure 30, Figure 31, and Figure 26.



"Set charging preferences" has sense when smart charging operations are available, in other words only if the charging point supports Smart Charging operations"

"Advantages include a lower price for CPO and/or users"

"To implement V2G it is necessary to have a planned time of arrival & departure for EV who are able to perform V2G"

"There is a strong dependency among these features and V2G could be implemented only if arrival and departure times are available with a good approximation."

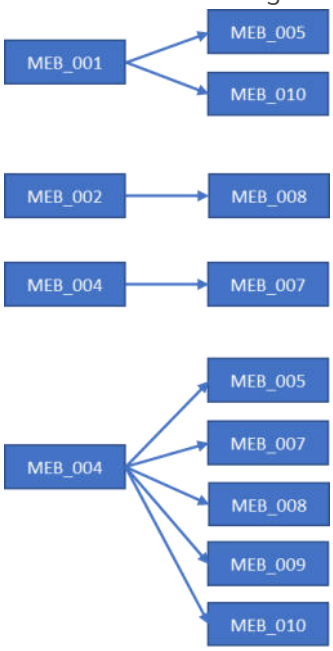
"I agree on that dependency. However, parking time is not the main data source to use for V2G"

"I think we should start separating charging time from parking time"

"This list of requirements depends on requirement INF_001 as legal and contractual aspects should be studied in INFRA"

"This is the general question of whether we want to address specific legal requirements within each technical product or collect them within the legal layer of INFRA. The first approach is clearer and better manageable. Legal interoperability = INFRA."

Figure 30: SMAC product. Dependencies identified during the requirements definition process



"A meaningful benefit comparison is possible if we have real world data (from USER-CHI demo sites)"

"V2G needs long stay parking. V2G would be included considering parking time longer than 1 hour"

"In order to have meaningful results, one must know the actual charging profiles of each users type and the real charge demand"

"To let the INSOC UC realistic it's needed to involve the stakeholder: municipalities, local DSO and rental e-bike companies".

"Some information have been collected, but they are probably not enough to solve the initial problem for INSOC."

"MEB 007, 008 and 009, are not impacted by this DEP as those requirements were created from the EV charging stations perspective (not LEVs)

Figure 31: MEB task. Dependencies identified during the requirements definition process

5.3.2.2 Conflicts

No conflicts detected on the SMAC and MEB requirements.

5.3.2.3 Objections

No objections detected on the SMAC and MEB requirements.

5.3.3 Final list of requirements

After the three iterations of identifying and solving issues from the preliminary requirement list introduced in Volere Tool, the final list of requirements have been obtained. An overview of all SMAC requirements provided by the consortium can be found in Table 83Table 81:

Table 83: Summary of SMAC specific requirements

ID	**Description**	**Type**
SMC_001	CPO platforms must implement OCPP 1.6 or 2.0 for smart charging operations	Operational requirements

SMC_002	From different smart charging inputs SMAC must calculate the optimal charging profile for a charging session. The calculated charging profile will be reported to CPOs, but it is responsibility of CPOs to execute smart charging operations	The scope of the product
SMC_003	CPOs must implement OCPP 2.0 for V2G operations	Operational requirements
SMC_004	SMAC services will not be available for charging stations not involved in INCAR platform	Operational requirements
SMC_005	CPOs must inform if their EVSEs support smart charging operations	Operational requirements
SMC_006	EMSPs should inform about users default charging profile in order to consider it as smart charging input	Operational requirements
SMC_007	SMAC should specify a prioritization for the identified smart charging inputs	Operational requirements
SMC_008	CPOs should inform about locations restrictions such as the maximum power the EVSEs can provide	Operational requirements
SMC_009	Energy prices should be aspect of smart charging	The scope of the work
SMC_010	SMAC should implement Planned start-charging time for slow charges	The purpose of the product
SMC_011	SMAC must include an assessment of V2G impact on battery life	Operational requirements
SMC_012	SMAC should give an indication of the advantages of a smart charging operation vs generic charging operation (less electric load, charging costs, battery life prolongation, ...) to CPO and end user	Functional and data requirements
SMC_013	SMAC should list the technical necessities (or products) to make smart charging operations implementable.	Users of the product
SMC_014	SMAC must implement OCPI 2.2 modules related with Smart Charging Service Providers (SCSP)	Operational requirements
SMC_015	SMAC needs to consider interoperability requirements deriving from Art. 4 (4) AFI-Directive (compatibility with Type 2 power sockets)	Legal requirements
SMC_016	Requirements deriving from European / national calibration and measurement laws need to be taken into account for different billing models	Legal requirements
SMC_017	SMAC needs to enable ad-hoc charging processes, as required by Art. 4 (9) AFI-D	Legal requirements

SMC_018	SMAC should consider national regulation on the topic of V2G - if existing	Legal requirements
SMC_019	SMAC should work without INCAR	Operational requirements
SMC_020	SMAC must consider the DSO as possible demander of V2G operations.	The purpose of the product
SMC_021	Could include information on EV being charged/requesting to charge	Functional and data requirements

As introduced in section 5.2.1, a specific group of requirements for T4.1 Modelling of EV batteries and charging solutions have also been carried out. An overview of all SMAC requirements provided by the consortium can be found in Table 84:

Table 84: Summary of the specific requirements for the EV batteries and charging solutions models

ID	**Description**	**Type**
MEB_001	Must include optimal sizing of a PV+EES+Charging infrastructure (on/off grid)	The scope of the work
MEB_002	Could include Charging infrastructure algorithms for long-stay parking	The scope of the work
MEB_003	Must give a tool to verify the feasibility of charging solution both from an investiment and operative point of views	The purpose of the product
MEB_004	Data on electric mobility and charging infrastructure usage	Functional and data requirements
MEB_005	Should data on solar radiation, available surface and PV characteristics for demo sites	Functional and data requirements
MEB_006	Must have data on new electric mobility modes	Functional and data requirements
MEB_007	The models of EV charging solutions should take into account different charging profiles VIP users, ECO users, Low-cost users...)	Functional and data requirements
MEB_008	The models of EV charging solutions should take into account negative charging profiles (V2G)	Functional and data requirements
MEB_009	Charging infrastructure models must take into account the combination of different powers being supplied at the same time, considering a station with X charging points with different users demands and limited power availability	Functional and data requirements

MEB_010	MEB should include a benefit comparison (technical, monetary) between non-integrated charging infrastructure and optimized charging infrastructure	The scope of the product
MEB_011	Regarding EV charging infrastructure, there must be models for the energy supplied of one charging point and models for the energy supplied of the whole station (a set of charging points connected to the same point of the grid)	Functional and data requirements
MEB_012	MEB would include the study of the optimal power supplied by renewable sources and the capacity of batteries to be installed (i.e if EV charging station integrated with photovoltaic modules)	The scope of the product
MEB_013	MEB should consider both AC and DC charging powers available in the existing in the USER-CHI demo sites.	The scope of the work

5.4 INSOC product

5.4.1 Overview

As stated in the DoA, INSOC- Integrated Solar DC-Charging for LEVs is an easily replicable and scalable low-power charging station for LEVs and e-bike sharing services, with integrated theft-proof parking, payment services and on-site produced RES through DC-network interconnection. INSOC will consist of a software and hardware combined solution to solve charging needs of LEVs, integrating on-site production of renewable energy and theft-proof parking. It will also integrate payment and billing services, making it especially convenient for new urban mobility modes, such as e-bike and e-scooter sharing services.

Figure 32: INSOC product icon

The main features and general requirements of INSOC, which have been obtained by the research study and the questionnaires section 4.6 are:

- INSOC should have a photovoltaic (PV) system to supply the renewable energy to the LEVs charging station.
- INSOC should have Anti-theft system to improve the security and prevent from vandalism.
- INSOC would have energy storage to improve the autonomy of system.
- There should be a study of the most suitable location to install these kind of charging stations.
- INSOC should consider the permits required by the public administrations to install charging stations and renewable energy production in public space.
- INSOC should consider the contracts required by the DSO for the connection to the grid.
- INSOC should meet general standards and laws.
- INSOC should allow the booking and payment by the end-user.

5.4.2 Figures of the Validation and Revision process

5.4.2.1 Dependencies

No dependencies detected on the INSOC requirements during the Validation process.

5.4.2.2 Conflicts

No conflicts detected on the INSOC requirements during the Validation process.

5.4.2.3 Objections

No objections detected on the INSOC requirements during the Validation process.

5.4.3 Final list of requirements

After the three iterations of identifying and solving issues from the preliminary requirement list introduced in Volere Tool, the final list of requirements have been obtained. An overview of all INSOC requirements provided by the consortium can be found in Table 85Table 81:

Table 85: Summary of the specific requirements of INSOC product

ID	Description	Type
INS_001	Solar chargers must be secure parkings	Users of the product
INS_002	Solar charger station could be part of a modal hub	Users of the product
INS_003	The urban furniture as an existing infrastructure for hosting solar charging points (e.g., streetlights and benches)	Users of the product
INS_004	The use of INSOC facilities requries the use of an app (similar to INCAR)	The purpose of the product
INS_005	Solar energy is renewable, and this principle must be present in the facilities	The purpose of the product
INS_006	INSOC needs to take into account national fire protection measures for the construction of solar systems	Legal requirements
INS_007	INSOC should consider necessary permits in order to set up LEV boxes in public spaces	Legal requirements
INS_008	INSOC should consider requirements deriving from national laws on preservation of historical monuments	Legal requirements
INS_009	INSOC must consider that infrastructure needs to be efficiently managed and operated	The scope of the product

5.5 INDUCAR product

5.5.1 Overview

As stated in the DoA, INDUCAR is an inductive charger for e-cars. This USER-CHI product will consist of a wireless and highly automated charging solution for electric vehicles. INDUCAR will deliver an inductive charging solution that with high level of automated power transfer and a highly positive charging experience to the user, avoiding manual handling of wires. The hardware components will come with software for the wireless charging systems and the adaptation of the different vehicle types selected, to allow wireless charging. The targeted vehicles will be retrofitted, applying reasonable standards, in order to allow wireless charging.

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Figure 33: INDUCAR product icon

With regards to INDUCAR, the wireless charging of electric vehicles is considered as an user-centred requirement with the aim of making the use of electric vehicles as comfortable as possible. The challenges for implementation are high. The installation space in the electric vehicle that can be considered for a wireless charging system is limited and the different vehicle types have very different ground clearances, which also depend on the loading condition of the vehicle. The electro-magnetic energy transfer is only reliable and efficient if the two corresponding inductors are optimally located in relation to each other.

The main topics that should be consider defining the technical requirements are those related to: Safety and operation for wireless charging, electro-magnetic compatibility (EMC) and magnetic field emissions. Moreover, existing regulations and standard should be also considered.

5.5.2 Figures of the Validation and Revision process

5.5.2.1 Dependencies

No dependencies detected on the INDUCAR requirements during the Validation process.

5.5.2.2 Conflicts

No conflicts detected on the INDUCAR requirements during the Validation process.

5.5.2.3 Objections

During the three iterations of the Volere methodology carried out in USER-CHI, a total of 4 objections were identified by the validators, which are shown in the Figure 34:

"Dynamic charge is out of the scope of this project.

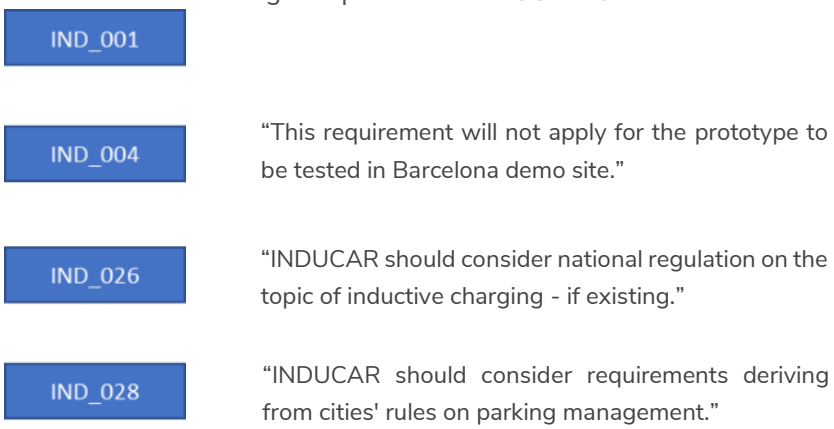


Figure 34: INDUCAR Product. Objections identified during the requirements definition process

5.5.3 Final list of requirements

After the three iterations of identifying and solving issues from the preliminary requirement list introduced in Volere Tool, the final list of requirements have been obtained. An overview of all INDUCAR requirements provided by the consortium can be found in Table 86Table 81:

Table 86: Summary of the specific requirements of INDUCAR product

ID	**Description**	**Type**
IND_001	Two inductive charge modalities: dynamic charge vs static charge. Dynamic charge is out of the scope of the project	Users of the product
IND_002	Static charge is a by-night charge for city neighbourhoods, or a charge for long term parking in an airport or a train station	Users of the product
IND_003	Dynamic charge is a on route charge, managed from the mobile phone, in signalized sections of the highway	Users of the product
IND_004	Payment modality should be solved, according to use and energy transferred. This requirement will not apply for the prototype to be tested in Barcelona demo site	Users of the product
IND_005	The use of INDUCAR facility requires the employment of an app (similar to INCAR)	The purpose of the product
IND_006	The system must charge with static charge while parking	The purpose of the product

IND_007	The system must have a very low maintenance	Maintainability and support requirements
IND_008	The system should charge the AMB fleet at the AMB offices or AMB's partner company	Relevant facts and assumptions
IND_009	The system should charge at least 3 electric cars from AMB fleet	Relevant facts and assumptions
IND_010	The system must be drivable	Functional and data requirements
IND_011	The individual charge for each vehicle should be about 3,6 kW	Functional and data requirements
IND_012	The total charge at a given time must not exceed 20 kW	Relevant facts and assumptions
IND_013	The charge must be available during the whole day and the whole night	Operational requirements
IND_014	The system must have all the safety requirements given for electro-magnetic fields	Security requirements
IND_015	The system must have MOD, FOD and/or LOD in proper combination to ensure user's safety	Security requirements
IND_016	The system should be user friendly	Usability and humanity requirements
IND_017	The system should be robust	Performance requirements
IND_018	The system must charge the vehicle automatically	Users of the product
IND_019	The system should inform status on the telephone	Look and feel requirements
IND_020	The system must charge on a specific position	Operational requirements
IND_021	The vehicle must be park with a specific parking direction to charge correctly	Functional and data requirements
IND_022	A positioning system must be available to guide the driver to park correctly	Operational requirements
IND_023	The guiding system could be through an App OR through a wall box indicator	Usability and humanity requirements

IND_024	The component on the pavement / parking surface must be easy to install over the surface of the parking position	Usability and humanity requirements
IND_025	The wireless charging system should have a competitive performance compare to standard cable charging solution	Performance requirements
IND_026	INDUCAR should consider national regulation on the topic of inductive charging - if existing	Legal requirements
IND_027	Requirements deriving from European / national calibration and measurement laws need to be taken into acount for different billing models	Legal requirements
IND_028	INDUCAR should consider requirements deriving from cities' rules on parking management	Legal requirements

5.6 INFRA product

5.6.1 Overview

INFRA is the Interoperability Framework that will be provided by USER-CHI. INFRA consists of a package of rules, guidelines and recommendations that will support highly interoperable processes among the electromobility stakeholders. INFRA will set common ground to facilitate the conduction of formal agreements among all involved agents, and will ensure the accuracy, reliability, continuity, and evolution of the service delivered.

