



DPC: 22 / 30435559 DC

BSI Group Headquarters

389 Chiswick High Road London W4 4AL

Tel: +44 (0)20 8996 9000

Fax: +44 (0)20 8996 7400

www.bsigroup.com

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Title: Draft BS EN IEC 63382-1 Management of Distributed Energy Storage Systems based on Electrically Chargeable Vehicles (ECV-DESS)

Part 1: Definitions, Requirements and Use Cases

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Responsible Committee Secretary: **Ms Andreea Vieru (BSI)**
Direct tel: **0208 996 7432**
E-mail: **andreea.vieru@bsigroup.com**

Introduction

This draft standard is based on national and international discussions. Your comments on this draft are invited and will assist in the preparation of the consequent standard.

For international standards, comments will be reviewed by the relevant UK national committee before sending the consensus UK vote and comments to the international committee, which will then decide appropriate action. If the international standard is approved, it is usual for the text to be published as a British Standard.

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Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx
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1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/Figure/ Table/Note	Type of comment	Commend (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	



69/872/CD

COMMITTEE DRAFT (CD)

PROJECT NUMBER: IEC 63382-1 ED1	
DATE OF CIRCULATION: 2022-12-09	CLOSING DATE FOR COMMENTS: 2023-03-03
SUPERSEDES DOCUMENTS: 69/743/NP, 69/753/RVN	

IEC TC 69 : ELECTRICAL POWER/ENERGY TRANSFER SYSTEMS FOR ELECTRICALLY PROPELLED ROAD VEHICLES AND INDUSTRIAL TRUCKS	
SECRETARIAT: Belgium	SECRETARY: Mr Peter Van den Bossche
OF INTEREST TO THE FOLLOWING COMMITTEES: TC 8, TC 13, TC 57, TC 125	PROPOSED HORIZONTAL STANDARD: ☐ Other TC/SCs are requested to indicate their interest, if any, in this CD to the secretary.
FUNCTIONS CONCERNED: ☐ EMC ☐ ENVIRONMENT ☐ QUALITY ASSURANCE ☐ SAFETY	

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- any relevant patent rights of which they are aware and to provide supporting documentation,
- any local regulations or technical reasons that may exist and should be considered should this proposal proceed, recognizing that failure to address such requirements could result in the need for new or existing "in some countries" clauses. See AC/22/2007.

TITLE:

Management of Distributed Energy Storage Systems based on Electrically Chargeable Vehicles (ECV-DESS) - Part 1: Definitions, Requirements and Use Cases

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MANAGEMENT OF DISTRIBUTED ENERGY STORAGE SYSTEMS BASED ON ELECTRICALLY CHARGEABLE VEHICLE BATTERIES

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0 Introduction

An increasing number of DERs is being interconnected to electrical power systems while control and communication standards provide interoperable interfaces between DERs and other actors involved in the needed exchange of information.

The growth of Electrical Vehicle (EV) circulation, associated with the expansion of the charging infrastructure and the advent of Smart Charging (V1G) and Vehicle to Grid (V2G) technology are creating a large number of DERs in the mobility sector.

Distributed Energy Storage Systems, based on Electrically Chargeable Vehicle batteries (ECV-DESS), can be created by aggregating several EVs connected to the charging infrastructure and acting as DERs.

The ECV-DESS may provide grid services to improve the stable and reliable operation of the electrical power network.

The Power Balancing will result from the coordinated efforts of conventional power systems in combination with the EV Charging infrastructure, the microgrids, the Virtual Power Plants, which will include DESS.

The specific nature of EV, which is a mobile DER, capable to connect to the charging infrastructure in different locations, with different charging modes, sets new requirements on communication interfaces.

The EV Charging Stations may have different configurations and modes of operations.

They can operate by AC or DC charge, they can charge and discharge, with mono or bidirectional power flow between EV and EVSE.

They can be composed by one or more EVSEs in one EV-Charging Station. In presence of multiple EVSEs, they can be arranged in AC or DC bus configurations. Finally, the bidirectional inverter can be installed on-board of vehicle or off board.

Appropriate standards are essential to rule the complexity of these systems.

These standards will sustain the growth of EV circulation, rule the V1G and V2X services, support the aggregation of multiple EV DERs, define how to specify the requirements between Aggregator/Flexibility Operator (FO) and EV Charging Station Operators.

Presence on the market of products and services offered by several vendors calls for interoperability and interchangeability between solutions provided by different suppliers.

Furthermore, the standards have to meet the requirements of cybersecurity, privacy and safety for the proper operation of ECV DESSs.

IEC 63382 is intended to cover all these aspects and to fill gaps in existing standards concerning communication between Aggregator/FO and EV Charging Station. It is aimed at completing the communication and control chain which connect the EV with the charging infrastructure (EVSE and Charging Stations) and with the Aggregator/FO at an upper hierarchical level.

In this respect it represents a complement of the standardization work made on IEC/ISO 15118 and IEC 63110.

1 Scope

The international standard IEC 63382 specifies the Distributed Energy Storage Systems, composed by Electrically Chargeable Vehicle batteries (ECV-DESS), managed by a common Aggregator/FO and capable to perform V1G, V2G and V2X functions.

The IS supports the Aggregator/FO in defining the technical and business requirements of grid services, both with the Charging Station Operator and the EV User, in order to provide the grid support functions utilizing the distributed energy resources offered by a multitude of EVs.

The IEC 63382 describes the various EV Charging Station configurations to identify the technical characteristics and requirements of ECV-DESS.

- EV Charging Stations, including several AC-EVSEs or DC-EVSEs.
- EV individually connected to grid by an EVSE, controlled by a common Aggregator/FO.

It specifies the technical requirements of system, the Use Cases, the information exchange between the EV Charging Station Operator (CSO) and the Aggregator/FO, including both technical and business data, the communication protocols and the conformance tests.

- 176 The IS covers many aspects associated to the operation of ECV-DESS:
- 177 • Privacy issues consequent to GDPR application (General Data Protection Regulation).
 - 178 • Cybersecurity.
 - 179 • Grid Code requirements, as set in EN 50549, to include ancillary services, mandatory
180 functions and remunerated services.
 - 181 • Grid functions associated to V2G operation, including new services, as fast reserve for
182 frequency regulation.
 - 183 • Authentication/authorisation/transactions relative to charging sessions, including
184 roaming, pricing and metering information.
 - 185 • Management of energy transfers and reporting, including information interchange,
186 related to power/energy exchange, contractual data, metering data.
 - 187 • Demand Response, as Smart Charging (V1G).
- 188 It makes a distinction between mandatory functions and market driven services, taking into
189 account the functions which are embedded in the FW control of DER smart inverters.
- 190 The IS defines the data models and the communication protocols to be utilized to perform the
191 grid service functions, assuming already existing standardized solutions, whenever possible.
- 192 The IEC 63382 standard consists of a common introductory section, including Introduction,
193 Scope, Normative references, Terms and definitions and other three parts which are dedicated
194 each to a specific subject.
- 195 Part 1 is dedicated to EV Charging Station configurations, Communication Architecture,
196 Requirements, both functional and non-functional, Use Cases, with actors, roles and domains
197 descriptions. Reference is made to CENELEC's SGAM (Smart Grid Architecture Model) and to
198 UML model.
- 199 Part 2 is dedicated to Communication Protocol specifications. It includes Layered model
200 according to OSI model from ISO, List of Requirements, Data models, Object Model, Messages
201 and Message Formats, Datatypes, Message sequences, Security aspects.
- 202 Part 3 is dedicated to Conformance testing. The conformance tests will cover the interface
203 between Aggregator/FO and CSO. It includes Test setup, Test suite, Test cases designed to
204 verify behaviour of system with respect to specifications and requirements.
- 205
- 206 The IEC 63382 standard is intended to be used by the many stakeholders of ECV-DESS:
207 Aggregators/FO, e-mobility Service Providers, Car makers, Utilities, EV users, EV Charging Station
208 operators and owners, manufacturers and maintainers of interfacing products, technology providers
209 (HW, SW, certification testing), software developers and system engineers.
- 210

211 2 Normative references

- 212 For dated references, only the edition cited applies. For undated references, the latest edition
213 of the referenced document (including any amendments) applies.
- 214 IEC 63110
- 215 Protocol for management of electrical Vehicles charging and discharging infrastructures. Part
216 1: Basic definitions, Use cases and architectures.
- 217 ISO 15118 series, Road vehicles – Vehicle to grid communication interface
- 218 IEC 61850-7-420

- 219 Communication networks and systems for power utility automation - Part 7-420: Basic
220 communication structure - Distributed energy resources logical nodes
- 221 IEC TR 61850-90-8:2016
- 222 Communication networks and systems for power utility automation - Part 90-8: Object model
223 for E-mobility
- 224 EN 50549-1:2019
- 225 Requirements for generating plants to be connected in parallel with distribution networks - Part
226 1: Connection to a LV distribution network - Generating plants up to and including Type B
- 227 EN 50549-2:2019
- 228 Requirements for generating plants to be connected in parallel with distribution networks - Part
229 2: Connection to a MV distribution network - Generating plants up to and including Type B
- 230 EN 50491-12-1:2018
- 231 General requirements for Home and Building Electronic Systems (HBES) and Building
232 Automation and Control Systems (BACS) – Smart grid – Application specification – Interface
233 and framework for customer – Interface between the CEM and Home/Building Resource
234 manager – General Requirements and Architecture
- 235 IEC 63119-1:2019
- 236 Information exchange for electric vehicle charging roaming service - Part 1: General.
- 237 IEC 62746-10-1:2018
- 238 Systems interface between customer energy management system and the power management
239 system – Part 10-1: Open automated demand response
- 240 IEC DTS 62913-2-4/Ed1 2018
- 241 Generic Smart Grid requirement part 2-4 Electrical Transportation domain.
- 242 IEC 62559-2 Definition of the templates for use cases, actor list and requirements list.
- 243 IEC 61850-8-2. Communication networks and systems for power utility automation - Part 8-2:
244 Specific communication service mapping (SCSM) - Mapping to Extensible Messaging Presence
245 Protocol (XMPP)
- 246 IEC 62361-104 : Power systems management and associated information exchange -
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248 new work item)
- 249 IEC 62351 – Cyber Security Series for the Smart Grid. Specifically:
- 250 IEC 62351-3, Power systems management and associated information exchange - Data and
251 communications security - Part 3: Communication network and system security - Profiles
252 including TCP/IP
- 253 IEC 62351-4, Power systems management and associated information exchange - Data and
254 communications security - Part 4: Profiles including MMS and derivatives
- 255 IEC 62351-8, Power systems management and associated information exchange - Data and
256 communications security – Part 8: Role-based access control for power system management
- 257 IEC 62351-9, Power systems management and associated information exchange - Data and
258 communications security – Part 9 : Cyber security key management for power system
259 equipment

260 IEC 62351-14—2, Power systems management and associated information exchange - Data
261 and communications security - Part 14: Cyber security event logging

262 ISA/IEC 62443, series of standards for Automation and Control Systems Cybersecurity

263 **3 Terms and definitions**

264 **AC charge**

265 It is an EV charging mode carried out by EVSE supplying AC current to the EV, which is then
266 converted into DC current by an On-Board Charger to be fed to the EV battery. It can involve also a
267 bidirectional power flow, to allow EV battery discharging.

268 **actor**

269 entity that communicates and interacts.

270 Note 1 to entry: These actors can include people, software applications, systems, databases, and
271 even the power system itself.

272 Note 2 to entry: In IEC SRD 62913 this term includes the concepts of Business Role and System Role
273 involved in Use Cases.

274 [SOURCE: IEC 62559-2:2015, 3.2]

275 **aggregator**

276 party who contracts with a number of other network users (e.g. energy consumers) in order to
277 combine the effect of smaller loads or distributed energy resources for actions such as demand
278 response or for ancillary services

279 [SOURCE: IEV 617-02-18]

280 Note1: Aggregator and Flexibility Operator have the same meaning in the context of this
281 standard

282 **ancillary services**

283 services necessary for the operation of an electric power system provided by the system operator
284 and/or by power system users.

285 Note – System ancillary services may include the participation in frequency regulation, reactive power
286 regulation, active power reservation, etc.

287 [SOURCE: IEV 617-03-09]

288 **balancing provider**

289 party contractually responsible for the observed differences between electricity supplied and electricity
290 consumed, within a defined area.

291 [SOURCE: IEV 617-02-13]

292 **bidirectional converter**

293 An AC-DC power converter capable to convert and transfer power in both directions. From AC to DC it
294 can act as a battery charger, from DC to AC can operate as an inverter and inject power into the grid.

296 **bidirectional power flow**

297 Bidirectional Power Flow refers to the capability to transfer energy in both directions: forward for
298 charging a vehicle, reverse for discharging the vehicle.

300 **Home CS Backend**

301 Charging Station Backend system hosting the entity which has a contract with the EV user and can
302 authorize an energy transfer session to another CSP/CSO

304 **home charging service provider - Home-CSP**

305 the entity which has a contract with the EV user and can authorize an energy transfer session to
306 another CSP/CSO.

307 [SOURCE: IEC 63119-2]

308

309 **Visited CS Backend**

310 Charging Station Backend of the CS site that the EV user visits for getting energy transfer service,
311 which is not the EV user's home-CSP

312

313 **visited charging service provider - Visited-CSO**

314 the CSP/CSO that the EV User visits for getting energy transfer service, which is not the EV User's
315 Home-CSP.

316 [SOURCE: IEC 63119-2]

317 **Charge Service Provider - CSP**

318 The role which does not operate EV supply equipment but manage and authenticate EV User's
319 credentials and provides charging and other value-added services for EV Users.

320 [SOURCE: IEC 63110-1]

321 **Charging Station – CS**

322 physical equipment consisting of one or more EV supply equipment managing the energy transfer to
323 and from EVs.

324 [SOURCE: IEC 63110-1]

325 **Charging Station Controller – CSC**

326 system responsible to manage one or more EV supply equipment. The protocol between the CSC
327 and the EV supply equipment is out of scope of IEC 63110.

328 [SOURCE: IEC 63110-1]

329 **Charging Station Management System – CSMS**

330 system responsible for managing the CS. CSMS can be local, cloud based or both.

331 [SOURCE: IEC 63110-1]

332 **charging station manufacturer - CSM**

333 party responsible to manufacture charging station providing software updates, upgrades of the
334 hardware and diagnostics support to the CSO.

335 [SOURCE: IEC 63110-1]

336 **Charging Station Operator – CSO**

337 party responsible for the provisioning and operation of a charging infrastructure (including charging
338 sites) and managing electricity to provide requested energy transfer services.

