IEC SRD 62913-2-4

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SYSTEMS REFERENCE DELIVERABLE

colour inside

Generic smart grid requirements –
Part 2-4: Electric transportation related domain

IEC SRD 62913-2-4:2019-05(en)

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FOREWORD

IEC SRD 62913-2-4, which is a Systems Reference Deliverable, has been prepared by IEC systems committee Smart Energy.

The text of this Systems Reference Deliverable is based on the following documents:

Draft SRD	Report on voting
SyCSmartEnergy/85/DTS	SyCSmartEnergy/101/RVDTS

Full information on the voting for the approval of this Systems Reference Deliverable can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC SRD 62913 series, published under the general title *Generic smart grid requirements*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

Under the general title *Generic smart grid requirements*, the IEC SRD 62913 series consists of the following parts:

– Part 1: *Specific application of the Use Case methodology for defining Generic smart grid requirements according to the IEC System approach*;

– Part 2 is composed of 5 subparts which refer to the clusters that group several domains:

- Part 2-1: *Grid related domains* – these include transmission grid management, distribution grid management, microgrids and smart substation automation;
- Part 2-2: *Market related domain*;
- Part 2-3: *Resources connected to the grid related domains* – these include bulk generation, distributed energy resources, smart home/commercial/industrial/DR-customer energy management, and energy storage;
- Part 2-4: *Electric transportation related domain*;
- Part 2-5: *Support functions related domains* – these include metering management and asset management.

IEC SRD 62913 refers to 'clusters' of domains for its different parts so as to provide a neutral term for document management purposes simply because it is necessary to split in several documents the broad scope of smart grid.

The purpose of this document is to define the generic smart grid requirements of electric transportation domain, i.e. electric transportation domain, based on the methods and tools developed in IEC SRD 62913-1.

The document for each domain is composed as follows.

– Purpose and scope.

– Business analysis: to address the domain's strategic goals and principles regarding its smart grid environment. It also lists business Use Cases and system Use Cases identified, their associated business roles and system roles (actors) and the simplified role model highlighting main interactions between actors.

– Generic smart grid requirements: extracted from Use Cases described in Annex B.

– Annex A lists links between domains, technical committees and gathered materials (existing standardization documents, user stories, Use Cases and functional architectures).

– Annex B includes a complete description of Use Cases per domain based on IEC 62559-2.

– Bibliography.

This document is based on the inputs from domain experts as well as existing materials in a smart grid environment.

GENERIC SMART GRID REQUIREMENTS –

Part 2-4: Electric transportation related domain

1 Scope

This part of IEC SRD 62913 initiates and illustrates the IEC's systems approach based on Use Cases and involving the identification of generic smart grid requirements for further standardization work for the electric transportation domain, based on the methods and tools developed in IEC SRD 62913-1.

This document captures possible "common and repeated usage" of a smart grid system, under the format of "Use Cases" with a view to feeding further standardization activities. Use Cases can be described in different ways and can represent competing alternatives. From there, this document derives the common requirements to be considered by these further standardization activities in terms of interfaces between actors interacting with the given system.

To this end, Use Case implementations are given for information purposes only. The interface requirements to be considered for later standardization activities are summarized (typically information pieces, communication services and specific non-functional requirements: performance level, security specification, etc.).

This analysis is based on the business input from domain experts as well as existing material on electric transportation in a smart grid environment when relevant. Table 1 highlights the domains and business Use Cases described in this document.

Table 1 – Content of IEC SRD 62913-2-4:2019

Domain	Content	Scope
Electric transportation	Described with 6 business Use Cases and 1 system Use Case	EV Charging Smart charging and bidirectional power transfer Vehicle to grid

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 61851-1:2017, *Electric vehicle conductive charging system – Part 1: General requirements*

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

NOTE Those definitions are consistent with ISO 15118 (all parts).

3.1.1
bidirectional power transfer
BPT
combination of forward or reverse power transfer transaction

3.1.2
charging session
collection of charging transactions at a charge point related only to the charging of an electric car assigned to a specific customer in a specific timeframe with a unique identifier

Note 1 to entry: The charging session is a subset of the service session.

3.1.3
charging transaction
smallest billable part of a charging session representing the transfer of energy in a specific timeframe

3.1.4
energy management system
EMS
system that controls electric power transfer among DER, premises appliances and the grid

3.1.5
electric vehicle communication controller
EVCC
embedded system, within the vehicle, that implements the communication between the vehicle and the SECC in order to support specific functions

3.1.6
e-mobility needs
needs expressed by the EV user in terms of departure time, minimum and maximum energy request and target energy request

3.1.7
forward power transfer
FPT
power transfer from external power supply to vehicle battery via EV supply equipment

3.1.8
reverse power transfer
RPT
power transfer from vehicle battery to home, loads or grid via EV supply equipment

3.1.9
identification
procedure for an actor/a system/a contract to provide its identifying information for the purpose of authorization, mostly to provide its capability for payments or a reference to a service contract

3.1.10
high level communication
HLC
bi-directional digital communication using protocol and messages and physical and data link layers as specified for example in ISO 15118 (all parts)

3.1.11
roaming
data interoperability process between e-mobility service providers and charging service operators in order to offer a continuity of services to a customer who travels outside the area of his or her original service provider

Note 1 to entry: IEC 63119 (all parts) provides a protocol specification for roaming.