Finally, INFRA will analyse roaming, crypto networks and virtual currencies as ways to facilitate payment interoperability among EV drivers, EMSPs and CPOs, and will also study cyber security and protection measures against the potential cyber threats that might target the payment, billing, data management and data sharing processes that take place in interoperability and roaming schemes among the involved stakeholders.

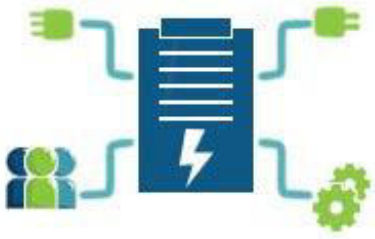
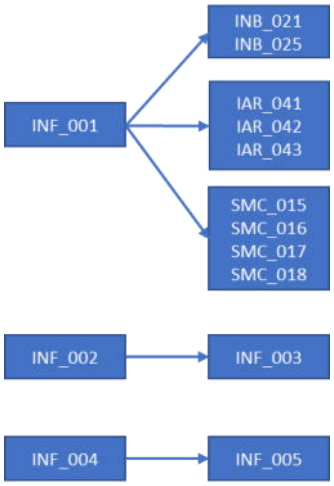


Figure 35: INFRA product icon

5.6.2 Figures of the Validation and Revision process

5.6.2.1 Dependencies

During the three iterations of the Volere methodology carried out in USER-CHI, 3 dependencies were identified by the validators. These dependencies are shown in



"This list of requirements depends on requirement INF_001 as legal and contractual aspects should be studied in INFRA"

Comment 1: "This is the general question of whether we want to address specific legal requirements within each technical product or collect them within the legal layer of INFRA. The first approach is clearer and better manageable. Legal interoperability = INFRA."

"Could the classification of requirements into functional and non-functional requirements to determine interoperability (INF_002) depend on the benchmark (INF_003)?"

"To have a common understanding (INF_005), all stakeholders should be involved in the implementation process of the products

Figure 36: INFRA Product. Dependencies identified during the requirements definition process

5.6.2.2 Conflicts

No conflicts detected on the INFRA requirements during the Validation process.

5.6.2.3 Objections

No objections detected on the INFRA requirements during the Validation process.

5.6.3 Final list of requirements

After the three iterations of identifying and solving issues from the preliminary requirement list introduced in Volere Tool, the final list of requirements have been obtained. An overview of all INFRA requirements provided by the consortium can be found in Table 87:

Table 81

Table 87: Summary of the specific requirements of INFRA product

ID	Description	Type
INF_001	INFRA should include organisational, legal, technical and semantic requirements to determine interoperability	The purpose of the product
INF_002	INFRA should classify requirements into functional and non-functional requirements to determine interoperability	The purpose of the product
INF_003	INFRA should benchmark functional and non-functional requirements to determine interoperability	The purpose of the product
INF_004	INFRA should include all stakeholders involved in the implementation process of the products (CLICK, INCAR, SMAC, INSOC and INDUCAR)	The scope of the work
INF_005	Have a common understanding among all stakeholders involved in the implementation process of the products (CLICK, INCAR, SMAC, INSOC and INDUCAR)	Cultural and political requirements
INF_006	INFRA should provide a role scheme specifying different understandings, goals, functions, system boundaries and responsibilities of the products	Performance requirements
INF_007	INFRA should identify national, regional and local barriers for interoperability from a legal perspective	The scope of the work
INF_008	Through INFRA the knowledge about legal feasibility of interoperability should be shared	The scope of the work

INF_009	Through INFRA the contractual complexity and heterogenity of B2B arrangements for access to charging networks should be reduced	The scope of the work
INF_010	INFRA research should provide the alternatives to simplify the EMSP/CPOs contracts.	The scope of the product
INF_011	INFRA should clarify the concepts of interoperability and roaming, in the scope of charging infrastructure	Operational requirements
INF_012	INFRA should clarify if it is mandatory, according to the current law, to provide ad-hoc payment in the EV charging points	Legal requirements
INF_013	INFRA research should provide indications on how the new technologies, such as Blockchain, could be incorporated in order to guarantee secure transactions	The scope of the product
INF_014	INFRA research should address Smart Contracts (blockchain) to identify how could it be applied to simplify interoperability in the EV charging infrastructure	Operational requirements
INF_015	Legal topics must be considered in INFRA	The scope of the product
INF_016	INFRA must study how Alliance for Parking Data Standards (APDS) will facilitate seamless integration for potential users	Legal requirements
INF_017	INFRA must consider interoperability requirements deriving from Art. 4 (4) AFI-Directive	Legal requirements
INF_018	INFRA should analyze and evaluate existing E-roaming platforms (e.g. hubject) and identify practical and legal shortcomings from the users' and operator's perspective	The scope of the product
INF_019	INFRA could provide legal information in a structured way as input for CLICK	Functional and data requirements

5.7 EMOBEST product

5.7.1 Overview

As stated in the DoA, the e-Mobility replication and best practice cluster EMOBEST, will be a collaboration platform to facilitate the transfer of best practices among the demonstration and replication cities and other leader and follower cities in Europe, enhancing results' replication even after the project completion. It will help local governments, urban planners, mobility departments and transport authorities to replicate solutions and learn from the experience of other cities, in a very direct and efficient way.

EMOBEST will make use of the experience gained through all USER-CHI actions and demonstration activities, and will provide technical, legal and economic feasibility analysis of USER-CHI business models, implications for Europe-wide take-up and rollout of results, methods and policies recommendations for action on European and national levels for a more harmonised take-up on the internal European market.

Figure 37: EMOBEST product icon

5.7.2 Figures of the Validation and Revision process

5.7.2.1 Dependencies

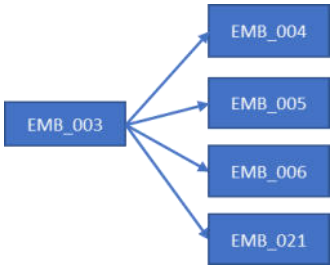
During the three iterations of the Volere methodology carried out in USER-CHI, only one dependency was identified by the validators, as it is shown below in Figure 38:

"Those two are linked together. EMB_022 can be either further explained, or merged with EMB_008"

Figure 38: EMOBEST Product. Dependencies identified during the requirements definition process

5.7.2.2 Conflicts

Also, one conflicts was detected on the INFRA requirements during the Validation process (Figure 39):



"FAIR principles can be applied since data the platform will collect/store are reused or could be reused. In case of best practices, this could be done by using a set of metadata fields to characterize/identify each of them."

Figure 39: EMOBEST Product. Conflict identified during the requirements definition process

5.7.2.3 Objections

No objections detected on the INFRA requirements during the Validation process.

5.7.3 Final list of requirements

After the three iterations of identifying and solving issues from the preliminary requirement list introduced in Volere Tool, the final list of requirements have been obtained. An overview of all EMOBEST requirements provided by the consortium can be found in Table 88:

Table 88: Summary of the specific requirements of EMOBEST product

ID	**Description**	**Type**
EMB_001	eMoBest must facilitate the exchange of best practices	The purpose of the product
EMB_002	eMoBest must target city experts	Users of the product
EMB_003	eMoBest would be a physical collaboration platform in the framework of existing Eurocities working groups	Look and feel requirements
EMB_004	eMoBest would be a virtual collaboration platform in the frame of USER-CHI dedicated webinars	Look and feel requirements
EMB_005	eMoBest would make use of the USER-CHI website as a public repository	Look and feel requirements
EMB_006	eMoBest must keep a flexible structure to adapt to needs	Naming conventions and definitions

EMB_007	eMoBest should rely on input from other WPs	Functional and data requirements
EMB_008	eMobest will provide the most suitable solutions for replicating successful business models considering the city peculiarities (e.g. size, local needs, etc.)	The scope of the product
EMB_009	sMoBest should facilitate standardisation recommendations	The scope of the product
EMB_010	eMoBest should facilitate policy recommendations on a more harmonised take-up in the EU market	The scope of the product
EMB_011	eMoBest should promote results of the EU regulatory and standard framework analysis	The scope of the product
EMB_012	Approval processes in different countries and cities for building up charging infrastructure should be shared	The scope of the work
EMB_013	Transparency on national regulations for charging like max time	The scope of the work
EMB_014	Make sure to be able to include citizensâ€™ inputs (citizen science)	The scope of the work
EMB_015	Be searchable for different audiences	The scope of the product
EMB_016	Have the opportunity to perform specific topic-related searches	The scope of the product
EMB_017	Searchable based on geographical location	The scope of the product
EMB_018	eMoBest could indicate KPIs to monitor in order to successfully carry out charging infrastructure projects	The scope of the product
EMB_019	Foster collaboration and co-creation with all involved parties	Cultural and political requirements
EMB_020	Foster a holistic perspective by moving from contents "tightly" clustered by type to an "all-encompassing" approach so creating synergies among them and so resulting to be more effective.	The scope of the product
EMB_021	Support FAIR data principles	Performance requirements
EMB_022	Provide users with instruments as much tailored as possible to their needs/peculiarities allowing them to roll out methodologies, tools and/or cost-effective business models meeting needs that matter	The scope of the product

EMB_024	eMoBest should include information about campaigns, how successfull they have been and what have been the results	Ideas for solutions

6. Conclusions

Chapter 6 presents the conclusions of the relevant general requirements that USER-CHI products must consider, illustrating the differences in the technical and legal frameworks of the different countries, but also the similarities on the European or international level.

The most important conclusion and thematic bracket here, in terms of user-centric charging infrastructure, is especially fostering interoperability along the technical and legal aspects of USER-CHI products´ development to help overcome the widely established proprietary charging systems and services in Europe. USER-CHI product INFRA (deliverable 3.2) will address this challenge by providing a framework and guidelines to support interoperable charging services in the European Union in terms of the organisational, technical, and legal aspects.

6.1 Technical Requirements

From the technical perspective, the report findings do not allow for drawing definitive, universal conclusions considering a dynamic industry, as electromobility, with so many different product and services across the EU. However, several remarks about the status of the technical standards that USER-CHI technical products must consider for its implementation in the EU countries where the project is implemented, are drawn in the subsections below.

- CROSS-CUTTING TECHNICAL REQUIREMENTS

> When implementing technical products like CLICK, INCAR, SMAC, and/or INDUCAR within the EU, the product-specific technical requirements (see 4.2) should be considered in conjunction with the cross-cutting technical requirements (see 4.1)

The report points out a set of technical requirements that are transversal to the technical USER-CHI products for BEVs and PHEVs (CLICK, INCAR, SMAC, and INDUCAR). However, the technical USER-CHI product INSOC focuses on the implementation of LEVs and complies therefore with a different set of technical requirements. The main standardisation areas and international standards relevant for USER-CHI technical products are twofold: 1) Charging infrastructure and charging point (IEC 61851-1:2017; IEC 62196-1:2014; and IEC 60364-7-722:2018), and 2) Electro-magnetic compatibility (IEC 61851-21-1:2017; and IEC 61851-21-2:2018).

- GRID CONNECTION

When developing charging infrastructure with outputs of more than 3.7 kVA and less than 12 kVA in Germany, there is an obligation to notify the grid operator. It should be noted that even with a relatively small number of plants of smaller capacity, the total capacity limit of 12 kVA of the local electricity supply can quickly be exceeded and, in addition to the obligation to notify, the grid operator must give his consent.

A significant number of relevant technical requirements emerging from the automotive engineering, information and communications technology, and electrical engineering sectors has been identified. These must be appropriately used and disseminated. Providing information on such standardisation activities and their status to product developers and service providers across the EU is relevant for further electromobility uptake. Moreover, further work should focus less on developing new standards than on expanding/adapting existing standards and specifications to the needs of electromobility. Interdisciplinary cooperation at an international level is required, mainly for interfaces standardisation.

- CHARGING SPEED

Charging speeds are directly related to the available charging technology in the EV itself, the charging points, and the charging plugs. Specific information regarding charging plug components for electromobility is provided in 4.1.1.1.

- TECHNICAL STANDARDISATION LANDSCAPE

International, European, and national organizations were identified as part of the standardisation landscape. The standardisation committees involved in the definition of technical standards in relevant domains for electromobility (namely: automotive technology, electrical technology, and telecommunications) and the relationships amongst the organizations and their regulatory bodies, were identified. International electrotechnical standardisation is carried out at IEC, while these activities in the automotive sector and the telecommunication sectors are carried out at ISO and ITU, respectively.

Moreover, to promote innovation, technical standardization must relate to functionality and provisions regarding technical solutions must be avoided ("performance-based rather than descriptive"). However, technical solutions must be determined to ensure the required interoperability for interfaces standards (e.g., between vehicle and grid infrastructure)

- CHARGING INFRASTRUCTURE FOR EVS

Within the USER-CHI consortium, the supply of electric energy for EVs charging infrastructure is mainly provided by the DSO. USER-CHI partners reported that in Italy and Germany, there are

available public charging points, connected to the grid, and private ones within a decentralized energy supply concept.

