D3.1

Services, use cases and requirements

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List of abbreviations

AC	Allocation Coefficients
API	Application Programming Interface
BM	Business Model
BN	Business Network
BRP	Balance Responsible Party
BSP	Balance Service Provider
BUC	Business Use Case
CBP	Crowd Balancing Platform
CEC	Citizen Energy Community
CPO	Charging Point Operator
DERMS	Distributed Energy Resources Management System
DMS	Distribution Management System
DoA	Description of Action
DSO	Distribution System Operator
DT	Dynamic Tariff
EC	Energy Community
EMS	Energy Management System
ESCo	Energy Service Company
EV	Electric Vehicle
EVSE	Electric Vehicle Supply Equipment
FR	Flexibility Register
FSP	Flexibility Service Provider
GCP	Grid Connection Point
GDBN	Grid Data and Business Network
HEMS	Home Energy Management System
IEC	International Electrotechnical Commission
KAM	Key Account Management
KPI	Key Performance Indicator
LFC	Load-Frequency Control
LFMO	Local Flexibility Market Operator
MV	Medium Voltage
MVP	Minimum Viable Products
NMF	Neutral Market Facilitator
PAS	Publicly Available Specification
PGUI	Power Grid User Interface
PMU	Phasor Measurement Unit
PoD	Point of Delivery
QoS	Quality of Service
REC	Renewable Energy Community
RES	Renewable Energy Source

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SC	Self-Consumption
SUC	System Use Case
TL	Traffic Light
ToU	Time-of-Use
TSO	Transmission System Operator
VPP	Virtual Power Plant
WDSO	Water Distribution System Operator
WNCS	Water Network Control System
WP	Work Package

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1. Executive Summary

This deliverable was developed in the scope of the BeFlexible project, which aims to increase the flexibility of energy systems by improving cooperation among system operators and facilitating the engagement of all energy-related actors. It presents the work developed in Task 3.1 – Definition of services and use cases (T3.1), part of Work Package 3 (WP3).

T3.1 is centred in the definition of System Use Cases (SUCs) and their requirements. The definition of SUCs is crucial for projects as they support the development of different systems and applications within the pilots. These SUCs are a direct outcome of the Business Use Cases (BUCs) defined in Task 1.4 of Work Package 1 (WP1). While BUCs are meant to describe business process, and the actors involved are often business roles, SUCs describe a function or subfunction supporting business processes, and the actors involved can be both business roles and systems roles, such as devices or information systems. Thus, SUCs describe the functions and processes which support the business activities specified in the BUCs.

In the case of BeFlexible, BUCs and SUCs are divided in 4 domains:

- Consumer/Community-centric flexibility.
- Grid-centric flexibility.
- TSO-DSO flexibility coordination.
- Cross-sector flexibility boosters.

The division of BUCs and SUCs by domain is presented in Table 1.1.

Table 1.1 – Domains covered in the project and corresponding BUCs and SUCs

Domain	BUC	SUC
Consumer / Community-centric flexibility	**BUC01 –** Planning and sizing of energy communities considering customer flexibility	**SUC01.1 –** DER sizing and economic evaluation of the LEC business model
	BUC02 – Operation, energy sharing and flexibility boosting of local energy communities	**SUC02.1 –** Operation of the energy community
	BUC03 – Optimize domestic thermal loads to reduce costs and boost flexibility	**SUC03.1 –** Retrofit of thermoelectric water heaters
		SUC03.2 – Optimize thermal loads to reduce energy use and costs
Grid-centric flexibility	**BUC04 –** Long-term distribution grid congestion (and voltage constraints) management	**SUC04.1 –** Load forecasts for long-term grid demand and quantification of flexibility needs
		SUC04.2 – Procure availability contracts
		SUC04.3 – Activate market-based and non-market-based long-term availability contracts
		SUC04.4 – Integrate flexibility into DSO grid planning processes and tools
	BUC05 – Aggregation for TSO and DSO grid services	**SUC05.1 –** Aggregate controllable assets to solve congestion problems to the DSO
		SUC05.2 – Aggregate controllable energy assets to provide flexibility services to the TSO
		SUC06.1 – Short term Flexibility procurement based on congestion forecasting

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	BUC06 – Short-term congestion constraints forecasting and management for local flexibility service activation	**SUC06.2** – Short term Flexibility activation for DSO congestion management
		SUC06.3 – Settlement of flexibility services from DER participating to local market
	BUC07 – Short-term voltage constraints forecasting and management for local flexibility service activation	**SUC07.1** – Online monitoring and observability enhancement to quantify the actual voltage condition
TSO-DSO flexibility coordination	**BUC08** – Crowd Balancing Interoperable data exchange between stakeholders	**SUC08.1** – Flexibility Register
		SUC08.2 – Market data exchange functionalities
		SUC08.3 – Traffic light data exchange functionalities
		SUC08.4 – Verification functionalities
	BUC09 – Local and global market coordination for distributed resources system service provision	n/a
Grid-centric flexibility	**BUC10** – Dynamic constraints management for global flexibility activation in transmission system operation	**SUC10.1** – Ex-ante validation
		SUC10.2 – Constraints definition
		SUC10.3 – Bids placements and verification
		SUC10.4 – Delivery validation
Cross-sector flexibility boosters	**BUC11** – Capitalizing on flexibility available by leveraging on water distribution network assets	**SUC11.1** – Evaluate the flexibility capability of water distribution networks
	BUC12 – Operating a value chain enabler for flexibility-centric energy and non-energy services	**SUC12.1** – Connect flexibility providers across the value chain
		SUC12.2 – Support investment in flexibility by value chain actors
	BUC13 – Combine energy services (production, storage) with mobility	**SUC13.1** – Optimize residential demand-side flexibility
		SUC13.2 – Incentives for charging from RES and EV chargers sharing
		SUC13.3 – Optimize and manage corporate EV charging
		SUC13.4 – Share EV charging data for non-energy services

From the final list of BUCs, BeFlexible consortium members derived 29 SUCs. To ensure and facilitate harmonisation across all SUCs, they were developed and written according to the IEC PAS 62559 standard methodology, which includes the following sections:

1. Description of the use case.
2. Diagrams of use case.
3. Technical details.
4. Step by step analysis of use case.
5. Information exchanged.
6. Requirements.
7. Common terms and definitions.

Moreover, this document describes the services to be tested within the pilots, the actors and systems involved in the SUCs, and the requirements, including both functional and non-functional ones. This

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document also includes a summarized version of all SUCs, providing the reader a short overview of their content. Complete SUCs are provided in the Annexes.

The resulting SUCs will serve as inputs for WP4, WP5 and WP6, associated with the project's pilots. There they will guide the development and testing of different systems and applications, marking a key step to achieve the objectives set for the BeFlexible project.

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2. Introduction

2.1. BeFlexible project

The objective of the BeFlexible project is to increase the flexibility of energy systems by developing a better coordination between Transmission System Operators (TSOs) and Distribution System Operators (DSOs) and by facilitating the involvement of all energy actors. This is done by validating and demonstrating proven and adaptable cross-sector services on a large scale, and by developing an interoperable platform to support the operation of smart grids, while further refining already proven solutions, and creating the required system architecture. This platform, named Grid Data and Business Network (GDBN), is expected to facilitate the enrolment and engagement of flexibility stakeholders despite their role and flexibility potential. Moreover, it provides energy markets the means to adapt to flexibility and makes Distributed Energy Resources (DERs) available and interoperable for all parties, thus helping to unlock the flexibility of consumers' assets. Ultimately, this concept shall facilitate the creation of new Business Models (BMs) that not only meet consumers' needs, but also provide added value, all while complying with a stable regulatory framework.

2.2. Work Package 3 organization and interaction with other Work Packages

Work Package 3 (WP3) is focused on identifying new requirements to enhance Minimum Viable Products (MVP) to accommodate future and emergent market and regulatory frameworks and boost flexibility-centric business models across and beyond the energy-centric value chain. The main objectives of WP3 include: i) delivering a Grid Data and Business Network platform to support the activities of the flexibility-centric energy and cross-sector value chain, where services, data, assets, knowledge, financial schemes, can be exchanged between energy sector and cross-sector actors, and ii) identifying and specifying new energy and cross-sector data driven digital services, based-on or profiting from local energy and flexibility markets, to foster investments in flexible resources and energy management systems, thus creating additional revenue streams for consumers to promoting their engagement.

WP3 is divided in four tasks:

- Task 3.1 – Definition of services and use cases (T3.1).
- Task 3.2 – Definition of a reference architecture and common data space (T3.2).
- Task 3.3 – Implementation of a cloud-based digital grid data and business network (T3.3).
- Task 3.4 – ADMS/DERMS for grid-centric services (T3.4).

The goal of T3.1 is to develop the system use cases (SUCs) of project and define their requirements and services. The resulting SUCs will support the development of different systems and applications within the project pilots. T3.2 aims to design a reference architecture for a common data space of interoperable digital platforms and services, aiming to ensure data trust, sovereignty, and data control. This architecture considers, as inputs, the current reference data models and architecture that have been brought into the BeFlexible ecosystem by TSOs, DSOs and aggregators. Meanwhile, T3.3 is centred on the implementation of the GDBN. Finally, T3.4 is to setup an environment that enables rapid development of new grid-centric products and services at low-cost via common interoperable components and services that can be used by

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both small- and large-scale distribution grid operators. T3.1 and T3.2 involve most of the partners within the consortium, while T3.3 and T3.4 involve only specific partners.

Regarding the interactions between these tasks and between this and other WPs (see Figure 2.1), WP3 receives multiple inputs from WP1, using the work from: T1.1, which proposes a framework to overcome existing regulatory barriers hindering the deployment of flexibility; T1.3, where the flexibility-centric energy and cross-sector value chain is designed; and T1.4, where the Business Use Cases (BUCs) and Key Performance Indicators (KPIs) are defined. It also receives inputs from WP2, including T2.1, which identifies the value propositions for the flexibility provision and flexibility markets actors, and T2.2, which defines the engagement strategies to recruit, onboard, and maintain customers. The outputs of WP3 are fed to WP4, WP5 and WP6, associated with the project's pilots, and include information about the GDBN, Distributed Energy Resources Management Systems (DERMS), Distribution Management Systems (DMS), services, use cases, and reference architecture. Meanwhile, these WPs provide inputs to WP3 regarding SUCs definition.

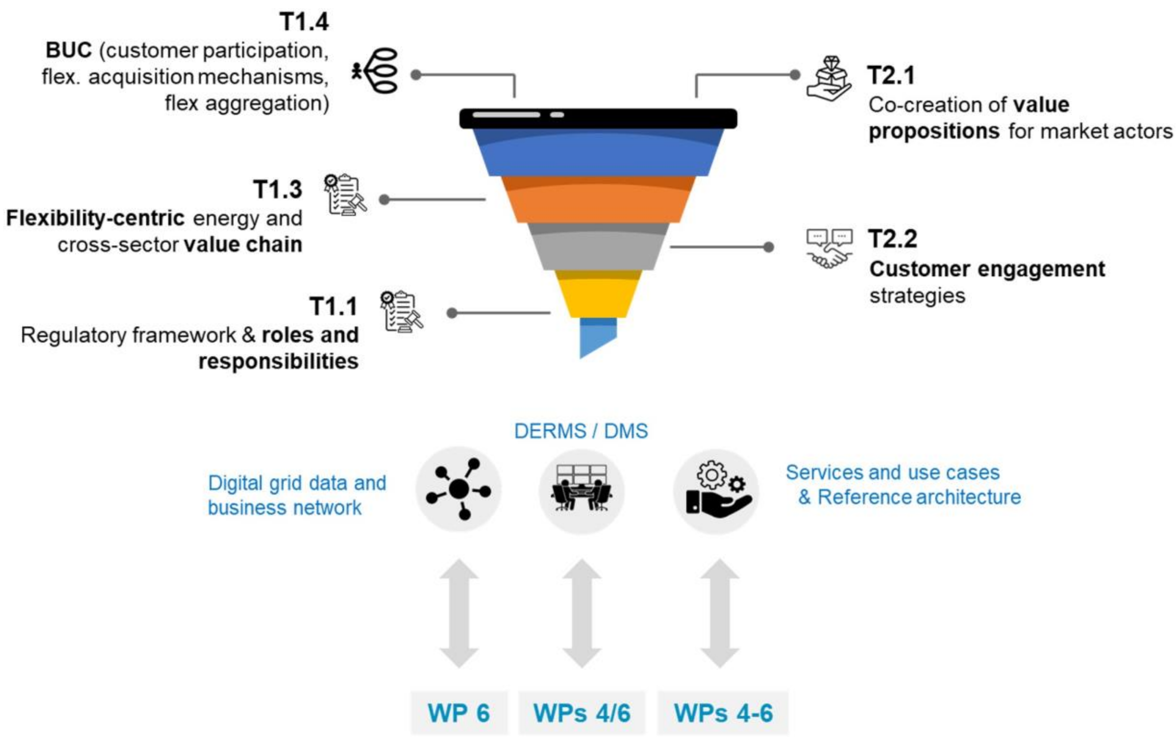

Figure 2.1 – Interactions with other tasks and WPs

2.3. Scope and objectives of the deliverable

This document presents the work carried out in T3.1. The main goals of this task are to develop all the BeFlexible SUCs using a standardized methodology, and to identify their requirements. For that purpose, the relationship between the BUCs defined in T1.4 and the SUCs developed in T3.1 is presented, along with the main differences between these two types of use cases. Then, the methodology used to describe the SUCs (IEC PAS 62559) is presented, followed by a summary of the services associated with each SUC, the list of the

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main actors identified in each SUC and the requirements. Subsequently, a summary of all SUCs, which provides a general overview of their characteristics is also provided.

2.4. Deliverable structure

The structure of this deliverable is the following:

- Chapter 1 is the executive summary.
- Chapter 2 is this introduction that refers to the scope, dependencies, and structure of the deliverable.
- Chapter 3 describes the relation between the BUCs and the SUCs and the standardized methodology adopted for writing the SUCs. In addition, the services from the Description of Action (DoA) are reviewed and the main actors and systems identified. At last, the requirements, especially the non-functional requirements established in the scope of the project, are presented.
- Chapter 4 provides a summarized description of all SUCs.
- Chapter 5, as a conclusive chapter, recaps the work done and the objectives accomplished.

Annex I contains the reference SUC template and Annexes II, III, IV and V contain the complete SUCs.

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3. BeFlexible System Use Cases Methodology

This chapter presents the BUCs and SUCs defined for BeFlexible, emphasising their links, while explaining the main differences between those types of uses cases. Next, the methodology used for writing the SUCs is described. The services to be developed in the project are presented, followed by list of the main system actors. At last, the SUC requirements are listed.

3.1. BeFlexible use cases

BUCs and SUCs are needed to ensure a streamlined workflow of software and service development across the pilots. BUCs are meant to describe business process, and the actors involved are usually business roles, such as organisations or individuals. Meanwhile, SUCs describe a function or a subfunction supporting business processes (i.e., they are inside the BUCs), and the actors involved can be both business roles and systems roles, such as devices or information systems (Table 3.1) [1]. SUCs are particularly important to help identifying requirements, such as functional requirements, which capture the intended behaviour of a system, and non-functional requirements, which capture restrictions the system is subjected to.

Table 3.1 – Differences between BUCs and SUCs [1]

Type	Description	Actors involved
BUC	Describes a business process and is expected to be system agnostic.	Business Roles (e.g., organisations, organisation entities or physical persons, etc).
SUC	Describes a function or sub-function supporting one or multiple business processes.	Business Roles and System Roles (e.g., devices, information systems, etc).

Thus, SUCs provide a lower-level description and they are closer to the pilots than the BUCs.

The methodology to define the BeFlexible BUCs and derive the SUCs is described next. The work on BUCs started in January 2023, with a workshop to evaluate the project and end-users' goals. The result was a list of 20 new or improved business processes towards the BUCs identification, with the following information [2]:

- Primary actor.
- Secondary actors.
- Business goals and priority: high, medium, low.
- New functional processes.

The information gathered from the workshop was compiled to create a preliminary version of the business goals and use cases. This also enabled offline assessment of the risks associated with the demonstration activities.

A second workshop took place in February 2023 and was dedicated to consolidating a first list of BUCs. The outcome was a preliminary list of 12 BUCs (later extended to 13), use cases briefs, and partners responsible for their writing [2].

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The final list of 13 BUCs was settled in a meeting in March 2023, where each BUC brief was presented. Additionally, a preliminary identification of the SUCs for each BUC was also made [2].

The scope and objectives of BeFlexible were mapped into 4 domains, namely:

- **Consumer/Community-centric flexibility**: planning and operation of REC and CEC considering provision of energy flexibility to energy system stakeholders (e.g., DSO); consumer using flexibility to optimize its own objective function (e.g., cost minimization).
- **Grid-centric flexibility**: integration of DER flexibility (individual and aggregated) in TSO and DSO long-term and short-term constraints management processes.
- **TSO-DSO flexibility coordination**: coordination between TSOs and DSOs in terms of flexibility monitoring, procurement, activation, and settlement, as well as related information exchange schemes.
- **Cross-sector flexibility boosters**: explore flexibility from other sectors, namely water distribution and electrical mobility; enabling interaction of the energy system sector with other business sectors (e.g., mobility, information) by solutions that support open APIs and solutions on open platforms, trust-raising technologies, and adequate service management.

Then, BUCs were mapped into these 4 domains, as in Figure 3.1.

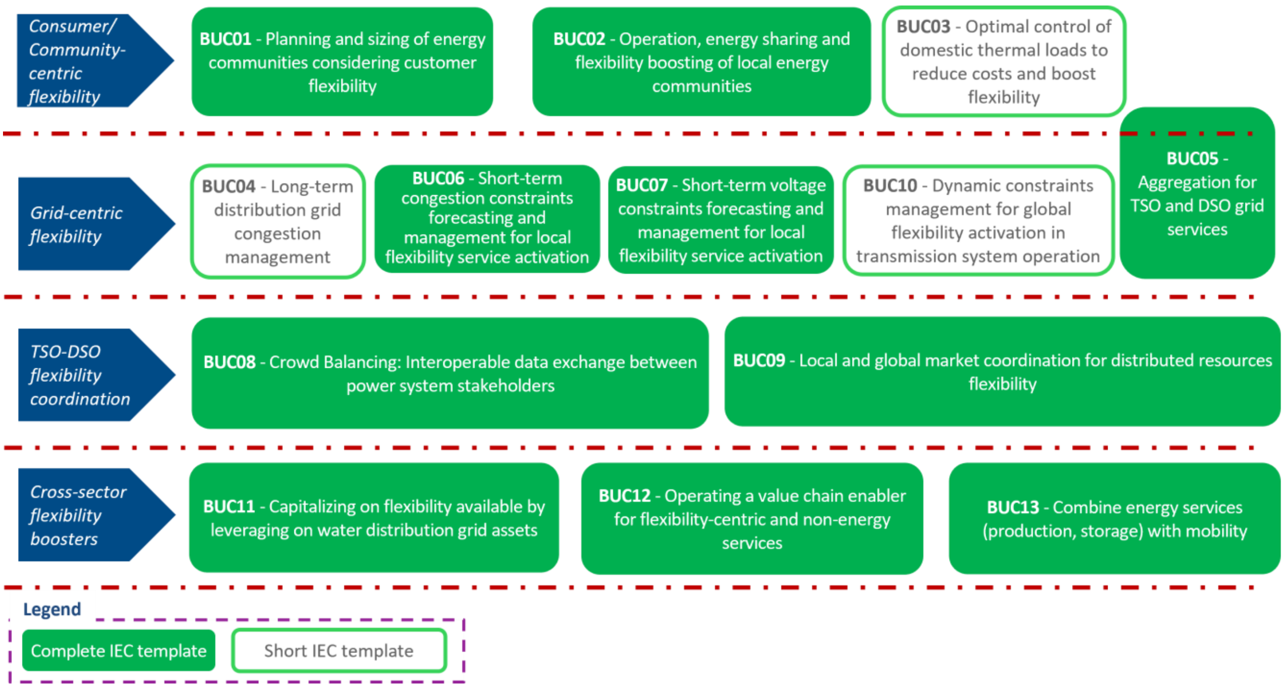

Figure 3.1 – BeFlexible's BUCs divided by domain [2]

Then, from those BUCs, the consortium members identified 29 SUCs, which are listed in Table 3.2.