339 [SOURCE: IEC 63110-1]

340 **Clearing House**

341 An optional intermediate actor that facilitates authorization, billing and settling procedure for EV
342 charging service roaming, between two clearing partners. The term is also known as MCH (Mobility
343 Clearing House), Roaming Platform and E_MOCH (E-Mobility Clearing House) in different regions.

344 [SOURCE: IEC 63119-1]

345 **Customer Energy Manager – CEM**

internal automation function for optimizing the energy consumption and/or production within the premises according to the preferences of the customer using internal flexibilities and typically based on external information received through the Smart Grid Connection Point and possibly other data sources. It provides the expected services while fulfilling contracted conditions with the Electricity Supplier, the DSO, the Flexibility Operator or any other system operators.

[SOURCE: EN 50491-12-1 July 2018]

DC charge

It is an EV charging mode carried out by EVSE supplying DC current to the EV, which is then fed directly to the EV battery. The DC current is provided by an off-board charger. It can involve also a bidirectional power flow, to allow EV battery discharging.

demand response – DR

action resulting from management of the electricity demand in response to supply conditions.

[SOURCE: IEC 617-04-16]

demand side management – DSM

process that is intended to influence the quantity or patterns of use of electric energy consumed by end-use customers.

[SOURCE: IEC 617-04-15]

distributed energy resources – DER

generators (with their auxiliaries, protection and connection equipment), including loads having a generating mode (such as electrical energy storage systems), connected to a low-voltage or a medium-voltage network.

[SOURCE: IEC 617-04-20]

distribution system operator - DSO

entity responsible for the planning, operation, maintenance, and the development in given areas of the electricity distribution network (low voltage, medium voltage, and potentially high voltage), the quality of electricity supply (power delivery, voltage, etc.) and for customer access to electricity provider market through his system under regulated conditions.

Note 1 to entry: This definition has been adapted from the one in IEC SRD 62913-2-4:2019, Table 3.

[SOURCE: IEC 63110-1]

e-mobility service provider - EMSP

party responsible for providing high-value service related to the use of an EV.

Note 1 to entry: Examples of service are renting an EV, reservation of parking service, navigation services, energy services which include charging station provider in relation with CSO.

Note 2 to entry: This definition has been adapted from the one in IEC SRD 62913-2-4:2019, Table 3.

electric vehicle supply equipment

[SOURCE: IEC 63110-1]

EV supply equipment

equipment or a combination of equipment, providing dedicated functions to supply electric energy from a fixed electrical installation or supply network to an EV for the purpose of charging and discharging.

385 [SOURCE: IEC 61851-1:2017, 3.1.1, modified – The words "and discharging" have been added to the
386 definition, and the examples have been removed.]

387 **electrical connection point – ECP**

388 point of electrical connection between the DER source of energy (generation or storage) and any
389 electric power system (EPS). Each DER (generation or storage) unit has an ECP connecting it to its
390 local power system; groups of DER units have an ECP where they interconnect to the power system
391 at a specific site or plant; a group of DER units plus local loads have an ECP where they are
392 interconnected to the utility power system.

393 NOTE For those ECPs between a utility EPS and a plant or site EPS, this point is identical to the point
394 of common coupling (PCC) in the IEEE 1547 "Standard for Interconnecting Distributed Resources with
395 Electric Power Systems".

396 [SOURCE: IEC 61850-7-420]

397 **electric vehicle user - EVU**

398 person or legal entity using the vehicle and providing information about its needs.

399 Note 1 to entry: This definition has been adapted from the one in IEC SRD 62913-2-4:2019, Table 3.

400 [SOURCE: IEC 63110-1]

401 **electricity provider - EP**

402 entity whose activity is the wholesale purchase of electricity and the subsequent direct resale to client
403 through a contract.

404 Note 1 to entry: The provider may also deliver energy related services.

405 Note 2 to entry: Provider can generate flexibilities through modulation of electricity prices (time-of-
406 use, critical peak prices, etc.), flexibilities which can have value on energy markets and/or for network
407 operations.

408 [SOURCE: IEC 63110-1]

409 **Energy transfer plan - ETP**

410 forecast of future energy transfer activities with associated uncertainties, flexibility options and limits
411 over time

412 Note 1 to entry:

413 The energy transfer plan is able to support all different charging techniques (ISO 15118 schedule and
414 dynamic modes, CHAdeMO, etc.).

415 [SOURCE: IEC 63110-1]

416 **Energy Management System (EMS)**

417 The Actor EMS represents a local system for monitoring and control of energy resources and loads. It
418 can manage the home's electrical systems to ensure energy optimized operation or visualize
419 information.

420 or

421 A system used to monitor and control the energy consuming devices in a building.

422 Note 1 to entry:

423 For the purposes of this standard, either a device located in a user's home or property, or a cloud
424 application. The energy manager enables energy-optimized operation of the devices connected to it
425 by harmonizing energy demand and availability.

426 [SOURCE: ISO 17800:2017]

427

428 **EV Charging Station Backend - CSBE**

429 It is a part of the EV charging infrastructure, which is not accessible to users. It is a computer system
430 responsible of remote management of EVCS, which is capable of storing, processing and transfer
431 data.

432 **Flexibility Operator – FO**

433 a party that is responsible for at least one of services like aggregating load flexibility from different
434 users of low voltage and/or medium voltage grids, trades it with other parties like Transmission
435 System Operator and/or the DSO in order to provide ancillary services (adjustment mechanism), or
436 any other (future) flexibility markets, e.g. optimization of balancing, grid billing.

437 Note 1 to entry: It may address EV charging through CSOs and may trade its service to other parties.

438 [SOURCE: IEC 63110-1]

439 Note2: Aggregator and Flexibility Operator have the same meaning in the context of this standard

440 **Flexibility Charging Station Backend - FCSBE**

441 It is the interface between the CSBE and the FO. It is a set of functions of the CSBE, responsible to
442 exchange information with the FO.

443

444 **forward power flow - FPF**

445 Direction of energy delivered by a battery charger during charge of a vehicle battery.

446

447 **frequency control**

448 automatic active power regulation in response to a measured deviation of system frequency
449 beyond pre-set thresholds, in order to maintain stable system frequency.

450 Note 1 to entry: Frequency control comprises several mechanisms, including frequency response
451 (P(f) droop = proportional controller, primary control) and secondary control (integrative controller).

452 [SOURCE: IEC FDIS 62934: 2021]

453

454 **JSON - JavaScript Object Notation**

455 JSON is a lightweight data-interchange format. It is easy for humans to read and write. It is easy for
456 machines to parse and generate. It is based on a subset of the JavaScript Programming Language
457 Standard ECMA-262 3rd Edition - December 1999. JSON is a text format that is completely language
458 independent but uses conventions that are familiar to programmers of the C-family of languages,
459 including C, C++, C#, Java, JavaScript, Perl, Python, and many others. These properties make JSON an
460 ideal data-interchange language.

461 [SOURCE: <https://www.json.org/json-en.html>]

462

463 **load profile**

464 curve representing supplied electric power against time of occurrence to illustrate the variance in a
465 load during a given time interval.

466 [SOURCE: IEC 617-04-05]

467 **Off Board Charger – Off-BC**

468 It is a power converter, installed in the EVSE, capable to charge or discharge the EV, feeding DC
469 current directly to the HV battery, bypassing the OBC. It can be either a DC-DC or an AC-DC
470 converter and it can implement either mono directional or bidirectional power flow.

471

472 On Board Charger - OBC

473 It is an AC-DC converter, installed on board an EV, capable to charge the HV battery and to vary the
474 charging current. It can be either a mono directional or bidirectional converter.

475 point of common coupling - PCC

476 point in an electric power system, electrically nearest to a particular load, at which other loads are, or
477 may be, connected.

478 Note 1 to entry: These loads can be either devices, equipment or systems, or distinct network users'
479 installations.

480 [SOURCE. IEC 614-01-12]

481 point of connection - PoC

482 reference point on the electric power system where the user's electrical facility is connected

483 [SOURCE. IEC 617-04-01]

484 power/frequency control

485 secondary control of the active power of generating sets in response to variations in system frequency
486 and to the variations in the grand total of active power exchanged with the interconnected systems.

487 [SOURCE. IEC 603-04-06]

488 primary control (of the speed of generating sets)

489 the control of the speed of each generating set by its individual governor which ensures that the
490 driving torque is a function of the system frequency.

491 [SOURCE. IEC 603-04-04]

492 Privately accessible charging Station

493 a charging station that is installed on private ground (driveway, residential building, or depot) where
494 access and use of the charging station is reserved for the residents on the property.

495 Publicly accessible charging station

496 A fully publicly accessible charging station provides non-discriminatory access to any EV driver and
497 use of the charging station is not conditional on purchase or use of any other service or contract.

498 reserves for system services

499 generating capacity, kept in reserve to compensate for all possible deviations in the power balance
500 that may occur between normal conditions and those which actually occur, and thus to ensure a
501 reliable and economic electricity supply.

502 [SOURCE. IEC 617-03-10]

503 residential customer

504 party purchasing electric energy for his own household consumption, excluding commercial or
505 professional activities.

506 [SOURCE. IEC 617-02-05]

507 Resource Manager - RM

508 software component that exclusively represents a logical group of devices or a single smart device,
509 and is responsible for sending unambiguous instructions to the logical group of devices or to a single
510 device, typically using a device-specific protocol.

511 [SOURCE: EN 50491-12-1]

512 **reverse power flow - RPF**

513 Direction of energy fed into grid or into the electrical power system by a battery charger during
514 discharge of a vehicle battery.

515 **Roaming**

516 Information exchanges and related provisions between CSPs, which allow EV drivers to use a single
517 credential and contract to access services on multiple e-mobility networks and contract to access the
518 charging services provided by multiple CSPs or CSOs through roaming endpoints.

519 [SOURCE: IEC 63119-1]

520 **secondary control (of active power in a system)**

521 coordinated control of the active power supplied to the network by particular generators.

522 [SOURCE: IEC 603-04-05]

523 **smart charging - SC**

524 controlled energy transfer process that supports bidirectional communication incorporating customer
525 e-mobility needs and tariffs and optimizes the energy transfer according to grid constraints.

526 [SOURCE: IEC 63110-1]

527 **smart grid**

528 electric power system that utilizes information exchange and control technologies, distributed
529 computing and associated sensors and actuators, for purposes such as:

530 – to integrate the behaviour and actions of the network users and other stakeholders,

531 – to efficiently deliver sustainable, economic and secure electricity supplies

532 [SOURCE: IEC 617-04-13]

533 **smart metering**

534 technology of recording usage from metering devices and providing communication and/or control
535 path extending from electric power utility to current-using equipment.

536 [SOURCE: IEC 617-04-14]

537 **stability (of an electric power system)**

538 ability of an electric power system to regain or to retain a steady-state condition, characterized by the
539 synchronous operation of the generators and a steady acceptable quality of the electricity supply, after
540 a disturbance due, for example, to variation of power or impedance.

541 [SOURCE: IEC 617-01-03]

542 **transmission system operator**

543 party operating an electric power transmission system.

544 [SOURCE: IEC 617-02-11 modified – The words "electric power" have been added to the definition,]

545 **vehicle to Grid - V2G**

546 plug-in electric vehicle interaction with the electric grid, including charging as well as discharging and
547 bi-directional communication interface.

548 [SOURCE: ISO/IEC 15118-1:2013]

549

550 **vehicle to home, vehicle to building.**

Vehicle-to-home (V2H) or vehicle-to-building (V2B) refers to an electric vehicle connected to the electrical power system of a home or building, and which is used as a back-up power supply during periods of power outage or to reduce power absorbed from the grid.

virtual power plant – VPP

group of distributed energy resources which combine to function as a dispatchable unit.

Note 1 to entry: A virtual power plant can be used for the purpose of participating in the electricity market or aggregating ancillary services.

[SOURCE: IEC 617-04-27]

XMPP - Extensible Messaging and Presence Protocol

XMPP is the Extensible Messaging and Presence Protocol, a set of open technologies for instant messaging, presence, multi-party chat, voice and video calls, collaboration, lightweight middleware, content syndication, and generalized routing of XML data.

[SOURCE: <https://xmpp.org/about/technology-overview/>]

4 Electrical Vehicle Charging Stations (EVCS) Configurations

IEC 63382-1 deals with EVCSs where normally a CS Backend System is present.

The EVCS may have different configurations, depending on several features:

- AC Charge or DC Charge
- Presence of AC bus or DC bus
- Single EVSE or multiple EVSEs
- power flow direction (only forward to charge, also reverse to discharge)
- presence of a bidirectional charger on board the EV

Some EVCS are illustrated as examples, by simplified diagrams.

The diagrams show both the power system of EVCS and the communication links among actors of the charging process.

Figure 1 lists the actors separating the Primary Actors and the Secondary Actors.

Primary Actors are those involved in the main information exchange described by IEC 63382-1.

Actors

FO	Flexibility Operator	EMSP CSP	E-Mobility Service Provider Charging Service Provider
CSO	Charging Station Operator	Roaming Endpoint	Roaming Endpoint
FCSBE	Flexibility Charging Station BackEnd	TSO	Transmission System Operator
CSMS	Charging Station Management System	DSO	Distribution System Operator
LCSMS	Local Charging Station Management System	CEM	Customer Energy Manager
RM	Resource Manager	EVU	EV User
CSC	Charging Station Controller	EV	Electrical Vehicle
		CS	Charging Station

Figure 1. Primary Actors and Secondary Actors

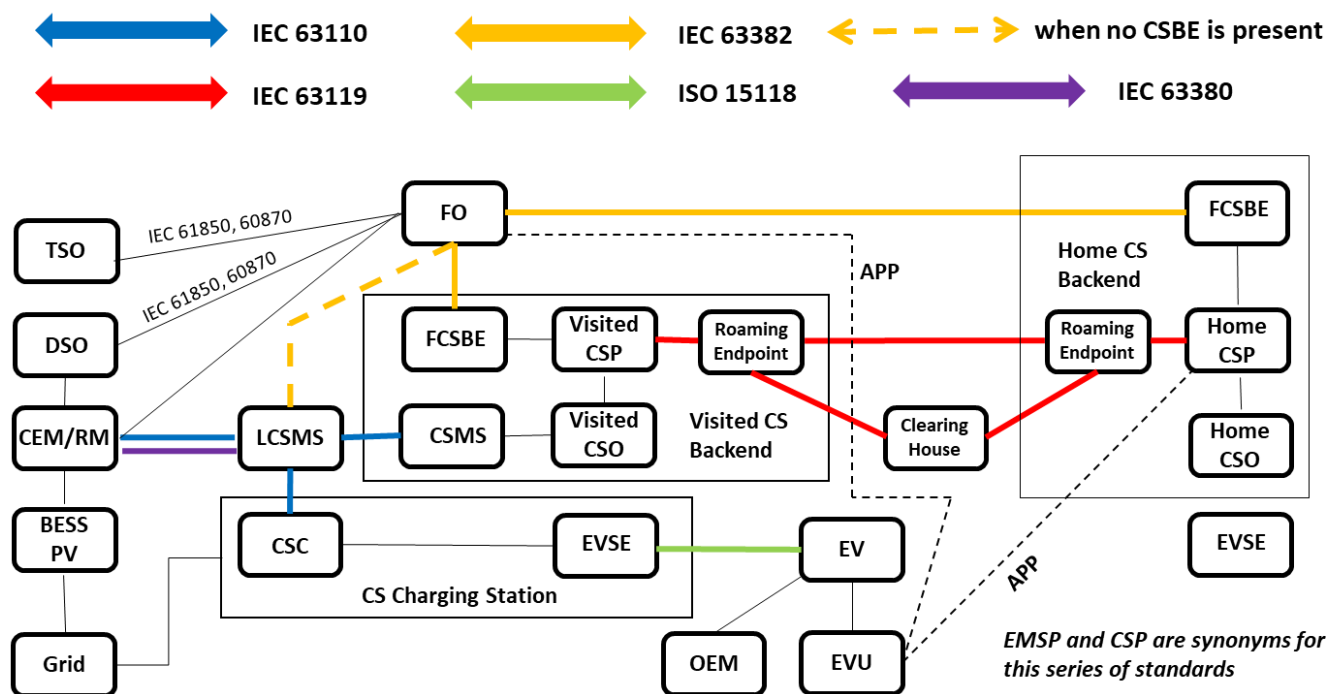


Figure 2. Overall Diagram with actors

The position of voltage and frequency measurements is significant for those grid support functions, which depend on the actual values of voltage and frequency sensed in the EVCS power system. The location of measurements illustrated in the EVCS diagrams are examples since the effective positioning of measurement devices depend on the specific application.