Charging speeds implemented in German, Italian, and Spanish USER-CHI cities are: AC 1-phase (3.7kW, up to 16A, 230V); AC 3-phases (22-44kW, up to 63, 400V), and DC charging (350kW, up to 500A, 400V-500V). In Italy, it is important to note that DC grid connection for HPC is made to MV grids, since the voltage varies from region to region. Charging speed variability may stem from the varied roles of public charging in different cities and countries within the EU and should be addressed when considering cross-border interoperability. The standard IEC/TS 61439-7 (VDE V 0660-600-7) defines specific requirements for the design of AC and DC charging equipment.

- INTEROPERABILITY – TOWARDS A UNIFORM WORLDWIDE CHARGING INFRASTRUCTURE

As with combustion engine vehicles, it must be possible to charge EVs everywhere, at all times within the EU. This means ensuring interoperability of different brands of vehicles with the infrastructure provided by various operators. The standardisation of charging techniques and billing/payment systems must ensure the development of a charging interface that is user-oriented, uniform, safe and easy-to-operate. User interests must have priority over the interests of individual companies.

The report Identified multiple roaming protocols for electric mobility in Europe, namely: OCHP, OICP, eMIP, and OCPI. All roaming protocols pursue the same goal: to offer roaming to EV drivers across the EU. However, the hubs that use their own proprietary protocol do not communicate with each other and do not exchange data, which is a barrier to European interoperability. OCPI offers alternative ways to connect (e.g., peer-to-peer) and to overcoming this barrier.

- COMMUNICATION BETWEEN EVS AND CHARGING INFRASTRUCTURE

In 2018, the test cases for a conformance test (ISO 15118-4 and ISO 15118-5) were published as an international communication standard. Nevertheless, the 2nd Edition of the communication standards ISO 15118-1 and ISO 15118-2 will merge wired and wireless communication and specify messages and parameters for energy recovery.

- ENERGY RECOVERY INTO THE ELECTRICAL SUPPLY NETWORK & V2G TECHNOLOGIES

Increasingly, the recovery of electrical energy from the vehicle battery into the electrical grid is being considered across the EU. An inverter installed in the EV or in the charging infrastructure converts DC stored in the vehicle battery into AC required by the consumer. Accordingly, first pre-normative activities are taking place that address the question of how bidirectional charging can be integrated sensibly and safely into a higher-level system. EVs can only contribute to grid stability and grid support if the EV is connected to the grid at the time of energy demand. Grid-serving control, nevertheless, makes sense mainly in the private sector, as there is a high flexibility potential compared to publicly accessible charging stations. In addition to reducing the charging power during the charging process in bottleneck situations, in the future, feeding back energy

quantities over longer periods of time and providing energy control over short periods of time in the range of seconds and minutes can also effectively support the grid. Technically, this is feasible and has already been successfully implemented in pilot projects. The Italian and German USER-CHI partners are currently testing and demonstrating V2G technologies. Italy refers to the ISO 15118 family "Road vehicles - Vehicles to grid communication interface" as the reference standard for V2G. At present, however, neither the EVs nor the charging stations are designed as standard for grid-connected regenerative power. This application has not yet been considered in detail in the standardization. Regarding the CCS charging process, it is planned to address the topic in the 3rd edition of IEC 61851-23.

- INDUCTIVE CHARGING

Inductive charging aims at facilitating everyday use of EVs and could enable, for example, to conveniently use short stops for charging. Conversion of existing conductive charging infrastructure to inductive charging is possible, e.g., an existing wallbox could be replaced by the inverter and a charging cable could be installed from the wallbox to a charging plate on the ground.

Analogous to conductive charging, technical connection conditions must also be considered. This means that charging with a power of up to 4.6 kVA is possible with 1-phase. When planning higher charging capacities, a 3-phase connection should be provided. The power classes currently being discussed in the standardisation process range up to a charging power of 22 kW.

The still under-development standards also examine the EMC of inductive charging. The standards provide for field strengths that are kept so low that none of the currently globally recognised limit recommendations is exceeded or there is any risk to the health of living beings. In addition, intrinsic safety of the system is required both on the vehicle and on the network side, so that in the event of a possible hazard (e.g., heating of metallic objects around the magnetic field), countermeasures are initiated immediately. With inductive charging, communication for controlling the charging process will also take place wirelessly. WLAN according to ISO15118-8 will be used for this purpose. The messages are standardised in ISO15118-20. The communication required for charging is standardised via ISO 15118.

6.2 Legal Requirements

The main conclusions of this report from the legal perspective include the key aspects of the analysis of the legal questionnaires on key topics of USER-CHI, such as the interoperability, user-friendliness of the use of charging points, as well as data sharing processes between CPOs.

- NATIONAL RULES ON TARIFF MODELS

The national legal frameworks analysed feature differences regarding tariff models for the use of public charging infrastructure. National rules regulating tariff models for the use of public charging infrastructure exist neither in the Finnish or the Spanish legal framework. However, regarding the Austrian legal framework a consumption-based tariff (kWh) is not approved by existing laws so far, whereas Austrian experts indicate that an update on this legal matter is expected. Furthermore, according to the German legal framework merely time-based tariff models are not possible under the current legal interpretation of the PangV by the by the Federal Ministry for Economic Affairs and Energy (BMWi).

- INTEROPERABILITY IN TENDER SPECIFICATIONS

Tender specification in Berlin and Murcia did not imply stricter requirements on questions of interoperability as laid out in the AFID in their last tender processed for charging infrastructure in 2015.

- MEASURING AND CALIBRATION LAW

The Swiss legal framework excludes EV charging stations for short-term customers from the need to use electricity meters as billing basis for electricity consumption, whereas in Germany the legal framework of measuring and calibration law applies to EV charging stations.

Austrian measurement and calibration are only applicable to the CPO instead of the users of measured values, like EMSPs. Regarding the Spanish and German legal framework the legal duty to comply with legal metrology is mostly relevant for the users of measuring instruments, like CPOs. However, within the German legal framework in some situations, it could affect EMSPs, who manage the billing process between CPOs and final users while using the measured values.

Regarding the Finnish, Austrian and Spanish legal framework back-end systems are not (yet) subject to the requirements arising out of measuring and calibration law.

In Germany, requirements from measuring and calibration laws are not only applicable for measuring devices, but also to the back-end systems of EV charging points if they are to be categorised as ‘additional equipment’.

- PUBLIC PARTICIPATION WITHIN THE PLANNING PROCEDURE

In Berlin and Murcia public participation during the planning process of charging infrastructure is not mandatory. However, experts recommend the public participation to foster acceptance in both cases. On the other hand, in the city of Turku public participation within the planning procedure of charging infrastructure is mandatory.

- DYNAMIC DATA OF CHARGING POINTS

Neither under the German, nor the Spanish, nor the Finnish legal framework CPOs are required to provide real-time location and availability data concerning their charging points.

However, in Barcelona a tool, which offers real-time location and availability data concerning charging points in the region has been established on a voluntary basis. In the city of Murcia CPOs might have to provide real-time location and availability data in case the authorities have included these requirements in the applicable contracts. On the other hand, the Austrian legal framework includes a requirement for CPO's to provide real-time location data regarding the availability of their charging points.

- INTEROPERABILITY OF DATA SHARING PROCESSES AMONG CPOS

In the national legal framework of Germany there are currently no provisions for the data sharing processes among providers of charging services regarding minimum standards of interoperability. However, the draft bill of the amendment of the LSV might include additional provisions on the use of standardized communication for CPOs. In Spain interoperability is not required by law. However, some municipalities require CPOs to use OCPP.

- BOOKING OF PUBLIC PARKING SPOTS FOR THE PURPOSE OF CHARGING

In the cities of Berlin, Barcelona, and Graz the booking/reservation of public parking spots for using charging infrastructure is not possible. However, in the city of Murcia public parking spaces next to charging points can be booked through an app. This privilege derives from a local ordinance issued by the municipality.

- REGULATION OF ROAMING FOR EV CHARGING

In neither the German, the Finish, the Spanish, nor the Austrian legal frameworks special legal requirements on the topic of roaming platforms exist, which are applicable for the charging process of EVs in Europe.

- REGULATION ON INDUCTIVE CHARGING

Neither the German, the Spanish, the Finnish nor the Austrian legal framework includes specific provisions on the topic of inductive charging for EVs yet.

- NATIONAL IMPLEMENTATION OF THE AFID

With regard to the Finnish national law framework the AFID has merely been approved by Finnish laws due to the fact that the national legal framework on the topic had already implemented stricter requirements.

Differences arise on the topic of national implementation of the AFID regarding Art. 4 No. 9 AFID in Austria, Germany, and Spain. Art. No. 4 No. 9 AFID requires that EV users should be able to charge without having to conclude a contract with the CPO.

No Austrian laws explicitly establishes this requirement. However, in the city of Graz a non-discriminatory access is implemented regarding the major public infrastructure. In the case of Murcia, EV users have to register as new users or clients in order to use the charging services of the local CPO. With regard to the city of Berlin § 4 LSV requires CPOs to allow EV users to charge without entering into long-term contracts and states explicit minimum requirements on how this could be achieved. However, the current draft bill of the amendment of the LSV provides the additional minimum requirement for the possibility to pay via a common credit card system.[192]

Moreover, the requirement of non-discriminatory access has been linked to the granting of national subsidies for infrastructure within the Austrian legal framework. The national implementation laws of Spain do not include this goal explicitly. In regard to the German national legal framework §§ 3 (1), (2) and (3) LSV require specific equipment of charging points in order to ensure the use with type 2 couplings in accordance with the DIN EN 62196-2 (AC standard and fast charging), as well as with couplers of type Combo 2 in accordance with the standard DIN EN 62196-3, July 2012 edition (DC normal and fast charging).

Regarding the city of Berlin and the German aspects of interoperability standardized communication interfaces are not required by the LSV. However, the current draft bill of the amendment of the LSV includes the requirement to use a standardized interface, which can be used to transmit (dynamic) data.[193] The Spanish legal framework does not include legal requirements on the interoperability between charging points run by different CPOs. However, Spanish experts indicate that legal requirement for interoperability are under development.

In the City of Turku, no national laws ensure aspects of interoperability. Regarding the City of Graz, the Austrian national government has offered subsidies to implement this aspect of interoperability in the past for local CPOs. Accordingly, various aspects of interoperability have been implemented as a result.

[192] available at: https://www.bmwi.de/Redaktion/DE/Downloads/J-L/konsolidierter-text-lsv-novelle.pdf?__blob=publicationFile&v=10.

[193] available at: https://www.bmwi.de/Redaktion/DE/Downloads/J-L/konsolidierter-text-lsv-novelle.pdf?__blob=publicationFile&v=10.

Acronyms

Acronym	Meaning
A	Amperage
AC	Alternating Current
AFID	Alternative Fuels Infrastructure Directive
BauO Bln	Bauordnung Berlin - Berlin Building Code
BDSchG	Bundesdatenschutzgesetz – Federal Data Protection Act
BerlStrG	Berliner Straßengesetz – Berlin Street Law
BEV	Battery Electric Vehicle
BMWi	Bundesministerium für Wirtschaft und Energie - Federal Ministry of Economy and Energy
BNetzA	Bundesnetzagentur - Federal Network Agency
CCS	Combined Charging System
CDR	Charge Detail Records
CEN	European Committee for Standardization
CENELEC	European Committee for Electrotechnical Standardization
CLICK	Charging infrastructure Locatlon and HolistiC Planning Kit (USER-CHI product)
CPO	Charge Point Operator
CsgG	Carsharinggesetz – Carsharing Act
DC	Direct Current
DE	Deutschland / Germany
DIN	Deutsches Institut Für Normung – German Institute for Standardization
DKE	Deutsche Kommission Elektrotechnik Elektronik Informationstechnik – German German Commission for Electrical, Electronic & Information Technologies
DoA	Description of Action

Acronym	Meaning
DR	Demand Response
DSchG Bln	Denkmalschutzgesetz Berlin - Law for the protection of historic monuments in Berlin
DSM	Demand Side Management
DSO	Distribution System Operator
EC	European Commission
EEG	Erneuerbare Energien Gesetz –Renewable Energy Sources Act
EMC	Electro-magnetic Compatibility
EMSP	Electromobility Service Provider
EMT	Electro-magnetic Tolerance
EnWG	Energiewirtschaftsgesetz – Energy Industry Act
ES	España / Spain
ETRA	ETRA I+D (USER-CHI project partner)
ETSI	European Telecommunications Standards Institute
EU	European Union
EV	Electric Vehicle
EVSE	Electric Vehicle Supply Equipment
FCD	Floating Car Data
GA	Grant Agreement
GDPR	General Data Protection Regulation
GDEW	Gesetz zur Digitalisierung der Energiewende - Act on the Digitalisation of the Energy Transition
GEIG	Gebäude-Elektromobilitätsinfrastruktur-Gesetz - Building and Electric Mobility Infrastructure Act
GIS	Geographic Information Systems
GUI	Graphic User Interface
GWB	Gesetz gegen Wettbewerbsbeschränkungen - Act against Restraints of Competition
HPC	High Power Charging
HU	Hungary
ICIO	Construction and Works Tax

Acronym	Meaning
ICT	Information and Communication Technology
IC-CPD	In Cable Control and Protection Device
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
IKEM	Institut für Klimaschutz, Energie und Mobilität – Institute for Climate Protection, Energy and Mobility
INCAR	Interoperability, Charging and Parking Platform (USER-CHI product)
INDUCAR	Inductive Charging for e-Cars (USER-CHI product)
INFRA	Interoperability Framework (USER-CHI product)
INSOC	Integrated Solar DC-Charging for LEVs (USER-CHI product)
ISO	International Organization for Standardization
IT	Italy
ITU	International Telecommunication Union
kVA	Kilo Volt-ampere
kW	Kilowatt
LEV	Light Electric Vehicle
LSV	Ladesäulenverordnung - Charging Point Decree
LV	Low Voltage
LVD	Low Voltage Directive
M2M	Machine-to-machine
MessG	Measuring and Callibration Act
MessV	Measuring and Callibration Ordinance
MID	Measuring Instruments Directive
MoU	Memorandum of Understanding
MV	Medium Voltage
NAV	Niederspannungsanschlussverordnung - Low Voltage Connection Ordinance
NFC	Near-field communication
NPE	Nationale Plattform Elektromobilität – National Platform for Electromobility