Table 3.2 – BeFlexible SUCs and BUCs for each domain

Domain	BUC	SUC
Co nsu me r/	**BUC01 –** Planning and sizing of energy communities considering customer flexibility	**SUC01.1 –** DER sizing and economic evaluation of the LEC business model

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	BUC02 – Operation, energy sharing and flexibility boosting of local energy communities	**SUC02.1 –** Operation of the energy community
	BUC03 – Optimize domestic thermal loads to reduce costs and boost flexibility	**SUC03.1 –** Retrofit of thermoelectric water heaters
		SUC03.2 – Optimize thermal loads to reduce energy use and costs
Grid-centric flexibility	**BUC04 –** Long-term distribution grid congestion (and voltage constraints) management	**SUC04.1 –** Load forecasts for long-term grid demand and quantification of flexibility needs
		SUC04.2 – Procure availability contracts
		SUC04.3 – Activate market-based and non-market-based long-term availability contracts
		SUC04.4 – Integrate flexibility into DSO grid planning processes and tools
	BUC05 – Aggregation for TSO and DSO grid services	**SUC05.1 –** Aggregate controllable assets to solve congestion problems to the DSO
		SUC05.2 – Aggregate controllable energy assets to provide flexibility services to the TSO
	BUC06 – Short-term congestion constraints forecasting and management for local flexibility service activation	**SUC06.1 –** Short term Flexibility procurement based on congestion forecasting
		SUC06.2 – Short term Flexibility activation for DSO congestion management
		SUC06.3 – Settlement of flexibility services from DER participating to local market
	BUC07 – Short-term voltage constraints forecasting and management for local flexibility service activation	**SUC07.1 –** Online monitoring and observability enhancement to quantify the actual voltage condition
TSO-DSO flexibility coordination	**BUC08 –** Crowd Balancing Interoperable data exchange between stakeholders	**SUC08.1 –** Flexibility Register
		SUC08.2 – Market data exchange functionalities
		SUC08.3 – Traffic light data exchange functionalities
		SUC08.4 – Verification functionalities
	BUC09 – Local and global market coordination for distributed resources system service provision	*no SUCs defined*
Grid-centric flexibility	**BUC10 –** Dynamic constraints management for global flexibility activation in transmission system operation	**SUC10.1 –** Ex-ante validation
		SUC10.2 – Constraints definition
		SUC10.3 – Bids placements and verification
		SUC10.4 – Delivery validation
Cross-sector flexibility boosters	**BUC11 –** Capitalizing on flexibility available by leveraging on water distribution network assets	**SUC11.1 –** Evaluate the flexibility capability of water distribution networks
	BUC12 – Operating a value chain enabler for flexibility-centric energy and non-energy services	**SUC12.1 –** Connect flexibility providers across the value chain
		SUC12.2 – Support investment in flexibility by value chain actors
	BUC13 – Combine energy services (production, storage) with mobility	**SUC13.1 –** Optimize residential demand-side flexibility
		SUC13.2 – Incentives for charging from RES and EV chargers sharing
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3.2. Use case methodology

BeFlexible use cases are written according to the use case methodology specified in the standard IEC PAS 62559 [3], which follows the template in Annex I – System Use Case Template. The full standard template is divided in the following 8 sections:

1. Description of the use case: main aspects of the use case, including its name, area/domain, scope and objectives, narrative, conditions, and other general remarks [4].
2. Diagrams of use case: diagrams (e.g., sequence diagrams) with the main steps of the use case and interactions between actors [4].
3. Technical details: list of actors, their type and description [4].
4. Step by step analysis of the use case: possible scenarios of the use case, which must comply with the sequence diagrams in section 2, so that every step describes a communication or action. Besides a normal success scenario, alternative or failure scenarios can be included to portray situations where preconditions are not fulfilled or a undesirable state is reached [4].
5. Information exchanged: detailed description of the information exchanged in section 4. The information ID refers to a specific information object, the name is a unique label, the description is a written description, and the requirements from section 6 are also included [4].
6. Requirements: needs of the use case, divided into categories with a unique Category ID. Each category has a name and a description. The requirements in each category have their own ID based on the ID of its category. Again, a requirement name and description are provided [4].
7. Common Terms and Definitions: glossary of common terms and definitions used in the use case [4].
8. Custom information (optional): additional custom information [4].

The use case methodology can be divided in 4 parts: General Information, Function, Technical Details, and Additional Information [4], as pictured in Figure 3.2.

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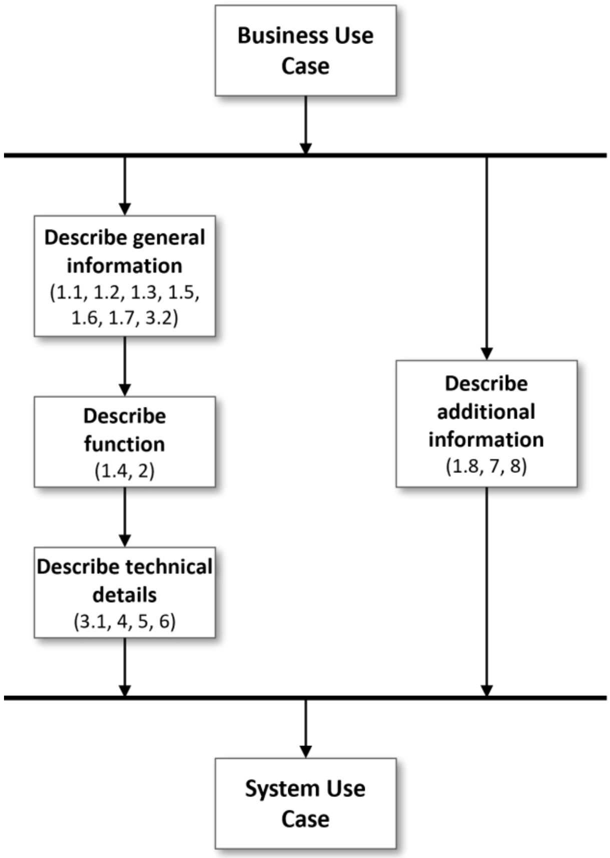

Figure 3.2 – Process of the use case methodology (adapted from [4])

The General Information in Figure 3.2 is derived from the BUC information and includes a unique identifier, scope, goals and the relation with other use cases. The Function of the use case includes a short and long description and diagram (e.g., sequence diagrams) showing the interactions and processes in each step. The Technical Details focus on scenarios, information flow, data types and functional and non-functional requirements (see Section 3.4). As last, the Additional Information, which is collected in parallel to the other parts, helps in clarifying terms and classifying the use case [4].

The main information contained in the SUC template includes:

- ID: Unique identifier for the SUC.
- Area/Domain(s): Maps the SUC into 1 of the domains defined.
- Name of use case: Name of the SUC.
- Scope and objectives of use case: Boundaries or limits of what the SUC is intended to do.
- Objective(s): List the objectives of the SUC.
- Related business case(s): List related BUCs
- Narrative of use case: Explain the SUC from a user's point of view, describing what occurs, when, why, with what expectation, and under which conditions. Also lists the services from the DoA that are related to each SUC.

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- Use case conditions: Describe which assumptions are made (e.g., which systems already exist, or which contractual relations exist) and which prerequisites should be met before the initiation of the SUC (e.g., prior state of the actors and activities).
- Diagrams of use case: Sequence diagrams illustrating the time sequence of the interactions between the actors/systems involved in the SUC.
- Actors: List and describe the actors involved in the SUC. Actors can include people, systems, applications, databases, devices, etc.
- Overview of scenarios: Identify the scenarios envisioned for the SUC, including normal and alternative scenarios.
- Steps – Scenarios: Sequential step-by-step description of the actions taken in each one of the scenarios, including information producer/receiver, information exchanged and requirements.
- Information exchanged: List and describe the information objects exchanged in the scenarios of the SUC.
- Requirements: List and describe functional and non-functional requirements

3.3. BeFlexible services

To contribute to the creation of additional revenue streams, increase consumer engagement, and stimulate investments in energy systems and flexible resources, BeFlexible project defined MVP focused on innovative energy and cross-sector data-driven digital services. These services were designed to be based on or to profit from local energy/ flexibility markets, offering a range of data-driven services with adaptable, interoperable, intuitive, multi-device, and secure functionalities. Afterwards, they are to be gathered into an open ecosystem, catering to user needs, and aligning with the objectives of energy stakeholders to foster economically viable investments in behind-the-meter flexibility considering local energy/flexibility markets, as well as aggregated participation in energy markets.

The resulting pool of services is expected to ensure a dynamic interconnection among consumers, markets, and the grid, providing benefits to all the actors involved. In this project, services were separated into two main areas:

- Consumer-Centric Services.
- Grid-Operators-Centric Services.

Consumer-Centric Services were further divided in:

- (CC-E) Energy and Value-Added Services:
    - (CC-E-BE) Basic Energy Services: includes individual optimisation (energy efficiency packages, energy consumption optimisation based on tariffs, peak shaving, storage optimisation, individual self-consumption optimisation, etc…), collective self-consumption and operation optimisation for local energy and commercial flexibility sharing/trading (including energy sharing mechanisms, energy management systems for energy communities, local energy markets, energy community flexibility aggregation, market access services, etc…).

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- (CC-E-AE) Advanced Energy Services for Energy Communities: includes resources and community sizing, estimation of the flexibility surplus in flexibility markets, billing and invoicing within the community and collective benefits sharing, shared ownership business models, intelligent pairing between consumers and producers, crowd charging and maintenance services for community assets.
- (CC-E-FX) Flexibility optimisation for grid services: includes flexibility assessment and flexibility provision tools for DSO and TSO grid services, estimation of the elasticity of consumers to enhance demand response programs, aggregation (VPP) of DER for BRP balancing.

- (CC-CS) Cross-Sector Services:
  - (CC-CS-HC) Smart buildings and heating/cooling: includes power and heat and cooling smart management systems coupling for flexibility.
  - (CC-CS-MO) Mobility: includes power and EV mobility coupling for flexibility.
  - (CC-CS-HE) Health&Safety: includes exploiting energy data for the provision of health services.
- (CC-CE) Customer enablement Services:
  - (CC-CE-DM) Data Market: includes data marketplaces for energy data monetisation for energy and cross-sector services.
  - (CC-CE-GM) Gamification: includes gamification strategies for customers engagement in energy efficiency and flexibility provision.
  - (CC-CE-TR) Energy Traceability: includes flows tracing systems for real-time assessment of the origin of electricity for a specific end use.

Meanwhile, Grid-Operator-Centric Services were divided in:

- DSO-Centric Services:
  - (DSO-G) DSO Grid Services:
    - (DSO-G-CM) Congestion Management.
    - (DSO-G-VC) Voltage Control.
    - (DSO-G-OT) Other DSO grid services.
  - (DSO-NG) DSO Non-Grid Services:
    - (DSO-NG-GO) Grid observability.
- TSO Grid Services:
  - (TSO-G) TSO Grid Services:
    - (TSO-G-CM): Congestion Management.
    - (TSO-G-BL): Balancing services.
    - (TSO-G-OT): Other TSO grid services.

- (TSO-NG) TSO Non-Grid Services:
  - (TSO-NG-GO) Grid observability.

By analysing the solutions offered by the different BeFlexible consortium members for each category, a final list of services to be developed and tested in the scope of the project was defined, which is given in Table 3.3.

Table 3.3 – BeFlexible's list of services

Service	Category	Description
Service 1: Optimization of thermal consumption considering self-consumption, peak shaving and ToU tariffs	CC-E-BE, CC-E-AE, CC-CS-HC	Includes concentrating consumption during sunny hours to reduce the cost of electricity and CO_2 emissions in the case of behind-the-meter RES, limiting consumption in case of excessive consumption, and adapting the loads' consumption to the hourly electricity prices to reduce energy bills cost.
Service 2: Aggregation for TSO and DSO grid services	CC-E-BE, DSO-G-CM	Demand response management and DERs aggregation for provision of services for TSO/DSOs.
Service 3: Energy management for building heating/cooling	CC-E-BE, CC-CS-HC	Offers tools that can be used to pursue different objectives associated to the heating and cooling of buildings. It includes optimization frameworks for COP maximization, energy cost minimization, and maximum power subscription minimization to reduce the energy provision fees.
Service 4: Identification of customers for retrofit	CC-E-BE	Includes data-driven algorithms for identifying potential customers for thermal appliance retrofit (and more efficient thermal appliances) and non-intrusive estimation of energy savings considering multiple options (e.g., thermal loads vs battery storage).
Service 5: Smart Charging Point Management System	CC-E-BE, CC-E-AE, CC-CS-MO	E-mobility is an energy supervision and smart charging solution and a holistic system for managing the charging processes of electric vehicles (CPMS) in real time. It provides an optimization of energy management (Energy Management System). Several energy production assets (e.g., solar panels), battery storage, buildings (smart building), and different charging points can be integrated, independently of their hardware manufacturer. Using the smart charging function, an intelligent control balances load imbalances, avoids energy peaks, and thus minimizes electricity costs. All information can be sent to multiple SAP and third-party software applications to obtain accurate information about cost, usage, and consumption.
Service 6: Customized interoperable digital home energy management systems	CC-CS-MO, CC-E-FX	Customized interoperable and digital home energy management systems (HEMS) for prosumers energy consumption or cost optimization and for flexibility identification for third parties.
Service 7: P2P blockchain based platform for energy trading	CC-E-AE	Digital platform for P2P energy trading based on a joint bilateral and pool post-delivery market (clearing and settlement algorithms according to different business models and regulations).
Service 8: Tools for optimal combination rapid instantiation of REC for aggregation	CC-E-AE	Includes data-driven algorithms for intelligent pairing (by exploring smart meter data, between potential producers and consumers to promote new renewable energy communities, maximizing benefits to the community and including resources sizing and energy assets operation strategies), estimation of the flexibility surplus for additional revenue sources in flexibility markets, maintenance services for community assets, crowd charging (define EV charging priority according to drivers preferences, planned routes, availability of RES), trading of tangible and intangible energy and

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		non-energy services and commodities (EV charging, water, RES surplus, etc.) and billing and invoice management and benefits sharing.
Service 9: Aggregation (VPP) of thermal flexibility for DSO congestion management & voltage control	CC-E-FX	Aggregation for DSO grid flexibility services.
Service 10: Intelligent slow charging EVSE for flexibility management	CC-E-FX	Electric vehicle supply equipment (EVSE) prototype developed according to ISO 15118 and with edge monitoring and control functions. Can be integrated with multiple platforms (from flexibility aggregators, charging operator). Integrate additional control functions at the edge, such as grid-aware charging and flexibility forecast.
Service 11: Battery-agnostic energy optimization	CC-E-FX	Optimization of battery storage (grid-connected or behind-the-meter) for multiple services (congestion, voltage, FCR, FRR, RR), agnostic of the battery manufacture and type.
Service 12: Thermal appliances retrofit and efficient control	CC-CS-HC	Energy efficiency provision on thermal loads (water heaters, space heaters and heat pumps), for energy savings of residential customers and optimization of their thermal loads' energy consumption combining machine learning prediction algorithms and consumption optimization.
Service 13: Energy management for EV charging	CC-CS-MO	Offers a set of different optimization algorithms for: optimal charging scheduling for cost minimization, optimal EV allocation to charger clusters, and coordinated charge power reductions to accommodate charging demand urgencies (customer service). The algorithms can be extended to consider optimal routing problems.
Service 14: Charging Point Supervision	CC-CS-MO	E-Mobility is largely hardware-independent and enables communication with almost all AC and DC charging stations that comply with the OCPP1.6 protocol. Each charging station/EVSE is attached to a charging area. Each charging area can be administered separately and can chose a different optimization charging strategy optimize the use of energy that can be share by multiple EVSE. Each EVSE can be remotely administered (e.g., start, stop, reboot) and a static charging profile can be setup to limit the consumption during certain periods of the day. Similarly, tariffs can be setup considering energy, time, session and be differentiated by time slot across the week.
Service 15: EV and EV Infrastructure usage data provider	CC-CS-MO, CC-CE-DM	The different charging sites and charging area can expose their infrastructure and the usage in near real time. This includes the description of the infrastructure including geo-localization, the status of the EVSE and connectors, the instant power delivered. On top of this real time information, common statistics (e.g. Consumption, transactions, usage, inactivity) by time or period. Transactions can also be retrieved.
Service 16: Ecosystem for flexibility valorisation and customer engagement	CC-CE-DM, CC-CE-GM, CC-CE-TR	To boost engagement and participation of all agents in the electricity sector. Includes: Consumer-centred flexibility ecosystem to boost consumer engagement and participation and sharing economy business models, weather and electricity market monitoring, prosumer care (e.g., KPIs, billing, maintenance, notifications), virtualization environment (e.g., prosumers and markets' digital twins), motivational engagement tools, interfaces, registering, quality assessment, logistics, prosumer automatic selection, open data using standards, collaborative tools for agents in the electricity sector and co-creation environment.
Service 17: Consumption best practice assistant	CC-CE-GM	The EV digital assistant service will capture the EV capabilities (e.g., battery size and technology, charging capabilities, battery charging curve) with the driving habits of the owner (e.g., energy need per

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		day, ETD and ETA) and charging access (e.g., charge at work / at home). Thanks to this information it could also predict the charging flexibility of a given vehicle for a given period.
Service 18: Sustainability dashboarding	CC-CE-TR	The sustainability dashboard will rely on the CPMS data providers to retrieve data to display KPIs related to the impact of EVSE usage. The dashboard will collect static data about the infrastructure and dynamic information including local RES and transactions, this will enable to evaluate the share of RES produced and consumed locally and the precise carbon footprint of the overall consumption by computing the CO2 eq/kWh for the fleet eventually connecting to network data (e.g. Eco2mix – CO2 Emissions per kWh of Electricity Generated in France | RTE (rte-france.com)).This data can then be included in the CSR report about carbon footprint of fleet to help the company to communicate its environmental performance and goals to its stakeholders and customers.
Service 19: Congestion forecasting service	DSO-G-CM	The DSO runs the forecast tool to evaluate the productions and the consumptions connected to the pilot grid, after it evaluates the state estimation to assess the grid and to detect the congestions.
Service 20: Technical grid constraints validation and local markets clearing	DSO-G-CM	A market platform is used for local energy and flexibility markets simulation with electricity/gas grid constraints, for validation of local energy market transactions and for distribution grid services provision.
Service 21: Voltage control (day ahead, intra-day, real-time)	DSO-G-VC	The DSO runs the forecast tool to evaluate the productions and the consumptions connected to the pilot grid, after it evaluates the state estimation to assess the grid and to detect the voltage issues.
Service 22: Dynamic Grid Constraints	DSO-G-OT	The DSO evaluates the state of the grid and defines dynamic constraints for the flexibility resources.
Service 23: Real-time monitoring for system awareness	DSO-NG-GO	The DSO acquires the data from the smart meters and from the field sensors installed on its grid (like sensors and devices) to improve the simulation reliability.
Service 24: Congestion Technical grid constraints forecasting service for local flexibility service activation	DSO-G-CM	Predict the possible occurrence of congestions in the distribution grid, using the available forecasts, enabling the DSO to take preventive measures to address these constraints by activating local flexibility.
Service 25: Voltage Technical grid constraints forecasting for local flexibility service activation	DSO-G-VC	Predict the possible occurrence of voltage constraints in the distribution grid, using the available forecasts, enabling the DSO to take preventive measures to address these constraints by activating local flexibility.
Service 26: Dynamic Grid Constraints assessment to coordinate with TSO	DSO-G-OT	TSO and DSO coordinate the definition of dynamic constraints for the flexibility resources.
Service 27: Improved grid observability service	DSO-NG-GO	Help DSO to have a better observability over its grids by equipping several nodes with device to collect and send data to a DMS. Resources involved in flexibility markets and power plants connected in MV level, can be equipped with devices for the real-time data collection at the Point of Delivery.
Service 28: Congestion management service provision with the demo resources	TSO-G-CM	Deploy services to avoid congestions in the transmission grid by using resources available at the demo's site.
Service 29: Balancing service provision with the demo resources	TSO-G-BL	Provide balancing services by using resources available at the demo's site.
Service 30: Other TSO services provision with the demo resources	TSO-G-OT	Provide other services to the TSO by using resources available at the demo's site.
Service 31: Grid observability processes testing in the demo	TSO-NG-GO	Test grid observability using resources available at the demo's site.

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Service 32: Health vulnerable customer data exchange DSO/Health services	CC-CS-HE	Health vulnerable customer (i.e., critical loads) data will be exchanged between DSO and Health services in order to consider the sensitivity of vulnerable customers in flexibility services management, long-term or short-term distribution grid congestion management.

3.4. SUC Requirements

SUCs encompass two types of requirements [3]:

- Functional Requirements: Describe what the system must do. These requirements are actions in response to events, or actions performed autonomously. They represent operations and features provided [3].
- Non-Functional Requirements: Describe what qualities the system must contain from an execution and performance point of view, setting limits on how well the system performs the functional requirements. This type of requirements includes: reliability, security, usability, upgradeability, expandability, scalability, compatibility, safety, performance, and conformance [3].

