Plug & Charge, ISO 15118, Public Key Infrastructure (PKI), and the Need for Proper Governance

ChargeUp Europe:

- Outlines the key aspects of ISO 15118 and how the implementation and governance of this standard will be fundamental to ensure a level playing field for operators and provide choice for EV drivers.
- If implemented correctly, the services enabled by ISO 15118 can deliver a smoother charging process and bring major benefits to EV drivers and the grid. However, if not governed in a way that enables open and fair competition, EV drivers risk being locked-in to a single provider which then prevents customers from (easily) choosing for access to alternative MSP services and offers.
- ChargeUp Europe calls for a single legislative instrument which lays out clear market and governance rules which ensure open and fair competition for both Plug & Charge and Smart Charging aspects of the standard. It should address both the vehicle and charger requirements.

As electric vehicles and EV charging enter the mainstream, new solutions and services are being developed and rolled out, and it is important for regulators to understand them, their strengths, weaknesses, and place in the EV charging ecosystem. One of the most interesting and widely talked about is the technical standard ISO 15118, which enables improved smart charging and Plug & Charge.

In this paper, ChargeUp Europe outlines the key aspects of ISO 15118 and how the implementation and governance of this standard will be fundamental to ensure a level playing field for operators and provide choice for EV drivers.

It's critical that the transition to e-mobility is supported by the ISO15118 standard and its related services, and not hampered through unfair competition and lack of consumer choice.

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I – ISO 15118 Overview

ISO 15118 is an international standard1 defining a vehicle to grid (V2G) communication interface for bi-directional charging/discharging of EVs. The standard provides multiple use case like secure communication, smart charging and the Plug & Charge feature.

Plug & Charge: whereby a driver can arrive at a charging station, plug in, and then the EV communicates directly with the charging station. Via this communication the contract certificate of the driver's account is automatically authenticated, followed by authorization to receive energy and then charging automatically commences. The driver will not need to do anything else, such as use an RFID card or mobile application, to start charging.

Smart charging: The standard supports communication and exchange of data between the vehicle and charger. The vehicle shares its battery state of charge, thus allowing the central energy management system in the charger to make decisions related to energy flow and load management. It can find the best balance between the mobility needs of the vehicle and the price of energy, to that enable the driver to get the optimal charging service in terms of price and energy.

ISO 15118 only covers the technical elements of the communication protocol itself. It does not concern itself with elements outside of that, such as its application in the market, its governance, how different market players deploy the standard, and what this means for EV drivers. However, these are of significant importance and we will address them later in this paper.

The latest edition in the ISO 15118 series, ISO 15118-20, was published in April 2022, and contains a range of enhancements and additional features for security, smart charging capabilities (dynamic/scheduled charging), wireless, bidirectional charging, and Plug & Charge. (See annex for an overview)
It is envisioned that Plug & Charge will become a standard expectation of EV drivers and that the implementation of ISO 15118 will increase significantly. Therefore, it is vital to ensure that the standard is implemented in such a way that EV drivers have a universal experience and that all touchpoints in a Plug & Charge charging event are secure.

II – What is a Public Key Infrastructure (PKI) & Why does it Matter?

To deliver all these services, high levels of privacy and security for the vehicle, the driver, the charging station and other actors (such as operators and providers) need to be ensured. This is enabled through digital certificates, which are themselves secured and managed through a PKI2.

A PKI is an overarching IT framework in which the specific communications listed above are conducted. PKIs are considered among the most secure digital frameworks available today and are already used by many other sectors, such as online for ecommerce and in the airline industry.

ISO 15118 will rely fully on an externally defined and operational PKI to enable its use of certificates for securing features, like identification and authentication of the driver to authorize the EV charging and activation of the charging process.
ISO 15118 does not look at issues related to market rules and implementation of a PKI which will be critical, as the organization(s) that run such a PKI will have the power to set access, data exchange format and auditing requirements, amongst others.

As the PKI issue will be fundamental to how the market for ISO 15118 operates, it's critical that it is set out in an open, secure, and interoperable way that ensures fair competition.

III – Issues to address to ensure the best experience for the EV driver

A) Vehicle, rather than driver centric approach

While ISO 15118 offers a variety of features and capabilities that are beneficial for the e-mobility ecosystem, it is designed based on an Electric Vehicle centric approach as opposed to driver-centric approach.