Table 1 lists some examples of EVCS configurations, which are illustrated by diagrams.

Diagram	multi/ single EVSE	AC charge	DC charge	bus	V2G	On Board Charger AC - DC	Off Board Charger	connection to grid
1	multi	no	yes	DC bus	no	unidirectional	unidirectional	rectifier
1	multi	no	yes	DC bus	yes	unidirectional	bidirectional	inverter
2	multi	no	yes	AC bus	no	unidirectional	unidirectional	rectifier
2	multi	no	yes	AC bus	yes	unidirectional	bidirectional	inverter
3	multi	yes	no	AC bus	no	unidirectional	no	rectifier
3	multi	yes	no	AC bus	yes	bidirectional	no	inverter
4	single	yes	no	no bus	no	unidirectional	no	rectifier
4	single	yes	no	no bus	yes	bidirectional	no	inverter
5	single	no	yes	no bus	no	unidirectional	unidirectional	rectifier
5	single	no	yes	no bus	yes	unidirectional	bidirectional	inverter

Table 1 - EVCS Configurations

All diagrams may refer to both unidirectional and bidirectional power flow, depending on the power converters functional capabilities.

All EVs are equipped with an on-board charger (OBC) which is an AC-DC power converter, with unidirectional or bidirectional power flow capability.

An EVCS is capable of V2G services if a bidirectional power flow is possible, between the EV and the charging infrastructure, which allows charging and discharging of EV batteries.

The communication interface between CSC and CS is out of scope of IEC63382-1.

The manufacturers of EVCS adopt proprietary communication solutions to transfer data (commands, alarms, status, setpoints, measurements) among components of the EVCS (EVSE, power converters, sensors).

They can be based on a fieldbus, LAN, Ethernet networks, or others.

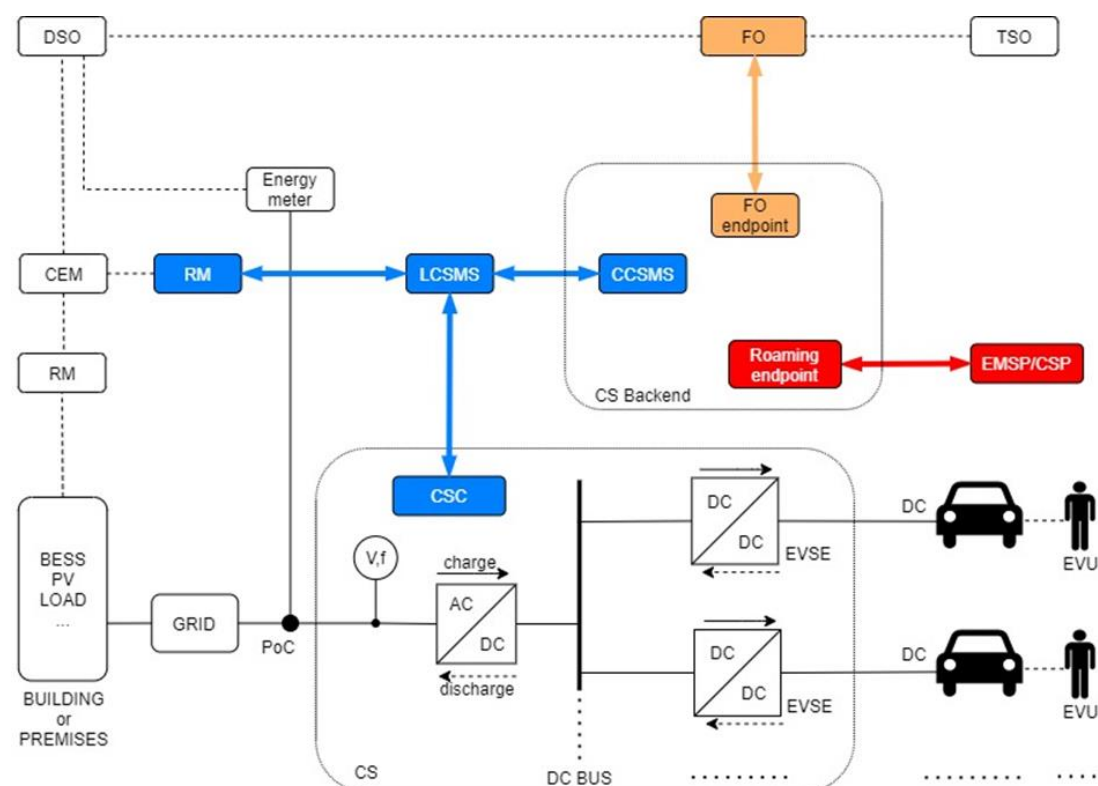


Figure 3. EVCS with multiple EVSE and DC bus. DC charge. (Diagram n.1)

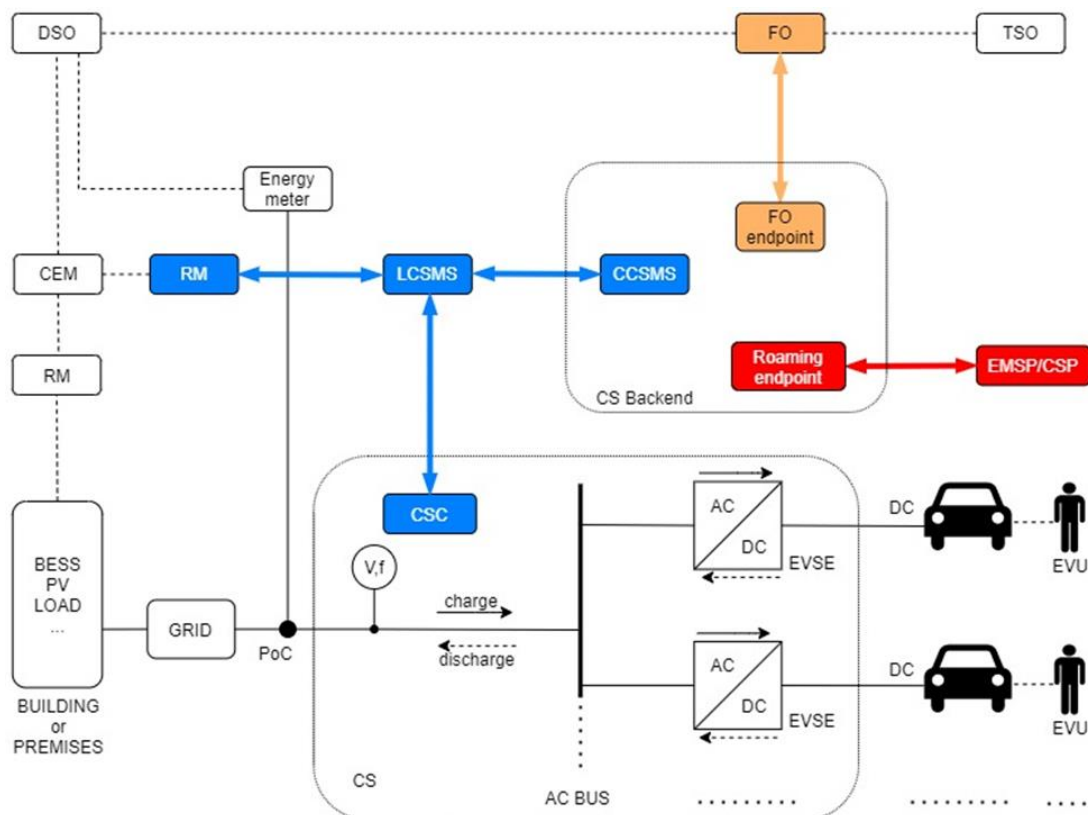


Figure 4. EVCS with multiple EVSE and AC bus. DC charge. (Diagram n.2)

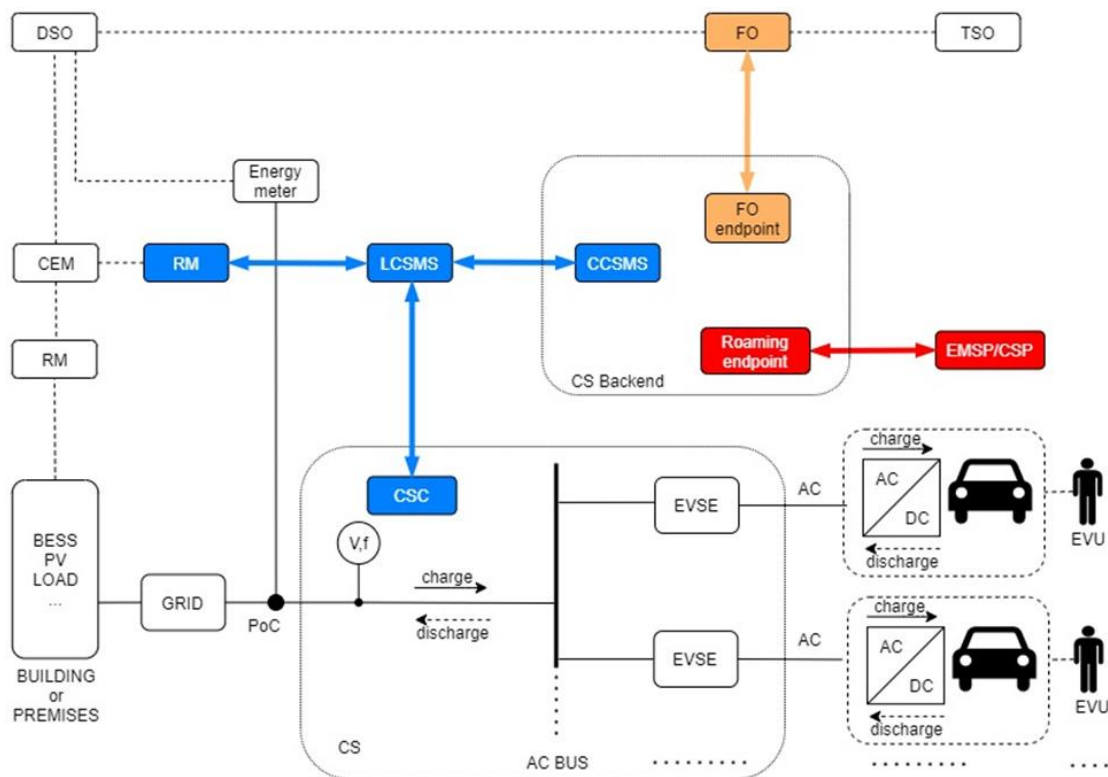


Figure 5. EVCS with multiple EVSE and AC bus, AC charge without off board power converter. (Diagram n.3)

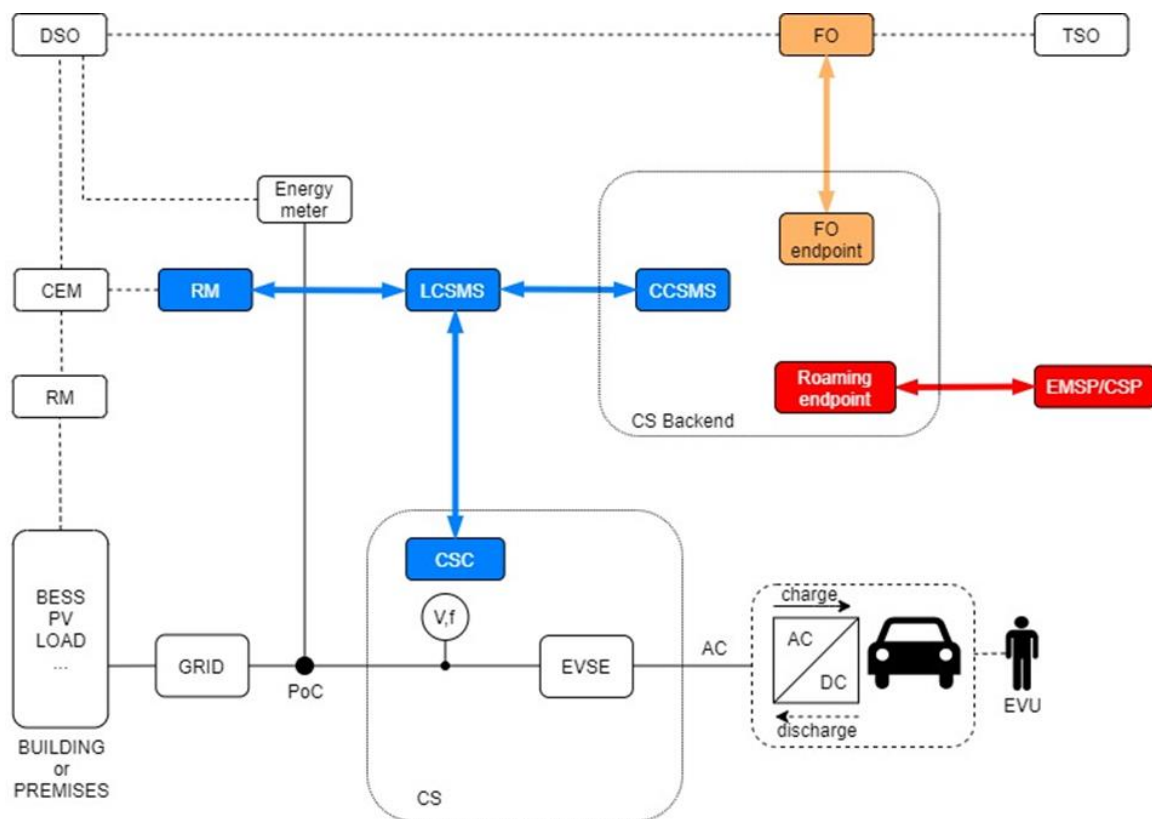


Figure 6. EVCS with single EVSE, AC charge, without off board power converter. (Diagram n.4)