In the scope of this project, and as described in IEC PAS 62559, non-functional requirements are divided in four categories [3]:

- Configuration Issues – Indicate the typical, probable, or envisioned communication configurations that are relevant for the steps of the use case. These include the numbers of devices and/or systems, expected growth of the system over time, locations, distances, communication types, network bandwidth, existing protocols, etc, but only from the user's point of view.
- Quality of Service (QoS) Issues – Handle system availability, such as acceptable downtime, recovery, backup, rollback, etc. QoS issues also address accuracy and precision of data, the frequency of data exchanges, and the necessary flexibility for future changes.
- Security Issues – Deal with the identification of the requirements and the concerns for implementing security measures. Ensuring the security of a specific information asset is based on: the probable risk of the security threat, the financial and non-monetary consequences of a successful security attack and the costs of minimizing the security threat (financial costs, data exchange performance impacts, implementation of methods for detecting attacks, etc). According to the IEC PAS 62559 standard, it is challenging to evaluate the security requirements for any item. Security must not only protect against deliberate attacks, but also against accidental mistakes, errors, and failures.
- Data Management Issues – Reflect the domain expert's point of view and thus, should not deal with database design, but concentrate on the user requirements for the interfaces to databases and other data handling applications. Typical data management issues include types of sources of data, correctness or validity of data, timeliness or time stamping of data, volume of data, synchronization, or consistency of data across systems, timely access to data, validation of data across organizational boundaries,

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transaction management, data naming, identification, formats across disparate systems, and maintenance of data and databases.

Constraints and issues not captured in these categories may be of political, legal or financial nature, or merely very specific to a particular step [3].

Non-functional requirements defined within the IEC PAS 62559 standard are listed in Table 3.4 [3].

Table 3.4 – Non-functional requirements [3]

<table>
<tr><th>Configuration Issues</th><th>QoS Issues</th><th>Security Issues</th><th>Data Management Issues</th></tr>
<tr><td>Communication access services requirements</td><td rowspan="3">Precision of data requirements (normally relevant only for conversions, e.g., analogue to digital)</td><td rowspan="2">Eavesdropping: Ensuring confidentiality, avoiding illegitimate use of data, and preventing unauthorized reading of data, is _____</td><td>Type of source data</td></tr>
<tr><td>Communication bandwidth</td><td>Correctness of source data</td></tr>
<tr><td>Communication configuration</td><td rowspan="2">Information integrity violation: Ensuring that data is not changed or destroyed is _____</td><td>Up-to-date management</td></tr>
<tr><td>Communication media</td><td>Frequency of data exchanges</td><td>Management of large volumes of data that are being exchanged</td></tr>
<tr><td>Communication ownership</td><td rowspan="3">Elapsed time response requirements for exchanging data</td><td rowspan="2">Authentication: Masquerade and/or spoofing: Ensuring that data comes from the stated source or goes to authenticated receiver is _____</td><td>Data consistency and synchronization management across systems</td></tr>
<tr><td>Communication paradigm</td><td>Management of timely access to data by multiple different users</td></tr>
<tr><td>Data exchange methods</td><td rowspan="2">Repudiation: Ensuring that the source cannot deny sending the data or that the receiver cannot deny receiving the data is _____</td><td>Validation of data exchanges</td></tr>
<tr><td>Data exchange pattern</td><td rowspan="2">Contractual timelines for exchanging data are required</td><td>Management of accessing different types of data to be exchanged</td></tr>
<tr><td>Distance between entities</td><td rowspan="2">Replay: Ensuring that data cannot be resent by an unauthorized source is _____</td><td>Management of data across organizational boundaries</td></tr>
<tr><td>Existence of legacy systems</td><td rowspan="4">Commonly used techniques for meeting quality of service requirements of this data exchange</td><td>Transaction integrity required (backup and rollback capability)</td></tr>
<tr><td>Growth</td><td rowspan="2">Information theft: Ensuring that data cannot be stolen or deleted by an unauthorized entity is _____</td><td>Data format requirements</td></tr>
<tr><td>Location of Information Producer</td><td>Management of data formats in data exchanges</td></tr>
<tr><td>Location of Information Receiver</td><td>Denial of Service: Ensuring unimpeded access to data is _____</td><td>Naming of data items</td></tr>
<tr><td>Number of Information Producers</td><td rowspan="3">Availability of information flows</td><td rowspan="2">This data exchange has the following requirements with respect to proof of conformance and/or non-repudiation with contractual agreements: _____</td><td>Management across different implementations</td></tr>
<tr><td>Number of Information Receivers</td><td>Data exchange maintenance in which a human changes or updates what is to be exchanged</td></tr>
<tr><td>Operation mode of Information Producer</td><td>Authentication and Access Control mechanisms commonly used with this data exchange</td><td>Database maintenance in which a human changes or updates what is in the database</td></tr>
<tr><td>Operation mode of Information Receiver</td><td>Accuracy of data requirements</td><td>Network security measures commonly used with this data exchange: _____</td><td>Data maintenance effort: human versus automation</td></tr>
</table>

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Relative maturity of current implementation		Procedural security measures commonly used with this data exchange: _____	Commonly used data formats and management techniques for this data
Existence of legacy systems		Other security measures commonly used with this data exchange: _____	

3.5. BeFlexible actors and systems

Another crucial step for defining the SUCs is the identification and description of the necessary actors, which perform specific functionalities in order to provide the services previously described. This section provides a comprehensive list and description of the systems and business actors present in the SUCs, organized by domain. Still, some of those system/business actors are shared across several domains. Those are listed next in Table 3.5.

Table 3.5 – Identification and description of common actors across several domains

Actor	Description
Aggregator	Aggregates (i.e., collects and combines) multiple resources for usage by a service provider for energy market services.
Consumer	Party connected to the grid which purchases and consumes electricity.
DERs	Small-scale energy resources connected to the distribution grid and usually located near sites of electricity use.
DSO	Responsible for the security of supply and reliability of the distribution network, real time operation and monitoring, ensuring the maintenance of and, if necessary, developing the distribution system in a given area and, where applicable, its interconnections with other systems and for ensuring the long-term ability of the system to meet reasonable demands for the distribution of electricity. Moreover, the DSO is responsible for connection of all grid users at the distribution level.
Flexibility Service Provider (FSP)	Provides flexibility via bilateral agreements or flexibility market agreements.
Prosumer	A consumer who can also produce electricity.
TSO	Responsible for security of supply and reliability of a transmission network, real time operation and monitoring, building, expanding, and maintaining the system.

3.5.1. Consumer / Community-centric flexibility

Regarding the actors and systems used in the SUCs within the Consumer / Community-centric flexibility domain, their definitions are provided in Table 3.6.

Table 3.6 – Actors identification and description for Consumer / Community-centric flexibility domain

Actor	Description	SUC
Billing Agent	Responsible for invoicing a concerned party. Not explicitly considered, the billing agent would be responsible for the final billing to the EC members.	SUC02.1
Billing System	Responsible to provide monthly bills for EC members. The billing methodology is composed by transactions and flexibility delivery. System operated by the billing agent.	SUC02.1
Controller modules	They are the modules that allow to monitor and control, for example, the thermal loads.	SUC03.2
DER Sizing Microservice	Performs the sizing of the DER considering different BM to compute schedules in representative long-term periods, using the forecast, historical data and the price and costs signals. From the schedules, computes the KPI to perform the economic analysis of the EC and its BM.	SUC01.1

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EC Manager	A party responsible for managing business activities within an EC.	SUC01.1, SUC02.1
Energy Management Microservice	Software tool that processes all the monitored data to optimize the control of flexible loads to adapt their consumption, reduce their energy costs and provide flexibility services. In SUC02.1 it is integrated in the EC management platform.	SUC02.1, SUC03.2
FMO system	A market platform that could be operated by a FMO or even a DSO where the flexibility among DSO and aggregators negotiated. In this SUC the DSO is the main procurer of flexibility.	SUC02.1
HEMS	Responsible for managing the operation of DER, receiving setpoints from energy management microservice and the accorded amount of flexibility delivery. Also, must communicate the flexibility bids. This system is accessible for prosumers (EC members).	SUC02.1
Household meter	Meter to monitor the household consumption.	SUC03.2
Installation App	Tool to help the installer to make the registration of the installed controllers to retrofit water heaters.	SUC03.1
Installer	Person in charge of connecting the needed physical equipment to control an asset.	SUC03.1
Integration Microservice	Integral part of the EC management platform, which is operated by EC Manager. System used by the EC Manager to administer and operate the EC. Also provides communication with DER and DSO. Responsible for receiving inputs and for sending outputs of the EC platform.	SUC01.1, SUC02.1
Scenario Preparation Microservice	Analyses consumers' historical data and gathers missing data to complete datasets. Also collects information on local meteorological data used to forecast generation potential of DER.	SUC01.1
Settlement Microservice	Integral part of the EC management platform, which is operated by EC Manager. Responsible for compute the allocation coefficients and receive the results validation from DSO. This microservice provides the fair benefits sharing according to market principles.	SUC02.1
Thermal load	Device that consumes electricity to convert it into thermal energy.	SUC03.2
Transactions Microservice	Generates the internal transactions for the internal EC energy sharing.	SUC02.1

3.5.2. Grid-centric flexibility

Regarding the actors and systems used in the SUCs within the Grid-centric flexibility domain, their definitions are provided in Table 3.7.

Table 3.7 – Actors identification and description for Grid-centric flexibility domain

Actor	Description	SUC
Aggregator platform	Platform typically operated by the Resource Aggregator to aggregate flexibility bids and bring them to the market.	SUC05.1, SUC05.2
Balancing Service Provider (BSP)	A party with reserve-providing units or reserve-providing groups able to provide balancing services to one or more Load-Frequency Control (LFC) operators.	SUC10.1, SUC10.3
BSP Platform	IT platform enabling commercial/technical communication exchanges from/to the BSPs participating in the system.	SUC10.1, SUC10.3
Crowd Balancing Platform (CBP)	CBP is a platform developed by Equigy, a joint venture participated by Terna, Tennet and Swissgrid, APG, Transnet BW, to facilitate the participation of small, distributed resources to the energy markets. The CBP constitutes the central technological layer of the system, creating a front-end which coordinates the proprietary back-end systems of the different actors (TSO, DSOs and BSPs).	SUC10.2, SUC10.4
Data Exchange Platform	System for sending activation signal to the FSPs.	SUC06.1
DER Provider	Responsible for installing and/or maintaining assets related with distributed energy equipment, which are provided/sold to other market agents.	SUC05.1
DERMS	Software package specifically tailored for utilities to support them in overcoming DER-imposed challenges and for using DERs to plan and operate the grid in the most efficient and economical way. DERMS provides long-term forecast in network planning module, as	SUC04.4, SUC06.1

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	well as a comprehensive set of advanced applications for constraint management, grid optimization, and planning of distribution systems with high DER penetration.	, SUC10.2
Distribution Management System (DMS)	A software-based system that manages the distribution network. It performs grid state estimation and productions and consumptions forecasting.	SUC07.1
DSO Activation system	Automatic system that, according to the measurements, proceeds with the dispatch of flexibility products.	SUC06.2
DSO Database	System responsible for storing DSO's data (energy meters' readings, baselines…)	SUC06.3
DSO Flexibility Controller	Oversees the transfer of data necessary for settling and compensating flexibility services in the energy grid, ensuring that transactions are accurate, and stakeholders are remunerated appropriately for their contributions to grid flexibility and reliability.	SUC04.3
DSO Flexibility KAM	Responsible for dialogue and signing contracts with FSPs.	SUC04.2
DSO Flexibility Planner	Responsible for defining product mix.	SUC04.2
DSO Flexibility Procurer	Responsible for choosing procurement method and performing the procurement. In addition, the role also includes responsible for guidance on procurement/legal issues.	SUC04.2
DSO Forecast Provider	In charge for assessing scenario and sharing information on consumption and production load curves.	SUC04.1
DSO Grid Operations	Grid operations involve managing and maintaining an electrical grid for a reliable and efficient electricity supply. This includes balancing supply and demand, ensuring system stability, coordinating with stakeholders, and adapting to changing energy conditions.	SUC04.3
DSO Grid planner	In charge for network development plan to be submit to the regulatory authority.	SUC04.1
DSO Load flow calculation tool	Runs the Optimal Power Flows algorithms to get the long-term load forecast and identify the congestion grid points.	SUC04.1
DSO O&M	In charge for distribution infrastructure operation and maintenance.	SUC04.1
DSO Registry	Internal registry for distributed resources stored in the DSO backend. It contains a list of all the validated PODs and local aggregates participating in the system.	SUC10.1
DSO Scada System	System responsible for displaying grid measurements, which serve as input for DSO activation system.	SUC06.2
DSO Settlement Service	System responsible for handling invoices and financial settlement with FSP.	SUC06.3
DSO Technical Platform	A software-based system that manages the distribution network. It performs grid state estimation and productions and consumptions forecasting. Moreover, it defines the flexibility requests for DSO's grid. The DSO Technical Platform exchanges data with SCADA and other system comprised in the Operation Domain.	SUC10.1 , SUC10.2 , SUC10.3
Energy Management System (EMS)	Software in the cloud that processes all the monitored data to optimize the control of flexible loads to change their consumption, reduce their energy costs and provide flexibility services.	SUC05.2
Energy Service Company (ESCo)	Offers energy related services. Can provide insights and energy management services as well as implementing energy efficiency and renewable energy projects.	SUC05.1
Flexibility Market Platform / Flexibility Platform	Place where buyers and sellers of flexibility meet to trade flexibility.	SUC04.3 , SUC05.2
Flexibility Register (FR)	Database that gathers all the data and services of flexibility resources and shares them with all the stakeholders.	SUC07.1 , SUC10.2 , SUC10.4
FSP Technical Platform	System responsible for taking care of business files exchange, bids, and financial settlement.	SUC06.2 , SUC06.3
GDBN	The GDBN is a facilitator of all the activities withing the flexibility provision value chain.	SUC06.2 , SUC06.3
Local Flexibility Market Operator (LFMO)	Responsible for the local flexibility market services. Responsible for calling, clearing, communicating results, and possibly settling the provision of distributed flexibility.	SUC04.3 , SUC06.1
Neutral Market Facilitator (NMF)	Operates a transparent and non-discriminatory platform to automate the exchange of flexibility among different parties.	SUC05.1

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Phasor Measurement Unit (PMU)	Phasor Measurement Unit measures the magnitude and phase angle of voltage or current signals, which are synchronised via the GPS system.	SUC07.1
Power Grid User Interface (PGUI)	Device installed on the DSO's smart meter in order to read, arrange, certify in Blockchain (at first level) and send to the FR measurements and other data for the flexibility market and observability.	SUC07.1 , SUC10.4
Power Plant Controller (PPC) or Controllore Centrale di Impianto (CCI)	Device installed on the MV producer power plant to read, arrange, and send to the DMS measurements and other data for the grid observability.	SUC07.1
Producer	A party that generates electricity.	SUC07.1
Production Responsible Party	A Production Responsible Party is responsible for its imbalances, meaning the difference between the energy volume physically injected to the system and the final nominated energy volume, including any imbalance adjustment within a given imbalance settlement period.	SUC05.1
TSO Market Operator	Third party entity that oversee and exercises the TSO global flexibility market.	SUC10.3
TSO Market Platform	Platform encompassing all the systems performing activities made necessary to exercise and manage the global flexibility market (both in terms of communication flows and market algorithms). It interfaces with the Market Operator which oversees the offers gathering and economic dimension of the market processes.	SUC10.3
TSO Registry	Internal registry for distributed resources stored in the TSO backend. It contains a list of all the validated PODs and global aggregates participating in the system.	SUC10.1
TSO Technical Platform	IT platform of the TSO encompassing all the systems involved in performing technical activities such as validation or prequalification.	SUC10.1
VPP	Platform to monitor and control flexible assets of a confined portfolio in an aggregated way, possibly combining several control objectives. It is typically operated by the Resource Aggregator or the Flexibility Services Provider.	SUC05.2

3.5.3. TSO-DSO flexibility coordination

Regarding the actors and systems used in the SUCs within the TSO-DSO flexibility coordination domain, their definitions are provided in Table 3.8.

Table 3.8 – Actors identification and description for TSO-DSO flexibility coordination domain

Actor	Description	SUC
Balancing Service Provider (BSP)	A party with reserve-providing units or reserve-providing groups able to provide balancing services to one or more LFC Operators.	SUC08.1, SUC08.2, SUC08.3
BSP Platform	IT platform enabling commercial/technical communication exchanges from/to the BSPs participating in the system.	SUC08.1, SUC08.2
Crowd Balancing Platform (CBP)	Constitutes the central technological layer of the system, creating a frontend which coordinates the proprietary back-end systems of the different actors (TSO, DSOs and BSPs). The CBP can include the functionalities of data registry, market operation and stakeholders' interaction, which can be operated as modules within the platform. The CBP represents the coordination and orchestration layer between all the stakeholders involved in the process and acts as single-entry point to centrally collects all relevant data from every user.	SUC08.1, SUC08.2, SUC08.3
Data Analysis Software	Software used for analysing and processing data received from various sources (including DERS and data storage) to evaluate the performance and outcomes of the verification process.	SUC08.4
Data Storage	A system for securely storing and managing data that is used in the verification process, ensuring data integrity and accessibility for analysis and reporting purposes.	SUC08.4
DERMS	Systems that manage and control distributed energy resources, providing flexibility data and other relevant information required for the verification of energy services.	SUC08.4
DSO Registry	Internal registry for distributed resources stored in the DSO backend. It contains a list of all the validated PODs and local aggregates participating in the system.	SUC08.1

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DSO Technical Platform	IT platform of the DSO encompassing all the systems involved in performing technical activities such as validation or prequalification.	SUC08.1, SUC08.2, SUC08.3
Flexibility Register	Repository system where all data related to flexible POD are stored and made available to demo platforms and stakeholders.	SUC08.3
Reporting System	A system that compiles, organizes, and presents the results of the verification process in a structured report format for review and finalization.	SUC08.4
TSO Market Operator	Third party entity that oversee and exercises the TSO global flexibility market.	SUC08.2
TSO Market Platform	Platform encompassing all the systems performing activities made necessary to exercise and manage the global flexibility market (both in terms of communication flows and market algorithms). It interfaces with the Market Operator which oversees the offers gathering and economic dimension of the market processes.	SUC08.2
TSO Registry	Internal registry for distributed resources stored in the TSO backend. It contains a list of all the validated PODs and global aggregates participating in the system.	SUC08.1
TSO Technical Platform	IT platform of the TSO encompassing all the systems involved in performing technical activities such as validation or prequalification.	SUC08.1
Verification Tool	A tool or system used to initiate and manage the verification process of flexibility services, ensuring compliance with specified criteria and standards.	SUC08.4

3.5.4. Cross-sector flexibility boosters

Regarding the actors and systems used in the SUCs within the Cross-sector flexibility boosters domain, their definitions are provided in Table 3.9.

Table 3.9 – Actors identification and description for Cross-sector flexibility boosters domain

Actor	Description	SUC
BSP	A party with reserve-providing units or reserve-providing groups able to provide balancing services to one or more LFC Operators.	SUC13.1, SUC13.3
Charge Point Operator (CPO)	Installs and maintains charge stations so customers/drivers can charge their EV (electric vehicles).	SUC13.3, SUC13.4
Community Manager/Pilot Leader	Entity responsible of managing the end-users in a demo location.	SUC12.1, SUC13.1
Customer	Consumer of the service.	SUC13.2, SUC13.4
EV Driver	Main user of the EVSE infrastructure provided by the company. They will be in majority employees or contractors of the company.	SUC13.3
Flexibility Tool	Is the system in charge of collect the needed info and calculate the potential flexibility.	SUC11.1
GDBN	A facilitator of all the activities withing the flexibility provision value chain.	SUC12.1, SUC12.2
GDBN (BN advanced)	Advanced service functions within the GDBN.	SUC12.1, SUC12.2
GDBN (BN Aggregator)	Aggregator functions within the GDBN.	SUC12.1, SUC12.2
GDBN (BN Customers)	Costumer functions within the GDBN.	SUC12.1, SUC12.2
GDBN (BN DSO)	DSO functions within the GDBN.	SUC12.1
GDBN (BN for Energy Repository)	Repository (catalogue) service that hosts energy services.	SUC12.1, SUC12.2
GDBN (BN master data mgmt.)	Data management service functions within the GDBN.	SUC12.1, SUC12.2
GDBN (BN service provider)	Service provider functions within the GDBN.	SUC12.1, SUC12.2
GDBN (Consent Administrator role)	Consent manager service functions within the GDBN.	SUC12.2

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Installer	Person in charge of connect the needed physical equipment to control an asset.	SUC13.1, SUC13.3
LFMO	Responsible for the local flexibility market services.	SUC13.1, SUC13.3
Market Operator	Provides a service whereby the offers to sell electricity are matched with the bids to buy it.	SUC13.1, SUC13.3
REC Manager	Platform that manages a REC and all its participants.	SUC12.2
Service Provider	Platform (often technical) that makes services available on behalf of service providers.	SUC12.1, SUC12.2
Third-party/ External Data Source	Any external agent. Example: Partners of consortium, Companies, Data sources.	SUC13.1, SUC13.3
Water Distribution System Operator (WDSO)	A WDSO is a party responsible for security of supply and reliability of the water distribution grid.	SUC11.1
Water Network Control System (WNCS)	Is the system that allow the WDSO the control the water network and collect info from that.	SUC11.1

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4. BeFlexible System Use Cases overview

This chapter provides a summary of all SUCs, divided by domain. It presents the scope and objectives of each SUC, along with a short description of its main aspects.