Acronym	Meaning
NPM	Nationale Plattform Zukunft der Mobilität – National Platform Future of Mobility
NSF	National Strategy Framework on the development of an Alternative Fuels Infrastructure
OCHP	Open Clearing House Protocol
OCPI	Open Charge Point Interface
OCPP	Open Charge Point Protocol
OICP	Open InterCharge Protocol
PHEV	Plug-in Hybrid Electric Vehicle
POI	Point of Interest
PV	Photovoltaic
PV system	Photovoltaic System
QR-Code	Quick Response-Code
R & D	Research & Development
RFID	Radio Frequency Identification
RES	Renewable Energy Sources
RS	Routing Service
SAE	Society of Automotive Engineers
SC	Sub Committee
SMAC	Smart Charging Tool (USER-CHI product)
StromNEV	Ordinance on Charges for Access to Electricity Supply Networks
StromStG	Stromsteuergesetz - Electricity Tax Law
StromStV	Stromsteuerverordnung - Electricity Tax Ordinance
TAB	Technische Anschlussbedingungen – Technical Connection Conditions
TAR	Technische Anschlussregeln (engl. TCR)
TAR-NS	Technische Anschlussregeln Niederspannung – Technical Connection Rules for low voltage
TC	Technical Committees
TCR	Technical Connection Rules
USER-CHI	Project Title: innovative solution for USER centric CHarging Infrastructure

Acronym	Meaning
V	Voltage
VBB	Verkehrsverbund Berlin Brandenburg – Transport Association Berlin Brandenburg
VDE	Verband der Elektrotechnik, Elektronik und Informationstechnik – German Association for Electrical, Electronic & Information Technologies
VDE FNN	Forum Netztechnik/Netzbetrieb im VDE – Network Technology/Network Operation Forum at VDE
VMZ	VMZ Berlin Betreibergesellschaft mbH (USER-CHI project partner)
VPP	Virtual Power Plants
WBS	Work Breakdown Structure
WP	Work Package
WPT	Wireless Power Transfer
BEV	Battery Electric Vehicle
PHEV	Plug-in Hybrid Electric Vehicle
Terna	Italian Transmission Grid Operator
RTCM	Radio Technical Commission for Maritime Services

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Annexes

Technical Questionnaires

Technical Requirements for CLICK

USER-CHI Product CLICK | Technical Questionnaire

The aim of the USER-CHI project is to unlock the potential of transnational and inter-regional electromobility in Europe. Therefore, innovative solution will be integrated to achieve interoperability for users. This includes services such as e-roaming, billing, authentication, and reservations of parking slots with charging points. The user is put at the centre of this research. Moreover, the synergies between electromobility and smart grids will be fostered to contribute to the European energy transition.

The developed technological tools, and business models will be put into practice and demonstrated in five demonstration cities: Barcelona metropolitan area (Spain), Rome (Italy), Berlin (Germany), Budapest (Hungary), and Turku (Finland). Also, two replication cities have been included in each of the TEN-T corridors involved in the project: Murcia (Spain) in the Mediterranean corridor and Florence (Italy) in the Scandinavian-Mediterranean corridor.

Currently, different charging technologies and types of charging stations in public, semi-public and private space exist. Hence, different requirements regarding local regulations and technical standards may apply. Publicly accessible charging infrastructure is subject to various EU, national, and local directives, regulations, technical safety requirements, and standards.

The aim of the questionnaire is to collect the technical standards that USER-CHI solutions should comply in all 5 USER-CHI partner countries and a set of at least 5 other relevant EU countries. The questionnaire will collect relevant technical standards for the implementation of USER-CHI products and will contribute to the deliverable D1.3 (Technical and Legal Requirements for USER-CHI Solutions) from a technical perspective.

The questionnaire focuses on the USER-CHI product SMAC (Smart Charging Tool) that will be developed and tested within the project. SMAC is a platform that provides smart grid integration services for slow, medium, fast, and ultra-fast charging by following the purpose of minimising the grid impact associated to the implementation of charging infrastructure. This smart charging tool will provide high-value services to electric vehicle (EV) drivers, such as minimum charging prices and maximum RES electricity supply, considering specific constraints that will be prioritised in the charging sessions scheduling process. Aside from that, SMAC will provide standard and scalable solutions for demand management and smart grid integration services by integrating V2G and using EVs as dynamic distributed storage devises, feeding electricity stored in their batteries back into the local electric grid when needed. That will bring benefits to the DSOs concerning flexibility and stabilisation while reducing the grid impact of new charging infrastructure. A main aspect of the demand management in SMAC will be an interconnected route management system for incoming vehicles while considering the grid availability, voltage, and frequency control constraints in real-time. Furthermore, SMAC will deliver a smart interconnection with AC and DC-Networks to uncover new value streams that attract investors to boost the up-scaling of the infrastructure.

Please, list the technical standards where requested and provide your answers where indicated as detailed as possible.

Respondent's Background Information

In the following respondent´s background information regarding its institutional affiliation is collected. This information is personal data as defined in Art. 4 (1) of the General Data Protection Regulation (GDPR).

The information will be collected for research purposes in order to better understand where the expert's answers are emerging from. It will only be saved as long as necessary for the analysis of the questionnaires' results and deleted afterwards.

We kindly ask you to provide your voluntary consent to the processing of your personal data in accordance with Art. 6 (1) GDPR. You can withdraw your consent any time in accordance with Art. 7 (3) GDPR by contacting: ...

1. I agree that my personal data is used for research purposes within the USER-CHI project.

However, if you do not wish to provide personal data for research purposes you can skip this first section and continue with the questionnaire.

Yes/No

2. What is the name of the institution you represent?
3. What is your position in the institution?

4. How many years have you been working in the field of electric mobility at the institution you represent?

Location of Park & Charge services

CLICK provides expert and 'smart' analysis, advanced simulations, and scenario planning for enabling CPOs, e-mobility providers, and real-state facility providers to adjust their service provision to user's needs, mobility habits, and preferences. Based on a decision support tool, supported by live maps and GIS based information, CLICK seeks to provide a wider perspective of the electric vehicle (EV) chargers' network. The following questions address the technical requirements for routing and GIS tools.

5. What are the current standards for routing applications in your city/country?

6. What are the current standards for geographic information systems/geomatics in your city/country?

Product standards and electrical safety

USER-CHI product CLICK will analyse, among other inputs, type of EVs and connectors. In the following, therefore, questions regarding product standards concerning electrical safety of the charging infrastructure are asked. Please, mention the technical standards in your city/country regarding the following aspects:

7. Electrical equipment and conductive charging systems for electric vehicles

8. Safety and operation for wireless charging, electro-magnetic compatibility (EMC) and magnetic field emissions

9. Location of fire extinguishers

10. Fire alarm systems

11. Safety inspections of charging stations

12. Data security regarding charging infrastructure

13. Functional safety

Charging plug components for electro mobility

The USER-CHI project and its products, like the USER-CHI product CLICK, are in line with the European Commission's provisions aiming at ensuring uniform charging methods for EVs across the EU, expressed in the standardisation mandate M/468, which focuses on unifying charging

interfaces between the vehicle and the power supply grid. Therefore, the following questions deal with the technical standards for the plugs and cables enabling EV´s charging.

14. Which are the plug and socket configurations required for AC charging in your city/country?

- Type 2
- CCS
- CHAdeMO
- Tesla Supercharger
- Other

15. If other, please name it.

16. Which are the plug and socket configurations required for DC charging in your city/country?

- Type 2
- CCS
- CHAdeMO
- Tesla Supercharger
- Other

17. If other, please name it.

18. What types of charging cables for charging electric cars are used in your city/country?

Hardware requirements for installed charging points

Due to the integration of the charging stations into an existing authentication system or the connection to an IT back end system, modifications of (standard) charging stations in which other IT systems or GSM components are usually installed may occur. In this case, the electrical safety of the entire system must be verified (if necessary, by means of inspection) and, if necessary, the replacement of components must be notified to the issuer of the certificate or the test documents for CE conformity. Please, mention the technical standards in your city/country regarding the following aspects:

19. Electronic equipment, e.g., components, in charging stations

20. Switch-gear (e.g. low voltage switch-gear, load-break switches, dis-connectors, switch-dis-connectors, and switch-fuse units)

21. Communication unit (e.g., modem, radio interfaces, etc.)

22. Electromagnetic tolerance (i.e., electromagnetic fields)

23. Installation, protection requirements and protection measures

24. How is it ensured that the communication between the charging infrastructure and the back end is secure? (IT security)

Safety and standard-compliant design of the mounting system (socket, pole, or wall-mount)

In the following, questions regarding the technical standards related to the build elements of the charging station are asked.

25. What are the technical standards for the built elements of the charging station, namely mounting system (socket, pole, or wall-mount)? Please mention the type of mounting system and list the existing standards in each case.

Testing of hardware/charging infrastructure

The following section asks questions regarding the considered standards for testing of hardware/charging infrastructure in your city/country. Please name the standard for the following environmental conditions:

26. Temperature change

27. Humid heat cyclic (12 + 12 hours) and constant (24 hours)

28. Hammer tests

29. Precipitation

30. Flood (resilience)

31. Storm

32. Electro-magnetic Compatibility (EMC)

33. Other

Technical records and documentation

In the following subsections questions regarding technical standards for records and documentation are asked. This section and sub-sections present crosscutting questions to all USER-CHI products.

34. What standards must the technical documentation meet in your country/city?

35. For how long should the documentation remain available in your city/country?

Technical Requirements for INCAR

USER-CHI Product INCAR | Technical Questionnaire

The aim of the USER-CHI project is to unlock the potential of transnational and inter-regional electromobility in Europe. Therefore, innovative solution will be integrated to achieve interoperability for users. This includes services such as e-roaming, billing, authentication, and reservations of parking slots with charging points. The user is put at the centre of this research. Moreover, the synergies between electromobility and smart grids will be fostered to contribute to the European energy transition.

The developed technological tools, and business models will be put into practice and demonstrated in five demonstration cities: Barcelona metropolitan area (Spain), Rome (Italy), Berlin (Germany), Budapest (Hungary), and Turku (Finland). Also, two replication cities have been included in each of the TEN-T corridors involved in the project: Murcia (Spain) in the Mediterranean corridor and Florence (Italy) in the Scandinavian-Mediterranean corridor.

Currently, different charging technologies and types of charging stations in public, semi-public, and private space exist. Hence, different requirements regarding local regulations and technical standards may apply. Publicly accessible charging infrastructure is subject to various EU, national, and local directives, regulations, technical safety requirements, and standards.

The aim of the questionnaire is to collect the technical standards that USER-CHI solutions should comply in all 5 USER-CHI partner countries and a set of at least 5 other relevant EU countries. The questionnaire will collect relevant technical standards for the implementation of USER-CHI products and will contribute to the deliverable D1.3 (Technical and Legal Requirements for USER-CHI Solutions) from a technical perspective.

The questionnaire focuses on the USER-CHI product SMAC (Smart Charging Tool) that will be developed and tested within the project. SMAC is a platform that provides smart grid integration services for slow, medium, fast, and ultra-fast charging by following the purpose of minimising the grid impact associated to the implementation of charging infrastructure. This smart charging tool will provide high-value services to electric vehicle (EV) drivers, such as minimum charging prices and maximum RES electricity supply, considering specific constraints that will be

prioritised in the charging sessions scheduling process. Aside from that, SMAC will provide standard and scalable solutions for demand management and smart grid integration services by integrating V2G and using EVs as dynamic distributed storage devises, feeding electricity stored in their batteries back into the local electric grid when needed. That will bring benefits to the DSOs concerning flexibility and stabilisation while reducing the grid impact of new charging infrastructure. A main aspect of the demand management in SMAC will be an interconnected route management system for incoming vehicles while considering the grid availability, voltage, and frequency control constraints in real-time. Furthermore, SMAC will deliver a smart interconnection with AC and DC-Networks to uncover new value streams that attract investors to boost the up-scaling of the infrastructure.

Please, list the technical standards where requested and provide your answers where indicated as detailed as possible.

Respondent's Background Information

In the following respondent´s background information regarding its institutional affiliation is collected. This information is personal data as defined in Art. 4 (1) of the General Data Protection Regulation (GDPR).

The information will be collected for research purposes in order to better understand where the expert's answers are emerging from. It will only be saved as long as necessary for the analysis of the questionnaires' results and deleted afterwards.

We kindly ask you to provide your voluntary consent to the processing of your personal data in accordance with Art. 6 (1) GDPR. You can withdraw your consent any time in accordance with Art. 7 (3) GDPR by contacting: …

5. I agree that my personal data is used for research purposes within the USER-CHI project.

However, if you do not wish to provide personal data for research purposes you can skip this first section and continue with the questionnaire.

Yes/No

6. What is the name of the institution you represent?
7. What is your position in the institution?
8. How many years have you been working in the field of electric mobility at the institution you represent?

Location of park & charge services

When it comes to electric mobility services for EVs, parking and charging services often go hand in hand. USER-CHI product INCAR aims at: offering booking features of parking slots and charging stations; searching and routing to EVSEs; and integration with rout planning of EV fleets. The following questions aim at collecting technical standards, or specific technical solutions regarding park & charge services and urban mobility planning aspects.