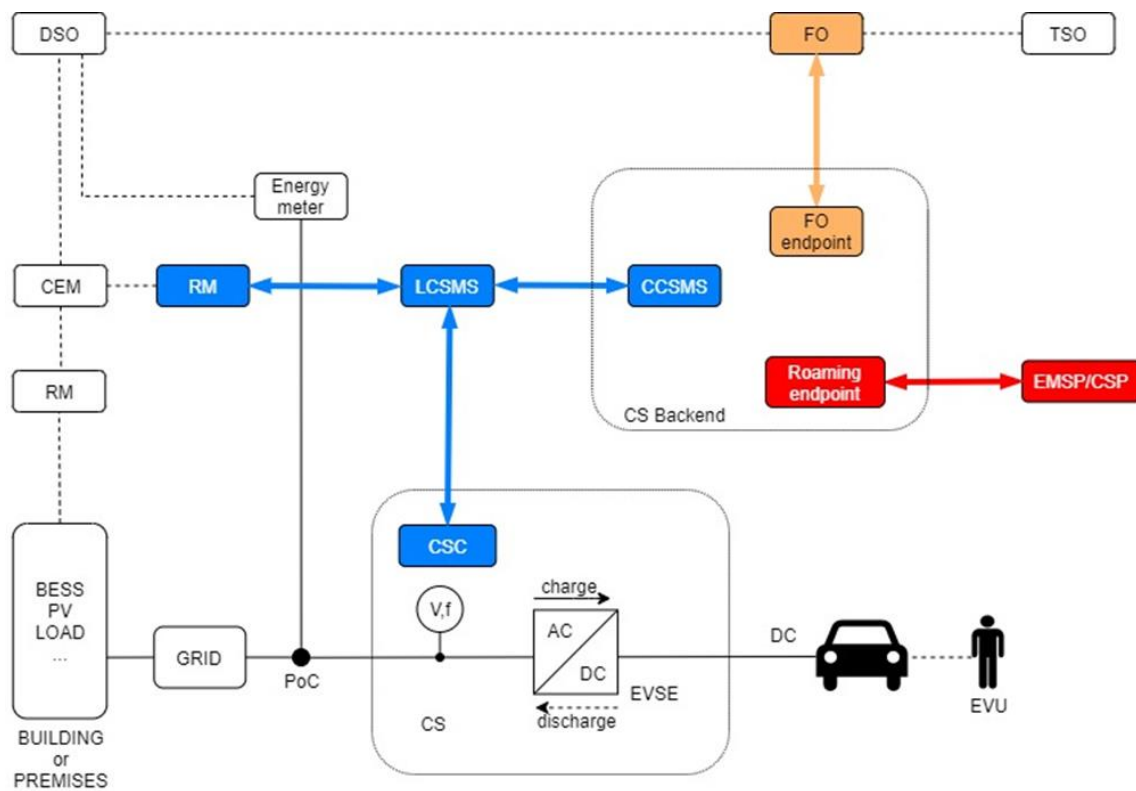


Figure 7. EVCS with single EVSE, DC charge. (Diagram n.5)

5 Functional Requirements

5.1 Data Communication

5.1.1 General

The information exchanges defined in the IEC 63382 series use the framework of the Smart Grid Architecture Model (SGAM).

The SGAM framework helps to separate the meaning of the information that is exchanged ("what"), and the particular encoding or technology used to transport the information ("how"). See Table 2. In general, the message encoding and transport protocol shall be compatible with that specified in IEC 63110.

Table 2 – Application of SGAM within IEC 63382

Layer	Description	Application within IEC 63382
Business	The business layer represents the business view on the information exchange related to smart grids. This	Not explicitly described.
Function	The function layer describes system use cases, functions and services including their relationships from an architectural viewpoint.	Functions are described in the use cases detailed in clause 6 of this document
Information	The information layer describes the information that is being used and exchanged between functions, services and components. It contains information objects and the underlying data models.	Data models are described in detail in IEC 63882-2
Communication	The communication layer describes the protocols and mechanisms for the interoperable exchange of information.	The communication protocols are described in detail in IEC 63882-2.
Component	The component layer consists of the physical devices and systems	Typical systems are described in Clause 4.

5.1.2 Information model principles

The information model shall describe the types of information that are exchanged between systems, for example, "the maximum active power that can be taken from the grid during a specific time period". The logical information model is defined independently of the physical transport and encoding protocols. This enables alternative transport mechanisms to be used if appropriate. Many of the information exchanges are intended to synchronise the internal data models of the sending and receiving systems. Each data exchange between systems will be a specific subset of objects and attributes described in the shared information model. This helps to simplify the processing of the exchange messages.

5.1.3 Information model compatibility and mapping to other standards

The information model for IEC 63882 shall be capable of being mapped with the relevant information exchanges defined in other standards as listed in Table 3.

Table 3 – Information model mapping or compatibility

a) Type of information exchange	b) Standard(s)
Energy and flexibility market information	IEC 62746
Grid operator monitoring & emergency control	IEC 61850 (information may be transported using IEC 60870-5-104, IEEE 1815 and other protocols)
Metering (proof-of-service)	IEC 62056 (DLMS/COSEM) (parts of this can be mapped to IEC 61968 and IEC 61850)
Charging station information exchanges	IEC 63110

5.1.4 Communication transport protocol

The communication shall use TCP/IP based networking.

The communication messages shall be defined in abstract terms that can be applied using these exchange paradigms:

- Subscription to spontaneous events (a particular type of request)
- Publication of spontaneous events
- Requests – typically to read or write settings
- Responses to requests

5.1.5 Message transport

The message transport shall be XMPP.

IEC 63382-2 shall describe

- the usage of the XMPP protocol, describing in details which features shall be used
- how to achieve end-to-end secured communications

5.1.6 Message payload encoding

The message encoding shall be JSON.

5.1.7 Physical layer

The physical medium is not defined by IEC 63382. It may be any form of hard-wired Ethernet, Wi-Fi or other mobile technology

5.2 Cybersecurity and Privacy

This section specifies the cybersecurity and privacy requirements of the flexibility services in the scope of IEC 63382.

5.2.1 Cybersecurity and privacy perimeter of IEC 63382

The cybersecurity and privacy perimeter of IEC 63382 includes the FO communication interfaces and data exchanged with the actors of the EV charging ecosystem, that support the implementation of the FO use cases.

With reference to the overall diagram in Figure 2 the cybersecurity and privacy perimeter of IEC 63382 perimeter includes the following interfaces:

- **Int1** (yellow fixed line) for the communications between FO management systems and the back-end systems of CSO/CSP. **Int1a** connects FO with Home CSO/CSP and **Int1b** connects FO with Visited CSO/CSP;
- **Int2** (yellow dashed line) for the communications between FO management systems and FO End Points of local CS controllers;
- **Int3** (black dashed line) for the communications between FO management systems and Electric Vehicle users.

In UC1.1 – EVU charge at Home CS equipped with a back-end system, Int1a shall be used for exchanging different data types (such as authentication, configuration, contractual and physical data) with the CSO/CSP.

In UC1.1 without a back-end system, Int2 shall be used instead.

In UC1.2 – EVU charge at Visited CS, contractual data shall be exchanged through Int1a (Home CSO/CSP), while authentication, configuration and physical data shall be exchanged through Int1b (Visited CSO/CSP).

Int3 shall be used by UC3.6 – Flexibility Service Phone App to implement the use cases of group 1 and 2 for the exchange of user related data.

5.2.2 Cybersecurity and privacy risks

IEC 63382 adopts a risk-based approach to the analysis of cybersecurity and privacy threats, necessary for the identification of the appropriate cybersecurity and privacy requirements and measures.

For the effect analysis of cybersecurity threats to IEC 63382 communications, the sequence diagrams of IEC 63382 use cases are considered.

IEC 63382 use cases are linked each other by generalization and aggregation relationships, as illustrated in the UML class diagram in Figure 8.

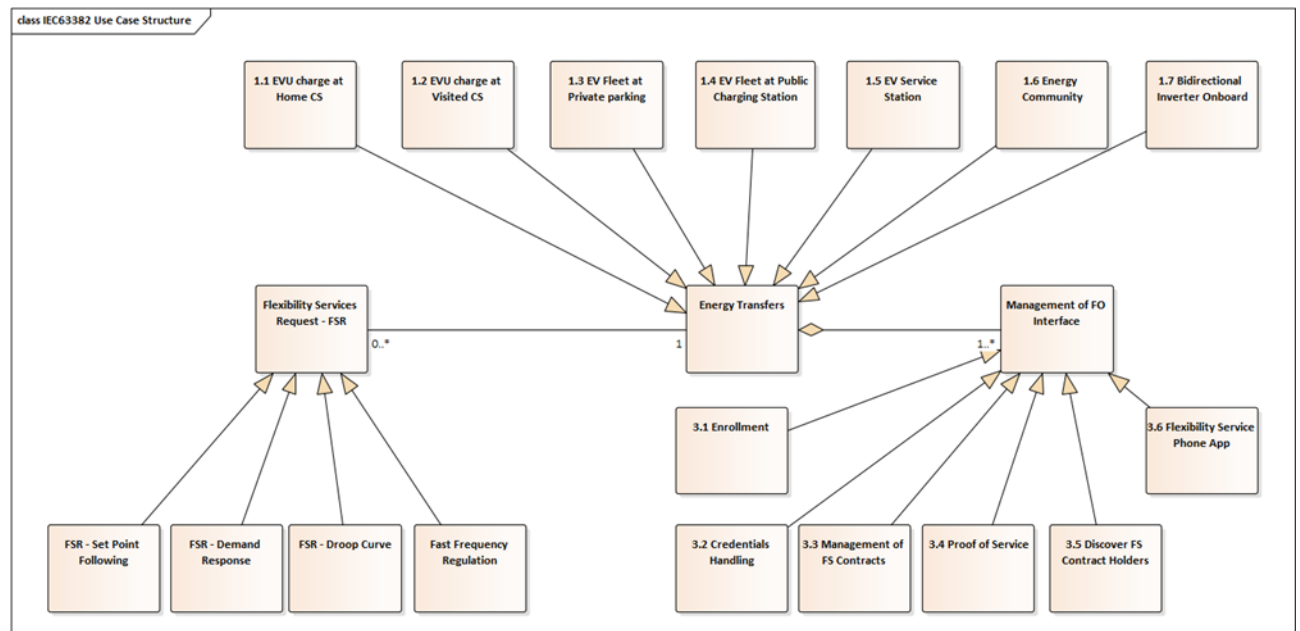


Figure 8 - IEC 63382 Use Case Structure

By focusing on the basic Energy Transfer use case 1.2, it is an aggregation of the support use cases 3.2, 3.6, 3.5 and 3.4, as shown in the UC1.2 sequence diagram in Figure 9.

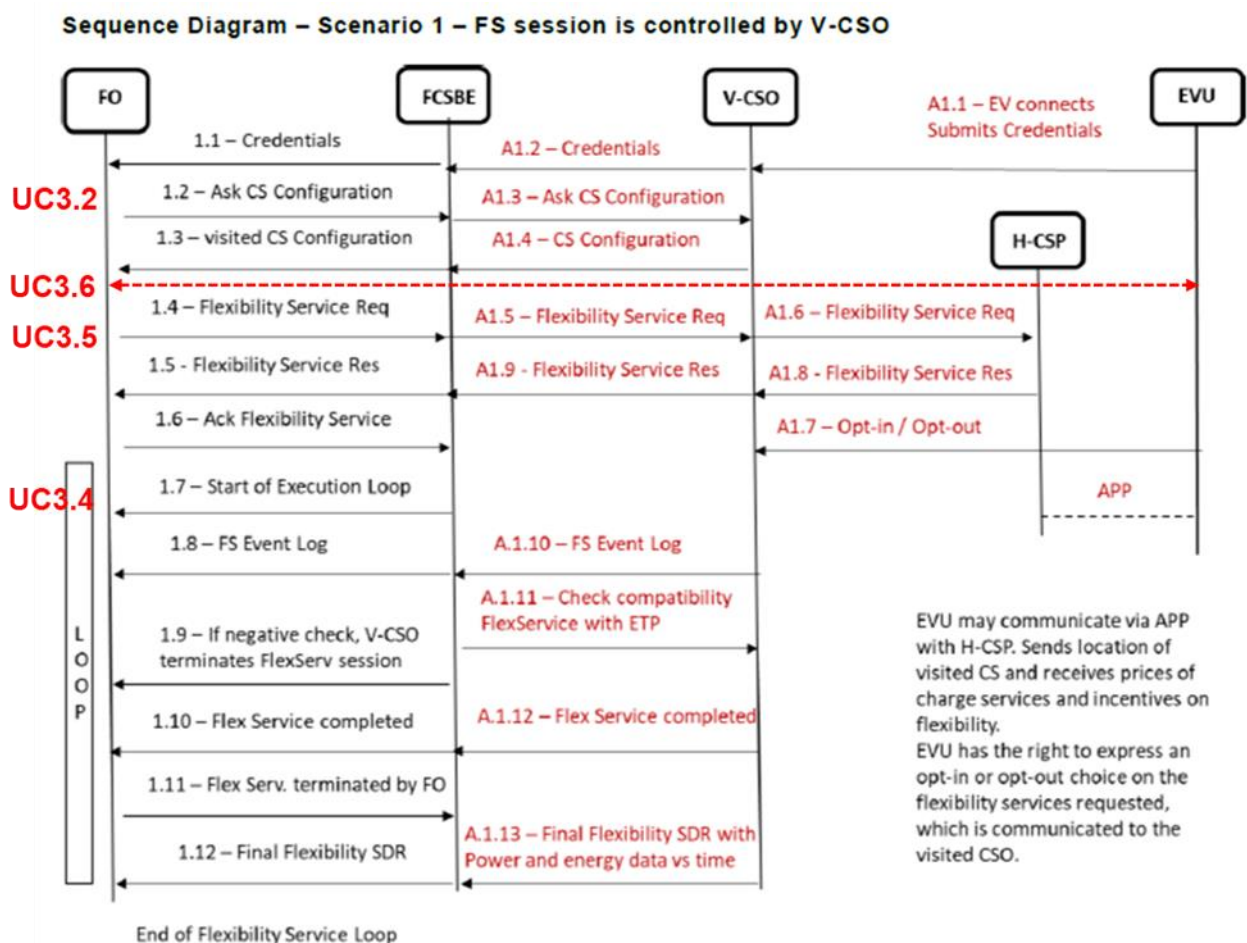


Figure 9. UC 1.2 structure

The cybersecurity and privacy requirements and measures of IEC 63382 are intended to protect and defend the FO communications by possible attacks (e.g. Denial of Service or Man In The Middle) compromising the confidentiality, integrity and availability of data exchanged (see Figure 10).