4.1. Consumer / Community-centric flexibility SUCs

Consumer/Community-centric flexibility SUCs are associated with consumer using flexibility for their own benefit, i.e., to optimize an objective function such as cost minimization, or integrated in energy communities to share energy and flexibility among them and provide flexibility to other energy system actors. The BUCs and SUCs included in this domain are listed in Table 4.1.

Table 4.1 – BeFlexible Consumer / Community-centric flexibility SUCs

Domain	BUC	SUC
Consumer / Community-centric flexibility	**BUC01**	**SUC01.1 –** DER sizing and economic evaluation of the LEC business model
	BUC02	**SUC02.1 –** Operation of the energy community
	BUC03	**SUC03.1 –** Retrofit of thermoelectric water heaters
		SUC03.2 – Optimize thermal loads to reduce energy use and costs

The complete versions of these SUCs are provided in Annex II – Consumer / Community-centric flexibility.

4.1.1. SUC01.1 – DER sizing and economic evaluation of the LEC business model

Scope

This SUC covers the sizing of DERs and economic performance and evaluation of ECs, including RECs and CECs, under different BMs.

Objectives

Its main objectives include:

- Conduct sizing of EC DER
- Economic evaluation of EC BM.
- Contemplate different asset ownership models.
- Estimate flexibility potential.

Short description

In this SUC, the EC Manager determines the optimal capacities of the DER to be installed in the EC considering typical (or measured) consumption profiles, availability of RES, and capital and operational cost of technologies.

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The main actor is the EC Manager, who uses a platform and a sizing tool to determine the optimal capacities of the DER to be installed in the EC. This platform incorporates several microservices, such as integration microservice, scenario preparation microservice, and the DER sizing microservice.

It includes the following steps:

- Data collection: the EC Manager acquires information about the planned EC structure, selected BM, historical consumption data and local meteorological data, DER characteristics are specified, and financial data provided (energy prices, tariffs, and costs for each DER type).
- Scenario preparation: problems related with missing data are addressed and meteorological data used to estimate DER production.
- DER sizing: optimize the capacities of the DER, and estimate available flexibility (outputs include DER size, optimal schedules, transacted energy and transaction prices, individual and collective investments, costs, and an estimation of the flexibility in the EC).
- EC BM economic evaluation: includes electricity cost reduction, payback period and energy sharing ratio.

4.1.2. SUC02.1 – Operation of the energy community

Scope

This SUC covers the creation and operation of ECs to share energy among the members and provide flexibility services to third parties.

Operation of ECs can be centralized or decentralized. In the centralized mode, the one that will be the focus of this SUC, a central energy management system is responsible for the computation of the schedules of the flexible assets and for sharing the collective benefits according to market principles. In the decentralized market-based mode, decisions are totally or partially decentralized and based on the market agents' behaviours.

Objectives

Its main objectives include:

- Energy community operation:
  - Under a central energy management system.
  - Under a decentralized market-based approach.
- Flexibility provision under a central energy management system.

Short description

In this SUC the EC Manager uses a platform to manage and operate an EC. As in SUC01.1, this platform has several microservices, including integration microservice, energy management microservice, transactions microservice, and settlement microservice.

It includes the following steps:

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- Structural definition of the EC: acquire information about the EC, its structure, BM, members, available DERs, define the interactions among EC Members and the methodology for benefits sharing.
- Energy management, transactions and pricing: gets energy metered/forecasted data from the EC Members and flexibility needs from the DSO. Transactions are computed with the metered/forecasted data and the DSO's flexibility needs. The energy management microservice obtains the optimal schedules of the DERs and the internal transactions. In the case of a market-based approach, the transactions come from the internal market clearing. If the EC provides flexibility the energy management microservice considers flexibility needs to determine schedules of the DERs.
- Settlement: Dynamic allocation coefficients are computed by the settlement microservice and provided to the DSO for validation. The settlement microservice computes the financial compensations and provides the settlement information to the EC.
- KPI computation: compute and show indicators for the individual or collective performance of the community after the settlement phase.

4.1.3. SUC03.1 – Retrofit of thermoelectric water heaters

Scope

This SUC describes the service to retrofit not smart thermoelectric water heaters to unlock flexibility provision.

Objectives

Its main objectives include:

- Increase the controllability of already installed water heaters.
- Enable the provision of flexibility services with already installed water heaters.

Short description

This SUC encompasses the processes needed to retrofit a thermoelectric water heater to unlock flexibility. It covers the registration and installation of devices to monitor and control water heaters. Once retrofitted, the water heater can be externally managed following energy efficiency orders and aggregated flexibility activations.

It includes the following steps:

- Register the devices to be installed: Retrofit modules to be installed (e.g., communication modules, controller modules) are registered in the system and linked to the consumer using the installation app.
- Install the modules and sensors: Devices are installed to retrofit the water heater. Additionally, a meter can be installed to monitor the consumption.
- Installation success test: With the help of the Installation App, it can be checked if the retrofit modules are properly connected and registered. It also checked if the monitored values are properly received and stored in the system from the consumption meters and the temperature probes.

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- Collect consent from the consumer: Collect the personal information from the consumers and get the signature for the approval of the external control of their thermal devices.

4.1.4. SUC03.2 – Optimize thermal loads to reduce energy use and costs

Scope

This SUC covers the optimal control of thermal loads to reduce energy consumption and costs.

Objectives

Its main objectives include:

- Reduce the energy consumption of the controlled thermal loads.
- Reduce the energy bill associated with the consumption of the controlled thermal loads.

Short description

Optimal control of domestic thermal loads refers to the application of technologies and data analytics to manage energy consumption to optimize the usage of domestic thermal loads, such as electric water heaters, to reduce costs and increase flexibility. By leveraging advanced technology and data analytics, thermal loads can be controlled to reduce their consumption and reduce energy costs by combining several services like:

- Increasing self-consumption (SC).
- Peak-shaving (PS).
- Dynamic tariff (DT) or Time-of-use (ToU) tariff optimization.

It includes the following steps:

- Monitoring: Once the thermal loads can be remotely controlled, the local controller sends monitoring and performance data to the EMS.
- Training of the model: Based on the received data, the EMS characterizes the thermal load model. This model includes parameters like heating needs and heating loses. This thermal load model is used in the next step, and it is updated every day.
- Optimization: After the training phase (based on the received data and combining machine learning algorithms and consumption optimization) the EMS can provide energy efficiency by optimizing thermal loads' energy consumption. Besides energy efficiency, the following services can be combined to reduce the energy bill costs:
    - Increasing self-consumption: Includes the decision of concentrating consumption during sunny hours and reducing the cost of electricity and the CO_2 emissions in the case of behind-the-meter RES.
    - Peak-shaving: Includes the capability of limiting thermal loads consumption in case of detecting excessive consumption in the smart meter.
    - Dynamic tariff or Time-of-use tariff optimization: Adapt the consumption to the hourly electricity prices to reduce heating costs.

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- Activation: As a result of the optimization carried out by the EMS, control signals are sent to the thermal device. In this case, these control signals are ON/OFF signals to control a water heater through the retrofit controller module relay.

4.2. Grid-centric flexibility SUCs

Grid-centric flexibility SUCs are associated with the integration of DER flexibility, both individually and aggregated, in TSO and DSO long-term and short-term management processes. The BUCs and SUCs included in this domain are listed in Table 4.2.

Table 4.2 – BeFlexible Grid-centric flexibility SUCs

Domain	BUC	SUC
Grid-centric flexibility	**BUC04**	**SUC04.1 –** Load forecasts for long-term grid demand and quantification of flexibility needs
		SUC04.2 – Procure availability contracts
		SUC04.3 – Activate market-based and non-market-based long-term availability contracts
		SUC04.4 – Integrate flexibility into DSO grid planning processes and tools
	BUC05	**SUC05.1 –** Aggregate controllable assets to solve congestion problems to the DSO
		SUC05.2 – Aggregate controllable energy assets to provide flexibility services to the TSO
	BUC06	**SUC06.1 –** Short term Flexibility procurement based on congestion forecasting
		SUC06.2 – Short term Flexibility activation for DSO congestion management
		SUC06.3 – Settlement of flexibility services from DER participating to local market
	BUC07	**SUC07.1 –** Online monitoring and observability enhancement to quantify the actual voltage condition
	BUC10	**SUC10.1 –** Ex-ante validation
		SUC10.2 – Constraints definition
		SUC10.3 – Bids placements and verification
		SUC10.4 – Delivery validation

The complete versions of these SUCs are provided in Annex III – Grid-centric flexibility.

4.2.1. SUC04.1 – Load forecasts for long-term grid demand and quantification of flexibility needs

Scope

This SUC covers long-term electricity load forecasts and quantification of flexibility needs in a constrained grid point.

Objectives

Its main objectives include:

- Integrate flexibility into DSO grid planning processes.

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- Procure adequate long-term active power products to manage congestions (and voltage constraints, only for Demo1).

Short description

The main functionality of DSO 'long-term load forecast' is a grid simulation module for the calculation of grid elements load conditions focused on the quantification of flexibility needs to solve grid congestions (and voltage constraints, only for Demo1) as an alternative to grid reinforcement.

The solution for long-term load and distribution grid congestions forecast shall support the Network Development Plan that the DSO Grid Planner has to submit to the Regulatory Authority on the medium and long-term, including, in some cases, flexibility services as an alternative to system infrastructures expansion.

It includes the following steps:

- Long-term scenario forecast: relies on the creation of load/generation scenarios.
- Perform long term load forecast and identify network constraints: relies on the utilization, as input of the DSO Load flow calculation tool, of the long-term scenario forecasts (previous step) and the information of planned network development and maintenance.
- Quantify flexibility volumes needed: the flexibility volumes needed to avoid the congestion (and voltage problems, only for Demo1) are quantified.

4.2.2. SUC04.2 – Procure availability contracts

Scope

This SUC describes the procurement of availability contracts to be used for long-term congestion management.

Objectives

Its main objectives include:

- Define mix of products to be used to manage the flexibility needs defined in SUC04.1.
- Specify identified availability needs as requirements in procurement documents.
- Procure availability contracts from flexibility service providers.

Short description

This use case describes the procurement of availability contracts to be used for long-term congestion management.

It includes the following steps:

- Define mix of products and specify identified needs: define a mix of products that can be used to manage the flexibility needs defined in SUC04.1, and specify identified availability needs in procurement documents.
- Find and engage potential FSPs: reach out to potential FSPs and engage them in the topic of flexibility.

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- Determine procurement method and ensure compliance: determine procurement method and the criteria for selection, and check that the procurement method and market procedures for the proposed products are compliant with national procurement laws.
- Perform procurement: perform the procurement of the availability contracts.
- Sign contracts: sign contracts with the FSPs selected in the procurement process.

4.2.3. SUC04.3 – Activate market-based and non-market-based long-term availability contracts

Scope

This SUC describes the activation of market-based and non-market-based long-term availability contracts.

Objectives

Its main objectives include:

- Develop and implement trading strategy.
- Monitor grid situation based on short-term load forecasts.
- Activate suitable availability contracts according to trading strategy.
- Validate flexibility delivery using baseline and metering data from contracted service provider.

Short description

This SUC focuses on the execution of both market-based and non-market-based long-term availability contracts. This systematic approach is vital for managing grid flexibility and maintaining stability in the power distribution network. It is divided in the following steps:

- Development and Implementation of Trading Strategy:
  - Load Limitation Decision: Determine grid limits.
  - Merit Order Decision: Decide merit order, ensuring alignment with regulations.
  - Intra-Category Merit Order Decision: Determine merit order within the categories of contracts.
  - Trading instructions: Planning for potential activations to secure the process of activating the availability of the FSPs.
- Grid Monitoring and Activation of Availability Contracts:
  - Grid Monitoring: Short-term load forecasts are provided. The Decision Support Tool within gives the Grid Operations information on grid status and recommended actions.
  - Market Clearing: Grid Operations use the Flexibility Platform to place activation orders, based on the trading strategy, to the LFMO. The LFMO matches FSP bids with activation orders, hence clearing the market.
  - Sending Activation Signals: LFMO sends activation signals to FSPs.
- Validation and Settlement:

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- Validation of Flexibility Delivery: Validating actual delivery using baseline and metering data from FSPs.
- Confirmation of Flexibility Delivery: LFMO confirms delivery to Flexibility Controller through the platform.
- Settlement Data Transfer: The final phase involves sending the settlement data. The LFMO processes the data and forwards it to the FSP for remuneration.

4.2.4. SUC04.4 – Integrate flexibility into DSO grid planning processes and tools

Scope

This SUC covers the integration of flexibility services into network planning process.

Objectives

Its main objectives include:

- Integrate flexibility into DERMS to exploit its potential in planning distribution network.
- Demonstrates business potential of demand side products for DERs.
- Demonstrates the ability of the DERMS in planning of the right amount of flexibility for forecasted congestions.

Short description

In this SUC, the main functionality of DSO in integrated network planning is to speed up DER connection process and to use flexibility services to address network overloads previously forecasted. This use case covers the integration of flexibility services into network planning process. DERMS will calculate the conditions of the grid during network planning and use the data from FSPs or aggregators to enable planning of the network using non-wire alternative.

It includes the following steps:

- New DER wants to connect to the network.
- DSO should calculate feasibility and technical conditions.
- DERMS forecasts the future congestions in the long-term period network planning process.
- DERMS receives the data from FSP about future available flexibility and integrates the FSP data in network planning.
- For these needs, it is necessary to integrate flexibility into the process of planning the distribution network.
- DERMS leverages FSP data in network planning.
- DSO can use flexibility for congestion management.

4.2.5. SUC05.1 – Aggregate controllable assets to solve congestion problems to the DSO

Scope

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This SUC covers the use of aggregation services to offer flexibility in order to solve congestion management problems to the DSO.

Objectives

Its main objective is:

- Aggregate distributed energy resources DERs to participate in DSO congestion management problems.

Short description

In this SUC an aggregator harnesses the flexible power of DERs to tackle congestion issues faced by DSOs. By integrating diverse energy sources such as solar panels, load, and energy storage systems, the aggregator optimizes the utilization and management of DERs. Aggregator intelligently orchestrates the DERs to dynamically balance supply and demand, alleviating grid bottlenecks and reducing strain on the DSO infrastructure.

This holistic approach not only enhances the reliability and stability of the grid but also promotes the efficient use of RES. By leveraging DERs, the system reduces dependency on traditional fossil fuel-based power plants, facilitating a sustainable energy transition. With its ability to mitigate DSO congestion problems, this innovative system contributes to the optimization of grid operations and supports the integration of renewable energy, ensuring a more resilient and eco-friendly energy landscape.

It includes the following steps:

- DSO: The DSO provides congestion requirements and DERs provide information about volumes, prices, and event durations for their assets.
- Communication to VPP: The DSO communicates the management congestion requirements to the VPP.
- Real-time Asset Monitoring: The aggregator/VPP continuously monitors the assets in real-time to ensure efficient and reliable operation. The assets communicate signals such as active power, reactive power, voltage, connectivity status, and communication status to the VPP.
- Load and Generation Forecasting: The VPP utilizes historical data uploaded by market participants to generate load and generation baselines.
- Activation and Feedback Signal Communication: Assets need to communicate activation and feedback signals to the VPP within DSO requirements.
- Manual Control Activation: DERS have the authority to manually activate control measures for their assets. Specifically, they can adjust the active power control signals.
- Aggregate Controllable Assets: The VPP utilizes the flexibility of controllable assets to address congestion problems faced by the DSO.
- Planning Tools: The VPP platform offers planning tools that enable asset owners to evaluate and identify the potential flexibility of their assets.

4.2.6. SUC05.2 – Aggregate controllable energy assets to provide flexibility services to the TSO

Scope

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This SUC describes the aggregation of flexibility from several energy assets to provide flexibility services to the TSO.

Objectives

Its main objectives include:

- Aggregate flexibility from several assets to offer flexibility services.
- Offer aggregated flexibility services to the TSO.

Short description

Flexibility can be offered for different kind of services to the TSO: balancing (FCR, aFRR, mFRR...), grid management (voltage control, congestion management...), adequacy (capacity market, strategic reserve...). Although each of them and the regulation in each country make the provision of each flexibility service slightly different, this SUC is focused on the previous step. In this step, the Resource Aggregator or the Flexibility Services Provider is in charge of the aggregation of flexibility from several energy assets to provide different kind of flexibility services to the TSO. Optionally, between the Flexibility market platform managed by the TSO and the VPP managed by the FSP, an intermediate Aggregator platform managed by a Resource Aggregator can be in place to facilitate the integration of FSPs that do not reach the minimum pool size to directly participate in the Flexibility market.

It includes the following steps:

- Aggregate data from energy assets: The EMS sends monitoring and performance data to the VPP of all the energy assets in the pool to be aggregated.
- Baseline: As a result of the aggregation of the data from the energy assets and based on forecast techniques, the VPP creates the aggregated baseline of the pool under control.
- Optimize: The VPP can provide aggregated flexibility by optimizing the answer to the flexibility needs among the several energy assets inside a pool.
- Flexibility offers: As a result of the optimization, the VPP creates the flexibility offers based on the previously defined baseline and the available flexibility of the assets integrated into the controlled pool.
- Activate: As a result of the optimization carried out by the VPP, constraints are sent to the EMS to be included into the optimization and control of the assets under its control.
- Report and settlement: Once the flexibility service has been satisfied, the amount and duration of the flexibility provision is reported and a settlement of the provision occurs.

4.2.7. SUC06.1 – Short term Flexibility procurement based on congestion forecasting

Scope

This SUC covers the short term flexibility procurement on based forecasted congestion and voltage violations.

Objectives

Its main objectives include:

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- Integrate flexibility into DERMS to exploit its potential in solving possible congestions and voltage violations.
- Demonstrates business potential of demand side products for DERs.
- Demonstrates the ability of the DERMS in procuring the right amount of flexibility for occurring congestions or violations.

Short description

The main functionality of DSO Short term flexibility procurement is the procurement of flexibility services to address network overloads previously estimated. DERMS will monitor the conditions of the grid in look ahead (short-term) period and send the activation signals to the FSPs or aggregators committed in the market phase, in accordance with the type of procured product.

It includes the following steps:

- DERMS forecasts the future congestions and voltage violations in the short-term period through forecast module to quantify future flexibility needs.
- DERMS periodically receives data from FSPs.
- DSO can communicate the flexibility needs to the LMO.
- LMO publishes the flexibility needs.
- LMO performs the market clearing about available flexibility.
- DERMS integrates the market clearing results.
- DERMS engages FSPs to resolve network constraints.

4.2.8. SUC06.2 – Short term Flexibility activation for DSO congestion management

Scope

This SUC covers the process for short-term activation of committed flexibility services for DSO congestion and voltage violations management.

Objectives

Its main objectives include:

- Monitoring conditions on the grid on real time.
- Send the activation signals and verify information exchange between stakeholders.
- Check the reception of the flexibility activation signal.

Short description

In this SUC, the DSO activates flexibility products to manage grid congestions and voltage violations. These products, pre-reserved in a flexibility market, supported by a Market Platform connected/integrated to the GDBN, are activated directly or through the GDBN in real-time or close to real-time. It includes the flexibility activation of flexibility resources in the distribution grid, the verification of the reception of activation signal

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(which should not be confused with the computation of the actual flexibility delivered), and the information exchange between all stakeholders in this process, enabling data as well as communication interoperability.

It includes the following steps:

- Grid monitoring: The DSO is monitoring the distribution grid in real-time, through its SCADA system, when it detects the need to proceed with the activation of contracted flexibility.
- Flexibility dispatch notice: DSO sends activation signal directly or through the GDBN.
- Flexibility activation requests: In the case of using GDBN, flexibility dispatch notices are forwarded from GDBN to the FSP whose bids are selected.
- Flexibility activation: The flexibility of the DER is activated.

4.2.9. SUC06.3 – Settlement of flexibility services from DER participating to local market

Scope

This SUC covers the process for settlement of flexibility products from DERs participating in local flexibility markets.