What this means in practice is that a vehicle manufacturer (OEM) must agree to the mobility service provider (MSP) selected by the driver (by providing the OEM provisioning certificate to the MSP). It does not define certificate install or uninstall measures and this means contract certificate installation into the EV3 ultimately depends on OEMs, not the driver, leaving them with disproportionate power regarding ISO 15118 services such as Plug & Charge and smart charging.

B) Bundled Services Limit Driver Choice

As some OEMs already offer their own MSP services, and others are starting to develop them, they can lock the driver into their own ecosystem by offering their mobility service contracts as part of a bundled service – similar to what some internet browsers in the 1990s/2000s or, more recently, with printer manufacturer that was accused of installing firmware to was forcing the consumers to only be capable to use ink cartridges from this printer manufacturer, and it would

not function when alternative cartridges were used4. This puts competing MSPs at a severe disadvantage and undermines the driver's ability to choose MSPs.

Ultimately, this can lead to the market being dominated by a small number of large players, reducing competition on innovation, services and pricing, ultimately impacting the driver experience because drivers will not be properly informed about the range of competing services available and will instead be guided into a bundled option.

C) Vehicle control Limits Smart Charging Benefits

While much of the conversation on this potential concern has related to Plug & Charge, it also applies to smart charging – a key aspect of ISO15118. Concerns exist around the potential gatekeeper role that OEMs can have in relation to smart charging and energy transfer as vehicles will have the last say in accepting requests from infrastructure.

It should be primarily the driver's option, based on their preferences, how to schedule their charging. Drivers can even be remunerated for scheduling their charging, or letting their MSP schedule it based on their preferences, at a time when energy is most plentiful. Vehicle based control doesn't allow for this.
ISO 15118, does not look at issues related to market rules and governance and therefore it is critical that the above issues are addressed in the implementation of ISO 15118 by developing clear market and governance rules which ensure open competition and the widest range of choice for the driver.
D) Compatibility

ISO 15118-20 is the 2nd generation of the standard and is not compatible with ISO 15118-2. They will coexist next to each other. If you want to support both, two software-stacks are needed in EV and/or EVSE.

IV – The way forward

To ensure a fair, open, trusted, and user-friendly PKI ecosystem, it is crucial that the PKI ecosystem limitations are supported by legislation and clear market rules/guidance to avoid the risk of a gatekeeper role for the EV OEMs and ensure that all parties can compete and offer the services enabled by PKI ecosystem on a level footing.

Without such fair competition and consumer choice, the transition to e-mobility and enhanced EV charging services will be hampered as opposed to accelerated.

These issues should be tackled through a single legislative instrument which lays out clear market and governance rules which ensure open and fair competition for both Plug & Charge and Smart Charging aspects of the standard. Such legislation should address both the vehicle and charger requirements and could potentially be achieved through a delegated Act in the Alternative Fuels Infrastructure Regulation

ANNEX – Overview of ISO 15118-20 vs ISO 15118-2

Functionality	Feature	ISO 15118 -2	ISO 15118 -20
AC charging	Basic charging	X	X
DC charging	Basic charging	X	X
Bidirectional Power Transfer	Charging / Discharging capabilities		X
Automated Connection Device	Automated conductive charging		X
Wireless Power Transfer	Contactless charging		X
Security	TLS encryption for Authorization	X	X
	TLS encryption for all communication		X
	Authentication of EVSE	X	
	Mutual authentication of EV and EVSE		X
Plug & Charge (PnC)	PnC Certificate based authorization	X	X
	Contract certificate installation via EVSE	X	X
	PnC multiple Contract Certificate handling		X
Smart Charging	Charge scheduling on Power and indicative cost	X	X
	EV Charging Profile (maximum power demand)		X
	EV Charging Profile (real power demand)		X
	Optimization of Charging power levels		X
	Dynamic charging		X
	Provide mobility needs (e.g. Target SoC) via the EVSE		X
Renegotiation of charging parameters	With interruption of energy flow	X	
	With parallel energy flow		X
	Change of charging Mode/service		X
Sleep Modes	Pausing	X	X
	Standby		X
Pricing information	Indicative cost for energy	X	X
	Currency based prices for energy and related services		X