Sequence Diagram – Scenario 1 – FS session is controlled by V-CSO

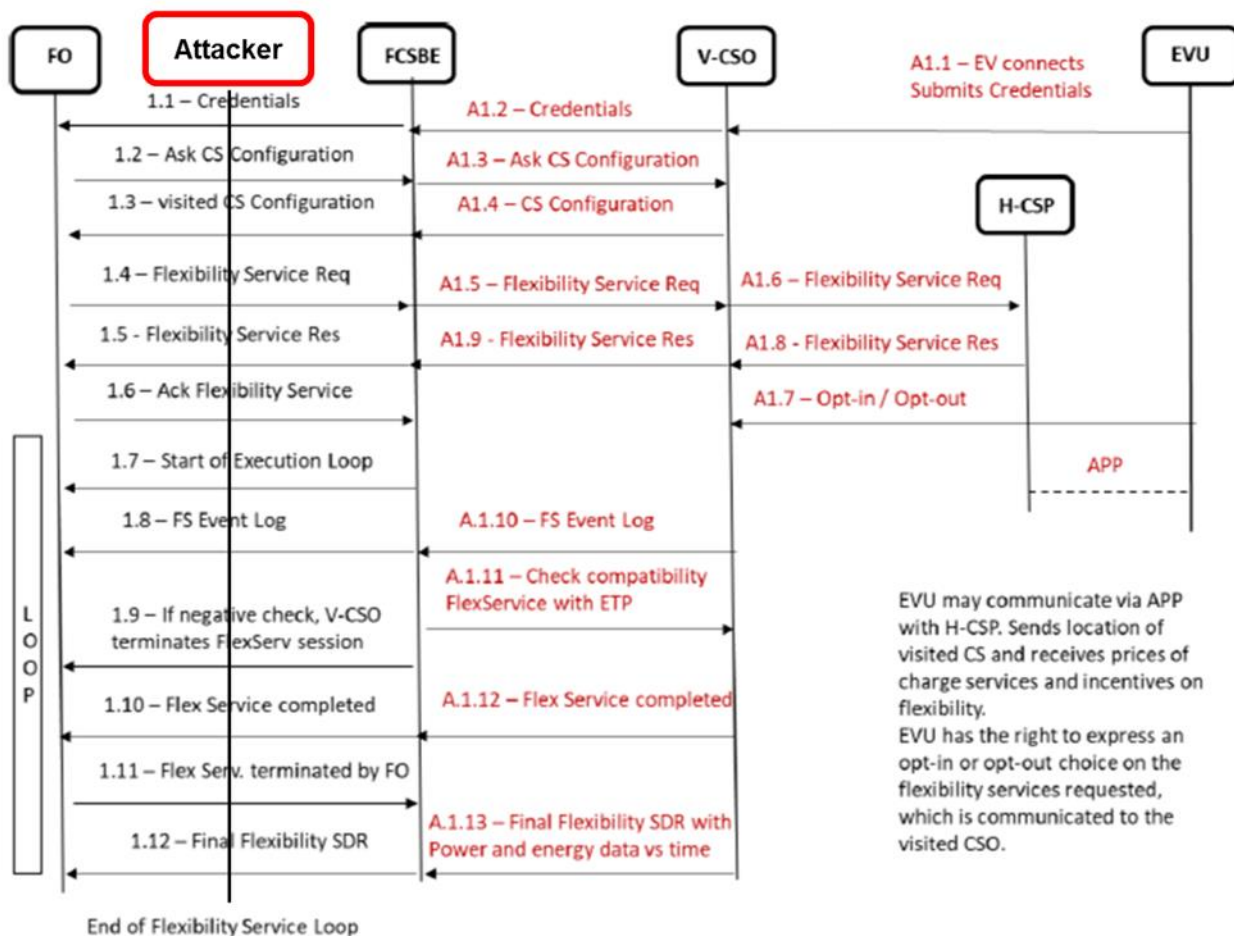


Figure 10. UC 1.2 compromised communications

The evaluation of cybersecurity risks considers a set of business parameters of IEC 63382 use cases. Table 4 lists such business parameters, their magnitude orders, and related communication interfaces. IEC 63382 shall guarantee the scalability, security, and efficiency of flexibility services to millions of electric vehicles charging in every country in the covered geographical area, contracted by a given number of home service providers in each country and served by such providers and by all the visited service providers within the covered geographical area.

Business Parameter	Magnitude Order	Related Interfaces
# of countries covered	hundreds	Int1 Int3
# of EV in each country	millions	Int1 Int2 Int3
# of FO in each country	hundred	Int1 Int2 Int3
# of H_CSP in each country	hundred	Int1 Int2 Int3
# of H_CSP contracted by each FO	ten	Int1 Int2 Int3
# of V_CSP contracted by each FO	hundred	Int1 Int2 Int3
# of V_CSP = $\sum$ H_CSP in all countries - # of H_CSP in a given country	hundreds	Int1 Int2 Int3
# of LCSMS in each country	hundred thousands	Int2
# of LCSMS contracted by each FO	thousands	Int2
# of EVU in each country	millions	Int3

Table 4 – Business parameters

5.2.3. Cybersecurity principles and requirements

5.2.3.1 Cybersecurity principles

IEC 63382 use cases involve information exchanged by multi-actor systems of the EV charging ecosystem. Therefore, the cybersecurity of IEC 63382 flexibility services is achieved if and only if all the communication interfaces in the communication path from the EV(EVU) to the FO meet appropriate cybersecurity requirements.

Homogeneity in the technologies adopted for the implementation of the communications in the EV charging ecosystem supports the interoperability of cybersecurity profiles from the different actors.

5.2.3.2 Cybersecurity and privacy requirements

All the communication interfaces in the IEC 63382 perimeter shall meet the following requirements:

- Network segregation
- End-to-end security at both transport and application layer
- User and device authentication, authorization and role-based access control
- Data confidentiality and integrity
- Privacy of personal data
- Key and certificate management
- Security monitoring and event management.

The cybersecurity requirements stated above shall be met by any type of back-end system architecture, i.e. standalone, private or public cloud.

5.2.4 Cybersecurity and privacy measures

This clause anticipates cybersecurity and privacy measures that are considered relevant for meeting the stated communication and cybersecurity requirements, by referencing available cybersecurity standards. The specification of cybersecurity and privacy measures will be addressed by IEC 63382-2.

For all the communication interfaces in the IEC 63382 perimeter, the following security solutions shall be provided:

- A specific TLS profile for transport layer security (see IEC 62351-3)
- A specific application-layer profile for end2end security
- A specific key and certificate management infrastructure (see IEC 62351-9).

5.3 Grid Support Functions and Flexibility Services

5.3.1 Grid Support Functions. General principles.

Grid support functions involve always exchange of power (active and/or reactive) at the PoC (Point of Connection) between the grid and the EV Charging Station.

Voltage and frequency values at the PoC affect the behaviour of some grid functions.

The power flow between AC grid and the DC EV battery requires always an AC-DC power conversion, which can be unidirectional or bidirectional.

The Power Conversion System (PCS) can consist of several power converters, parallel connected and/or with more stages in cascade.

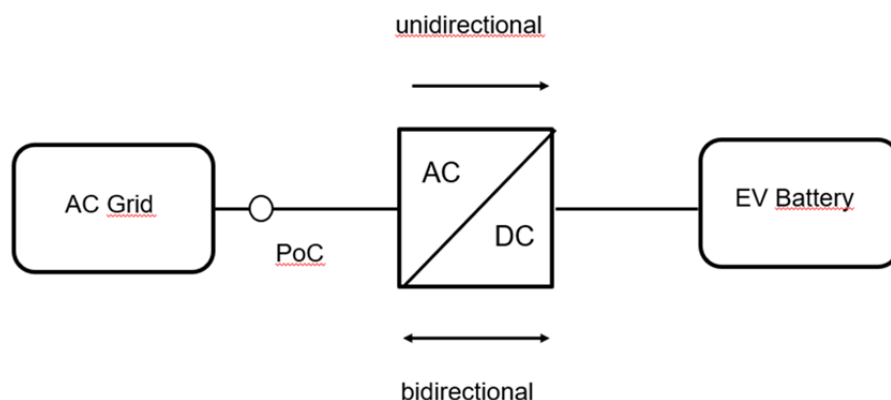


Figure 11. AC-DC Power Conversion Generic Diagram

The FS requires that the control of PCS in the CS can perform the requested functions. For example:

- Droop Control according to an externally provided droop curve
- Follow setpoints, externally provided by the FO, through any secondary actors

The PCS can be installed in:

- EV
- EVSE
- within the CS, stand-alone (for example the grid tied inverter)

The correct execution of the FS requires that the PCS involved in the service are properly addressed by the messages transporting the FS parameters (droop curve, setpoints).

In principle only the PCS connected to the resources participating to the service shall be “activated”. This depends on the opt-in or opt-out choice made by the actors of the CS (EV, CSO, CSP).

5.3.2 Flexibility Services

The FO/Aggregator converts Grid Services and/or Grid Support Functions requested by the grid operators (TSOs) into multiple Flexibility Services to be provided by a number of CSs, utilizing its own optimization algorithms.

A classification of Flexibility Services provided to FO by CSs may include:

- Following a dynamic setpoint from FO

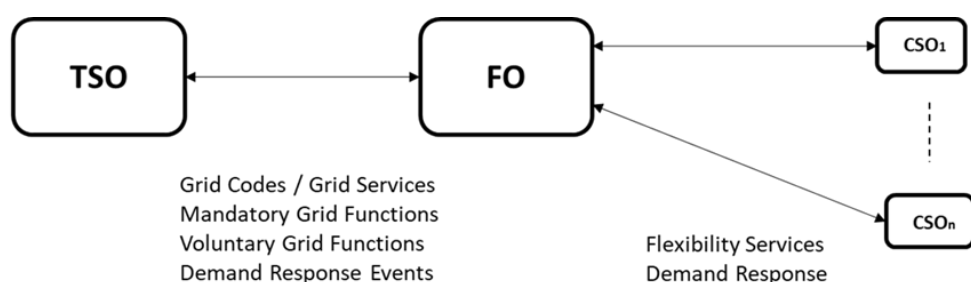
- Automatic execution of a droop curve provided by FO, according to local measurements (Hz, V, W)
- Demand Response tasks, stimulated by price signals from FO
- Fast Frequency Regulation

All services are subject to safety conditions and to the right of the EV owner/manager (EVU, EV Fleet Manager) to express an opt-in or opt-out choice.

Provision of Flexibility Services is ruled by a Flexibility Service Contract (FSC) between FO and EV owner/manager.

Mandatory grid services are delivered at PoC in presence of bidirectional power converters in the EVCS. Bidirectional inverters shall be certified according to applicable grid code and they will provide mandatory grid services. They can provide also market driven services.

Grid tied unidirectional power converters shall comply with applicable grid connection rules and they may provide some market driven grid support functions.



FO/Aggregator converts Grid Services/Grid Support Functions into multiple Flexibility Services to be provided by a number of CSOs, utilizing optimization algorithms

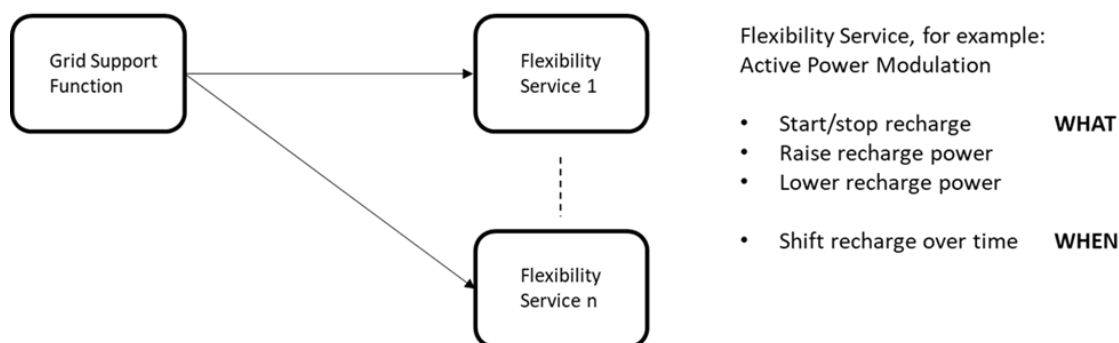


Figure 12. Flexibility Services by FO. Basic Principle of Operation

6 Use Cases

The Use Cases of IEC 63382-1 will be described according to IEC 62559-2.

IEC 62559-2:2015 defines the structure of a use case template, template lists for actors and requirements, as well as their relation to each other.

IEC 63382-1 deals with Use Cases involving FO and a FO Endpoint located at the CS Backend. We shall refer to FCSBE (Flexibility endpoint at the Charging Station Back End) to identify this interface or endpoint of the FO data link.

FO and FCSBE will be the primary actors of these UCs. There are secondary actors, the CS Backend (CSBE) normally includes the CSMS and the Roaming Endpoint (REP).

The CSP and CSO can also be considered parts of the CSBE, and they cover business roles.

The purpose of IEC 63382 is mainly focused on the information exchange between FO and FCSBE.

The FCSBE endpoint (or interface to FO) may be located in the CS Backend, both at a Visited CS and at a Home CS.

Thus, there will be two data links between FO and FCSBE endpoints

IEC 63382-1 utilizes Use Case Sequence Diagrams to illustrate the exchange of messages over the data links between FO and FCSBE.

The purpose of these Use Case Sequence Diagrams is to provide an overall description of the messages exchanged between actors, primary and secondary, also beyond the scope of IEC 63382-1. They will help the reader to understand the general context of the UC.

They involve actors participating in Use Cases ruled by other IEC standards (as IEC 63110, ISO/IEC 15118 and IEC 63119) and clarify the information exchange needed for the best operation of the UC of IEC 63382-1.

It is utilized a convention to illustrate messages in red color, when they refer to exchange of information out of scope of IEC 63382-1.