Objectives

Its main objectives include:

- Quantify the delivered flexibility as response to activation request.
- Calculate financial settlement based on the delivered results in comparison with requested quantity.

Short description

This SUC use available monitoring information to evaluate the response of the FSPs after the provision of flexibility service procured in a local market. The objective is to determine if the response of the FSPs corresponds to the awarded bids cleared by the short-term local market. This is done by gathering metering data and comparing it to a baseline. Financial settlement is calculated based on the delivered results, comparing the actual delivered flexibility and requested flexibility. In some cases, penalties may apply if described within the product specification.

Two alternatives are considered:

- Settlement is done by the DSO, independently, and outside the GDBN.
- Settlement is done within the Grid Data and Business Network (GDBN).

It includes the following steps:

- Calculate delivered flexibility: delivered flexibility is calculated as the difference between baseline and metered consumption/generation of that FSP.
- Verify that delivered flexibility matches with requested flexibility: comparing the actual delivered flexibility and requested flexibility by the DSO.
- Settlement: monetarized delivery including penalty calculation.

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4.2.10. SUC07.1 – Online monitoring and observability enhancement to quantify the actual voltage condition

Scope

This SUC covers the improve of grid observability.

Objectives

Its main objectives include:

- Increase the LV nodes monitoring in real time.
- Increase the MV nodes monitoring in real time.
- Use the real time measurements to improve the grid simulation.

Short description

This SUC outlines the methods and technologies employed to enhance the observability of the low and medium-voltage network. To increase the grid observability, several nodes of the distribution grid will be equipped with devices able to gather, collect and send the data to DMS. Moreover, exploiting the synergy with the experimentations ongoing, the resources involved into flexibility market and the distributed power plants connected in MV level, will be equipped with devices for the real-time data collection at the PoD. An innovative measurement device, named PMU, will be tested to increase grid observability with a very high time-resolution and accuracy. The PMU is an open-source low-cost device and relatively easy to integrate.

The flexible resource real-time data will be collected in the FR and transfer to DMS. Instead, the data coming from producers will be sent directly to the DMS. The DSO uses all real-time data collected to enhance its estimations and optimize network management.

Certain actors perform the following steps:

- MV producers:
  - Installs the CCI to enable real-time data collection.
  - Performs the accreditation and registration procedures.
  - Executes the communication testing procedure.
  - Initiates real-time data collection.
  - Transfers the measurements to the DMS.
- Flexible resource:
  - Installs the PGUI to enable real-time data collection.
  - Performs the accreditation and registration procedures.
  - Executes the communication testing procedure.
  - Initiates real-time data collection.
  - Transfers the measurements to Flexibility Register.
- Flexibility Register:

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- Collects and organizes the data.
- Performs reconstruction processing for missing measurement values.
- Makes the data available to DMS.

- DSO substation:
  - Installs the PMU to enable real-time data collection.
  - Performs the accreditation and registration procedures.
  - Executes the communication testing procedure.
  - Initiates real-time data collection.
  - Transfers the measurements to DMS.
- DMS:
  - Acquires the real-time measurements.
  - Retrieves the measurements from the Flexibility Register.
  - Performs the SE tool.

4.2.11. SUC10.1 – Ex-ante validation

Scope

This SUC defines a coherent procedure of ex ante validation of the resources participating in the local and global markets.

Objectives

Its main objectives include:

- To validate resources in such a way to be compliant with both TSO and DSO prescriptions for their respective markets.
- To communicate the ex-ante distribution grid constraint.

Short description

The SUC refers to the ways in which the TSO and DSO jointly set up a scheme performing an ex-ante validation of the flexibility resources presented by the BSPs. To do so, a series of information exchanges from the DSO and the TSO must take place – involving a Static Traffic Light and the set-up of a Topological Matrix. Additionally, a set of data about the GCPs of each BSP must be provided.

In detail, BSP registers the flexibility resource of its portfolio and its information (technical) considering the interface of GCP as reference point. The DSO is informed of every single GCP that the BSP registers onto the platform and starts the validation process. The aim of the validation process is to confirm the possibility for the BSP to use that resource in a pool and if so for which amount of flexible power. Furthermore, the DSO is requested to complement the information available for the resource by adding the field that indicated the reference grid element and the Static Traffic Light as the colour code among a predefined list of green, yellow, red associated with a Go, Go-If, No-Go. When the DSO has concluded the analysis of the GCP it is then enabled

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to change the status of the asset so that the asset itself can continue along the prequalification journey. The information is shared with TSO. The information registered by the BSP on every GCP is complemented by the information available in the TSO systems so that a consistent data package for every GCP is considered. At the end of the GCP validation process, full spatial information is available and therefore the Topology Matrix can be setup. The Topology Matrix includes the reference DSO Perimeter, the reference TSO perimeter and the GCP linked to both the elements and as registered by the BSP. The Matrix is made available to all parties: BSP, DSO, TSO for the relevant actions and acknowledgment feedback. After the GCPs are registered by the BSP and validated by the DSO, the BSP itself can proceed to combine them together in pools of resources (where number of resources is >=1) and register them. The resource group information is shared with the TSO and the pool qualification process starts so that the asset can be qualified into the market.

4.2.12. SUC10.2 – Constraints definition

Scope

This SUC describes the process to define the Dynamic Traffic Light which expresses the limits given by the DSO to the flexibility activation of the TSO.

Objectives

Its main objective includes:

- Define common conventions to communicate flexibility limits.

Short description

This SUC define the structure and contents of the exchanged data to coordinate the use of distributed flexibility for transmission purposes closer to real time with respect to the registration and prequalification process. Leaving the evaluation of distribution grid limitations to the DSO, the SUC starts defining the methodology deployed to express distribution grid limitations and so limits to flexibility activation. The meaning of the DTL colours (green, yellow, and red) is described. Then the structure of the data exchange is defined: DSO informs the TSO about Dynamic traffic light values referring to the grid interface defined in the Topology Matrix.

It includes the following steps:

- Constraint evaluation: The DSO evaluates the network constraints so as to minimize the flexibility limitations considering all necessary technical data.
- Dynamic Traffic Light Determination: The values, obtained during DSO analyses, are expressed in relation to the Topology Matrix, thus it is indicated for each TSO-DSO grid interface.
- Information Exchange: The information is transmitted by the DSO to the TSO by means of a dedicated and shared platform.

4.2.13. SUC10.3 – Bids placements and verification

Scope

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This SUC covers bid placement and verification process within the TSO and DSO coordination of the procurement of system services from distributed resources through local and global markets.

Objectives

Its main objectives include:

- Manage the procurement of services via efficient data exchange.
- Avoiding network constraint violation when the resources are activated.
- Allowing value stacking for the distributed resources.
- Striving for overall economic efficiency of market-based procurement.

Short description

The SUC describes the process of bidding by the BSP on the Global Flexibility Market and how these bids are collected and processed by the TSO, together with Dynamic Traffic Light, to avoid distribution grid bottlenecks in case of activation.

It includes the following steps:

- Flexibility bids creation & Definition of components at DSO perimeter.
- Bid Components Reception & Bid Components Allocation to Respective Constraint.
- Overall Bids Selection.
- Confirmed Bids Registration & Confirmed Bids Communication.

4.2.14. SUC10.4 – Delivery validation

Scope

The SUC describes the process to validate compliance with offer set points and with distribution grid limitations.

Objectives

Its main objective includes:

- Verify that BSPs successfully comply with the constraints set on flexibility (flexibility limits).

Short description

In this SUC the DSO will be able to verify whether the BSP has correctly activated the resources in its portfolio compliant to the selection made by the TSO (which in turn is compliant with the DSO constraint) by using the measurements of the certified meter installed at the resource premises as for any flexibility service in place.

It includes the following steps:

- DSO notifies the TSO on the necessity to conduct a verification: The DSO requests to the TSO how the distribution grid constraints have been considered during the market clearing process.
- Activation Limits and Baseline reporting: TSO sends to the DSO the requested information.

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- Measurements: DSO is authorized to read hourly measurements of the GCP of each DSO perimeter, mostly provided by devices installed at DERs' premises able to gather metering data.
- Evaluation of compliance: DSO verifies that BSP fulfilled activation limits for each DSO perimeter.
- Notification of results: DSO communicate the positive or negative outcome of the analyses referring them to a single DSO perimeter.

4.3. TSO-DSO flexibility coordination SUCs

TSO-DSO flexibility coordination SUCs are associated with DSO-TSO coordination in terms of flexibility monitoring, procurement, activation, and settlement, as well as required information exchange. The BUCs and SUCs included in this domain are listed in Table 4.3.

Table 4.3 – BeFlexible TSO-DSO flexibility coordination SUCs

Domain	BUC	SUC
TSO-DSO flexibility coordination	**BUC08**	**SUC08.1 –** Flexibility Register
		SUC08.2 – Market data exchange functionalities
		SUC08.3 – Traffic light data exchange functionalities
		SUC08.4 – Verification functionalities
	BUC09	n/a

The complete versions of these SUCs are provided in Annex IV – TSO-DSO flexibility coordination.

4.3.1. SUC08.1 – Flexibility Register

Scope

This SUC covers how to coordinate local flexibility markets and global ancillary services market in the processes for procuring flexibility services from distributed resources.

Objectives

Its main objectives include:

- Provide to global and/or local BSPs a common channel allowing data registry, market operation functionalities.
- Enable a common data exchange approach between TSO, DSOs and BSPs.

Short description

This SUC is about how the Flexibility Register is used to facilitate markets participation by establishing a common data model across grid operators and across different flexibility products/services. Here, the CBP acts as a central layer for coordinating actors like TSOs, DSOs, and BSPs. It manages data exchange between their systems, allowing seamless communication and data sharing. The CBP handles registrations, validations, and data management. It maintains a Flexibility Register, managing data about resources provided by BSPs, while overseeing all information flows related to data creation and updates.

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It includes the following steps:

- The BSPs register the GCPs they intend to qualify for the local/global flexibility markets.
- The DSOs use CBP's registration functionalities to receive the resource's own data to perform the ex-ante validation of the resources (Static Traffic Light).
- As a user of the CBP the TSO receives the information on the GCP and then transfers the same information into the backend systems.
- The Topology Matrix is considered an additional way of sharing information about a resource in a specific format and is therefore redundant from a merely data exchange perspective. Information shared and updated by BSP, DSO and TSO during registration and prequalification steps are indeed distributed among the parties involved in the Resource registration and Resource constraint flows. A specific service of the CBP enables it to forward the Topology Matrix to all the participant of the system in order to keep updated the repository stored in their own backend systems.
- The TSO, DSO and BSP use the CBP for updating the resources' data.
- The CBP allows the BSPs to define the aggregates through CBP's aggregation functionalities and associate them with the services for which it intends to enable the aggregates.
- The CBP is used to forward the information to the responsible for the pre-qualification (TSO and/or DSO), then the TSO and/or DSO uses CBP prequalification functionalities to qualify the aggregates for the provision of global and/or local services.

4.3.2. SUC08.2 – Market data exchange functionalities

Scope

This SUC covers how to coordinate local flexibility markets and global ancillary services market in the processes for procuring flexibility services from distributed resources.

Objectives

Its main objectives include:

- Provide to global and/or local BSPs a common channel allowing data registry, market operation functionalities.
- Enable a common data exchange approach between TSO, DSOs and BSPs.

Short description

This SUC is about how TSO and DSOs exchange market data through the CBP in the ex-ante market phases, enabling TSO-DSO coordination and to guarantee visibility over aggregates activation. The market data information exchange taking place through the CBP, includes the following steps:

- Bids creation: based on their own business operations the BSP creates ASM bids based on available flexibility and forwards them to the market operator.

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- Bids validation: After the reception of DSO information regarding constraints per DSO perimeter and BSP cumulative flexibility bids available at DSO perimeter, the TSO evaluates the resources activation taking into consideration the DSO constraints to avoid distribution grid bottlenecks.

4.3.3. SUC08.3 – Traffic light data exchange functionalities

Scope

This SUC describes the process of data exchange between TSO and DSOs where transparency over respective aggregates activation is guaranteed.

Objectives

Its main objectives include:

- To enable local and global market coordination and, respectively, stakeholders coordination.
- To guarantee coherent flexibility activations between local and global markets.
- To provide TSO information about how much flexibility can be exploited from the distribution network and to allow an efficient exploitation of them.

Short description

TSOs and DSOs are responsible for ensuring security of supply respectively on transmission and distribution networks. The development of two separate parallel markets (global and local markets) introduces the necessity of a coordination which must guarantee and facilitate the procurement of flexibility in both markets. The TL mechanism represents the coordination process thanks to which TSO is allowed to access distributed flexibility without compromising the operation of the distribution grid.

The CBP is a market-intermediary platform which, among other scopes, enables the communication of TL data sets created by DSO by means of distribution grid analyses. The CBP collects local market data and grid constraints data, as well as global market data, and enables the parallel run of separate markets. It allows to guarantee that the global market is operated within distribution grid bottlenecks. TL data sets are divided into static data and dynamic data sets; they represent respectively the overall possibility to exploit flexibility from a resource independently from the temporary grid load and the impracticability due to the temporary grid status. The data sets are then made available to the TSOs that perform grid analyses considering the distribution grid constraints to activate flexibility.

4.3.4. SUC08.4 – Verification functionalities

Scope

This SUC describes how to coordinate local flexibility markets and global ancillary services market in the processes for procuring flexibility services from distributed resources.

Objectives

Its main objectives include:

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- Provide to global and/or local BSPs a common channel allowing data registry, market operation functionalities.
- Enable a common data exchange approach between TSO, DSOs and BSPs.

Short description

This SUC is about the phase after flexibility services are delivered, BSPs report their outputs to TSOs and DSOs. These reports undergo verification against actual grid data. Discrepancies are resolved, ensuring the economic neutrality of BSPs due to service imbalances. The process concludes with a transparent settlement, maintaining grid stability and fostering stakeholder trust.

4.4. Cross-sector flexibility boosters SUCs

Cross-sector flexibility boosters SUCs are associated with exploring flexibility from other sectors and the enablement of interaction between the energy sector with other business sectors by using solutions that support open APIs and solutions on open platforms, trust-raising technologies, and adequate service management. The BUCs and SUCs included in this domain are listed in Table 4.4.

Table 4.4 – BeFlexible Cross-sector flexibility boosters SUCs

Domain	BUC	SUC
Cross-sector flexibility boosters	**BUC11**	**SUC11.1 –** Evaluate the flexibility capability of water distribution networks
	BUC12	**SUC12.1 –** Connect flexibility providers across the value chain
		SUC12.2 – Support investment in flexibility by value chain actors
	BUC13	**SUC13.1 –** Optimize residential demand-side flexibility
		SUC13.2 – Incentives for charging from RES and EV chargers sharing
		SUC13.3 – Optimize and manage corporate EV charging
		SUC13.4 – Share EV charging data for non-energy services

The complete versions of these SUCs are provided in Annex V – Cross-sector flexibility boosters.

4.4.1. SUC11.1 – Evaluate the flexibility capability of water distribution networks

Scope

This SUC investigates new methods to boost cross-sector flexibility.

Objectives

Its main objective includes:

- Calculation of the potential flexibility on the water distribution network, in order to be made available for the electrical grid.

Short description

The energy consumption of water facilities along with their flexible components such as water pumps and tanks make them suitable candidates for energy efficiency and optimization applications. A joint effort between electrical system and the water facilities creates a great opportunity for enhancing the flexibility of power systems. In this use case a model is developed to optimize the demand response and regulation capacity that a water distribution network can offer in power systems operation. From the power system point of view, the resource flexibility improves the system operations, reduce operation costs, and reduce emission from the electricity sector. The pilot is focused on the load shifting solution from water facilities and considers its impacts on power systems.

However, the water distribution grid operator may be also concerned about the negative impacts of modifying the operation of his systems on the reliable delivery of water to the consumers. This would require a comprehensive model to optimize the dynamic energy flexibility of the asset considering the underlying hydraulic constraints.

It includes the following steps:

- Define a portion of the water distribution grid and his interaction with the power system.
- Characterize the topology of the water distribution grid.
- Gather the historical and the real time measurement (where available).
- Check and control the data.
- Identify and characterize the flexibility components.
- Implement a tool to study the behaviour of water distribution assets.
- Quantifying the flexibility potential to make it available to the electrical grids.
- Parametrize the output for a scalability and replicability analyses.

4.4.2. SUC12.1 – Connect flexibility providers across the value chain

Scope

This SUC covers part of the value-chain enabler that ensures all stakeholders are onboarded, namely consumers/prosumers, service providers (e.g., Flexibility Service Providers), Aggregators or DSOs. Specific requirements for each stakeholder type provide ground data for the services detailed in this SUC.

Objectives

Its main objective includes:

- Connect consumers with suppliers/installers/O&M service providers of flexible DER to participate in the value chain and exploit flexibility business models.

Short description

This SUC details the first and second stages of the Flexibility-centric Energy Value-chain embodied by the GDBN. The GDBN is a cloud-based digital platform that links and engages key stakeholders to promote new business services for energy flexibility. The GDBN holds services to onboard consumers/prosumers, FSPs, Aggregators, EC Managers, Market Operators and DSOs.

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Consumers/Prosumers register their flexibility potential by registering the flexible assets they have available or show availability to receive recommendations on services with business opportunities that capacitate them (i.e., install) with flexible assets; afterwards deciding for the subscription of services.

It includes the following steps:

- Engage consumers with flexible assets to participate in the value chain: Consumers, prosumers and asset owners register their flexible assets to participate in the value chain to take their flexibility potential to market. Service providers capture/provide that flexibility potential in return for the available flexibility.
- Integrate flexible assets and services in the value chain: Service providers integrate their operational platforms with the value chain enabler to collect the flexibility potential from prosumers. Prosumers integrate their smart flexible assets with the value-chain enabler.

4.4.3. SUC12.2 – Support investment in flexibility by value chain actors

Scope

This SUC covers part of the value-chain enabler that ensures all stakeholders are onboarded, namely consumers/prosumers, service providers (e.g., Flexibility Service Providers), Aggregators or DSOs. Specific requirements for each stakeholder type provide ground data for the services detailed in this SUC. It promotes sustainable business models to unlock the potential distributed flexibility of final consumers for an improved system operation, with special emphasis on DSO flexibility system services.

Objectives

Its main objectives include:

- Offer and search for targeted energy and non-energy services to consumers.
- Identify and characterise available flexible assets.

Short description

The current SUC details the first and second stages of the Flexibility-centric Energy Value-chain embodied by the GDBN.

Consumers/Prosumers register their flexibility potential by registering the flexible assets they have available or show availability to receive recommendations on services with business opportunities that capacitate them (i.e., install) them with flexible assets; afterwards deciding for the subscription of such services.

It includes the following steps:

- Install flexible assets in candidate consumers through service subscriptions: Service providers exploit business models to install flexible assets in candidate consumers in exchange for their participation while providing them incentives.
- Pair consumers with flexible assets and service providers exploiting flexibility business models: Service providers are matched with consumers with assets available in the value chain, engaging consumers and increasing flexibility potential.

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- Aggregate flexibility potential: A renewable energy community manager embodying the role of aggregator, or an aggregator creates and pre-qualifies a flexibility bid that will be submitted to market negotiation. Service providers with subscribed prosumers or capacitated prosumers are expected to activate the flexible loads.

4.4.4. SUC13.1 – Optimize residential demand-side flexibility

Scope

This SUC describes the services to optimize residential demand-side flexibility.

Objectives

Its main objective is to address the following questions:

- How residential demand gets involved?
- How is the normal operation performed?
- How is the flexibility of residential demand optimized?

Short description

This SUC gathers the different use cases needed to optimize the residential demand side flexibility. This starts with the client onboarding stage where the device able to monitor and control energy assets are installed. Once installed the device can be managed following energy efficiency optimization orders (normal operation) or following flexible activations (flexible operation). In all cases, different KPIs are being monitored to obtain insights from clients usage of interfaces, devices, energy behaviours and monetary indicators.

4.4.5. SUC13.2 – Incentives for charging from RES and EV chargers sharing

Scope

This SUC describes the services to incentive EV drivers to charge their cars to best leverage RES.

Objectives

Its main objective is to address the following questions:

- How to maximize RES mix in EV charging?
- How to avoid EV usage disruption?
- How to best motivate EV drivers to use RES for charging?

Short description

This SUC focus on how to incentivize EV drivers to privilege flexible or carbon friendly energy to charge from private EVSE (e.g., home or office) leveraging grid renewable energy sources (RES). The SUC requires to gather forecast about the RES ratio available at the main EVSE sites (typically home and office), the forecast of EVSE usage and the EV forecast on location and energy needs. Leveraging this information it will investigate on how to modify EV behaviours.