Note 2 to entry: Roaming between mobile telephone operators illustrates best the concept. A given contract with an international option allows one to telephone in his or her home country and abroad. Mobile phone operators financially compensate the telecommunication made abroad.

Note 3 to entry: Charging facility could be provided with one unique RFID (Radio Frequency Identification Device) card (or mobile phone), either in one's home country or abroad. CSOs financially compensate the electricity and/or the charging service itself.

3.1.12
smart charging
controlled charging process that meets the mobility constraints and requirements of the EV user while optimizing the use of the grid and the available electrical energy to minimize additional investments in the grid and facilitate the integration of DER

[SOURCE: Eurelectric and ESMG Smart Charging report]

3.1.13
wireless power transfer
WPT

transfer of electrical energy from a power source to an electrical load via electric and/or magnetic fields or waves between a primary and a secondary device without current flow over a galvanic connection

Note 1 to entry: The receiver can be affixed to the vehicle's bottom or front and the transmitter on a parking lot surface or parking specific charging device.

[SOURCE: IEC 61980-1:2017, 3.10, modified – The words "without current flow over a galvanic connection" have been added to the definition, and the note to entry has been added.]

3.1.14
original equipment manufacturer
OEM
original producer of a vehicle's components (such as cars, boats, buses and lorries), a company that manufactures spare parts, mainly on behalf of another company, the integrator or the assembler

3.1.15
pairing
process by which a vehicle is correlated with the unique EVSE at which it is located and from which the power will be transferred either through a cable or through a wireless technology

3.1.16
service detail record
SDR
data package containing all necessary information within one unique identification which is needed for billing or informing of/about a service session of a specific customer

3.1.17
service session
collection of services around a charge point mainly related to the charging of an electric car assigned to a specific customer in a specific timeframe with a unique identifier.

3.1.18
supply equipment communication controller
SECC
entity which implements the communication to one or multiple EVCCs and which may be able to interact with secondary actors

3.2 Abbreviated terms

DER Distributed Energy Resource

EMS Energy Management System

EV Electric Vehicle

EVSE Electric Vehicle Supply Equipment

RFID Radio-Frequency Identification Device

FCR Frequency Containment Reserve

SDR Service Detail Record

4 Electric transportation

4.1 Purpose and scope

4.1.1 Clause objective

The purpose of this document is to present a business analysis of the electric transportation domain, and more specifically to describe the smart grid requirements of the domain using the Use Case approach as defined in IEC SRD 62913-1.

This analysis is based on existing materials, including user stories, set of Use Cases, and architectures. It is also based on latest updates from IEC TC 69 experts working on communication protocols.

4.1.2 General context

This document considers non-guided electrical transportation using batteries, which require electricity charging through electric power grids (public and private), travelling on land (public streets, roads, motorways). It includes private or professional battery electric vehicles, plug-in hybrid electric vehicles, cars, lorries, buses and motorbikes. Planes, boats, trains and trams are out of the scope of this document.

There is a need to standardize the naming and definition of electric transportation domain roles in relation with the roles of the electrical system and markets, and smart grid Functions, bearing also in mind that they have to be articulated with non-electrical systems for mobility and associated services.

In order to ensure implementation of interoperability between roles in future e-mobility solutions, it is necessary to describe comprehensive business Use Cases defining their relationships and interactions, in view of satisfying needs of the final customers by adequate service provision.

Example of application of these Use Cases shall be given for the main common situations (charge or discharge an EV, provide service to the grid, etc.).

The couple EV-EVSE will be considered as a DER. DERs are described in IEC SRD 62913-2-3. However, the mobile and possible bidirectional natures of the EV, unusual for a classical DER, led to this document.

4.2 Business analysis

4.2.1 General overview

The transition towards a more sustainable economy is a key driver of the development of electric transportation, with a stronger political impetus to reduce carbon dioxide emissions and promote alternatives to fuel vehicles – both at regional and national levels. The number of electric vehicles in circulation has increased over the past years and will continue to grow as technologies are becoming more mature and new stakeholders are entering this new market. In the coming years smart charging and bidirectional power transfer will be key to allow a smooth transition for grid operators.

The development of electric vehicles therefore creates various opportunities and challenges for the actors of the electric power system, as well as for the actors of the Mobility Sector (OEM, service providers…).