Use cases of IEC 63382-1 are organized in three main groups

- Flexibility Energy Transfers
- Flexibility Services
- Management of the interface FO-FCSBE

UC Group : Energy Transfers			UC Group : Flexibility Services		UC Group : Management of FO Interface	
ID	Description of Use Case	Scenarios	ID	Description of Use Case	ID	Description of Use Case
UC1.1	EVU charge at Home CS	with CSBE without CSBE	UC2.1	FS - Setpoint Following	UC3.1	Enrollment
UC1.2	EVU charge at Visited CS	FS controlled by V-CSO FS controlled by H-CSP	UC2.2	FS - Demand Response	UC3.2	Credentials Handling
UC1.3	EV Fleet at Private parking		UC2.3	FS - Droop Curve	UC3.3	Discover FS Contract Holders
UC1.4	EV Fleet at Public Charging Station	FS controlled by V-CSO FS controlled by H-CSP	UC2.4	Fast Frequency Regulation	UC3.4	Proof of Service
UC1.5	EV Service Station				UC3.5	Management of FS Contracts
UC1.6	Energy Community	on grid off grid			UC3.6	Flexibility Service Phone App
UC1.7	Bidirectional Inverter Onboard					

Table 5 . List of Use cases and Use Case Groups

Legenda:

H-CSP = Home-Charging Service Provider
FS = Flexibility Service

V-CSO = Visited-Charging Station Operator
FSR = Flexibility Service Request

908 **Actors**

Actor Name	Actor Type	Actor Description
FO	Business role	Flexibility Operator - a party that aggregates load flexibility from different users of low voltage and medium voltage grids and trades it with the Transmission System Operator and/or the DSO in order to provide ancillary services
CSO	Business role	Charging Station Operator - party responsible for the provisioning and operation of a charging infrastructure (including charging sites) and managing electricity to provide requested energy transfer services.
CSP	Business role	Charging Service Provider - party which does not operate EV supply equipment but manages and authenticates EV User's credentials and provides charging and other value-added services for EV Users.
FCSBE	System role	Flexibility Charging Station Backend – FCSBE. It is the interface between the CS Backend (CSBE) system and the FO. It is a set of functions of the CSBE, responsible to exchange information with the FO
CSMS	System role	Charging Station Management System – Local and remote system responsible for managing the CS.
CSC	System role	Charging Station Controller - system responsible to manage one or more EV supply equipment.
CS	System role	Charging Station - physical equipment consisting of one or more EV supply equipment managing the energy transfer to and from EVs.
CEM/RM	System role	Customer Energy Manager/Resource Manager - internal automation function for optimizing the energy consumption and/or production within the premises according to the preferences of the customer using internal flexibilities and typically based on external information received through the Smart Grid Connection Point and possibly other data sources. CEM's interface to the CS is the Resource Manager
EMS	System role	The local EMS is the plant controller, set of control functions and software libraries integrated in a single automation system that make it possible to control the overall performance and functionality of the power plant as a single generating plant in the point of connection. The EMS represents a local system for monitoring and control of energy resources and loads. It can manage the EVSS's electrical systems to ensure energy optimized operation or visualize information.
PCS	System role	Power Conversion System responsible to transform AC and DC power. It can be located in the EV, the EVSE or externally, as a stand-alone unit. It is equipped with embedded control, which can be capable to implement droop functions or to follow setpoints.
FMU	System role	Frequency Measurement Unit. It provides accurate electric measurements of frequency; it is directly connected with the TSO and it can forward command signals to start/stop a Fast Frequency Response session.
Certified meters	System role	They can provide accurate electric measurements of power, energy, voltage, current, frequency, and digitally store and transmit these data in a secure way to other connected actors.
EVU	Business role	Electrical Vehicle User - person or legal entity using the vehicle and providing information about its needs.

909
910 **Table 6. List of Actors**911
912
913 **6.1 Flexibility Energy Transfer Use Cases**
914

915 6.1.1 Individual EVU recharge at home CS

916 Name of use case

<i>Use case identification</i>		
<i>ID</i>	<i>Area(s)/Domain(s)/Zone(s)</i>	<i>Name of use case</i>
UC1.1	Management of Energy Transfers	Individual EVU recharge at home CS

917

918 Scope and objectives of use case

<i>Scope and objectives of use case</i>	
<i>Scope</i>	Individual EVU recharges EV at home CS, receives a FS request, evaluates it, responds to it and executes the task if he chooses to opt-in
<i>Objective(s)</i>	Execution of the requested Flexibility Service by the EV connected to home CS

919 Narrative of Use Case

<i>Narrative of use case</i>
Short description
Complete description
An individual EVU connects his EV to home CS to recharge. Home CS means that the EVU has a contract with the CSP/CSO managing the CS. For example, the CS may have a single EVSE architecture with unidirectional power transfer capability, which is the simplest and most common case. There are different situations, depending on the presence of a CSBE or not, and the actors who have a Flexibility Service Contract with the FO: 1. CSBE exists, Home CSO/CSP and/or EVU have a FSC with FO 2. CSBE does not exist, EVU has a FSC with FO The FO sends a Flexibility Service Request to the FCSBE at the CS backend system (CSBE), in case 1, corresponding to scenario1 of Use case. The FO sends a Flexibility Service Request to the EVU, via APP or other direct data link, in case 2, corresponding to scenario2 of Use Case. No FS request is sent in case 3. The use case covers two following scenarios: - Execution of the FS task by the home CS, in presence of a CSBE - Execution of the FS task by the home CS, in absence of a CSBE This use case doesn't cover following points (since they are out of scope): - Communication between CSMS, CSC and EVSE - Optimization algorithms to allocate power and energy between EVSE and load, in order to avoid tripping of the main breaker/protection at the interface with grid. - How the FO creates the FS Request, starting from the requirements of the grid operator. Note that a direct data communication link between the FO and the EVU may exist, via a Mobile Phone App. By this App the FO and the EVU may exchange information on EV and CS location, credentials, Flexibility Service Requests and Responses and other relevant data. See Use Case 3.6 for details. For simplicity, this direct link is not shown on the Sequence Diagram of the use case. Detailed description, scenario1: - FO has received from the FCSBE the CS configuration parameters.

- FO gets credentials of EV, CSO/CSP upon connection of EV to CS.
- FO verifies in its archive the existence of a valid FS Contract with any of the actors involved.
- According to contract terms an eligible FS Contract Holder is selected.
- FO sends a FS Request (for example Smart Charging, by active power modulation) to the FCSBE, including parameters, to be forwarded to the eligible FS Contract Holder (EV, or CSO/CSP).
- CSO/CSP verifies the availability of CS to execute the FS task by checking the actual ETP, the active power variation, the price offered and the choice of EVU.
- In case CS is not available (opt out) or capable, CSO/CSP sends a negative Response to FO
- In case CS is available (opt in) and capable to execute the FS task, then CSO/CSP responds to FO confirming participation.
- CS implements the requested FS task (for example active power modulation, with positive or negative variation) for the specified time duration.
- For the duration of the FS task the recharge power level has to be compatible with the actual ETP.
- FS event log is continuously updated with power and energy exchange data, associated to time
- In case ETP and the FS task become not compatible, the FS task is interrupted and CSP/CSO sends a message to FO that the FS session is terminated.
- At the end of the FS task execution the Flexibility Service Detail Record is updated by recording the power and energy data exchanged during the FS session.
- The “loop” is interrupted when the FO sends a message to FCSBE to end the Flexibility Service Session.

Scenario2

In absence of a CSBE, the communication of FO with CS may take place through the LCSMS or through an APP connecting directly FO with EVU. The CS is managed by a LCSMS, which communicates with CS and with CEM/RM to take decisions on power allocation and ETP.

- FO gets credentials of EV, upon connection of EV to CS.
- FO asks the EV Charging Station configuration and technical data through LCSMS.
- FO receives the EV Charging Station configuration and technical data.
- Certified meters continuously provide CS with voltage and frequency measurements at the PoC and the PCSs react implementing the grid supporting functions, whenever necessary..
- FO verifies in its archive the existence of a valid FS Contract with EV.
- FO sends a FS Request (for example Smart Charging, by active power modulation) to the LCSMS, including parameters, to be forwarded to the EV.
- LCSMS verifies the availability of CS to execute the FS task by checking the actual ETP, the active power variation, the price offered and the choice of EVU.
- In case CS is not available (opt out) or capable, LCSMS sends a negative Response to FO.
- In case CS is available (opt in) and capable to execute the FS task, then LCSMS responds to FO confirming participation.
- CS implements the requested FS task (for example active power modulation, with positive or negative variation) for the specified time duration.
- For the duration of the FS task the recharge power level has to be compatible with the actual ETP.
- FS event log is continuously updated with power and energy exchange data, associated to time

- In case ETP and the FS task become not compatible, the FS task is interrupted and LCSMS sends a message to FO that the FS session is terminated.
- At the end of the FS task execution the Flexibility Service Detail Record is updated by recording the power and energy data exchanged during the FS session.
- The “loop” is interrupted when the FO sends a message to LCSMS to end the Flexibility Service Session.

920 Use case conditions

<i>Prerequisites</i>	
1	Secured communication channels have been established between FO and CSP/CSO, through FCSBE and between CSMS and CEM/RM. Identification, Authentication and Authorization have been successfully performed. The EVU and/or CSP/CSO have signed a valid contract with FO to provide Flexibility Services. All related business clauses have been already set. The CSO has discovered the CS architecture

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922 Actors

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924 See table 6 for the description of the actors and their acronyms. The following actors are active in this
 925 use case: FO, FCSBE, CSO, CSP, CSMS, CSC
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927 Overview of scenarios

No.	Scenario name	Scenario description	Primary actor	Post-condition
1	Execution of the FS in presence of a CSBE	Execution of the FS task by the home CS, in presence of a CSBE	FO FCSBE	End conditions: The FO informs FCSBE that the FS action is terminated The CSO/CSP responds to FO through FCSBE that CS is not available or capable to perform the FS task requested The CSO/CSP informs the FO through FCSBE that the on-going FS action cannot continue as scheduled. CSO/CSP inform FO through FCSBE that FS task is completed
2	Execution of the FS in absence of a CSBE	Execution of the FS task by the home CS, in absence of a CSBE	FO LCSMS	End conditions: - The FO informs LCSMS that the FS action is terminated - The LCSMS responds to FO that CS is not available or capable to perform the FS task requested - The LCSMS informs the FO that the on-going FS action cannot continue as scheduled. - LCSMS informs FO that FS task is completed

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929 **Scenario 1. CSBE is present. Step by step analysis**

Step No	Name of process/activity	Description of process/activity	Information producer (actor)	Information receiver (actor)	Information exchanged (IDs)
1.1	FO gets credentials	FO gets credentials of EV, CSO/CSP upon connection of EV to CS from FCSBE	FCSBE	FO	Info 1 – EV credentials
1.2	FO sends a FS Request to the eligible FS Contract Holder	FO verifies in its archive the existence of a valid FS Contract with any of the actors involved. According to contract terms an eligible FS Contract Holder is selected. FO sends a FS Request to the FCSBE, including parameters, to be forwarded to the eligible FS Contract Holder (EV, or CSO/CSP).	FO	FCSBE	Info2 -The FS Request from FO including parameters
	The CSO/CSP verifies the availability of CS to execute the FS task	CSO/CSP communicates with CSMS to verify the availability of CS to execute the FS task by checking the actual ETP, the power variation, the price offered and the choice of EVU (opt in or opt out options).	CSO/CSP	CSMS	Info-Request to perform FS task with parameters
	The CSMS checks ETP and answers to CSO/CSP	The CSMS checks the Energy Transfer Plan (ETP) with the FS Request parameters to decide participation and provides technical response to CSO/CSP.	CSMS	CSO/CSP	Info-The CSMS decision on FS task.
1.3	Response to FS Request from CS	CSO/CSP responds to the FS request of FO, accepting or declining the proposal through the FCSBE. It indicates the resources available to provide the Flexibility Service, which are the EVSE-EV pairs in the CS opting for the proposal.	FCSBE	FO	Info3 - Response to FS Request with available resources
1.3a	Negative Response from CSO/CSP to FO on FS Request	In case CS is not available (opt out) or capable, CSO/CSP sends a negative FS Response to FO through FCSBE	FCSBE	FO	Info3a – Negative FS response from CSO to FO
1.3b	Positive Response from CSO to FO on FS Request	In case CS is available (opt in) and capable to execute the FS task, then CSO/CSP responds to FO confirming participation through FCSBE. It starts a loop to execute the Flexibility Service Session.	FCSBE	FO	Info3b – Positive Response CS is available for FS task

1.4	Start FS task	Start of an execution loop of FS task. FCSBE informs FO. CS implements the requested FS task (for example active power modulation, with positive or negative variation) for the specified time duration. For the duration of the FS task the recharge power level has to be compatible with the actual ETP.	FCSBE	FO	Info4 – start of FS task to FO
1.5	FS Event Log	FS event log is continuously updated with power and energy exchange data, associated to time and it is forwarded to FO	FCSBE	FO	Info 5 – FS Event Log
	End of FS task	CSC informs CSMS that FS task has been completed or terminated	CSC	CSMS	Info – FS task completed or terminated
	End of FS task	CSMS informs CSO that FS task has been completed or terminated	CSMS	CSO	Info – FS task completed or terminated
1.6a	FS session is terminated by CSO/CSP	In case ETP and the FS task become not compatible, the FS task is interrupted and CSO sends a message to FO that the FS session is terminated.	FCSBE	FO	Info 6a – FS task is terminated by CSO, and FO is informed
1.6b	FS task is completed by CS	CSO informs FO through FCSBE that FS task has been completed	FCSBE	FO	Info6b – FS task completed
1.7	FS session is terminated by FO	FO informs CS through FCSBE that the FS session is terminated.	FO	FCSBE	Info 7 – FS session is terminated by FO
1.8	Update the FSDR	At the end of the FS task execution the Flexibility Service Detail Record is updated by recording the power and energy data exchanged during the FS session and it is forwarded to FO	FCSBE	FO	Info8 – Flexibility SDR

931 **Scenario 1. Information exchanged**

Information exchanged, ID	Name of information	Description of information exchanged
Info 1	EV and CSO/CSP credentials	Upon connection of EV to CS, credentials of EV, CSO/CSP are forwarded from FCSBE to FO
Info2	FS Request from FO to eligible FS Contract Holder	The FS Request from FO, with FS task parameters, is forwarded to eligible FS Contract Holder
Info3a	Negative Response on FS Request	In case CS is not available (opt out) or capable, CSO/CSP sends a negative FS Response
Info3b	Positive Response on FS request, CS is available for FS task	In case CS is available (opt in) and capable to execute the FS task, then CSO/CSP sends a positive response indicating the available resources
Info4	Start of FS task, FO is informed	A loop to execute the Flexibility Service Session is started
Info5	FS Event Log	FS event log is continuously updated with power and energy exchange data, associated to time
Info6a	FS task is terminated by CSO, and FO is informed	In case ETP and the FS task become not compatible, the FS task is interrupted and CSO sends a message to FO that the FS session is terminated.
Info6b	FS task completed	CSO informs FO through FCSBE that FS task has been completed
Info7	FS session is terminated by FO	FO informs CS through FCSBE that the FS session is terminated
Info8	Flexibility SDR	At the end of the FS task execution the Flexibility Service Detail Record is updated by recording the power and energy data exchanged during the FS session