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4.4.6. SUC13.3 – Optimize and manage corporate EV charging

Scope

This SUC describes the services to optimize and manage corporate EV charging in the flexibility context.

Objectives

Its main objective is to address the following questions:

- How corporation demand gets involved?
- How is the normal operation performed?
- How is the flexibility of corporate site demand optimized?

Short description

This SUC gathers the different use cases needed to optimize and manage corporate EV charging in the flexibility context. This starts with the onboarding stage where the different charging areas able to monitor and control corporate fleet charging are installed. Once installed the EVSE can be managed following energy efficiency optimization orders (normal operation) or following flexible activations (flexible operation), the level of flexibility will be driven by the type of fleet (e.g. employee, delivery, commercials) that will modify the need of energy and the business constraints. In all cases, different KPIs are being monitored to obtain insights from fleet usage of EV, EVSE usage, energy behaviours and monetary indicators and to ascertain that business constraints are not jeopardized. The current CPMS does not support flexibility.

4.4.7. SUC13.4 – Share EV charging data for non-energy services

Scope

This SUC describes the services to share EV charging data for non-energy services.

Objectives

Its main objective is to address the following question:

- How external services can subscribe to a data service and leverage data to propose services?

Short description

This SUC gathers the different use cases needed to access the charging station optimize the residential demand side flexibility. It is intended that the data will be used to provide extra service to the CPO (e.g. Identification of infrastructure improvement, cost analysis or contract recommendation) or for the EV ecosystem (e.g. Find a cheap or empty charging areas). The services may include to pay a fee depending on the usage, it is not intended to share private information).

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5. Conclusion

The BeFlexible project aims to increase the flexibility of energy systems, facilitate the participation of all energy-related actors, and enhance the cooperation between system operators.

This deliverable presents the outcomes of the work carried out in T3.1, centred on the definition of the use cases that will support the BUCs defined in T1.4 [2] and the services to be tested in scope of the project. These SUCs have been organized according to the type of services they are related with, that is, consumer/community-centric flexibility, grid-centric flexibility, TSO-DSO flexibility coordination, and cross-sector flexibility boosters. A total of 29 SUCs were developed, following the IEC PAS 62559 standard methodology to ensure their uniform development across all components.

The work carried out goes beyond the definition of SUCs, since it also provided an overview of the services to be tested in the project's pilots and the relationship between SUCs and services to be tested. Moreover, a detailed description was provided for all the business and systems actors involved in all the SUCs, along with the listing of the SUCs functional and non-functional requirements. At last, a summarized overview of the SUCs is presented, and the complete versions the IEC PAS 62559 standard are included in the Annex II to V.

The SUCs identified and described provide adequate support for the implementation of BUCs. Additionally, their resourcefulness is expected to support the testing of an extensive range of services, which goes beyond those included in the initial proposal.

At last, SUC writing provides a crucial input for WP4, WP5 and WP6, the WPs that deal with the implementation of the project’s pilots. Indeed, the SUCs specify the systems and services needed to support the pilots’ demonstrations, guiding the development, and testing of different systems and applications, and marking a key step to achieve the objectives set for the BeFlexible project.

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References

[1] TDX-ASSIST, ‘D4.7: Project Needs Report’. 2020. Accessed: Nov. 23, 2023. [Online]. Available: https://ec.europa.eu/research/participants/documents/downloadPublic?documentIds=080166e5d46e6bb7&appId=PPGMS

[2] BeFlexible, ‘D1.2: Framework for a Flexibility-Centric Energy and Cross-sector Value Chain, Business Use Cases and KPI Definition’.

[3] IEC, ‘Publicly Available Specifications - IntelliGrid Methodology for Developing Requirements for Energy Systems’. 2008.

[4] M. Gottschalk, M. Uslar, and C. Delfs, *The Use Case and Smart Grid Architecture Model Approach*. in SpringerBriefs in Energy. Cham: Springer International Publishing, 2017. doi: 10.1007/978-3-319-49229-2.

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6. Annex I – System Use Case Template

1 Description of the use case

Use case describes functions of a system in a technology-neutral way. It identifies participating actors which can for instance be other systems or human actors which are playing a role within a use case. Use cases can be specified on different levels of granularity and are according to their level of technological abstraction and granularity either described as Business Use Case (BUC) or System Use Case (SUC).

1.1 Name of the use case

ID	Area / Domain(s)	Name of Use Case
	Select from: (1) Local energy sharing and flexibility market; (2) Grid-centric flexibility; (3) TSO-DSO flexibility coordination; (4) Cross-sector	

1.2 Version management

Version Management			
Version No.	Date	Name of Author(s)	Changes
	DD.MM.YYYY		

1.3 Scope and objectives of use case

Scope and Objectives of Use Case	
Scope	The scope defines the limits of the use case.
Objective(s)	List of objectives of the use case
Related business case(s)	Provides a description or reference with some rationale for the suggested use case. Usually the business case is related to several use cases. Therefore, an external reference or link to a business case/business requirements might be more efficient and can be added here.

1.4 Narrative of use case

Narrative of Use Case
Short description
Short text intended to summarize the main idea as service for the reader who is searching for a use case or looking for an overview. Recommendation: This short description should have not more than 150 words.
Complete description
Complete Description Provides a complete narrative of the use case from a user's point of view, describing what occurs when, why, with what expectation, and under what conditions. This narrative should be written in plain text so that non-domain experts can understand it. The complete description of the Use Case can range from a few sentences to a few pages.

This section often helps the domain expert to think through the user requirements for the function before getting into the details required by the next sections of the Use Case.

1.5 Use case conditions

Use case conditions
Assumptions
May be used to define further, general assumption for this use case. In some use cases, it is critical to understand which preconditions or other assumptions are being made. • Any assumptions shall be identified, such as: which systems already exist, which contractual relations exist, and which configurations of systems are probably in place. • Any initial states of information exchanged in the steps in the next section shall be identified.
Prerequisites
Describes what condition(s) should have been met prior to the initiation of the use case, such as prior state of the actors and activities.

1.6 Further Information to the use case for classification / mapping

Classification Information
Relation to other use cases
Known relations to other use cases can be provided here if e.g. the use case is a more detailed one related to a business level use case, or it is an alternative to an existing use case. Could be used to include the IDs of BeFlexible use cases related to this one, or even to refer to external Use Cases (from BRIDGE use cases repository: https://smart-grid-use-cases.github.io/docs/usecases/bridge/) from which the particular BeFlexible Use Case derives.
Level of depth
Defines the level of depth of the use case: **Business use case** (BUC) use case which describes a general requirement, idea or concept independently from a specific technical realization like an architectural solution **System use case** (SUC) use case which describes in detail the functionality/technological solutions of (a part of) a business process.
Prioritisation
Considering a larger number of use cases it might be interesting to cluster them according to priority. This prioritisation might be different from country to country. Nonetheless, in BeFlexible this field should indicate whether the solutions will be implemented in more than one demo and if replicability is a key objective.
Generic, regional or national relation
Generic, regional or national relation: On international level, the use case description might be generic enough to describe a use case in a more general way independently from the national or regional market design. But use cases might be used to describe regional or national specific circumstances like laws or even project-specific details. If the use case reflects those circumstances, it should be characterized accordingly. **Note: Use Cases demonstrated in more than one country should be classified and written as Generic.**
Nature of the use case
This field can help to classify the main focus of the use case. EXAMPLE: Technical/system use case, business use cases (e.g. market processes), political, test use cases.
Further keywords for classification
Keywords can be defined in order to support extended search functionalities within a use case repository. Multiple keywords should be provided as a comma-separated list.

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EXAMPLE: Smart grid, electric vehicles, loading of vehicles, electricity metering, storage.

1.7 General Remarks

General Remarks
Is used for further comments which are not considered elsewhere.

2 Diagrams of use case

For clarification, in general it is recommended to provide drawing(s) by hand, by a graphic or as UML graphics. The drawing should show interactions which identify the steps where possible.

Diagram(s) of use case

3 Technical details

3.1 Actors

In this section 3.1, actors which are involved in the use case are listed and described. These can for instance include people, systems, applications, databases, devices, etc.

With the aim of improving consistency among Use Case descriptions, we shall use the BRIDGE "Harmonized Electricity Market Role Model" (HEMRM) - https://energy.ec.europa.eu/system/files/2021-06/bridge_wg_regulation_eu_bridge_hemrm_report_2020-2021_0.pdf - for actor names and description. Thus, the information included in the fields of the following table should be obtained from the Actors List defined in BRIDGE HEMRM. Nevertheless, it is possible to add new Actions.

Actors		
Actor Name	Actor Type	Actor Description

3.2 References

References (which are standards, reports, mandates and regulatory constraints) associated with the Use Case. The writers must identify the standards that should be used to realize the Use Case and improve the replicability of the solution.

Identify any legal issues that might affect the design and requirements of the function, including contracts, regulations, policies, financial considerations, engineering constraints, pollution constraints, and other environmental quality issues.

References						
No.	References Type	Reference	Status	Impact on use case	Originator / organisation	Link
			The status of the referenced document.	e.g. copy right, IPR		

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4 Step by step analysis of use case

Template section 4 focuses on describing scenarios of the use case with a step-step analysis (sequence description). There should be a clear correlation between the narrative and these scenarios and steps.

4.1 Overview of scenarios

The table provides an overview of the different scenarios of the use case like normal and alternative scenarios which are described in section 4.2 of the template.

In general, the writer of the use case starts with the normal sequence (success). In case precondition or post-condition does not provide the expected output (e.g. no success = failure), alternative scenarios have to be defined.

Scenario conditions						
No.	**Scenario name**	**Scenario description**	**Primary actor**	**Triggering event**	**Pre-condition**	**Post-condition**
			Refers to the actor that triggers the scenario. For instance, a function called “Protection” would probably be triggered by an “Intelligent Electronic Device (IED)”. It is worth pointing out that the names of the Actors should be consistent with Actors List in all sections of the Use Case description.	Event that triggers the scenario. It can be a real event (such as, “a fault occurs in the grid”), or it is also possible to define scenarios that occur “periodically”.	Describes the state of the system before the scenario starts.	Describes the expected state of the system after the scenario is realized.

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4.2 Steps – Scenarios

For this scenario, all the steps performed shall be described going from start to end using simple verbs like – get, put, cancel, subscribe etc. Steps shall be numbered sequentially – 1, 2, 3 and so on. Further steps can be added to the table, if needed (number of steps are not limited).
Should the scenario require detailed descriptions of steps that are also used by other use cases, it should be considered creating a new "sub" use case, then referring to that "subroutine" in this scenario.

Scenario								
Scenario name :		*No. 1 - Reference scenario*						
Step No.	*Event*	*Name of process/ activity*	*Description of process/ activity*	*Service*	*Information producer (actor)*	*Information receiver (actor)*	*Information Exchanged (IDs)*	*Requirement, R-IDs*
	Event that triggers the activity. This triggering event can be an event, such as "a fault that occurs in the grid", or it may refer to an activity that occurs "periodically".	Label that would appear in a process diagram. Action verbs should be used when naming activity. EXAMPLE: "Fault occurs in the grid".	This describes what action takes place in this step. The focus should be less on the algorithms of the applications and more on the interactions and information flows between actors.	Identifies the nature of flow of information and the originator of the information (*).	Name of the actor that produces the information. When the activity is an internal process, the information producer is the actor that carries out the internal process. For instance, when the activity is an internal algorithm within an Intelligent Electronic Device (IED), then the information producer is the actor "Intelligent Electronic Device (IED)".	Name of the actor that receives the information. When the activity is an internal process, the information receiver is the same actor as the information producer.	Here the information can use a short ID referring to template section 5 for further details. Several information exchanged IDs can be listed, comma separated.	Refer to the identifiers (R-ID) of the detailed requirements that apply for each activity. These R-ID should be obtained from the BeFlexible Requirements List, which is based in the IEA PAS 62559 list of requirements/issues, and revised in the project. Refer to template Clause 7 "Definition of a list for requirements" for further details.

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(*) Available options are:

- CREATE means that an information object is to be created at the Producer.
- GET (this is the default value if none is populated) means that the Receiver requests information from the Producer (default).
- CHANGE means that information is to be updated. Producer updates the Receiver's information.
- DELETE means that information is to be deleted. Producer deletes information from the Receiver.
- CANCEL, CLOSE imply actions related to processes, such as the closure of a work order or the cancellation of a control request.
- EXECUTE is used when a complex transaction is being conveyed using a service, which potentially contains more than one verb.
- REPORT is used to represent transferral of unsolicited information or asynchronous information flows. Producer provides information to the Receiver.
- TIMER is used to represent a waiting period. When using the TIMER service, the Information Producer and Information Receiver fields shall refer to the same actor.
- REPEAT is used to indicate that a series of steps is repeated until a condition or trigger event. The condition is specified as the text in the "Event" column for this row or step. Following the word REPEAT, shall appear, in parenthesis, the first and last step numbers of the series to be repeated in the following form REPEAT(X-Y) where X is the first step and Y is the last step.

5 Information exchanged

These information objects are corresponding to the "Name of Information" of the "Information Exchanged" column referenced in the scenario steps in template section 4 "Step by Step Analysis". If appropriate, further requirements to the information objects can be added.

Information exchanged			
Information exchanged (ID)	***Name of information***	***Description of information exchanged***	***Requirement, R-IDs***
Refers to an identifier used in the field "Information Exchanged" of Table 4.2.	Is a unique ID which identifies the selected information in the context of the use case.	Brief description, in case a reference to existing data models/information classes should be added. Using existing canonical data models is recommended.	Can be used to define requirements referring to the information and not to the step as in the step by step analysis (see template section 6 below): EXAMPLE: Data protection class corresponding to this information object.

6 Requirements

A list of non-functional requirements was defined in BeFlexible (here) to provide guidelines on possible values that could be given to each type of requirement. However, other values not included in the list could be used if necessary.

Requirements		
Categories ID	**Category name for requirements**	**Category description**
Unique identifier for the category.	Name for the category of requirements.	Description of the requirement category.
Requirement R-ID	**Requirement name**	**Requirement description**
Unique identifier which identifies the	A name of the requirement.	Description of the requirement (this might be populated automatically from the repository, if the requirement has already been described in the external document before).

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requirement within its category and which can link the requirement to an external requirement document.		

7 Common Terms and Definitions

Should be defined in a common glossary for all use cases. Here relevant terms belonging to this use case are listed. Using a database repository for the glossary, the definitions might be filled automatically based on existing information.

Common Terms and Definitions	
Term	**Definition**

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7. Annex II – Consumer / Community-centric flexibility

7.1. SUC01.1 – DER sizing and economic evaluation of the LEC business model

1 Description of the use case

1.1 Name of the use case

ID	*Area / Domain(s)*	*Name of Use Case*
SUC1.1	Consumer/Community-centric flexibility	DER sizing and economic evaluation of the LEC business model

1.2 Version management

Version Management			
Version No.	*Date*	*Name of Author(s)*	*Changes*
0.1	14.07.2023	J. Villar, L. Rodrigues, D. Faria, J. Mello, R. Bessa	First draft version.
0.2	19.07.2023	J. Villar, L. Rodrigues, D. Faria, J. Mello, R. Bessa	Revision of short and complete description; added use case diagram; edited list of actors, step by step analysis of use case and information exchange.
0.3	29.09.2023	J. Villar, L. Rodrigues, D. Faria, J. Mello, K. Ganesan	Version to be reviewed.
1.0	26.11.2023	J. Villar, L. Rodrigues, D. Faria, J. Mello, K. Ganesan, R. Bessa	Final version.

1.3 Scope and objectives of use case

Scope and Objectives of Use Case	
Scope	Sizing of Distributed Energy Resources (DER) and economic performance and evaluation of Energy Communities (EC), including Renewable Energy communities (REC) and Citizen Energy Communities (CEC), under different Business Models (BM).
Objective(s)	1. Conduct sizing of EC DER 2. Economic evaluation of EC BM. 3. Contemplate different asset ownership models. 4. Estimate flexibility potential
Related business case(s)	BUC 01 – Planning and sizing of energy communities considering customer flexibility BUC 02 – Operation, energy sharing and flexibility boosting of local energy communities

1.4 Narrative of use case

Narrative of Use Case
Short description

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In this use case, the Energy Community Manager (EC Manager) will determine the optimal capacities of the DER to be installed in the EC considering typical (or measured) consumption profiles, availability of Renewable Energy Sources (RES), and costs of technologies (both capital and operational cost).

The EC Manager uses a Digital Platform (DP) that incorporates several microservices, including:

- Integration microservice
- Scenario preparation microservice
- DER sizing microservice

The DP main activities consist of:

- Data collection and curation
- EC structure collection
- Generation potential assessment
- DER sizing and flexibility potential
- EC BM economic evaluation

Complete description

Services from the DoA:

- Service 8: tools for optimal combination rapid instantiation of REC for aggregation (INESC TEC)

The main goal of this use case is the determination of the optimal capacities of DER to be installed in an EC. For that, typical (or measured) consumption profiles, availability of RES, price signals, and capital and operational costs of DER are considered.

The main actor of this use case is the EC Manager that manages its digital platform to determine the optimal capacities of the DER to be installed in the EC.

The required inputs include pre-installed DER specification (e.g., PV, EV chargers, BESS, HPWH, HVAC) and consumption/generation profiles, local RES potential expansion, costs of the technologies available (capital and operating expenses), DER, Consumers (EC Members), Consumers' opportunity costs, and environmental goals/constraints (carbon emissions target, sustainability goals).
Note that only a reduced set of DER and goals will be implemented.

1. Data collection

Acquire information about the planned EC structure, selected BM, historical consumption data from smart meters and local meteorological data. If available, besides metering data, submetering data can also be included.
DER characteristics and constraints are specified, and financial data are provided, including tariffs and opportunity costs, and operation and capital costs for each DER technology. Past energy prices can also be used.

Tools called by the step
Integration Microservice

2. Scenario preparation

Problems related to missing data are addressed by employing typical load profiles, public databases, or specific algorithms. Local meteorological data are used to estimate the production of the DER. The resulting data make up the scenario.

Tools called by the step
Scenario preparation microservice

3. DER sizing

The pre-defined EC structure and BM, DER characteristics, constraints, costs and energy prices and the calculated scenario data are used by the sizing microservice to optimize the capacities of the DER. Other factors that may affect cost-effectiveness of DER technologies are also accounted for (e.g., financial incentives, grants, or tax credits available for specific technologies).
Sizing depends on the physical configuration of the EC but also on the pre-chosen BM and the pre-defined objective for the EC. Several objectives can be defined by the EC Manager and are reflected on the sizing algorithm employed by the DER sizing microservice. These objectives can include economic goals (e.g., the

minimization of operation costs or the maximization of profits from energy sale) and/or environmental goals (e.g., minimizing CO_2 emissions), occasionally resulting in multi-objective optimization models. The available flexibility to be offered to the DSO and/or TSO for long-term congestion management is estimated. The outputs of the DER sizing include the size (amount and installed capacity) of each DER, optimal schedules, transacted energy and transaction prices, individual and collective investments, operation, and total costs and an estimation of the available flexibility in the EC.

Tools called by the step
DER sizing microservice

4. EC BM economic evaluation

At last, an economic evaluation of the EC is performed by calculating the KPI, which include electricity cost reduction, payback period and energy sharing ratio, that allow to compare different BM. Other KPI may also be considered.

Tools called by the step
DER sizing microservice

1.5 Use case conditions

Use case conditions
Assumptions
In terms of geographical scope, we will consider two possibilities: CEC do not bind to immediate vicinity (according to Recast Internal Electricity Market Directive); REC must be in the vicinity of renewable energy projects owned/developed by that community (according to Recast Renewable Energy Directive).
Prerequisites
• The initial potential structure of the EC must be known • Availability of smart meters or sub-metering in consumers premises or standard profiles • Data owner consent for data sharing in case personal data are used.

1.6 Further Information to the use case for classification / mapping

Classification Information
Relation to other use cases
BUC 01 – Planning and sizing of energy communities considering customer flexibility BUC 02 – Operation, energy sharing and flexibility boosting of local energy communities
Level of depth
System use case (SUC)
Prioritisation
To be demonstrated in Spain (Pilots 3.1).
Generic, regional or national relation
Generic
Nature of the use case
System use case for a local energy community. The temporal scope is long-term (planning).
Further keywords for classification
Local energy community, DER sizing, renewable energy community, citizen energy community, storage, asset sharing, renewable energy, local flexibility, long-term planning.