The following actors will play a major role in the development of smart charging.

a) Roles related to metering services will be concerned, as the bidirectional energy flowing from or to the EV will need to be measured and associated with a metering point for example for billing purposes – whether the charging station is public or private (commercial and tertiary offices, residential building, private parking, etc.).

b) For system and grid operators, the charging or discharging of electric vehicles, for which location, timing and load profile is by nature variable and not easily predictable and can have a significant impact on the planning, operation, and maintenance of the grids. It will contribute to the growth of possible multiple peak loads – at wholesale system and at local levels – leading to increased network investment needs. Grid operators will have to take into account EV charging and discharging in their network operations business processes, but also develop operational planning and Demand Response models and tools to anticipate its effects on the grid at minimum cost.

c) EV, potentially considered as a flexible DER, will be enrolled in electricity markets by flexibility operators.

d) According to local regulations on flexibilities, the EV user will be able to choose a charge plan/schedule depending on price signals for instance (based on charging time, power, energy, renewable energy mix according to local regulations) but also other demand response signals in addition to local constraints managed by an EMS.

Furthermore, other roles are emerging with the development of electrical transportation.

e) Installation, maintenance, operation and monitoring of charging station (charging service operators, CSO) or the operations of electric vehicle supply equipment and the charging of EV.

f) E-mobility service providers will provide high-value services related to the use of EV, such as the identification of the closest currently operational charging station(s) or the charging station(s) in a given area, the calculation of the route between two charging stations, the reservation of a parking spot equipped with a charging station, access to charging stations of different charging service operators with a single contract and payment, etc.

g) E-mobility clearing house operators will ensure the exchange of data between charging service operators and e-mobility service providers, and therefore allow an interoperable easy and open access to the market.

h) Users of the vehicles (EV user, fleet operators, public transportation operators, etc.) will have access to high value services, through interactions with the roles listed above using smart cards, smartphones and IT solutions.

The evolutions implied by the development of electric vehicles tend to change the way the vehicle is considered by EV users, from an object that can be owned to a service or set of services that can be purchased. Different models of services may be considered for the electric transportation domain:

- infrastructure or charging services, with the possibility to charge any EV on any public or private charging station;
- mobility services, with the rental of EV/batteries, the reservation of a charging and parking spot for instance;
- energy services, with the purchase of electricity, but also the management of power demand peaks, BPT, ancillary services, frequency regulation, reserves services;
- data and communication services, with the exchange of various data between the different roles (tariffs, energy imported to charge the EV, etc.).

In this context, the development of interoperability becomes crucial to ensure communication between the different infrastructures (EV, EVSE, etc.) and information systems related to infrastructure and energy services (charging station operations, network operations, etc.), as well as mobility and data services.

4.2.2 List of business Use Cases and business roles of the domain

The business Use Cases listed are a result of the business analysis carried out previously – the list is not exhaustive, and it is likely to grow as new Use Cases come to light.

The business Use Cases are associated with one or several of the business objectives of the domain, which include: deliver charging, bidirectional and ancillary services.

Table 2 lists and provides a brief description of the business Use Cases that have been identified so far (they do not cover the entire domain business Use Cases). Figure 1 describes the Use Cases a hierarchical organization proposal.

Table 2 – Identified business Use Cases of the domain

Index of the business Use Case	Identified business Use Case	Brief description	Level of maturity
UC62913-2-4-B001	Charge an EV	During a timeframe, energy is exchanged between an EV and an EVSE. This Use Case describes the information exchanges between roles involved in this process and requirements associated with it.	Already implemented
UC62913-2-4-B002	Control the charge of an EV	This business Use Case describes the information exchanges between roles involved in controlling the energy transfer to charge an EV in order to comply with energy secondary actors while responding to the EV User needs.	Already implemented

Index of the business Use Case	Identified business Use Case	Brief description	Level of maturity
UC62913-2-4-B003	Charge an EV with Demand Response	The scope of this business Use Case is EV charging based on flexibility incentives coming from the market. These incentives can be for example price signals and renewable mix signals. The objective is to optimize customer, grid, DER and e-production needs.	Already implemented
UC62913-2-4-B004	Charge an EV with smart charging	The business Use Case describes the smart charging process of an electric vehicle in a private network (public car-park, residential condominium, etc.). This Use Case is based on ISO 15118 mechanism.	Incomplete due to uncertainty
UC62913-2-4-B005	Provide smart bidirectional energy transfer	Bidirectional power transfer into the grid based on messages sent by local energy management system.	Explorative
UC62913-2-4-B006	Provide smart charging services to an EV fleet	This business Use Case describes the information exchanges between roles involved in the process of optimizing users, fleet operator, grid and market constraints for the charge of an EV fleet.	Incomplete due to uncertainty
UC62913-2-4-B007	Provide frequency containment reserve services through EV	This business Use Case describes the process to provide primary frequency-regulation services using electric vehicles controllable charge and discharge possibilities. Frequency-restoration or replacement reserve are out of scope. Primary frequency-regulation services can be provided through injection or consumption power transfer and this contribution to frequency regulation can be symmetric or dissymmetric (only positive or negative regulation).	Explorative
UC62913-2-4-B008	Discharging an EV to a load disconnected from the grid	This business Use Case describes the information exchanges between roles involved in an energy transfer between an EV and a load (other EV, battery, home appliances, etc.) disconnected from the grid (main distribution grid, microgrid, etc.).	Explorative