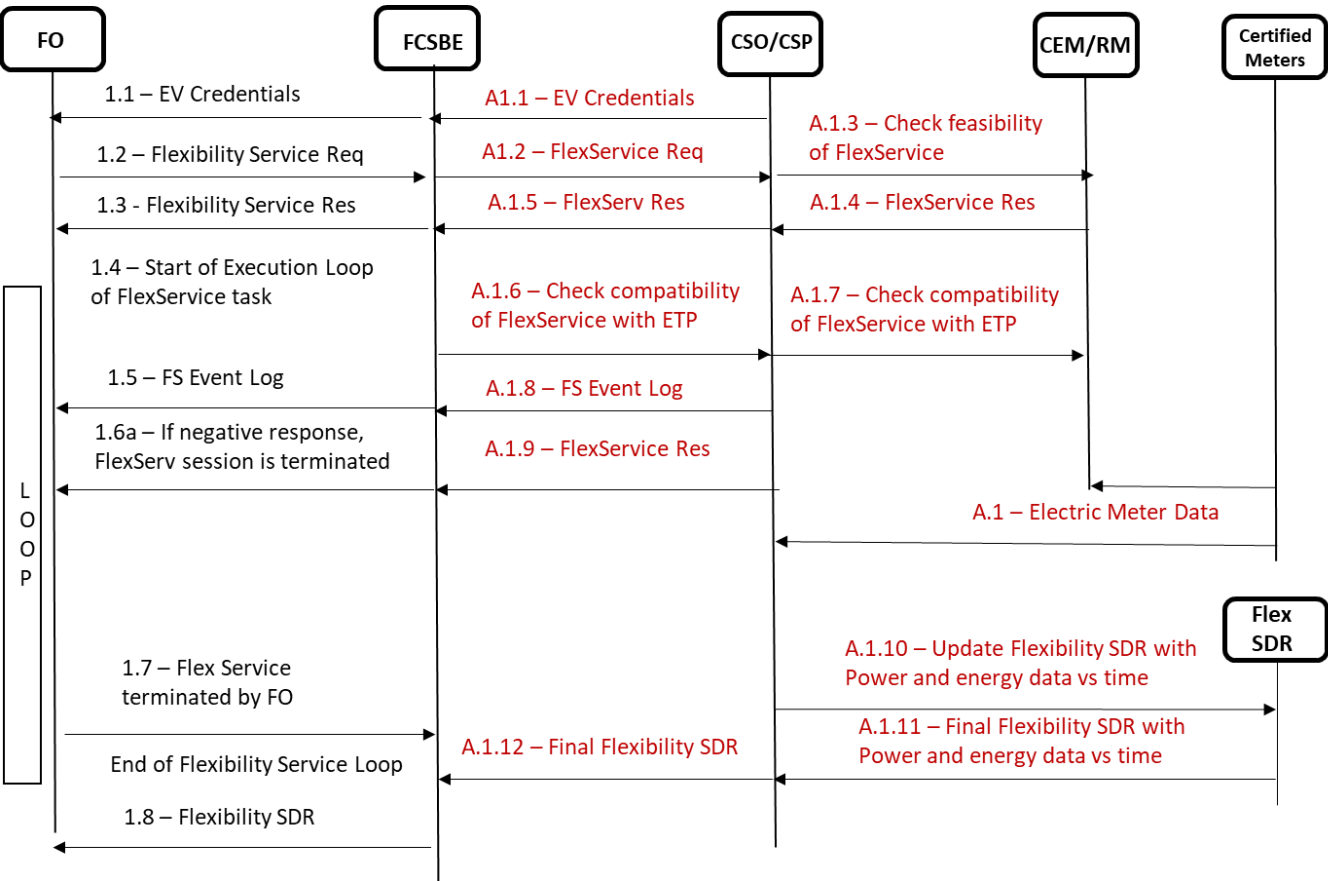
Scenario1. Requirements

Requirement R-ID	Requirement name	Requirement description
Req1	Eligible FS Contract Holder selected	FO verifies in its archive the existence of a valid FS Contract with any of the actors involved. According to contract terms an eligible FS Contract Holder is selected
Req2	Execution of FS Session Loop	CS executes the requested FS task by a session loop, with interaction between CSMS, CEM/RM and CSC
Req3	CSC-CSMS communication on end of FS	CSC informs CSMS that FS task has been completed or terminated
Req4	CSMS-CSO communication on end of FS	CSMS informs CSO that FS task has been completed or terminated

Scenario1. Post Conditions

End Condition EndC-ID	End Condition name	End Condition description
EndC1	FS terminated by FO	FO informs CS that Flexibility Service Session is over
EndC2	CS not available for FS	CSO/CSP responds to FO through FCSBE that CS is not available (opt-out) or capable to perform the FS task associated to requested Flexibility Service
EndC3	FS completed by CS	CSO/CSP inform FO through FCSBE that FS task is completed
EndC4	FS terminated by CSO/CSP	The requested FS is no more compatible with the actual ETP and the CSO/CSP through FCSBE informs the FO that the on-going flexibility service session is over.

Figure 13. Sequence Diagram – Use case 1.1 Scenario 1 – CSBE is present



944 **Step by step analysis. Scenario 2 – CSBE is not present**

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Step No	Name of process/activity	Description of process/activity	Information producer (actor)	Information receiver (actor)	Information exchanged (IDs)
1.1	FO gets credentials	FO gets credentials of EV upon connection of EV to CS from LCSMS	LCSMS	FO	Info 1 – EV credentials
		Identification, Authentication and Authorization are successfully performed			
		Certified meters continuously provide voltage and frequency measurements at the PoC and the PCSs in the CS react implementing the mandatory grid supporting functions.			
1.2	FO asks CS configuration	FO asks CS configuration	FO	LCSMS	Info 2 – CS configuration request
1.3	FO receives CS configuration	FO receives CS configuration with parameters, including the technical data of PCSs and their capabilities to operate following a setpoint, or to implement a droop control.	LCSMS	FO	Info 3 – CS configuration
1.4	FO sends a FS Request to the EV	FO verifies in its archive the existence of a valid FS Contract with EV. FO sends a FS Request to the LCSMS, including parameters, to be forwarded to the EV.	FO	LCSMS	Info4 -The FS Request from FO including parameters
	The LCSMS checks ETP with CSC	The LCSMS checks the Energy Transfer Plan (ETP) against the FS Request parameters to decide participation	LCSMS	CSC	Info4- The FS Request from FO including parameters

1.5	Response to FS Request from CS	LCSMS responds to the FS request of FO, accepting or declining the proposal. It indicates the resources available to provide the Flexibility Service, which are the EVSE-EV pairs in the CS opting for the proposal.	LCSMS	FO	Info5 - Response to FS Request with available resources
1.5a	Negative Response to FO on FS Request	In case CS is not available (opt out) or capable, LCSMS sends a negative FS Response to FO	LCSMS	FO	Info5a – Negative FS response from CSO to FO
1.5b	Positive Response to FO on FS Request	In case CS is available (opt in) and capable to execute the FS task, then LCSMS responds to FO confirming participation. It starts a loop to execute the Flexibility Service Session.	LCSMS	FO	Info5b – Positive Response CS is available for FS task
1.6	Acknowledge Flexibility Service	FO acknowledges the Flexibility Service	FO	LCSMS	Info6 – Ack Flex Service
1.7	Start FS task	Start of an execution loop of FS task. LCSMS informs FO. CS implements the requested FS task (for example active power modulation, with positive or negative variation) for the specified time duration. For the duration of the FS task the recharge power level has to be compatible with the actual ETP.	LCSMS	FO	Info7 – start of FS task to FO
1.8	FS Event Log	FS event log is continuously updated with power and energy exchange data, associated to time and it is forwarded to FO	LCSMS	FO	Info 8 – FS Event Log
	End of FS task	CSC informs LCSMS that FS task has been completed or terminated	CSC	LCSMS	Info – FS task completed or terminated
1.9	FS session is terminated by CS	In case ETP and the FS task become not compatible, the FS task is interrupted and LCSMS sends a message to FO that the FS session is terminated.	LCSMS	FO	Info 9 – FS task is terminated by CS, and FO is informed
1.10	FS task is completed by CS	LCSMS informs FO that FS task has been completed	LCSMS	FO	Info 10 – FS task completed
1.11	FS session is terminated by FO	FO informs CS through LCSMS that the FS session is terminated.	FO	LCSMS	Info 11 – FS session is terminated by FO
1.12	Update the FSDR	At the end of the FS task execution the Flexibility Service Detail Record is updated by recording the power and energy data exchanged during the FS session and it is forwarded to FO	LCSMS	FO	Info12 – Flexibility SDR

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948 **Information exchanged**

Information exchanged, ID	Name of information	Description of information exchanged
Info1	EV credentials	Upon connection of EV to CS, credentials of EV are forwarded from LCSMS to FO
Info 2	CS configuration request	FO requests CS configuration through LCSMS
Info3	CS configuration	FO receives the CS configuration and technical data of PCSs
Info4	FS Request from FO including parameters	The FS Request from FO, with FS task parameters, is forwarded to EV
Info5	Response to FS Request	Response to FS Request
Info5a	Negative FS response to FO	In case CS is not available (opt out) or capable, LCSMS sends a negative FS Response
Info5b	Positive Response CS is available for FS task	In case CS is available (opt in) and capable to execute the FS task, then LCSMS sends a positive response indicating the available resources
Info6	Ack Flex Service	FO confirms Flexibility Service to LCSMS
Info7	Start of execution loop	A loop to execute the Flexibility Service Session is started
Info 8	FS Event Log	FS event log is continuously updated with power and energy exchange data, associated to time
Info 9	FS session terminated by CS	In case ETP and the FS task become not compatible, the FS task is interrupted and LCSMS sends a message to FO that the FS session is terminated.
Info 10	FS session completed	CS informs FO through LCSMS that FS task has been completed
Info 11	FS session terminated by FO	FO informs CS through LCSMS that the FS session is terminated
Info 12	Flexibility SDR	At the end of the FS task execution the Flexibility Service Detail Record is updated by recording the power and energy data exchanged during the FS session

Requirements

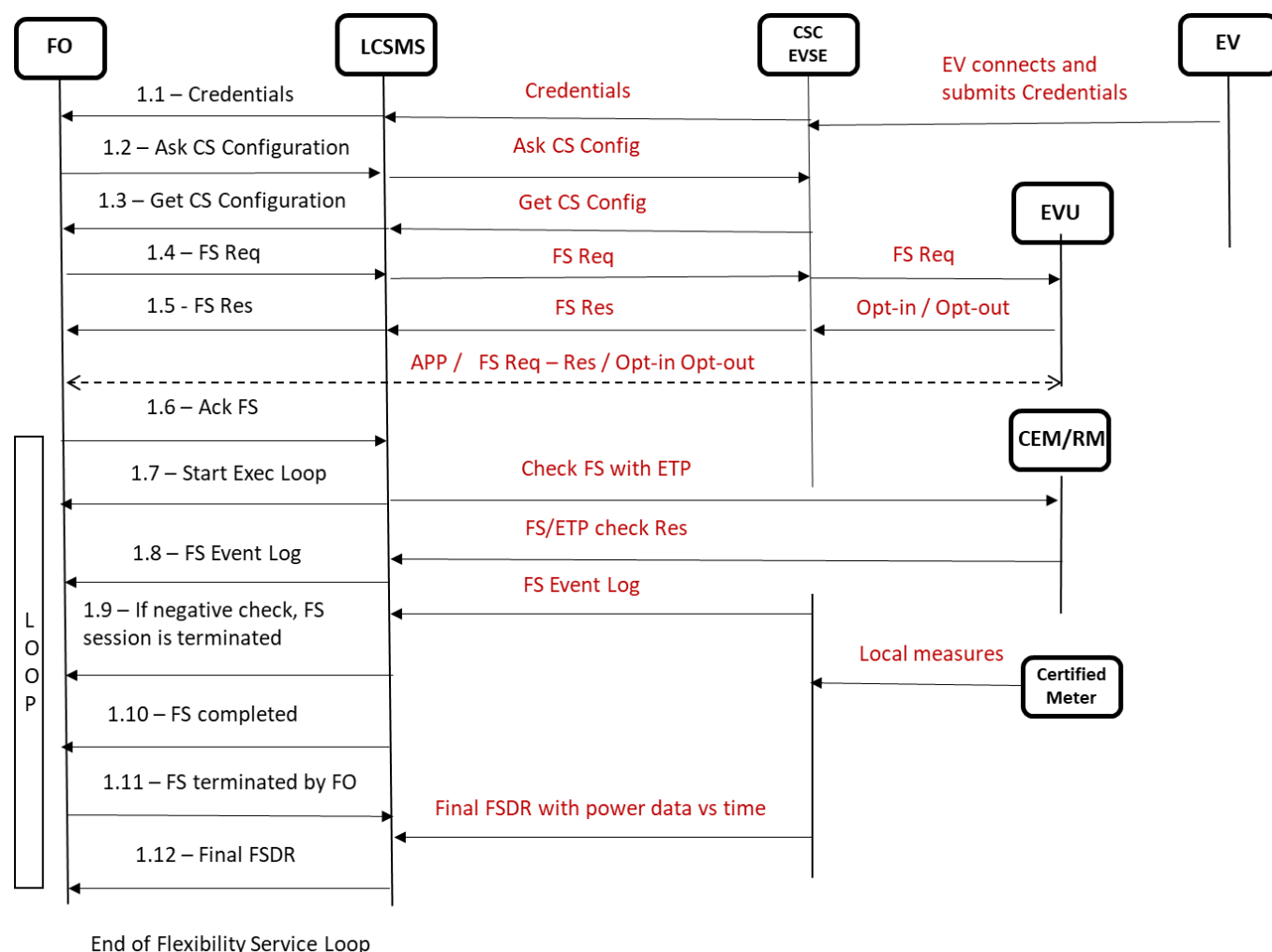
Requirement R-ID	Requirement name	Requirement description
Req1	Certified meters provide measures to implement grid functions	Certified meters continuously provide CS with voltage and frequency measurements at the PoC and the PCSs react implementing the grid supporting functions.
Req2	Eligible FS Contract Holder discovered	FO verifies in its archive the existence of a valid FS Contract with EV
Req3	Execution of FS Session Loop	CS executes the requested FS task by a session loop, with interaction between LCSMS, CEM/RM and CSC
Req4	Continuous check of ETP	The LCSMS and CEM/RM continuously check the compatibility of the FS with the actual ETP.
Req5	CSC-LCSMS communication on end of FS	CSC informs CSMS that FS task has been completed or terminated
Req6	LCSMS-CSC communication on end of FS	LCSMS informs CSC that FS task has been completed or terminated
Req7	Final FSDR	The final Flexibility Service Detailed Record is created by LCSMS, to be forwarded to the FO

Post Conditions

End Condition EndC-ID	End Condition name	End Condition description
EndC1	FS terminated by FO	FO informs CS that Flexibility Service Session is over
EndC2	CS not available for FS	LCSMS responds to FO that CS is not available (opt-out) or capable to perform the FS task associated to requested Flexibility Service
EndC3	FS completed by CS	LCSMS inform FO that FS task is completed
EndC4	FS terminated by LCSMS	The requested FS is no more compatible with the actual ETP and the LCSMS informs the FO that the on-going flexibility service session is over.