1.7 General Remarks

General Remarks

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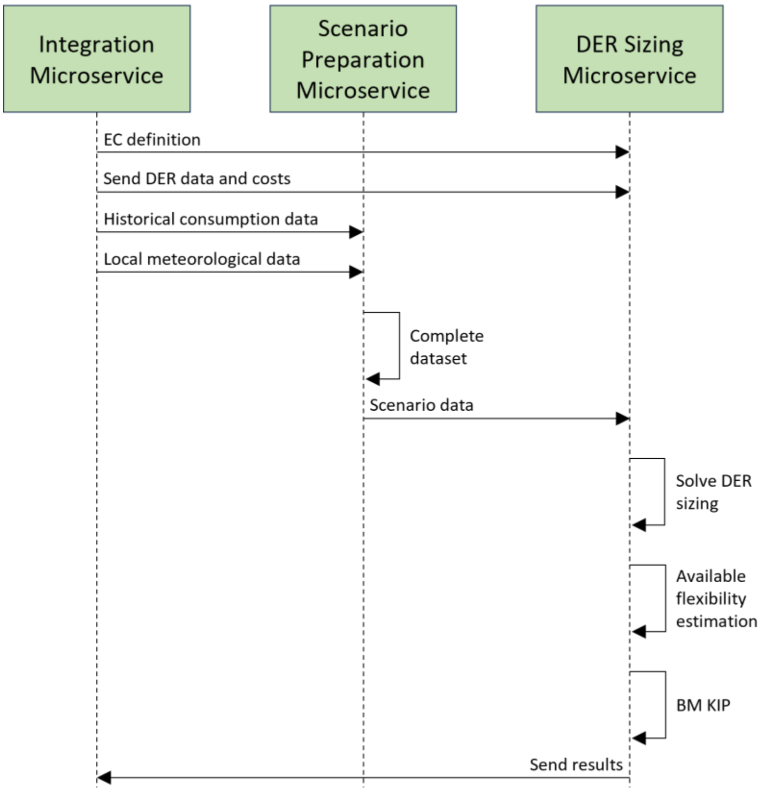
2 Diagrams of use case

Diagram(s) of use case
Sequence Diagram:



3 Technical details

3.1 Actors

Actors		
Actor Name	***Actor Type***	***Actor Description***
Integration Microservice	System	Integral part of the EC management platform, which is operated by Energy Community Manager. System used by the EC Manager to administer and operate the EC. Also provides communication with DER and DSO. Responsible for receiving inputs and for sending outputs of the EC platform.
Scenario Preparation Microservice	System	Analyses consumers' historical data and gathers missing data to complete datasets. Also collects information on local meteorological data used to forecast generation potential of DER.
DER Sizing Microservice	System	Performs the sizing of the DER considering different BM to compute schedules in representative long-term periods, using the forecast, historical data and the price and costs signals. From the schedules, computes the KPI to perform the economic analysis of the EC and its BM.
Consumer	Business Role (BRIDGE HEMRM)	A party that consumes electricity.

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Energy Community Manager (EC Manager)	Business Role (BeFlexible)	A party responsible for managing business activities within an energy community.

3.2 References

References						
No.	***References Type***	***Reference***	***Status***	***Impact on use case***	***Originator / organisation***	***Link***
1	Technical Report	Harmonized Electricity Market Role Model (HEMRM)	Public	Role Model	BRIDGE	https://energy.ec.europa.eu/system/files/2021-06/bridge_wg_regulation_eu_bridge_hemrm_report_2020-2021_0.pdf
2	Scientific paper	A. Moreno, J. Villar, C. S. Gouveia, J. Mello, and R. Rocha, "Investments and Governance Models for Renewable Energy Communities," in EEM 2022, Sep. 2022.	Published	Financing and energy sharing mechanisms	IEEE	https://doi.org/10.1109/EEM54602.2022.9921004
3	Deliverable	E-LAND, "D3.2 Functional and operational requirements", 2019	Published	Optimal sizing mechanism	EU	https://elandh2020.eu/wp-content/uploads/2020/09/D3.2-Functional-and-operational-requirements.pdf
4	Scientific paper	S. Bahramara, M. Parsa Moghaddam, and M.R. Haghifam, "Optimal planning of hybrid renewable energy systems using HOMER: A review" Renewable and Sustainable Energy Reviews, 2018	Published	DER sizing	Elsevier	https://doi.org/10.1016/j.rser.2016.05.039

4 Step by step analysis of use case

4.1 Overview of scenarios

Scenario conditions						
No.	**Scenario name**	**Scenario description**	**Primary actor**	**Triggering event**	**Pre-condition**	**Post-condition**

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1	DER sizing and economic evaluation of the BM	Determining the optimal installed capacities of DER in an EC and evaluating economic benefits	EC Management Platform	Request for sizing DER of EC and BM assessment	Consumption and generation profiles / time series available & tariff data	Results of EC optimal sizing and economic benefits of different BM

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4.2 Steps – Scenarios

Scenario								
Scenario name:		**No. 1 – DER sizing and economic evaluation of the BM**						
Step No.	Event	Name of process/ activity	Description of process/ activity	Service	Information producer (actor)	Information receiver (actor)	Information Exchanged (IDs)	Requirement, R-IDs
1	Occurs once	EC definition	Define EC structure and BM.	GET	Integration Microservice	DER Sizing Microservice	I-1, I-2, I-3, I-6, I-7, I-9, I-10, I-11	C-1, QoS-1, QoS-2, SEC-1, SEC-2, D-1, D-2, O-X, F-1, F-2
2	Occurs once	Send DER data and costs	Send DER technical characteristics, constraints, investments, operation and opportunity costs and energy prices.	GET	Integration Microservice	DER Sizing Microservice	I-4, I-5, I-8, I-11, I-14, I-17	C-1, QoS-1, QoS-2, SEC-1, SEC-2, D-1, D-2, O-X, F-3, F-4, F-5
3	Occurs once	Historical consumption data	Send historical consumption data (collected from energy meters within the EC).	GET	Integration Microservice	Scenario preparation microservice	I-11, I-12	C-1, C-2, QoS-1, QoS-2, SEC-1, SEC-2, D-1, D-2, D-3 O-X, F-6
4	Occurs once	Local meteorological data	Send available meteorological data from the geographical location of the EC.	GET	Integration Microservice	Scenario preparation microservice	I-13	C-1, QoS-1, QoS-2, SEC-1, SEC-2, D-1, D-2, F-7
5	Occurs once	Complete dataset	Analysis of the available data and missing data is completed with typical profiles and public databases.	EXECUTE	Scenario preparation microservice	Scenario preparation microservice		
6	Occurs once	Scenario data	Send complete data set.	GET	Scenario preparation microservice	DER Sizing Microservice	I-15, I-16	C-1, QoS-1, QoS-2, SEC-1, SEC-2, D-1, F-8, F-9
7	Occurs	Solve DER	Sizing problem is solved to find	EXECUTE	DER Sizing	DER Sizing		

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	once	sizing	the optimal installed capacity in the EC considering an optimal operation with perfect information		Microservice	Microservice		
8	Occurs once	Available flexibility estimation	From the results of the previous event, the available flexibility is estimated.	EXECUTE	DER Sizing Microservice	DER Sizing Microservice		
9	Occurs once	BM KPI	KPI associated with each BM are calculated	EXECUTE	DER Sizing Microservice	DER Sizing Microservice		
10	Occurs once	Send results	DER sizing results, schedules, transactions, total costs, estimated flexibility, and BM KPI are communicated	GET	DER Sizing Microservice	Integration Microservice	O-1, O-2, O-3, O-4, O-5	F-10

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5 Information exchanged

Information exchanged			
Information exchanged (ID)	***Name of information***	***Description of information exchanged***	***Requirement, R-IDs***
I-1	Community size	Minimum size of the community	F-1
I-2	Max distance	Maximum distance between member of the communities	F-1
I-3	% asset sharing	Percentages of asset sharing	O-X, F-1
I-4	DER technologies	Generation technologies and DER assets and capacity constraints	O-X, F-3
I-5	DER OPEX	Reference costs for technologies	F-4
I-6	Consumer ID	Consumers ID to consider	O-X, F-1
I-7	Community type	Type of community (REC /CEC)	O-X, F-1
I-8	Opportunity cost	Opportunity costs of the consumers (usually their full electricity tariffs)	O-X, F-4
I-9	Business model	Business model that determines the objective function to optimize (e.g., total energy costs minimization, profit of specific members maximization, self-consumption maximization)	O-X, F-2
I-10	Pricing mechanism	Pricing mechanism for the internal transactions and can be: 1) mid-market rate, 2) intermediate market rate, 3) based on the supply-demand ratio, 4) based on a post-delivery pool	O-X, F-1
I-11	Consent	Explicit consent for data use	O-X
I-12	Electrical energy consumption	Electrical energy consumption: past measurements or typical profile	O-X, F-6
I-13	Weather-based generation	Weather conditions or typical generation profiles of renewable generators	F-7
I-14	DER CAPEX	Investments costs of DER technologies	F-4
I-15	Consumption profile	Electrical energy consumption profile obtained by client type (LV, MT), contracted power and annual total electrical energy consumed or from data clustering algorithms	O-X, F-8
I-16	Simulated weather-based generation	Simulated generation obtained from software such as PVGIS	F-9
I-17	Public electricity tariffs	Tariffs published by the electricity retailers	F-5
O-1	DER size	Size of the DER assets to be installed	F-10
O-2	Schedules	Schedules of the flexible assets	F-10
O-3	Transactions	Energies transacted and transaction prices	F-10
O-4	Investments	Individual and collective investments, operation, and total costs	F-10
O-5	Energy flexibility	Upward and downward flexibility potential of the community in the long-term horizon	F-10

6 Requirements

Configuration Requirements		
Categories ID	**Category name for requirements**	**Category description**
C	Configuration	Reflect the typical, probable, or envisioned communication configurations that are

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		relevant to the use case step. These configuration issues include numbers of devices and/or systems, expected growth of the system over time, locations, distances, communication types, network bandwidth, existing protocols, etc.
Requirement R-ID	**Requirement name**	**Requirement description**
C-1	Data exchange methods	The exchange of data follows a peer-to-peer method.
C-2	Location of information producer	The information is produced and measured in domestic customer site.
C-3	Growth	Growth perspective in the number of participating devices, but not defined.

	Quality of Service Requirements	
Categories ID	**Category name for requirements**	**Category description**
QoS	Quality of Service	Address availability of the system, such as acceptable downtime, recovery, backup, rollback, etc. QoS issues also address accuracy and precision of data, the frequency of data exchanges, and the necessary flexibility for future changes.
Requirement R-ID	**Requirement name**	**Requirement description**
QoS-1	Availability of information flows	Requirements for the availability of information flow: Continuous availability not required but must be available at specific times or under specific conditions
QoS-2	Frequency of data exchanges	How frequently data is exchanged: Upon request

	Security Requirements	
Categories ID	**Category name for requirements**	**Category description**
Sec	Security	Assess how different security measures applied to different items can potentially interact and either leave security holes or make user interfaces very laborious and possibly unworkable. Security must not only protect against the very harmful but quite rare deliberate attacks, but also against the far more likely inadvertent mistakes, failures, and errors. At the same time, it is necessary to try to identify the requirements and the concerns for implementing security measures.
Requirement R-ID	**Requirement name**	**Requirement description**
SEC-1	Eavesdropping	Ensuring confidentiality, avoiding illegitimate use of data, and preventing unauthorized reading of data, is crucial
SEC-3	Authentication	Masquerade and/or spoofing: Ensuring that data comes from the stated source or goes to authenticated receiver is crucial

	Data Management Requirements	
Categories ID	**Category name for requirements**	**Category description**

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D	Data Management	Management of the data exchanges in each Use Case step and the management of data at either end if that management is impacted by data exchanges. It should not address database design but should concentrate on the user requirements for the interfaces to databases and other data handling applications.
Requirement R-ID	**Requirement name**	**Requirement description**
D-1	Type of source data	How the source data were acquired: source data was previously automatically stored in a database
D-2	Validation of data exchanges	Requirements for the validity of data: Data can be assumed as valid (or validity checking is handled elsewhere)
D-3	Data format requirements	Data format is a choice of smart-meters owners, most of the time DSO.

Other Requirements		
Categories ID	**Category name for requirements**	**Category description**
O	Regulatory obligation related to privacy	2016/679 (General Data Protection Regulation)
Requirement R-ID	**Requirement name**	**Requirement description**
O-1	Data processing consent	Personal data may not be processed unless there is at least one legal basis to do so.
O-2	Data retention policy	Data retention policy outlines the specific sensitive time period data can be retained, plus how it will be disposed of when the time to do so comes.
O-3	Right to access, rectify, erasure, restriction	The data subject shall have the right to obtain from the controller without undue delay the access/rectification/erasure/restriction of inaccurate personal data concerning him or her.
O-4	Data transfer consent	Personal data may not be transferred to a third-party if the data subject did not agree and the third party provide appropriate safeguard.
O-X	All constraints also apply.	All requirements in this category.

Functional Requirements		
Categories ID	**Category name for requirements**	**Category description**
F	Functional	Essential functionalities that build the core concept of the service/SUC.
Requirement R-ID	**Requirement name**	**Requirement description**
F-1	Access to the EC characterization	Request the main characteristics of the EC, including its type (REC or CEC), size, maximum distance between EC Members, asset sharing, and pricing for transactions inside the EC
F-2	Access to the BM definition	Request information on the BM of the EC
F-3	Identification and characterization of Consumer assets	Request information on Consumer flexible assets, including technical specifications
F-4	Costs related to each DER technology	Collect CAPEX and OPEX of different DER technologies, and determine opportunity costs

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F-5	Collect electricity prices offered by retailers	Get electricity prices from the regulated market and from retailers in the deregulated/free market
F-6	Consumer historic metering data is made available	Request the consumers' consumption data
F-7	Information on weather-based generation is collected	Request weather conditions or typical generation profiles of renewable generators
F-8	Complete incomplete consumption profiles	Complete consumption profiles where data is missing
F-9	Forecast weather-based generation	Perform forecasts of weather-based DER generation
F-10	Perform DER sizing	The EC Manager performs the DER sizing to determine the size of each DER to be installed, the corresponding optimal schedules, energy transactions, transaction prices, investments and costs and potential flexibility of the EC

7 Common Terms and Definitions

Common Terms and Definitions	
Term	**Definition**
Renewable Energy Community (REC)	A legal entity: (a) which, in accordance with the applicable national law, is based on open and voluntary participation, is autonomous, and is effectively controlled by shareholders or members that are located in the proximity of the renewable energy projects that are owned and developed by that legal entity. (b) the shareholders or members of which are natural persons, SMEs or local authorities, including municipalities. (c) the primary purpose of which is to provide environmental, economic or social community benefits for its shareholders or members or for the local areas where it operates, rather than financial profits.
Citizen Energy Community (CEC)	A legal entity that: (a) is based on voluntary and open participation and is effectively controlled by members or shareholders that are natural persons, local authorities, including municipalities, or small enterprises. (b) has for its primary purpose to provide environmental, economic or social community benefits to its members or shareholders or to the local areas where it operates rather than to generate financial profits. (c) may engage in generation, including from renewable sources, distribution, supply, consumption, aggregation, energy storage, energy efficiency services or charging services for electric vehicles or provide other energy services to its members or shareholders.
Mid-market rate	Pricing mechanism based on computing the average between the price of buying price from the retailer and the price of selling energy back to the retailer. When different community members have different retailers and tariffs, we propose to use the maximum selling price and minimum buying price. It is necessary to determine, for each consumer, its net balance, to know if it is consuming, therefore buying, or generating, therefore selling energy.
Intermediate market rate	Based on the mid-market rate, but instead of a simple average, we propose a weighted average to allow giving more weight to the buying or to the selling prices. It is again necessary to determine, for each consumer, its net balance, to know if it is consuming, therefore buying, or generating, therefore selling energy.
Supply-demand ration-based price	This procedure provides a price probably closer to a real market outcome, since it takes into account the amount of supply available compared to the existing demand, providing a better economic signal. It is again necessary to determine, for each consumer, its net balance, to know if it is consuming, therefore buying and contributing to the aggregated demand, or generating, therefore selling energy and contributing to the aggregated supply.
Post-delivery pool-based price	This price is the result of simulating a post-delivery pool, post-delivery local markets. In the simplest case, the simulation consists in crossing the aggregated supply and demand curves. To do so, for each consumer, its net

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	balance is computed, to know if it is consuming, therefore buying energy and producing a buying bid at its opportunity cost (usually the integral tariff of buying energy from its retailer), or generating, therefore selling energy and producing a selling bid at its opportunity cost (usually the integral tariff of selling energy to its retailer). With these bids, the aggregated supply and demand curves of the pool can be computed. If there are no flexible resources, the price is computed by crossing these curves. In case there are flexible resources whose dispatch depends on the transactions price, an iterative procedure can be used to estimate the schedule, determining again the consuming or generating behaviour of the consumers, re-estimating the pool price, until prices and schedules convergence. Alternatively, it may be possible to maximize the welfare so as to determine, in one step optimization problem, the price and the flexible resources schedules.

7.2. SUC02.1 – Operation of the energy community

1 Description of the use case

1.1 Name of the use case

ID	*Area / Domain(s)*	*Name of Use Case*
SUC 2.1	Consumer / Community-centric flexibility	Operation of the energy community

1.2 Version management

Version Management			
Version No.	*Date*	*Name of Author(s)*	*Changes*
0.1	19.07.2023	J. Villar, L. Rodrigues, D. Faria, J. Mello	First draft version.
0.2	07.09.2023	J. Villar, L. Rodrigues, D. Faria, J. Mello	Added Requirements.
0.3	29.09.2023	J. Villar, L. Rodrigues, D. Faria, J. Mello	Version to be reviewed.
1.0	26.11.2023	J. Villar, L. Rodrigues, D. Faria, J. Mello	Final version

1.3 Scope and objectives of use case

Scope and Objectives of Use Case	
Scope	This SUC covers the creation and operation of Energy Communities (EC) to share energy among the members and to provide flexibility services to third parties. Operation of energy communities can be centralized or decentralized. In the centralized mode, it involves a central energy management system responsible for the computation of the schedules of the flexible assets and for sharing the collective benefits according to market principles. In the decentralized market-based mode, decisions are totally or partially decentralized and based on the market agents' behaviours.
Objective(s)	Energy community operation: 1. Under a central energy management system. 2. Under a decentralized market-based approach. Flexibility provision under a central energy management system.

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Related business case(s)	BUC 01 – Planning and sizing of energy communities considering customer flexibility BUC 02 – Operation, energy sharing and flexibility boosting of local energy communities

1.4 Narrative of use case

Narrative of Use Case
Short description
This use case includes the EC management platform and the microservices necessary to operate the EC: • the integration microservice • the energy management microservice • the transactions microservice • the settlement microservice. These systems are needed to operate the EC by sharing energy among its members and managing its flexible assets, and to integrate the EC in electricity and flexibility markets. The presentation of the methodology behind the transactions' calculations, benefits sharing, and operation of flexible assets are the main objectives of this system use case.
Complete description
Services from the DoA: - Service 7: P2P blockchain based platform for energy trading (INESC TEC) The main goal of this use case is to detail and explain the main steps of Energy Communities' operation. For that, it is essential to consider the EC structural information and selected business model, the operation methodology applied, price signals, DER availability and costs and finally the DSO needs. The main role for this use case is the EC Manager, which is responsible for the management and operation of EC. **1.1. Structural definition of the EC** Acquire information about EC Manager and EC Members. Define and upload the EC structure to the EC platform and configure the selected Business Model (BM). Data describing the EC Members, resources, ownerships, and tariffs are saved in the EC platform database. To complete the EC definition, the EC Manager defines the rules and operation mode that should comply with the country regulation and be approved by the EC Members. Therefore, this step defines the interactions among the EC Members and the methodology for the energy and collective benefits sharing. ***Tools called by the step***: EC management platform; Integration microservice **1.2. Energy management, transactions and pricing** In the case where flexibility provision exists in the BM, there is the need to acquire metered or forecasted energy data from the EC Members smart meters (DSO or internal meters), and get flexibility needs from DSO systems. Either from the information provided by the energy management microservice or from a market-based approach, the transactions are computed with the metered and forecasted data and the DSO flexibility by the transactions microservice (see Figure). For the case of the energy management microservice, this system has the capability to obtain the optimal schedules of the assets and the internal transactions. In the case of a market-based approach, the transactions come from the internal market clearing made by the transaction microservice. In the case of flexibility provision, the energy management microservice considers these needs to determine the schedules of the flexible assets, considering a baseline from a baseline methodology previously agreed with the DSO, which is used by the DSO to verify the flexibility provision. Finally, the dynamic allocation coefficients (AC) that represent the energy sharing inside the community are computed by the settlement microservice of the EC platform and provided to the DSO systems. This information is validated by the DSO, which returns the final energy allocated, supplied, surplus and self-consumed for each of the members, and provides this information also to the corresponding retailers.