5. What are the current standards for routing applications in your city/country?

6. What are the current standards for geographic information systems/geomatics in your city/country?

Supply of electric energy for EVs charging infrastructure

Within the USER-CHI project, conductive and inductive charging technologies are to be implemented/tested. Moreover, conductive charging equipment is generally subject to the obligation of CE labelling. For the declaration of CE conformity, the product standards listed below, referring to general requirements, must be fully met. The respective product standard also refers to the general standards on electrical safety are listed below. Please, mention the technical standards in your city/country regarding the following aspects:

7. AC charging technologies

8. AC grid integration

9. DC charging technologies

10. DC grid integration

11. Public wireless charging

Product standards and electrical safety

In the following, questions regarding technical standards for safety are asked. Please, mention the technical standards in your city/country regarding the following aspects:

12. Equipment and conductive charging systems for electric vehicles

13. Safety and operation for wireless charging, electro-magnetic compatibility (EMC) and magnetic field emissions

14. Location of fire extinguishers
15. Fire alarm systems
16. Safety inspections of charging stations
17. Data security regarding charging infrastructure
18. Functional safety

Charging plug components for electro mobility

The USER-CHI project and its products are in line with the European Commission's provisions aiming at ensuring uniform charging methods for EVs across the EU, expressed in the standardisation mandate M/468, which focuses on unifying charging interfaces between the vehicle and the power supply grid. USER-CHI product INCAR will allow users to give their instant feedback regarding its charging experiences, where an expedited connection between vehicle and charging station plays a relevant role. Therefore, the following questions deal with the technical standards for the plugs and cables enabling EV ´s charging.

19. Which are the plug and socket configurations required for AC charging in your city/country?

- Type 2
- CCS
- CHAdeMO
- Tesla Supercharger
- Other

20. If other, please name it.
21. Which are the plug and socket configurations required for DC charging in your city/country?

- Type 2
- CCS
- CHAdeMO
- Tesla Supercharger
- Other

22. If Other, please name it.
23. What types of charging cables for charging electric cars are used in your city/country?

Hardware requirements for installed charging points

Due to the integration of the charging stations into an existing authentication system or the connection to an IT back end system, modifications of (standard) charging stations in which other IT systems or GSM components are usually installed may occur. In this case, the electrical safety of the entire system must be verified (if necessary, by means of inspection) and, if necessary, the replacement of components must be notified to the issuer of the certificate or the test documents for CE conformity. Please, mention the technical standards in your city/country regarding the following aspects:

24. Electronic equipment, e.g., components, in charging stations

25. Switch-gear (e.g. low voltage switch-gear, load-break switches, dis-connectors, switch-dis-connectors, and switch-fuse units)

26. Communication unit (e.g., modem, radio interfaces, etc.)

27. Electromagnetic tolerance (i.e., electromagnetic fields)

28. Installation, protection requirements and protection measures

29. How is it ensured that the communication between the charging infrastructure and the back end is secure? (IT security)

Safety and standard-compliant design of the mounting system (socket, pole, or wall-mount)

In the following, questions regarding the technical standards related to the build elements of the charging station are asked.

30. What are the technical standards for the built elements of the charging station, namely mounting system (socket, pole, or wall-mount)? Please mention the type of mounting system and list the existing standards in each case.

Testing of hardware/charging infrastructure

The following section asks questions regarding the considered standards for testing of hardware/charging infrastructure in your city/country. Please name the standard for the following environmental conditions:

31. Temperature change

32. Humid heat cyclic (12 + 12 hours) and constant (24 hours)

33. Hammer tests

34. Precipitation

35. Flood (resilience)

36. Storm

37. Electro-magnetic Compatibility (EMC)

38. Other

Technical Communication

An accounting of the individual charging processes may be necessary for reasons related to the business model or for balancing and taxation aspects. The following subsections raise questions on this regard.

39. What are the current standards for acquisition of information about charging processes in your city/country?

40. What are the current standards for data management and interchange regarding booking and billing of charging services in your city/country?

41. What are the current standards for data sharing processes among providers of charging services in your city/country?

Communication protocols, eRoaming Platforms/ eMobility Service Providers (EMSPs)

USER-CHI product INCAR will offer innovative integrated EV-related services such as interoperability and roaming to access EVS within the different partner cities/countries and across them. Moreover, it is necessary for the various e-mobility service providers to have seamless communication in order to offer an effective service to the final user. The following subsections raise technical questions on this regard.

42. Which charging protocols are used in your city/country?

- OCPI (e.g., NKL Nederland)
- OCHP (e.g., eClearingNet)
- EMEP3 (e.g., Gireve)
- OICP (e.g., Hubject)

43. Are there any other charging protocols used in your city/country? If yes, please name it.

44. Which versions of the indicated charging protocols are used in your city/country?

Authorization and Authentication methods

To implement an interoperable system, technical standards for wireless authorisation and authentication must be implemented. USER-CHI product INCAR will offer booking features of parking slots and charging stations where end users should be able to log in by using the authorization and authentication methods given by their local EMSPs. Please indicate which of the following alternatives for user authentication are currently used in your city/country and mention under which technical standards.

45. Radio Frequency Identification (RFID) Card; if yes, which type?

46. Near-field communication (NFC) (e.g., via smartphone app)

47. Quick Response-Code (QR-Code)

48. Ad hoc charging/payment (authentication):

- Credit card, debit card
- Online money transfers
- Pay by phone bill
- Cash payment
- Virtual currencies (e.g., Bitcoins)

49. Are there any other?

Technical records and documentation

In the following subsections questions regarding technical standards for records and documentation are asked. This section and sub-sections present crosscutting questions to all USER-CHI products.

50. What standards must the technical documentation meet in your country/city?

51. For how long should the documentation remain available in your city/country?

Technical Requirements for SMAC

USER-CHI Product SMAC | Technical Questionnaire

The aim of the USER-CHI project is to unlock the potential of transnational and inter-regional electromobility in Europe. Therefore, innovative solution will be integrated to achieve interoperability for users. This includes services such as e-roaming, billing, authentication, and reservations of parking slots with charging points. The user is put at the centre of this research. Moreover, the synergies between electromobility and smart grids will be fostered to contribute to the European energy transition.

The developed technological tools, and business models will be put into practice and demonstrated in five demonstration cities: Barcelona metropolitan area (Spain), Rome (Italy), Berlin (Germany), Budapest (Hungary), and Turku (Finland). Also, two replication cities have been included in each of the TEN-T corridors involved in the project: Murcia (Spain) in the Mediterranean corridor and Florence (Italy) in the Scandinavian-Mediterranean corridor.

Currently, different charging technologies and types of charging stations in public, semi-public and private space exist. Hence, different requirements regarding local regulations and technical standards may apply. Publicly accessible charging infrastructure is subject to various EU, national, and local directives, regulations, technical safety requirements, and standards.

The aim of the questionnaire is to collect the technical standards that USER-CHI solutions should comply in all 5 USER-CHI partner countries and a set of at least 5 other relevant EU countries. The questionnaire will collect relevant technical standards for the implementation of USER-CHI products and will contribute to the deliverable D1.3 (Technical and Legal Requirements for USER-CHI Solutions) from a technical perspective.

The questionnaire focuses on the USER-CHI product SMAC (Smart Charging Tool) that will be developed and tested within the project. SMAC is a platform that provides smart grid integration services for slow, medium, fast, and ultra-fast charging by following the purpose of minimising the grid impact associated to the implementation of charging infrastructure. This smart charging tool will provide high-value services to electric vehicle (EV) drivers, such as minimum charging prices and maximum RES electricity supply, considering specific constraints that will be prioritised in the charging sessions scheduling process. Aside from that, SMAC will provide standard and scalable solutions for demand management and smart grid integration services by integrating V2G and using EVs as dynamic distributed storage devises, feeding electricity stored

in their batteries back into the local electric grid when needed. That will bring benefits to the DSOs concerning flexibility and stabilisation while reducing the grid impact of new charging infrastructure. A main aspect of the demand management in SMAC will be an interconnected route management system for incoming vehicles while considering the grid availability, voltage, and frequency control constraints in real-time. Furthermore, SMAC will deliver a smart interconnection with AC and DC-Networks to uncover new value streams that attract investors to boost the up-scaling of the infrastructure.

Please, list the technical standards where requested and provide your answers where indicated as detailed as possible.

Respondent's Background Information

In the following respondent´s background information regarding its institutional affiliation is collected. This information is personal data as defined in Art. 4 (1) of the General Data Protection Regulation (GDPR).

The information will be collected for research purposes in order to better understand where the expert's answers are emerging from. It will only be saved as long as necessary for the analysis of the questionnaires' results and deleted afterwards.

We kindly ask you to provide your voluntary consent to the processing of your personal data in accordance with Art. 6 (1) GDPR. You can withdraw your consent any time in accordance with Art. 7 (3) GDPR by contacting: ...

9. I agree that my personal data is used for research purposes within the USER-CHI project.

However, if you do not wish to provide personal data for research purposes you can skip this first section and continue with the questionnaire.

Yes/No

10. What is the name of the institution you represent?
11. What is your position in the institution?
12. How many years have you been working in the field of electric mobility at the institution you represent?

Energy Sources | Power supply for Charging Infrastructure

Within the USER-CHI project different energy sources for powering the charging infrastructure are being implemented. Moreover, the USER-CHI product SMAC aims at providing smart grid integration services for slow, medium, fast, and ultrafast charging. Considering energy supply, specially the use of RES electricity supply, will enable SMAC to provide high-value services to electric vehicle (EV) drivers. The following sections to collect the existing technical standards in your city/country.

13. How is the power supply of the charging infrastructure implemented in your city/country? (e.g., connection of the general power supply network, decentralized energy concept)
14. Is charging infrastructure implemented as alternating current (AC) or direct current (DC) charging infrastructure in your country? Please name the main voltage and amperage in each case.
15. Are Vehicle to Grid (V2G) technologies being implemented/tested in your city/country? If so, under which technological standards?
16. Demand side management (DSM) aims to improve the flexibility of the energy system on the consumer side by encouraging final users to be more energy efficient. DSM encompasses many different technological measures, which can range from improving energy efficiency with better insulation materials to fully autonomous energy systems that automatically respond to shifts in supply and demand. Are there any DSM strategies applications being implemented in your city/country? If so, under which technological standards?

Technical Requirements of the grid operator and metering device operator

The technical requirements consider balanced load conditions and unacceptable grid effects or circuit feedback. Please, list below the technical standards in your city/country regarding the following aspects:

17. Grid connection
18. Electricity meter location
19. Circuit distributor

Technical Connection Rules (TCR)

The TCR outline the essential issues to consider when connecting customer systems to the public utility grid. Moreover, the TCR contain important information on the operation of such systems. Please, mention the technical standards in your city/country regarding the following aspects:

20. What are the technical connection rules regarding charging infrastructure in your city/country?

Grid connection, provision of the grid connection and commissioning

The grid operator is responsible for providing, commissioning, and operating the grid connection. The metering point operator is responsible for the metering point (meter). The sub-distribution and remaining installation are to be carried out in connection with the installation of the charging point. The following sections to collect the existing technical standards in your city/country.

21. Which technical connection conditions apply to the metering point operator regarding charging infrastructure in your city/country?
22. Are there any other applicable standards, depending on the components and assemblies, that are relevant to consider in your city/country? E.g. definition of voltages and voltage ranges, switch cabinets, and switch-gear combinations.

Location of Park & Charge services

When it comes to electric mobility services for electric vehicle (EV), parking and charging services often go hand in hand. The USER-CHI product SMAC aims at providing high-value services to EV drivers, e.g. minimum charging prices; it is therefore relevant to EV drivers to know the location of best alternatives for charging stations in their city. The following questions aim at collecting technical standards, or specific technical solutions regarding park & charge services and urban mobility planning aspects.

23. What are the current standards for routing applications in your city/country?
24. What are the current standards for geographic information systems/geomatics in your city/country?

Types of energy supply for EVs´ charging infrastructure

Within the USER-CHI project, conductive and inductive charging technologies are to be implemented/tested. Moreover, conductive charging equipment is generally subject to the obligation of CE labelling. For the declaration of CE conformity, the product standards listed below, referring to general requirements, must be fully met.

The respective product standard also refers to the general standards on electrical safety are listed below. Please, mention the technical standards in your city/country regarding the following aspects:

25. AC charging technologies
26. AC grid integration
27. DC charging technologies
28. DC grid integration
29. Public wireless charging

Product standards and safety

In the following, questions regarding technical standards for safety are asked. Please, mention the technical standards in your city/country regarding the following aspects:

30. Equipment and conductive charging systems for electric vehicles
31. Safety and operation for wireless charging, electro-magnetic compatibility (EMC) and magnetic field emissions
32. Location of fire extinguishers
33. Fire alarm systems
34. Safety inspections of charging stations
35. Data security regarding charging infrastructure
36. Functional safety

Charging plug components for electromobility

The USER-CHI project and its products are in line with the European Commission's provisions aiming at ensuring uniform charging methods for EVs across the EU, expressed in the standardisation mandate M/468, which focuses on unifying charging interfaces between the vehicle and the power supply grid. USER-CHI product SMAC will provide high-value service to EV drivers, where an expedited connection between vehicle and charging station plays a relevant role Therefore, the following questions deal with the technical standards for the plugs and cables enabling EV´s charging.

37. Which are the plug and socket configurations required for AC charging in your city/country?

- Type 2
- CCS
- CHAdeMO
- Tesla Supercharger
- Other

38. If other, please name it.

39. Which are the plug and socket configurations required for DC charging in your city/country?

- Type 2
- CCS
- CHAdeMO
- Tesla Supercharger
- Other

40. If other, please name it.

41. What types of charging cables for charging electric cars are used in your city/country?

Hardware requirements for installed charging points

Due to the integration of the charging stations into an existing authentication system or the connection to an IT back end system, modifications of (standard) charging stations in which other IT systems or GSM components are usually installed may occur. In this case, the electrical safety of the entire system must be verified (if necessary, by means of inspection) and, if necessary, the replacement of components must be notified to the issuer of the certificate or the test documents for CE conformity. Please, mention the technical standards in your city/country regarding the following aspects:

42. Electronic equipment, e.g., components, in charging stations

43. Switch-gear (e.g. low voltage switch-gear, load-break switches, disconnectors, switch-disconnectors, and switch-fuse units)

44. Communication unit (e.g., modem, radio interfaces, etc.)

45. Electromagnetic tolerance (i.e., electromagnetic fields)
46. Installation, protection requirements and protection measures
47. How is it ensured that the communication between the charging infrastructure and the back end is secure? (IT security)

Safety and standard-compliant design of the mounting system (socket, pole, or wall-mount)

in the following, questions regarding the technical standards related to the build elements of the charging station are asked.