Figure 14. Sequence Diagram – Use Case 1.1 - Scenario 2 - CSBE is not present

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963 **6.1.2 EVU recharge at a visited Charging Station**

964 **Name of use case**

Use case identification		
ID	Area(s)/Domain(s)/Zone(s)	Name of use case
UC1.2	Management of Energy Transfers	EVU recharge at a visited CS

965 **Scope and objectives of use case**

Scope and objectives of use case	
Scope	In a public parking an EV connects to a CS to recharge by Roaming service and the FCSBE receives a Flexibility Service Request from a FO.
Objective(s)	Execution of the requested Flexibility Service by visited CS
Related business case(s)	

966 **Narrative of Use Case**

Narrative of use case	
Short description	

Complete description

In a public parking an EV connects to a CS to recharge.

The credentials of the visited CSO and connecting EV are sent to the Home CSP by roaming service.

There are various possible situations depending on whom the FO has a Flexibility Service Contract with:

Visited CSO

Home CSP

none of the above listed actors

The Visited-CSO forwards the above credentials to the FO through FCSBE in case 1.

The Home-CSP forwards the above credentials to the FO through FCSBE in case 2.

In case 3 no credentials are sent to the FO.

Upon receipt of the a.m. credentials the FO performs a Discovery of FS Contract Holders searching its archives, identifies the holders of valid FS contracts and select an eligible holder, according to contract terms.

FO requests the visited CS configuration and receives it from FCSBE.

The FO sends a request for a Flexibility Service (FS) through the FCSBE (Flexibility Charging Station Backend) to the eligible holder of the FS contract.

The flexibility service is described in the FS Request (refer to the proper FS Use Case)

Note that a direct data communication link between the FO and the EVU may exist, via a Mobile Phone App. By this App the FO and the EVU may exchange information on EV and CS location, credentials, Flexibility Service Requests and Responses and other relevant data. See Use Case 3.6 for details.

For simplicity, this direct link is not shown on the Sequence Diagrams of the use case.

The use case covers two scenarios:

the visited-CSO has a FS contract with FO, and it controls the execution of the Flexibility Service by the CS

the home-CSP or the EVU have a FS contract with FO and the home CSP controls the execution of the Flexibility Service by the CS.

This use case doesn't cover following points (since they are out of scope):

Communication between CSMS, CSC and EVSEs

CSC's Optimization algorithms to allocate power and energy among the EVSEs

How the FO creates the Flexibility Service Request starting from the grid operator requirements

Detailed description.**Scenario1: execution of FS controlled by Visited-CSO**

Upon connection of EV to visited CS, the Visited-CSO sends the credentials of Visited-CSO and connecting EV to the FO through FCSBE.

FO receives from the FCSBE the CS configuration parameters including local grid connection requirements (for example a power-frequency table) and it compares with the grid service it has to provide to the grid operator. It elaborates a flexibility service request, based on its optimization algorithms.

FO sends a Flexibility Service Request to the FCSBE, to be forwarded to the Visited-CSO. Visited-CSO verifies the availability of CS to provide the requested Flexibility Service, sending the parameters of the FS to the CSMS, to be forwarded to the CSC.

EVU may communicate via APP with H-CSP. EVU may send location of visited CS and may receive prices of charge services and incentives on flexibility.

The Visited-CSO responds to the FS request, accepting or declining the proposal and indicating the EVSE-EV pairs and PCSs available to provide the FS. The response depends on the opt-in or opt-out choice made by the EVU, which ultimately has the right to accept or refuse any proposal of remunerated service to its EVs.

FCSBE forwards the response to the FO.

In case of acceptance, it starts a “loop” to execute the Flexibility Service Session (according to the proper FS use case)

The Visited-CSO checks the ETP with CEM/RM continuously, to confirm the feasibility of Flexibility Service.

In case ETP and the power and energy requested by FR are not compatible, the loop is interrupted and the Visited-CSO sends a message to FO, through the FCSBE, that the Flexibility Service Session is over.

A FS event log is continuously updated with power and energy exchange data, associated to time and it is sent to FO through FCSBE.

The FS session is terminated by the CS when the FS task is completed.

The “loop” is interrupted when the FO sends a message to FCSBE to end the Flexibility Service Session.

The Flexibility Service Detail Record is updated by recording the power and energy data exchanged during the FR service session and it is sent to the FO by the FCSBE.

Scenario2: execution of FS controlled by Home-CSP

Upon connection of EV to visited CSO, the Home-CSP receives the credentials of Visited-CSO and connecting EV via roaming and it forwards them to the FO through FCSBE.

Upon receipt of the a.m. credentials the FO performs a Discovery of FS Contract Holders searching its archives, identifies the holders of valid FS contracts and select the eligible holder according to contracts.

FO requests and receives from the FCSBE the CS configuration parameters including local grid connection requirements (for example a power-frequency table) and it compares with the grid service it has to provide to the grid operator. It elaborates a flexibility service request, based on its optimization algorithms.

The FO sends a request for a Flexibility Service (FS) through the FCSBE (Flexibility Charging Station Backend) to the eligible holder of the FS contracts.

Visited-CSO verifies the availability of CS to provide the requested Flexibility Service, sending the parameters of the FS to the CSMS, to be forwarded to the CSC.

Visited-CSO informs Home-CSP about the feasibility of the FS.

The Home-CSP responds to the FS request, accepting or declining the proposal and indicating the EVSE-EV pairs and PCSs available to provide the FS. The response depends on the opt-in or opt-out choice made by the EVU, which ultimately has the right to accept or refuse any proposal of remunerated service to its EVs.

FCSBE forwards the response to the FO.

In case of acceptance, it starts a “loop” to execute the Flexibility Service Session (according to the proper FS use case)

The Visited-CSO checks the ETP with CEM/RM continuously, to confirm the feasibility of Flexibility Service.

In case ETP and the power/energy requested by FR are not compatible, the loop is interrupted and the Visited-CSO informs the Home-CSP which sends a message to FO, through the FCSBE, that the Flexibility Service Session is over.

A FS event log is continuously updated with power and energy exchange data, associated to time and it is sent to FO through FCSBE.

The FS session is terminated by the CS when the FS task is completed.

The “loop” is interrupted when the FO sends a message to FCSBE to end the Flexibility Service Session.

The Flexibility Service Detail Record is updated by recording the power and energy data exchanged during the FR service session and it is sent to the FO by the FCSBE.

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968 **Use case conditions**

Prerequisites	
1	Prerequisites: Secured and trusted communication channels have been established between FO and the FCSBE.
	Secured and trusted communication channels have been established between CSO, CSMS and CEM/RM.
	The Visited-CSO, or the Home-CSP, have signed a valid FS contract with FO to provide Flexibility Services, all related business clauses have been set, the FO has verified the existence and validity of the FSC.
	The visited CSO has discovered the CS configuration and the local grid connection requirements, and it has sent them to the FO, through the FCSBE.

969 **Actors**

970 See table 6 for the description of the actors and their acronyms. The following actors are active in this
 971 use case: FO, FCSBE, CSO, CSP, CSMS, CSC, PCS, CS

972 **Overview of scenarios**

No.	Scenario name	Scenario description	Primary actors	Post-condition
1	Execution of a Flexibility Service controlled by Visited-CSO	A Flexibility Service is requested by FO to visited-CSO through FCSBE and the flexibility service session is executed under control of visited-CSO	FO, FCSBE, V-CSO	End conditions: The FO informs that Flexibility Service Session is over The Visited-CSO responds to FO that CS is not available or capable to perform the Flexibility Service requested The requested service is not compatible with current ETP and the visited-CSO informs the FO that the on-going service session is over.
2	Execution of a Flexibility Service controlled by Home-CSP	A Flexibility Service is requested by FO through FCSBE and the flexibility service session is executed	FO, FCSBE, H-CSP	End conditions: The FO informs that Flexibility Service Session is over

		under control of Home-CSP		The Home-CSP responds to FO that CS is not available or capable to perform the Flexibility Service requested The requested service is not compatible with current ETP and the visited-CSO informs the FO that the on-going service session is over.
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975 **Scenario 1 - Execution of a Flexibility Service controlled by Visited-CSO - Step by step analysis**

Step No	Name of process/activity	Description of process/activity	Information producer (actor)	Information receiver (actor)	Information exchanged (IDs)
1.1	Credentials to FO	Visited-CSO sends the credentials of Visited-CSO and connecting EV to the FO through FCSBE	V-CSO/FCSBE	FO	Info1- Credentials of V-CSO and EV
1.2	Request for CS Configuration by FO	FO asks for CS Configuration to FCSBE	FO	FCSBE	Info2 – ask CS configuration
1.3	FO receives the CS configuration parameters	FO receives from Visited-CSO the CS configuration parameters including local grid connection requirements (as a power-frequency table).	V-CSO/FCSBE	FO	Info3-CS configuration parameters
1.4	Flexibility Service Request from FO	The FO sends a Flexibility Service Request to the V-CSO, through the FCSBE	FO	V-CSO/FCSBE	Info4-Flexibility Service Request (FSR) with parameters
	Data exchange via APP	EVU and H-CSP may communicate via APP, location of visited CS, prices and incentives	EVU	H-CSP	Data exchanged by EVU and H-CSP
	Parameters of the FS request are forwarded to the CSMS	CSO sends to CSMS the parameters of the FSR, to be forwarded to the CSC to verify the feasibility of flexibility service function	V-CSO	CSMS	Flexibility Service Request (FSR) with parameters
	Opt-in or Opt-out	EVU chooses whether to provide FS or not	EVU	V-CSO	Info – Opt-in or Opt-out
1.5	Response to Flexibility Service request of FO	The visited CSO verifies the availability of CS to provide the requested Flexibility Service and respond to FO, indicating resources available	FCSBE/V-CSO	FO	Info5-Response to Flexibility Service request of FO

1.6	Acknowledgement on FS by FO	FO sends an ACK to start the execution of FS Session	FO	FCSBE	Info6 – ACK to start execution of FS
1.7	Start Execution Loop of flexibility service	It starts a “loop” to execute the Flexibility Service Session. CS implements the functions specified in the FS request, according to proper FS Use case and FO is informed by FCSBE	FCSBE	FO	Info7 – Execution loop is started
	Continuous check of feasibility of flexibility service	V-CSO checks the ETP with CEM/RM to confirm the feasibility of service	CSO	CEM/RM	
1.8	Event Log update	The V-CSO continuously sends to FO, through FCSBE an updated Event Log, with all relevant information about the execution of the FS	V-CSO/FCSBE	FO	Info8 – FS Event Log
	CEM/RM confirms, or not, feasibility of service step	CEM/RM confirms, or not, feasibility of service step	CEM/RM	V-CSO	
1.9	V-CSO decision: Service session is over	In case ETP and the power/energy requested by Flexibility Service are not compatible, the loop is interrupted and V-CSO sends a message to FO that the Flexibility Service Session is over.	V-CSO/FCSBE	FO	Info9 – Flexibility Service Session is terminated by CSO
1.10	FS task completed	Cs has completed the FS task and it terminates the FS session	FCSBE	FO	Info10 – FS task completed
	Update the FSDR	The Flexibility Service Detail Record is updated by recording the power and energy data exchanged during the service session.	V-CSO	FSDR	
1.11	End of Flexibility Service Session by FO	The “loop” is interrupted when the FO sends a message to V-CSO to end the Flexibility Service Session.	FO	V-CSO/FCSBE	Info11 - Flexibility Service Session is terminated by FO
1.12	Flexibility Service Detailed Record is sent to FO	V-CSO/FCSBE provides FO with the final Flexibility Service Detailed Record	V-CSO/FCSBE	FO	Info12 – Flexibility service detailed record

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978 **Information exchanged**

Information exchanged, ID	Name of information	Description of information exchanged
Info1	Credentials to FO	Credentials of V-CSO and connecting EV
Info2	Ask CS configuration	CS configuration request
Info3	CS configuration	CS configuration parameters
Info4	Flexibility Service Request from FO	The Flexibility Service Request (FSR) with parameters
Info5	Response to the FSR from V-CSO/FCSBE	Response to Flexibility Service request from FO
Info6	ACK to FS session	ACK by FO to start execution of FS session with actual parameters
Info7	Start Execution of FS	Start execution loop of FS session
Info8	FS Event Log	Flexibility Service Event Log
Info9	FS Session terminated by V-CSO	Flexibility Service Session is terminated by V-CSO
Info10	FS task completed	FS task completed by CS
Info11	Flex Service session is terminated by FO	Flexibility Service Session is terminated by FO
Info12	Flexibility SDR	Final Flexibility Service Detailed Record including energy, power data of service, associated with time

979 **Requirements**

Requirement R-ID	Requirement name	Requirement description
Req1	Execution of FS	The functions associated to the FS request are continuously executed during the loop
Req2	ETP-FS compatibility check	The CSO, CSMS, CEM/RM continuously check the compatibility of the FS with the actual ETP
Req3	Interrupt FS session request	In case the actual ETP is no more compatible with the FS, the CSMS informs the CSO to interrupt the FS session
Req4	Final FSDR	The final Flexibility Service Detailed Record is created by CSMS, to be forwarded to the FO

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Post Conditions

End Condition EndC-ID	End Condition name	End Condition description
EndC1		The FO informs that Flexibility Service Session is over
EndC2		The V-CSO/FCSBE responds to FO that CS is not available or capable to perform the Flexibility Service requested

EndC3		The FS task has been completed by CS
EndC4		The requested FS is no more compatible with the actual ETP and the V-CSO/FCSBE informs the FO that the on-going flexibility service session is over.

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