48. What are the technical standards for the built elements of the charging station, namely mounting system (socket, pole, or wall-mount)? Please mention the type of mounting system and list the existing standards in each case.

Testing of hardware/charging infrastructure

The following section asks questions regarding the considered standards for testing of hardware/charging infrastructure in your city/country. Please name the standard for the following environmental conditions:

49. Temperature change
50. Humid heat cyclic (12 + 12 hours) and constant (24 hours)
51. Hammer tests
52. Precipitation
53. Flood (resilience)
54. Storm
55. Electro-magnetic Compatibility (EMC)
56. Other

Technical records and documentation

In the following subsections questions regarding technical standards for records and documentation are asked. This section and sub-sections present crosscutting questions to all USER-CHI products.

57. What standards must the technical documentation meet in your city/ country?
58. For how long should the documentation remain available in your city/country?

Technical Requirements for INDUCAR

USER-CHI Product INDUCAR | Technical Questionnaire

The aim of the USER-CHI project is to unlock the potential of transnational and inter-regional electromobility in Europe. Therefore, innovative solution will be integrated to achieve interoperability for users. This includes services such as e-roaming, billing, authentication, and reservations of parking slots with charging points. The user is put at the centre of this research. Moreover, the synergies between electromobility and smart grids will be fostered to contribute to the European energy transition.

The developed technological tools, and business models will be put into practice and demonstrated in five demonstration cities: Barcelona metropolitan area (Spain), Rome (Italy), Berlin (Germany), Budapest (Hungary), and Turku (Finland). Also, two replication cities have been included in each of the TEN-T corridors involved in the project: Murcia (Spain) in the Mediterranean corridor and Florence (Italy) in the Scandinavian-Mediterranean corridor.

Currently, different charging technologies and types of charging stations in public, semi-public and private space exist. Hence, different requirements regarding local regulations and technical standards may apply. Publicly accessible charging infrastructure is subject to various EU, national, and local directives, regulations, technical safety requirements, and standards.

The aim of the questionnaire is to collect the technical standards that USER-CHI solutions should comply in all 5 USER-CHI partner countries and a set of at least 5 other relevant EU countries. The questionnaire will collect relevant technical standards for the implementation of USER-CHI products and will contribute to the deliverable D1.3 (Technical and Legal Requirements for USER-CHI Solutions) from a technical perspective.

The questionnaire focuses on the USER-CHI product SMAC (Smart Charging Tool) that will be developed and tested within the project. SMAC is a platform that provides smart grid integration services for slow, medium, fast, and ultra-fast charging by following the purpose of minimising the grid impact associated to the implementation of charging infrastructure. This smart charging tool will provide high-value services to electric vehicle (EV) drivers, such as minimum charging prices and maximum RES electricity supply, considering specific constraints that will be prioritised in the charging sessions scheduling process. Aside from that, SMAC will provide standard and scalable solutions for demand management and smart grid integration services by integrating V2G and using EVs as dynamic distributed storage devises, feeding electricity stored in their batteries back into the local electric grid when needed. That will bring benefits to the DSOs concerning flexibility and stabilisation while reducing the grid impact of new charging infrastructure. A main aspect of the demand management in SMAC will be an interconnected route management system for incoming vehicles while considering the grid availability, voltage, and frequency control constraints in real-time. Furthermore, SMAC will deliver a smart interconnection with AC and DC-Networks to uncover new value streams that attract investors to boost the up-scaling of the infrastructure.

Please, list the technical standards where requested and provide your answers where indicated as detailed as possible.

Respondent's Background Information

In the following respondent´s background information regarding its institutional affiliation is collected. This information is personal data as defined in Art. 4 (1) of the General Data Protection Regulation (GDPR).

The information will be collected for research purposes in order to better understand where the expert's answers are emerging from. It will only be saved as long as necessary for the analysis of the questionnaires' results and deleted afterwards.

We kindly ask you to provide your voluntary consent to the processing of your personal data in accordance with Art. 6 (1) GDPR. You can withdraw your consent any time in accordance with Art. 7 (3) GDPR by contacting: ...

1. I agree that my personal data is used for research purposes within the USER-CHI project.

However, if you do not wish to provide personal data for research purposes you can skip this first section and continue with the questionnaire.

Yes/No

2. What is the name of the institution you represent?
3. What is your position in the institution?
4. How many years have you been working in the field of electric mobility at the institution you represent?

Location of park & charge services

When it comes to electric mobility services for electric vehicle (EV), parking and charging services often go hand in hand. Since the USER-CHI product INDUCAR seeks to enable wireless charging technology for EVs' users, it is relevant for EVs' users to know the availability of this technology within each city. The following questions aim at collecting technical standards, or specific technical solutions regarding park & charge services and urban mobility planning aspects.

5. What are the current standards for routing applications in your city/country?

6. What are the current standards for geographic information systems/geomatics in your city/country?

Supply of electric energy for electric vehicle (EV) charging infrastructure

Within the USER-CHI project, conductive and inductive charging technologies are to be implemented/tested. Moreover, conductive charging equipment is generally subject to the obligation of CE labelling. For the declaration of CE conformity, the product standards listed below, referring to general requirements, must be fully met. The respective product standard also refers to the general standards on electrical safety are listed below. Please, mention the technical standards in your city/country regarding the following aspects:

7. AC charging technologies

8. AC grid integration

9. DC charging technologies

10. DC grid integration

11. Public wireless charging

Product standards and safety

In the following, questions regarding technical standards for safety are asked. Please, mention the technical standards in your city/country regarding the following aspects:

12. Equipment and conductive charging systems for electric vehicles

13. Safety and operation for wireless charging, electro-magnetic compatibility (EMC) and magnetic field emissions

14. Location of fire extinguishers

15. Fire alarm systems

16. Charging infrastructure and electrical systems

17. Safety inspections of charging stations

18. Data security regarding charging infrastructure

19. Functional safety

Hardware requirements for installed charging points

Due to the integration of the charging stations into an existing authentication system or the connection to an IT back end system, modifications of (standard) charging stations in which other IT systems or GSM components are usually installed may occur. In this case, the electrical safety of the entire system must be verified (if necessary, by means of inspection) and, if necessary, the replacement of components must be notified to the issuer of the certificate or the test documents for CE conformity. Please, mention the technical standards in your city/country regarding the following aspects:

20. Electronic equipment, e.g., components, in charging stations

21. Switch-gear (e.g. low voltage switch-gear, load-break switches, dis-connectors, switch-dis-connectors, and switch-fuse units)

22. Communication unit (e.g., modem, radio interfaces, etc.)

23. Electromagnetic tolerance (i.e., electromagnetic fields)

24. Installation, protection requirements and protection measures

25. How is it ensured that the communication between the charging infrastructure and the back end is secure? (IT security)

Safety and standard-compliant design of the mounting system (socket, pole, or wall-mount)

In the following, questions regarding the technical standards related to the build elements of the charging station are asked.

26. What are the technical standards for the built elements of the charging station, namely mounting system (socket, pole, or wall-mount)? Please mention the type of mounting system and list the existing standards in each case.

Testing of hardware/charging infrastructure

The following section asks questions regarding the considered standards for testing of hardware/charging infrastructure in your city/country. Please name the standard for the following environmental conditions:

27. Temperature change

28. Humid heat cyclic (12 + 12 hours) and constant (24 hours)

29. Hammer tests

30. Precipitation

31. Flood (resilience)

32. Storm

33. Electro-magnetic Compatibility (EMC)

34. Other

Technical records and documentation

In the following subsections questions regarding technical standards for records and documentation are asked. This section and sub-sections present crosscutting questions to all USER-CHI products.

35. What standards must the technical documentation meet in your country/city?

36. For how long should the documentation remain available in your city/country?

Technical Requirements for INSOC

USER-CHI Product INSOC | Technical Questionnaire

The aim of the USER-CHI project is to unlock the potential of transnational and inter-regional electromobility in Europe. Therefore, innovative solution will be integrated to achieve interoperability for users. This includes services such as e-roaming, billing, authentication, and reservations of parking slots with charging points. The user is put at the centre of this research. Moreover, the synergies between electromobility and smart grids will be fostered to contribute to the European energy transition.

The developed technological tools, and business models will be put into practice and demonstrated in five demonstration cities: Barcelona metropolitan area (Spain), Rome (Italy), Berlin (Germany), Budapest (Hungary), and Turku (Finland). Also, two replication cities have been included in each of the TEN-T corridors involved in the project: Murcia (Spain) in the Mediterranean corridor and Florence (Italy) in the Scandinavian-Mediterranean corridor.

Currently, different charging technologies and types of charging stations in public, semi-public and private space exist. Hence, different requirements regarding local regulations and technical standards may apply. Publicly accessible charging infrastructure is subject to various EU, national, and local directives, regulations, technical safety requirements, and standards.

The aim of the questionnaire is to collect the technical standards that USER-CHI solutions should comply in all 5 USER-CHI partner countries and a set of at least 5 other relevant EU countries. The questionnaire will collect relevant technical standards for the implementation of USER-CHI products and will contribute to the deliverable D1.3 (Technical and Legal Requirements for USER-CHI Solutions) from a technical perspective.

The questionnaire focuses on the USER-CHI product SMAC (Smart Charging Tool) that will be developed and tested within the project. SMAC is a platform that provides smart grid integration services for slow, medium, fast, and ultra-fast charging by following the purpose of minimising the grid impact associated to the implementation of charging infrastructure. This smart charging tool will provide high-value services to electric vehicle (EV) drivers, such as minimum charging prices and maximum RES electricity supply, considering specific constraints that will be prioritised in the charging sessions scheduling process.

Aside from that, SMAC will provide standard and scalable solutions for demand management and smart grid integration services by integrating V2G and using EVs as dynamic distributed storage devises, feeding electricity stored in their batteries back into the local electric grid when needed. That will bring benefits to the DSOs concerning flexibility and stabilisation while reducing the grid impact of new charging infrastructure. A main aspect of the demand management in SMAC will be an interconnected route management system for incoming vehicles while considering the grid availability, voltage, and frequency control constraints in real-time. Furthermore, SMAC will deliver a smart interconnection with AC and DC-Networks to uncover new value streams that attract investors to boost the up-scaling of the infrastructure.

Please, list the technical standards where requested and provide your answers where indicated as detailed as possible.

Respondent's Background Information

In the following respondent´s background information regarding its institutional affiliation is collected. This information is personal data as defined in Art. 4 (1) of the General Data Protection Regulation (GDPR).

The information will be collected for research purposes in order to better understand where the expert's answers are emerging from. It will only be saved as long as necessary for the analysis of the questionnaires' results and deleted afterwards.

We kindly ask you to provide your voluntary consent to the processing of your personal data in accordance with Art. 6 (1) GDPR. You can withdraw your consent any time in accordance with Art. 7 (3) GDPR by contacting: …

1. I agree that my personal data is used for research purposes within the USER-CHI project.

However, if you do not wish to provide personal data for research purposes you can skip this first section and continue with the questionnaire.

Yes/No

2. What is the name of the institution you represent?
3. What is your position in the institution?
4. How many years have you been working in the field of electric mobility at the institution you represent?

Energy supply for LEVs charging box – Photovoltaic (PV) systems

Within the USER-CHI project different energy sources for powering the charging infrastructure are being implemented. The USER-CHI product INSOC consist of a hybrid PV-powered charging box for LEVs combined with local grid power supply. Therefore, the following sections aim to collect the existing technical standards in your city/country in this area.

5. How is the power supply of the charging infrastructure for LEVs implemented in your city/country? (e.g., connection of the general power supply network)

6. Are decentralized power supply systems, such as photovoltaic low-power DC charging infrastructure for LEVs, implemented your city/country? If so, under which technological standards?

7. Which are the technological standards for the photovoltaic system performance monitoring in your city/country?

8. Is there any experience regarding energy trading involving PV systems and energy service providers in your city/country? If yes, please mention the technical standards for equipment for electrical energy measurement (smart meter) and load control.

Technical requirements of the grid operator and metering device operator

The requirements consider balanced load conditions and unacceptable grid effects or circuit feedback. Please, list below the technical standards in your city/country regarding the following aspects:

9. Grid connection

10. Electricity meter location

11. Circuit distributor

Energy Storage

To ensure the provision of energy for charging LEVs, the USER-CHI product INSOC also considers an energy storage system. The system accumulates solar energy which, in case there is excess energy in the system, it could be transferred into the local grid. On the other hand, the system could accumulate energy from the local network during low demand hours (low price) to allow charging LEVs at a convenient price. The following questions ask for the technical standards in the field.

12. Are there any DC-coupled storage systems for PV systems implemented in your city/country? If so, under which technological standards?

13. In order to get the most life from a solar battery used in PV systems, it must be discharged and recharged properly. Against which performance measures are the batteries measured in your country/city?

Location of LEVs charging infrastructure

When it comes to electric mobility services for LEVs, parking and charging services could go hand in hand. Moreover, INSOC seeks to integrate park & charge with payment & billing services, making it especially convenient for new urban mobility offers, such as e-bike and e-scooter sharing services, while enabling a thief-proof storage of LEVs. The USER-CHI product INSOC seeks to enable users of a LEV sharing service to access real-time information on the availability of parking and charging services in their cities. Based on online mapping tools a wider perspective of the LEV chargers' network is provided. The following questions address the technical requirements for routing and GIS tools.

14. What are the current standards for routing applications in your city/country?

15. The information analysed by online mapping tools could be originated in different sources; for enabling a proper integration in the system, standardization it is necessary. What are the current standards for geographic information systems/geomatics in your city/country?

Technical connection rules

The Technical Connection Rules (TCR) outline the essential issues to consider when connecting customer systems to the public utility grid. Moreover, the TCR contain important information on the operation of such systems. Please, mention the technical standards in your city/country regarding the following aspects:

16. What are the technical connection rules regarding charging infrastructure in your city/country?

Grid connection, provision of the grid connection and commissioning

The grid operator is responsible for providing, commissioning, and operating the grid connection. The metering point operator is responsible for the metering point (meter).

The sub-distribution and remaining installation are to be carried out in connection with the installation of the charging point. The following sections to collect the existing technical standards in your city/country.

17. Which technical connection conditions apply to the metering point operator regarding charging infrastructure in your city/country?

18. Are there any other applicable standards, depending on the components and assemblies, that are relevant to consider in your city/country? E.g., definition of voltages and voltage ranges, switch cabinets, and switch-gear combinations.

Supply of electric energy for electric vehicles (EVs) charging infrastructure

Within the USER-CHI project, ***conductive and inductive charging*** *technologies are to be implemented/tested. Moreover, conductive charging equipment is generally subject to the obligation of CE labelling. For the declaration of CE conformity, the product standards listed below, referring to general requirements, must be fully met. The respective product standard also refers to the general standards on electrical safety are listed below. Please, mention the technical standards in your city/country regarding the following aspects:*

19. AC grid integration

20. DC charging technologies

Product standards and electrical safety

In the following, questions regarding technical standards for safety are asked. Please, mention the technical standards in your city/country regarding the following aspects:

21. Equipment and conductive charging systems for electric vehicles

22. Location of fire extinguishers

23. Fire alarm systems

24. Safety inspections of charging stations

25. Data security regarding charging infrastructure

26. Functional safety

Charging plug components for LEVs charging

The USER-CHI project and its products are in line with the European Commission's provisions aiming at ensuring uniform charging methods for EVs across the EU, expressed in the standardization mandate M/468, which focuses on unifying charging interfaces between the vehicle and the power supply grid. Therefore, the following questions deal with the technical standards for the plugs and cables enabling EV´s charging.

27. Which are the plug and socket configurations required for DC charging of LEVs in your city/country?

28. What types of charging cables for charging electric cars are used in your city/country?

Hardware requirements for installed LEVs charging box

Due to the integration of the charging stations into an existing authentication system or the connection to an IT back end system, modifications of (standard) LEVs charging stations in which other IT systems or GSM components are usually installed may occur. In this case, the electrical safety of the entire system must be verified (if necessary, by means of inspection) and, if necessary, the replacement of components must be notified to the issuer of the certificate or the test documents for CE conformity. Please, mention the technical standards in your city/country regarding the following aspects:

29. Electronic equipment used in the LEVs charging box (e.g. components, charger controllers with digital display, solar hybrid Inverter, etc.)

30. Switch-gear (e.g. low voltage switch-gear, load-break switches, dis-connectors, switch-dis-connectors, and switch-fuse units)

31. Communication unit (e.g., modem, radio interfaces, etc.)

32. Electromagnetic tolerance (i.e., electromagnetic fields)

33. Installation, protection requirements and protection measures

34. How is it ensured that the communication between the charging infrastructure and the back end is secure? (IT security)

Safety and standard-compliant design of the LEVs charging Box (Box envelope, PV Module)

In the following, questions regarding the technical standards related to the build elements of the LEVs charging station are asked.

35. What are the technical standards for the structural envelope of the LEV box? Are there any standards regarding the minimum dimensions of the box, materials, or any other construction requirements?

36. What are the technical standards for the photovoltaic generator (PV Modules)?

37. What are the technical standards for the module support structure

38. What are the technical standards for charge regulator

39. What are the technical standards for the system installation and wiring?

40. What are the technical standards for the grounding and lightning protection?

Testing of the LEV box hardware components

The following section asks questions regarding the considered standards for testing of hardware/charging infrastructure in your city/country for ensuring the LEV box´s technical operation safety. Please name the standard for the following environmental conditions:

41. Temperature change

42. Humid heat cyclic (12 + 12 hours) and constant (24 hours)

43. Hammer tests

44. Precipitation

45. Flood (resilience)

46. Storm

47. Electro-magnetic Compatibility (EMC)

48. Are there any other requirements? For example: guidelines on how to end the charging process and mechanisms to unlock the charging cable given by the authorities; automatic interruption/end of the charging process (by the operator) for grid stabilisation, after exceeding a certain time threshold.

Booking & Billing

An accounting of the individual charging processes may be necessary for reasons related to the business model or for balancing and taxation aspects. Moreover, the LEVs considered within the USER-CHI product INSOC are offered by local E-mobility sharing service providers.

In the following, questions regarding technical standards for booking and billing of such services and the interactions within the communication system are asked.

49. What are the current standards for data management and interchange regarding booking and billing of charging services for LEVs in your city/country?

50. What are the current standards for data sharing processes among providers of charging services in your city/country? E.g., between the grid operator, different service providers for e-bike or e-scooter sharing services.

Communication protocols

USER-CHI product INSOC will offer innovative services for LEV such booking and parking within the different partner cities/countries and across them. Moreover, it is necessary for the various LEV sharing service providers to have seamless communication in order to offer an effective service to the final user. The following subsections raise technical questions on this regard.

51. Which charging protocols are used in your city/country?

- OCPI (e.g., NKL Nederland)
- OCHP (e.g., eClearingNet)
- EMEP3 (e.g., Gireve)
- OICP (e.g., Hubject)

52. Which versions of the indicated charging protocols are used in your city/country?

Authorization and authentication methods

To implement an interoperable system, technical standards for wireless authorisation and authentication for LEVs charging stations must be implemented. Please indicate which of the following alternatives for user authentication for providers for e-bike or e-scooter sharing services are currently used in your city/country and mention under which technical standards.

53. Radio Frequency Identification (RFID) Card; if yes, which type?

54. Near-field communication (NFC) (e.g., via smartphone app)

55. Quick Response-Code (QR-Code)

56. Ad hoc charging/payment (authentication):

- Credit card, debit card
- Online money transfers
- Pay by phone bill
- Cash payment
- Virtual currencies (e.g., Bitcoins)

57. Are there any other?

Technical records and documentation

In the following subsections questions regarding technical standards for records and documentation are asked. This section and sub-sections present crosscutting questions to all USER-CHI products.

58. What standards must the technical documentation meet in your country/city?

59. For how long should the documentation remain available in your city/country?

Legal Questionnaire

Legal Requirements for USER-CHI Solutions

USER-CHI Project

The aim of USER-CHI is to unlock the potential of transnational and inter-regional electromobility in Europe. Therefore, different charging technologies will be integrated to achieve interoperability for users. This process includes, for example, charging technologies, e-roaming, billing, authentication, and reservations of parking slots in front of charging infrastructure.

Moreover, the synergies between electromobility and smart grids will be fostered to contribute to the European energy transition. The developed technological tools, and business models will be put into practice and demonstrated in five areas: Barcelona metropolitan area (Spain), Rome (Italy), Berlin (Germany), Budapest (Hungary), and Turku (Finland).

Besides, replication cities have been included in each of the Trans-European Transport Network (TEN-T) corridors involved in the project: Murcia (Spain) in the Mediterranean corridor and Florence (Italy) in Scandinavian-Mediterranean corridor.

QUESTIONNAIRE

This questionnaire will contribute to the deliverable D1.3 (Technical and Legal Requirements for USER-CHI Solutions) from a legal perspective. Concrete technical requirements will be collected by means of a different questionnaire.

The following questions refer to technical products, which will be developed and implemented during USER-CHI, such as:

a) CLICK-Charging Location and Holistic Planning Kit,

b) INCAR - Interoperability, Charging and Parking Platform

c) SMAC - Smart Charging Tool and

d) INDUCAR - Inductive Charging for e-Cars.

Aim of the Questionnaire

The aim of the questionnaire is to collect the legal standards that USER-CHI solutions must meet in all five partner countries and a set of at least five other relevant EU countries. The questionnaire will collect relevant legal standards for the implementation of USER-CHI products dealing with electric vehicles (EVs) charging infrastructure.

There are several fields of law, which influence the expansion of charging infrastructure for electric vehicles. The areas of law range from construction and planning law, road traffic law (reservation of parking spots in public spaces), energy law (energy supply to charging point, grid connection, requirements for network operator in regard to network stability), calibration law (billing models, roaming-platforms) as well as data protection law and data security (authentication processes / handling of personal data).

The legal requirements may vary in accordance with different types of charging infrastructure and business models in public, semi-public, or private spaces. Moreover, the legal requirements derive from European, as well as national laws.

Furthermore, the link between technical standards and the legal framework arises through references within the applicable legal texts. In general, technical standards are not legally binding and are applied by parties on a voluntary basis or contractual obligation under private law. However, in cases where European or national regulations explicitly refer to technical standards, they become legally binding.

This questionnaire aims at mapping out especially requirements set up by national laws indicated by experts. A variety of answers will provide relevant information for more than one of the USER-CHI products. However, they will only be raised once where similar answers are anticipated in order to prevent repetitions.

Therefore, we kindly ask you to provide all possible answers to the different USER-CHI products, even though they might not be implemented at your demo site.

Respondent´s Background Information

In the following respondent´s background information regarding its institutional affiliation is collected. This information is personal data as defined in Art. 4 (1) GDPR.

The information will be collected for research purposes in order to better understand where the expert's answers are emerging from. It will only be saved as long as necessary for the analysis of the questionnaires' results and deleted afterwards.

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(....) I agree that my personal data is used for research purposes within the USER-CHI project

However, if you do not wish to provide personal data for research purposes you can skip this first section and continue with the questionnaire.

1. What is the name of the institution you represent?
2. What is your position in the institution?
3. How many years have you been working in the field of electromobility at the institution you represent?

CLICK - Charging Location and Holistic Planning Kit

CLICK will support administrators within the process of top-down location planning for charging infrastructure in cities and the TEN-T corridors. Building upon an application used by Rome Mobility Agency (RSM), it will serve as a question-and-answer online tool considering user's needs and habits in regard of charging technologies. The results generated by CLICK will address exact proposed locations, preferred technologies as well as the number of charging points needed, amongst other factors.

Moreover, CLICK will enable a post-planning monitoring process by offering interfaces to be fed with actual utilization of data of electric vehicle supply equipment (EVSE) This will trigger the demand-oriented expansion of the charging infrastructure network.

Building and construction law:

Building and construction law plays a relevant role for the planning and building phase of infrastructure for EVs. Therefore, the following section will address requirements deriving from this field of law.

1. Which permissions are needed for the construction of charging points (AC and DC) in public spaces and private spaces under national building and construction laws? If none are needed, please indicate this as well.
2. Which public authorities or public bodies are involved in the administrative process in regard to the installation of charging points? On which level are the involved authorities located in the administrative structure and what are their competences?
3. Please describe the steps that are included in the administrative approval process (e.g., building/planning permission, registration of a grid connection, …).
4. Are there any laws regulating the construction and operation of charging infrastructure? E.g., fostering non-proprietary technical solutions in charging, sockets, and plugs?
5. Which requirements must be met by the construction of charging points (AC and DC) in regard to fire protection provisions on a national / local level?
6. Are local provisions on the preservation of historical monuments in force, which might oppose the construction of charging points in certain public or private spaces?
7. With regard to new non-residential buildings and non-residential buildings undergoing major renovation, which measures were implemented to ensure the installation of at least one charging point according to Art. 8 (2) of the EPBD-Directive (2018/844/EU)?
8. Are there national implementation laws regarding Art. 8 (5) of the EPBD Directive (2018/844/EU), which ensure that new residential buildings install charging infrastructure for electric-vehicles in the applicable scope?
9. Did your country already lay down requirements for the installation of a minimum number of charging points for existing non-residential buildings with more than twenty parking spaces in accordance to Art. 8 (3) of the EPBD Directive (2018/844/EU)?

Alternative Fuels Infrastructure Directive:

The implementation of the AFI-Directive (2014/94/EU) into the national legal framework ensures interoperability and the goal of non-discriminatory access to public charging infrastructure European-wide. Therefore, it plays an important role for the development of CLICK.

10. Which measures were taken for the implementation of the AFI-Directive (2014/94/EU) into the national legal framework? Are the adopted measures sufficient to fulfil the obligation to implement the directives or is the implementation still incomplete?
11. Is there an obligation to report the building and decommissioning of charging points for operators of charging points to authorities? If yes, under which national laws are they obliged to do so and to whom?
12. How is the goal of non-discriminatory access to public charging infrastructure (for users as well as for electricity suppliers; see Art. 2 No. 7, Art. 4 No. 8-11 AFI-Directive) implemented in national regulations?
13. Are there any rules implemented in order to guarantee that EV-drivers are able to charge their vehicle without previously having to conclude a contract with the charging point operator (CPO) in accordance to Art. 4 No. 9 AFI-Directive?
14. Are there any national rules regulating tariff models for the use of public charging infrastructure?
15. Has your country implemented laws to ensure interoperability of charging infrastructure run by different CPOs?

Procurement Law, concession law and subsidies:

The topic of procurement and concession law is important for CLICK, as the development of charging infrastructure by companies could include the procurement or concession. Moreover, the development of charging infrastructure is often subsidized.

16. Which measures were taken for the implementation of Directive 2014/24/EU (Public procurement) into the national legal framework?
17. Which measures were taken for the implementation of Directive 2014/25/EU (on procurement by entities operating in the water, energy, transport and postal services sector) directives into the national legal framework?
18. Which measures were taken for the implementation of Directive 2014/23/EU (Awarding of concession contracts) into the national legal framework?
19. Are there any public subsidy directives to promote charging infrastructure, e.g. by national or local authorities?

If yes, is the granting of the relevant subsidies tied to any conditions? How are these subsidies granted (e.g. financial aid, tax privileges)?

20. Are there any rules belonging to the public procurement law to regulate the assignment of constructing charging infrastructure?

    Please also mention any national programs, which are legally binding like ordinances, but have not undergone a formal, legislative procedure.

21. Directive 2014/24/EU, which deals with requirements for public procurements processes, lays down thresholds for public procurements in order for the Directive to apply (Art. 4 Directive 2014/24/EU).

    Are there national thresholds, which differ from the European thresholds, indicating that no procurement rules have to be taken into consideration at all?

    If yes, what are the amounts? Are they the same country-wide or do they differ from region to region? If they differ on a local level – please indicate the different amounts as well.

22. Did your country ratify the WTO-GPA (Agreement on Government Procurement)?

    If yes, has your country ratified the revised agreement version (2014) of the GPA yet? What are the main impacts on your national and local legislation?

Energy Law:

The topic of energy law raises important legal requirements as the connection to the electricity grid is mandatory for charging infrastructure.

23. Which EU electrical safety regulations are applicable to the installation / operation of charging points for electric vehicles in your city/country?

Mobility planning:

The topic of mobility planning can influence the development of charging infrastructure. The concept of sustainable urban mobility plans (SUMP) is recommended by the European Commission.

24. Has a SUMP been implemented in your city?

If yes, what are the relevant regional, national and European legal requirements for the SUMP, which were identified within the preparation process and what is the political framework for the topic of charging points for electric vehicles?

Public, civil, or stakeholder participation:

The topic of public, civil, or stakeholder participation can play an important role in the planning process of charging infrastructure. Therefore, the following questions are aimed at providing information on the regulatory framework on the topic in your country.

25. Is public participation mandatory by national or local laws during the authorisation procedure regarding charging infrastructure in public spaces?
26. Where is public participation determined in the regulatory framework and what does it entail?

    If it is not determined by law, is it addressed elsewhere or usually undertaken on a voluntary basis?
27. Please describe the outcome of the participation. Is it binding or is the result of a mere recommendation?

Tender specifications:

Tender specifications could be designed by your city / municipality in the process of the development of charging infrastructure.

28. Do the tender specifications of your city / municipality for charging stations demand stronger minimum standards concerning e.g. interoperability or safety requirements, e.g. fire protection, for CPOs compared to the framework of existing European or national legislations?

    If yes, please describe examples where the tender specification requires additional requirements for CPOs, such as “instructions for users at charging points”, or the use of certain data protocols.

Legal framework regulating road use

The regulatory framework for road use could determine legal requirements for charging infrastructure in public spaces.

29. Are there any permissions needed under road use regulation in order to set up charging infrastructure in public spaces?

    If yes, which authority is responsible for issuing the permission? Please indicate the national / regional legal basis.

30. Are they any permissions needed in order to set up charging infrastructure in public spaces, which derive from neither national construction law nor road use law?

INCAR - Interoperability, Charging and Parking Platform

INCAR will offer innovative integrated EV-related services for both individual and professional EV drivers. It is going to set new ambitious standards regarding interoperability and roaming to access EVSEs across the Mediterranean and the Scandinavian-Mediterranean TEN-T corridor to facilitate international long-distance travelling. The INCAR application will combine booking features of parking slots and charging stations to increase the usage of existing infrastructure and decrease waiting times (park and charge combined service). In addition, INCAR will provide its users with real-time information about publicly accessible EVSEs as well as searching and routing to EVSEs alongside with integrated route planning for EV fleets.

Following the user centric approach of the project, INCAR will allow instant user feedback in terms of charging experiences and application usability to enhance the users' satisfaction level. INCAR will provide an operator and service provider independent platform to enable, non-discriminatory, convenient, and barrier-free access to EVSE by end users. In cities where this kind of platform already exists, the project will integrate all of them in order to enable cross-link features.

Parking management

In order to enable the booking feature of parking spots for EV drivers, all national legal requirements as well as possible specific legal privileges given to EV drivers must be considered for INCAR.

31. Do legal privileges exist which allow booking parking spots on public roads for EVs for the purpose of using charging infrastructure?

    If not, are there any other norms regulating parking management for e-mobility services in your city/country?

32. Are there any exemptions from or reductions of parking fees for EVs in your country/city?

33. Are there any rules regulating privileges of vehicles which are part of a carsharing fleet, e.g., use of parking facilities providing charging infrastructure?
34. Do options exist for parking management and enforcement of administrative offences, which could be used for example to ensure that users will leave charging points as fast as possible after finishing the charging process?

Roaming platforms:

Specific regulation for roaming platforms would influence INCAR and its innovative integrated EV-related services.

35. Is there national regulation on the topic of roaming platforms for the charging of EVs implemented in your country?

    If yes, what requirements are provided by the national regulation? If specific regulation on the topic does not exist, please indicate this well.

SMAC - Smart Charging Tool

SMAC is a platform that provides smart grid integration services for slow, medium, fast, and ultrafast charging by following the purpose of minimizing the grid impact associated to the implementation of charging infrastructure. This smart charging tool will provide high-value services to EV drivers, such as minimum charging prices and maximum RES electricity supply, considering specific constraints that will be prioritized in the charging sessions scheduling process. Moreover, SMAC will provide standard and scalable solutions for demand management and smart grid integration services by integrating V2G and using EVs as dynamic distributed storage devises, feeding electricity stored in their batteries back into the local electric grid when needed. That will bring benefits to the DSOs concerning flexibility and stabilization while reducing the grid impact of new charging infrastructure.

A main aspect of the demand management in SMAC will be an interconnected route management system for incoming vehicles while considering the grid availability, voltage, and frequency control constraints in real-time. Furthermore, SMAC will deliver a smart interconnection with AC and DC networks to uncover new value streams that attract investors to boost the upscaling of the infrastructure.

Measuring and calibration law

The field of measuring and calibration law is important for the technical products of USER-CHI, because it can raise legal requirements for the design of charging point technology.

36. Which transposition laws of Directive 2014/32 (EU) (Measuring Instruments Directive) have entered into force applicable to the context of charging points (sale of electricity to users)?
37. Which (measurement and calibration) laws and arising duties have been applicable to the context of charging points before 2016 (end of the implementation period of Directive 2014/32) and still are?
38. Are there any national rules regulating the calibration of measuring devices in charging infrastructure?
39. Is there a legal duty to save data of measured values of energy within the electricity meter of the charging point?
40. Is the obligation to comply with legal metrology, which means the application of legal requirements to measurements and measuring instruments, only relevant for the users of measuring instruments, like the CPOs, or also for users of measured values, like the mobility providers?
41. Are the obligations arising of legal metrology requirements applicable for measuring devices or also back end systems?
42. Are there any national rules regulating tariff models in regard to payment for the use of public charging infrastructure?

Data access and sharing

The topic of data access and sharing is relevant as the regulatory framework may implement rights and duties for CPOs in regard of the data generated by the use of their charging infrastructure.

43. Are CPOs required by national regulation to provide online / real-time location and availability data of their charging points (e.g., information on whether the charging points are available, blocked, reserved...) to the general public, a centralized platform, some local authority or another recipient?

44. Are CPOs required by national regulation to provide historic consumption data of their charging points (e.g., information on how many charging processes were

started, how much energy was consumed at which times, by which cars, ...) to some local authority?

45. What are the current provisions for data sharing processes among providers of charging services in your city/country in regard to minimum standards and interoperability?

Energy Law

The topic of energy and mobility are more and more viewed together from the regulatory perspective on European and national level. Therefore, legal requirements for charging infrastructure may arise from the field of energy law.

46. Recital (40) of the Directive 2019/944/EU (on common rules for the internal electricity market) defines electromobility as an important element of the energy transition which will be crucial for the process of decarbonising transport. Therefore, amongst other things the Directive sets up regulations for flexibility services and connections to EV charging infrastructure.

    Art. 32 of the Directive 2019/944/EU states, that "the Member States shall provide the necessary regulatory framework to allow and provide incentives to distribution system operators (DSOs) to procure flexibility services".

    Furthermore, Art. 33 of the Directive 2019/944/EU states, that "the Member States shall provide the necessary regulatory framework to facilitate the connection of publicly accessible and private recharging points to the distribution networks."

    Is the European legislation on the integration of EVs and Renewable Energy Sources (RES) into Smart Grid Services implemented already within the national framework?

47. Directive 2019/944 introduces relevant European legislation on the topic of connection to the distribution network for charging points. In this regard, Art. 33 (1) of the Directive 2019/944 states that, "(...) Member States shall provide the necessary regulatory framework to facilitate the connection of publicly accessible and private recharging points to the distribution networks. Member States shall ensure that distribution system operators cooperate on a non-discriminatory basis with any undertaking that owns, develops, operates or manages recharging points for electric vehicles, including with regard to connection to the grid."

48. Which regulations did your country implement for facilitating the connection of publicly accessible and private charging points to the distribution network and providing the non-discriminatory cooperation between the actors?

49. Has the national legislation commissioned a study to evaluate whether flexibility services are economically efficient (above Article 33 Directive 2019/944/EU)?
50. Do DSOs have the right to adjust consumer's demand from controllable loads?

    If yes under which circumstances? Are there any restrictions?
51. Which laws regulate the physical electricity grid on a national level in regard to operation and maintenance as well as other kinds of interaction in regard to relevant stakeholders (public and non-public)?
52. Did your country (or state/province, individual municipality) already set up some specific regulation on the topic of Vehicle to grid (V2G)?

    If not, are there legislative initiatives regarding the topic, which are planned or already initiated?
53. Does your country (or state/province, individual municipality) already use or test vehicle to grid (V2G) technologies (e.g., bidirectional charging)?

    If yes, which of the rules stated above (in question 15) affect their application?

    If no, which of these rules (addressed in question 15) would probably have an influence on future application of V2G?
54. In order to foster the feasibility of V2G technologies applicable network charges need to differentiate between both the network use for consumption of electricity as well as the network use in order to feed electricity into the grid.

    Therefore, Art. 15 (4) of the Directive 2019/944 states, that “Member States that have existing schemes that do not account separately for the electricity fed into the grid and the electricity consumed from the grid, shall not grant new rights under such schemes after 31 December 2023. In any event, customers subject to existing schemes shall have the possibility at any time to opt for a new scheme that accounts separately for the electricity fed into the grid and the electricity consumed from the grid as the basis for calculating network charges.”

    Does the scheme in your country separate electricity fed into the grid and electricity consumed from the grid?

    If not, do costumers already have the right to opt for new schemes, which account separately for electricity fed into and consumed from the grid?

Data protection law

The topic of data protection and security is important for the technical USER-CHI products as personal data is generated and saved by the use of charging infrastructure.

55. Directive 2019/944/EU (on common rules for the internal electricity market) addresses the topic of smart metering systems and their impact on data protection and security. In this regard, Directive 2019/944/EU recital (57) states that, „currently, different models for the management of data have been developed or are under development in Member States following deployment of smart metering systems. Independently of the data management model it is important that Member States put in place transparent rules under which data can be accessed under non-discriminatory conditions and ensure the highest level of cybersecurity and data protection as well as the impartiality of the entities which process data."

    Are there regulations on management of data models for smart metering systems, which have been already implemented in your country regarding the issue of cybersecurity and data protection of smart metering systems?

    If not, are there other regulations contributing to data protection and security regarding charging processes in general?

INDUCAR - Inductive Charging for e-Cars

INDUCAR allows inductive charging on a high-level of automated power transfer, consisting of both, hardware, and software. The handling of cables is rendered unnecessary with this product, which offers a convenient charging experience for users. Sets of components enabling 3 kW and 20 kW power transfers for vehicles will be developed. In order to demonstrate inductive charging, two types of targeted vehicles will be retrofitted. The current state of the art concerning standardisation as well as prior discussions will be taken into account.

The wireless charging technology of INDUCAR will be completed by M2M (machine-to-machine) communication technologies offering charging features, payment as well as transparent identification. Moreover, outcomes of different USER-CHI products (INFRA and INCAR) will be integrated concerning topics of roaming, currency exchange, cyber security, and data protection.

Energy Law

The topic of energy law raises important legal requirements as the connection to the electricity grid is necessary for charging infrastructure.

56. Charging stations could be defined as different actors from a legal point of view within the electricity market.

    Are charging stations defined as final users or suppliers of electricity under the applicable national regulation?

    If they are defined as neither, please indicate this as well.

57. Which national energy law regulations concerning reporting obligations must be observed by charging point operators under your national framework?

    If none arise, please indicate this as well.

Regulation on inductive charging

As INDUCAR will implement the technology of inductive charging, regulation on the topic would implement relevant legal requirements.

58. The charging process with INDUCAR will be using electromagnetic induction pads installed both in EVs and in the ground of parking spots to enable a wireless and hands-free charging system for EVs.

    Has your country already adopted regulation on the topic of inductive charging?

INSOC - Integrated Solar DC-Charging for LEVs

INSOC will consist of a software and hardware combined solution to solve charging needs of LEVs (light electric vehicles), integrating on-site production of renewable energy and theft-proof parking (LEV box), as well as integrated payment and billing services. A standardised and replicable low-power DC charging solution with on-site produced renewable energy will reduce the price for end users and will cause a higher market acceptance due to the integration of all services: vehicle sharing, charging, parking, paying and renewable energy usage.

E-mobility sharing service providers will benefit from INSOC with the objective of minimising logistics and operation costs, avoiding the need to remove and charge batteries in an external hub. Moreover, energy suppliers and DSOs can also profit from the system, due to the smart integration with decentralised renewable energy that minimises the grid impact and offers flexibility to the grid.

Building and construction law

Building and construction law may implement legal requirements for the combination of a solar system and a LEV box. Therefore, the following section will address requirements deriving from this field of law for INSOC.

59. Which permissions are required for the installation of a solar system by your national building and construction law?

    If there is any specific size legally codified, under which there is no permission needed, please indicate that as well.

60. If a solar system for LEV charging stations will be installed in the inner city of your city, are there different requirements e.g. in comparison to an installation in a suburban or rural area?

61. Which requirements must be met by the construction of solar systems in regard to fire protection provisions on a national and local level?

62. Is there any permission needed to set up a LEV box in public space for parking and charging of LEVs under building and construction law?

    If yes, please describe the administrative approval process.

Energy law

As electricity will also be generated by the solar systems of INSOC special legal requirements may arise in this regard.

63. Which rights and duties arise for electricity generators and suppliers under the applicable national energy law framework?

    Please differentiate between electricity generators, which are connected to the grid and those who are not. In the latter case no rights and duties may arise.

Legal framework regulating road use

The regulatory framework for road use could determine legal requirements for the construction of INSOC in public spaces.

64. Are any permissions needed under national road use law in order to set up a LEV box on public ground?

65. Are local provisions on the preservation of historical monuments in force, which might oppose the construction of a “LEV box” and a solar system for LEV charging stations in certain public spaces?