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Tools called by the step
EC management platform Integration, transactions, energy management and settlement microservices

1.3. Settlement

With the information supplied by the DSO, after the validation of the dynamic AC, the settlement microservice computes the financial compensations and provides the settlement information (energy allocated, supplied, surplus and self-consumed) to the community members, considering the transactions for energy and flexibility and the corresponding prices, securing fair compensations to each one of the members (see Figure).

Tools called by the step
EC management platform Integration, settlement microservice

1.4. KPI computation

The EC management platform computes and shows indicators for the individual or collective performance of the community to EC Manager and EC Members, after the settlement phase.
Indicators and information to validate the whole process can be accessed through the interface of the EC management platform.

Tools called by the step
EC management platform Integration microservice

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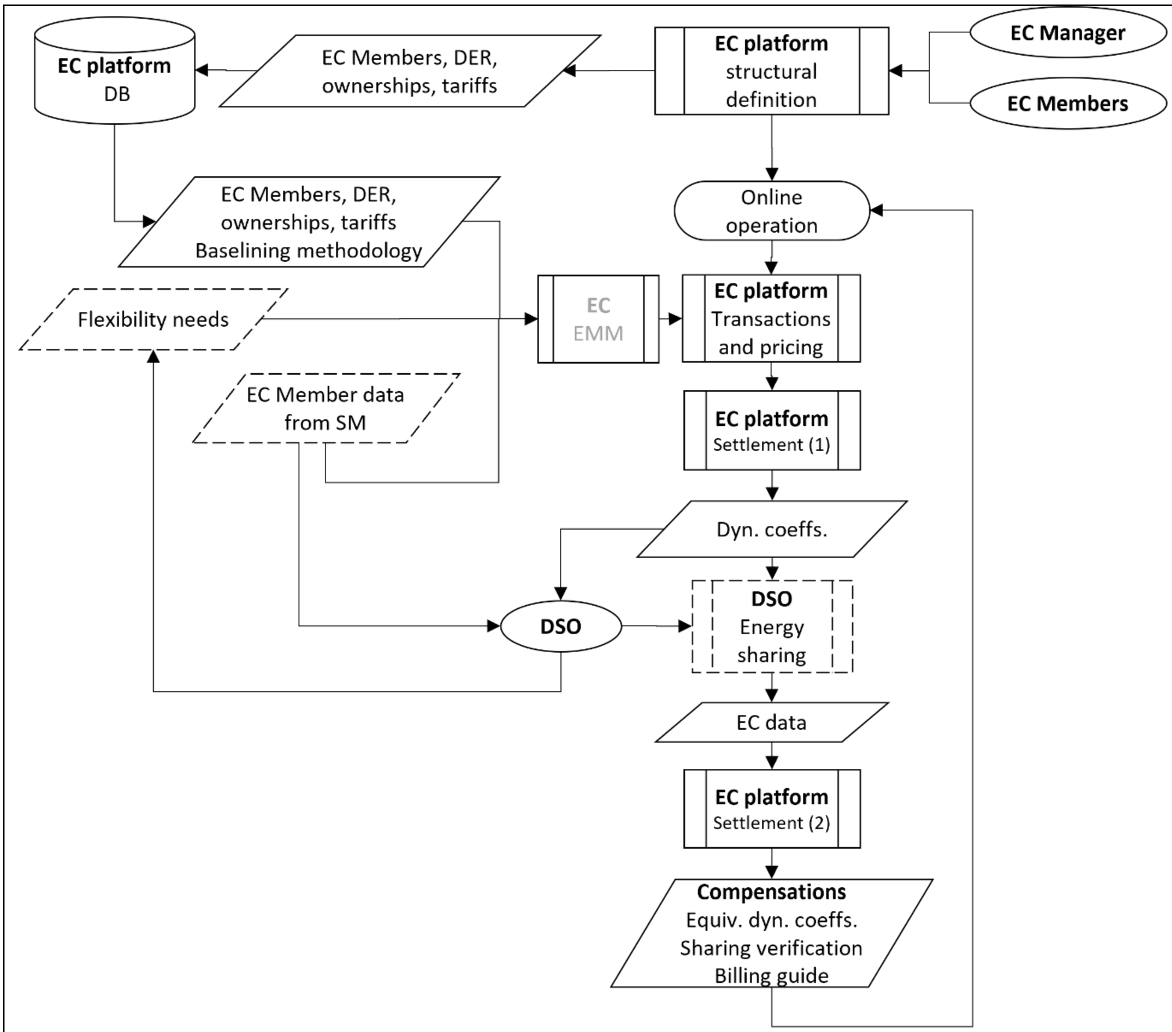

Figure 1: definition and operation of an energy community

The provision of flexibility is computed by the energy management microservice, and results from the aggregated available flexibility of the DER assets and the flexibility needs from the DSO.

The energy management microservice is responsible for computing the flexibility according to the DSO or FMO requirements, depending on the flexibility market specifications and the market platform being used. At this level, the EC offers flexibility to the DSO/FMO considering the aggregated set of flexible assets of the EC members. The optimal offer is calculated based on EC structure, DER forecasts/historical data and price signals. This dispatch considers all opportunity costs and the expected flexibility price, so that the EC Members are compensated for the flexibility delivered in comparison to a non-flexibility scenario, following a centralized way. These data are provided to the energy management microservice which, based on the baseline methodology previously established, computes the DER schedules and consequently a baseline to DSO or FMO. This offer can be the energy offered at specific hours in case the DSO/FMO buying prices are provided. In case no prices are provided, it would assess the feasibility of computing a supply curve to offer different quantities at different prices. It is assumed that flexibility can be activated or reserved the day before according to an agreed baseline methodology between all parties. Knowing the EC availability, after an analysis of grid constraints, DSO provide its flexibility needs to the EC platform or using an FMO as an intermediary, via integration microservice, which will forward that information to the energy management microservice. At this moment, the energy management microservice is responsible for another DER schedule calculation, but this time considering the DSO/FMO flexibility requirements. The new DER schedule is returned to the integration microservice, now with the flexibility that can be provided by the EC, and this information is forwarded to the DSO/FMO.

Prior to the delivery period, the DSO/FMO can activate flexibility, according to the DER schedule provided before, via integration microservice. The energy management microservice sends the activation signals and setpoints to the flexible assets that were chosen to provide flexibility in that session. The delivered flexibility is verified by the DSO/FMO according to the baseline defined previously. To prepare the energy bids, the DER needs to know how much flexibility is necessary for the session, information that is provided by the DSO measurements. DER energy

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bids are provided to the transaction microservice, which is responsible to clearing the bids and forwarding the transactions results to the settlement microservice. DER may trade their final energy positions on the local energy post-delivery market. However, the activated flexibility assets must compensate the EC aggregator for any delivery difference from the commitment. Finally, to compensate the assets inside the EC that provided flexibility to DSO, settlement microservice, knowing the settlement results, calculate EC billing for each DER. The settlement microservice computes the allocation coefficients for the DSO, which is responsible for calculating the supplied, self-consumed, and surplus energies. After a validation of AC and the calculation of supplied, self-consumed and surplus energies, DSO provides those results to the settlement microservice. After a communication between settlement and the integration microservice, a billing guide is provided to retailers, aggregators and energy community information systems or billing systems. To evaluate the total EC performance and individually, by EC member, the EC management platform could provide some KPIs and metrics, through the respective interface.

1.5 Use case conditions

Use case conditions
Assumptions

• Smart meters acquiring DER data
  • DSO requiring flexibility from EC
  • EC availability to provide flexibility
  • Assuming the regulation allows dynamic coefficients as in Spain or Portugal

Prerequisites
• EC platform continuously operating • Smart meters installed for DER • Connection between EC management platform and DSO system • Microservices communicating with EC management platform • SCADA systems to measure grid data • Congestion analysis module to evaluate the DSO needs • Common baseline methodology agreed between DSO, EC, and the EC Members to compute delivered flexibility • Billing platform existence

1.6 Further Information to the use case for classification / mapping

Classification Information
Relation to other use cases
BUC 02 – Operation, energy sharing and flexibility boosting of local energy communities
Level of depth
System use case (SUC)
Prioritisation
To be demonstrated in Spain (pilots 3.1)
Generic, regional or national relation
Generic
Nature of the use case
Technical/system use case
Further keywords for classification
Energy community operation, renewable energy, flexibility provision, EC management platform

1.7 General Remarks

General Remarks

2 Diagrams of use case

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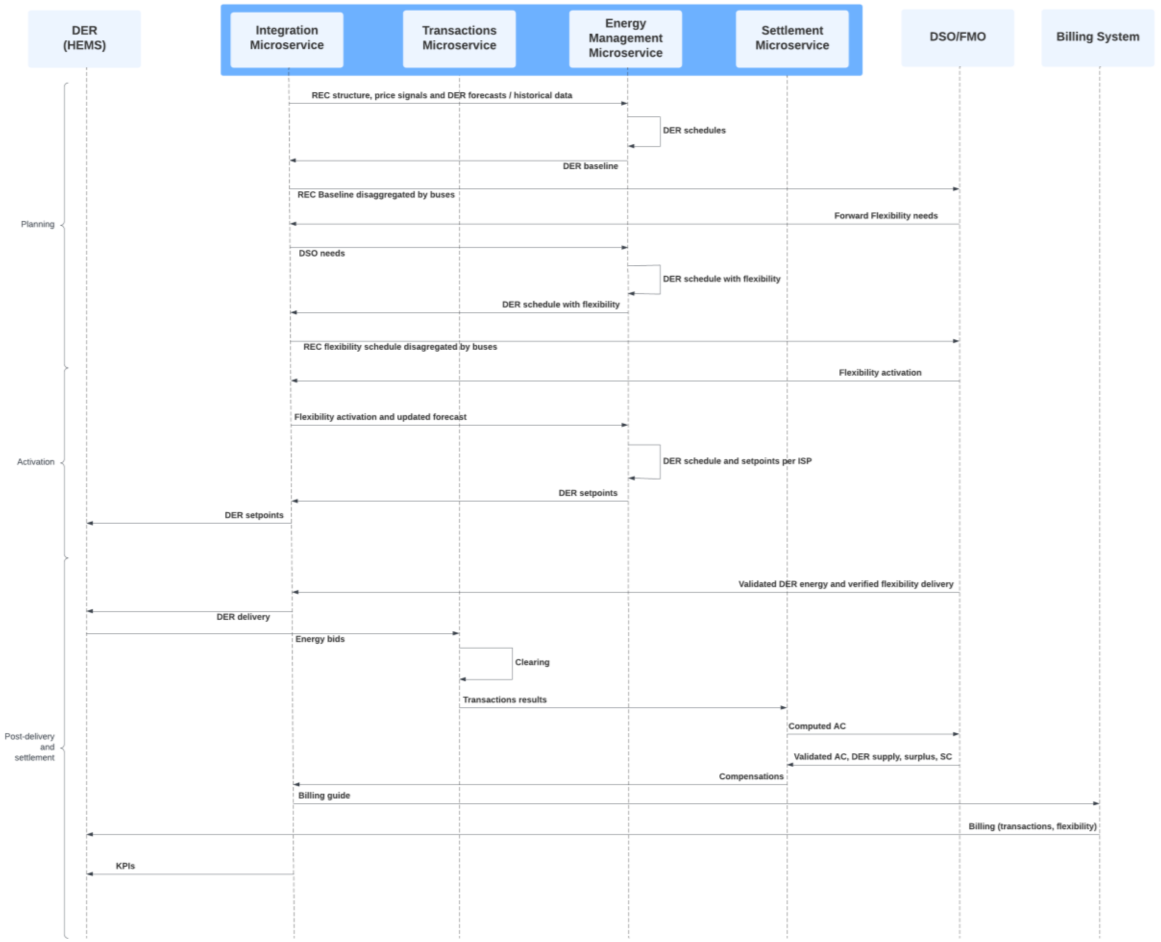
Diagram(s) of use case

Sequence Diagram



Note: in this diagram the DSO and FMO are grouped in the same box because, in this case, the DSO always interacts with the EC Manager through the FMO

3 Technical details

3.1 Actors

Actors		
Actor Name	***Actor Type***	***Actor Description***
Integration Microservice	System	Integral part of the EC management platform, which is operated by Energy Community Manager. System used by the EC Manager to administer and operate the EC. Also provides communication with DER and DSO. Responsible for receiving inputs and for sending outputs of the EC platform.
Energy Management Microservice	System	Integral part of the EC management platform, which is operated by EC Manager. Microservice which is responsible for EC energy management and computing the flexibility. Receives the DSO needs and DER forecasts to determine the DER schedules and provide operation setpoints to them.
Transactions Microservice	System	Integral part of the EC management platform, which is operated by Energy Community Manager.

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		Receives energy bids from DER and operates the energy market clearing. Responsible by the energy transactions inside the EC and provide that information to DER assets.
Settlement Microservice	System	Integral part of the EC management platform, which is operated by EC Manager. Responsible for compute the allocation coefficients and receive the results validation from DSO. This microservice provides the fair benefits sharing according to market principles.
DSO/FMO System	System	System responsible for the security of supply and reliability of the distribution network. It continuously monitors the grid to detect potential issues and, whenever necessary, it uses multiple resources to solve such problems, including network reconfiguration and/or requesting assistance from market operators or directly from contracted customers. Also, responsible to communicate the flexibility needs to the EC management platform. This system can be operated by DSO or FMO, depending on the flexibility market specification, if the DSO negotiate directly the flexibility required or if FMO acts like an intermediary. In this SUC the DSO is the main procurer of flexibility.
Billing System	System	Responsible to provide monthly bills for EC members. The billing methodology is composed by transactions and flexibility delivery. System operated by the billing agent.
DER (HEMS)	System	System responsible for managing the operation of DER, receiving setpoints from energy management microservice and the accorded amount of flexibility delivery. Also, must communicate the flexibility bids. This system is accessible for prosumers (EC members).
Energy Community Manager (EC Manager)	Business Role (BeFlexible role model)	Responsible for managing business activities within an Energy Community. In this BUC the ECM is rather and actor that also performs the role of aggregator.
Prosumer	Business Role (BeFlexible role model, BRIDGE HEMRM)	The Prosumer is a Consumer who can also produce electricity. In BeFlexible role model (T1.3) it is assumed that a prosumer also adopts an active role in the energy chain, by, for example, be willing to joint self-consumption structures or provide flexibility (sometimes Flexumer is also used). The EC members are assumed to be prosumers.
Billing Agent	Business Role (BRIDGE HEMRM)	Responsible for invoicing a concerned party. Not explicitly considered, the billing agent would be responsible for the final billing to the EC members.

3.2 References

References						
No.	***References Type***	***Reference***	***Status***	***Impact on use case***	***Originator / organisation***	***Link***
1	Technical Report	Harmonized Electricity Market Role Model (HEMRM)	Public	Role Model	BRIDGE	https://energy.ec.europa.eu/system/files/2021-06/bridge_wg_regulation_eu_bridge_hemrm_repo

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4 Step by step analysis of use case

4.1 Overview of scenarios

Scenario conditions						
No.	**Scenario name**	**Scenario description**	**Primary actor**	**Triggering event**	**Pre-condition**	**Post-condition**
1	EC centralized operation	Based on a centralized optimization to determine the schedules of the flexible assets, the energy shared internally, and the flexibility provided	Energy Community Manager	Occurs periodically	Structural configuration of the energy community.	Optimal schedules of the assets, billing guide for internal settlement, performance indicators.
2	EC market-based operation	Based on market approaches (such as post-delivery pool).	Energy Community Manager	Occurs periodically	Structural configuration of the energy community.	Optimal schedules of the assets, billing guide for internal settlement, performance indicators.

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4.2 Steps – Scenarios

Scenario								
Scenario name:		*No. 1 – EC centralized operation*						
Step No.	*Event*	*Name of process/ activity*	*Description of process/ activity*	*Service*	*Information producer (actor)*	*Information receiver (actor)*	*Information Exchanged (IDs)*	*Requirement, R-IDs*
1.1	Occurs once	EC definition	Access the microservice, register, and define and upload the energy community structure (members, assets, assets ownerships, grid usage, retail selling and buying tariffs, grid tariffs for self-consumption, etc) and configure the business model selected (operation mode and sharing mechanism, share assets operation rules, community objective, etc).	CREATE	DER (HEMS)	energy management microservice	I-1, I-2, I-3, I-4, I-5, I-6, I-7, I-8, I-9, I-12	F-1, F-2, F-3, F-5 C-2 D-1, D-2 O-X QoS-1, QoS-2 Sec-1, Sec-2
1.2	Occurs periodically (daily)	Get Operation Data	Receive price signals and DER forecasts	GET	DER (HEMS)	energy management microservice	I-10, I-11, I-12	F-4, F-6, F-7, F-8, F-9 D-1, D-2 O-X QoS-1, QoS-2 Sec-1, Sec-2
1.3	Occurs periodically (daily)	Get Baseline	Get DER baseline calculated by the energy management microservice	CREATE	energy management microservice	Integration microservice	ScheduleID	F-10 O-X Sec-1, Sec-2
1.4	Occurs periodically (daily)	Share DSO flexibility needs	Communication of DSO needs to the platform	GET	DSO	energy management microservice	DSOFlexID	F-11 O-X Sec-1, Sec-2
1.5	Occurs periodically (daily)	Get Baseline	Get DER baseline calculated by the energy management microservice, now with the flexibility needs	CREATE	energy management microservice	DSO	ScheduleID DSOFlexID	F10, F-11 D-1 O-X Sec-1, Sec-2
1.6	Occurs periodically (daily)	Flexibility activation	Send flexibility activation signal	GET	DSO	energy management microservice	ScheduleID	F-10 D-1, D-2 O-X Sec-1, Sec-2

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1.7	Occurs periodically (daily)	Get Schedule	Computation and communication of DER schedule and setpoints per ISP	CREATE	energy management microservice	DER (HEMS)	ScheduleID	F-10 C-1 D-1, D-2 O-X Sec-1, Sec-2
1.8	Occurs periodically (daily)	Verification	DER energy validation and flexibility delivery verification according with the baseline defined	GET	DSO	DER (HEMS)	SM-1, SM-2, SM-3, SM-4, SM-5, SM-6, SM-7, SM-8	F-12 C-1 D-1, D-2 O-X QoS-2 Sec-1, Sec-2
1.9	Occurs periodically (daily)	Share energy bids	Provide energy bids from each DER	GET	DER (HEMS)	Transactions microservice	Bid-1, Bid-2	F-13 O-X QoS-2 Sec-1, Sec-2
1.10	Occurs periodically (daily)	Get transactions	Compute bids clearing and optimize transactions and flexible asset schedules and communicate the transactions results to settlement	CREATE	Transactions microservice	Settlement microservice	TransactionID	F-10, F-13 O-X Sec-1, Sec-2
1.11	Occurs periodically (daily)	Share AC and flexibility bids with DSO	Provide allocation coefficients (AC) and flexibility bids to DSO	CREATE	Settlement microservice	DSO	ACFlexID	O-X Sec-1, Sec-2
1.12	Occurs periodically (daily)	Validate AC	Validate AC for the calculation of DER supply, surplus and self-consumption	CREATE	DSO	Settlement microservice	Settl-1, Settl-2, Settl-3, Settl-4	F-14 O-X Sec-1, Sec-2
1.13	Occurs periodically (daily)	Share internal settlement with members	Compute the financial compensations (settlement) among the community members	CREATE	Settlement microservice	EC Management Platform	Settl-1, Settl-2, Settl-3, Settl-4	F-14 D-2 O-X Sec-1, Sec-2
1.14	Occurs periodically (daily)	Share billing guide	Compute billing guide based on the compensations	CREATE	EC Management Platform	Billing System	Settl-1, Settl-2, Settl-3, Settl-4	F-14 O-X QoS-2 Sec-1, Sec-2
1.15	Occurs periodically (monthly)	Share final billing	Provide final billing to DER	GET	Billing System	DER (HEMS)	Settl-1, Settl-2, Settl-3, Settl-4	F-14 D-1, D-2 O-X QoS-2 Sec-1, Sec-2

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1.16	Prosumers request	Share performance indicators	Provide indicators to show the individual and community performances.	CREATE	EC Management Platform	Prosumers	O-1, O-2, O-3, O-4, O-5, O-6, O-7	F-15 D-1, D-2 O-X QoS-1 Sec-1, Sec-2

Scenario								
Scenario name:		***No. 2 – EC market-based operation***						
Step No.	***Event***	***Name of process/ activity***	***Description of process/ activity***	***Service***	***Information producer (actor)***	***Information receiver (actor)***	***Information Exchanged (IDs)***	***Requirement, R-IDs***
2.1	Occurs periodically (daily)	EC definition	Access the microservice, register, and define and upload the energy community structure (members, assets, assets ownerships, grid usage, retail selling and buying tariffs, grid tariffs for self-consumption, etc) and configure the business model selected (operation mode and sharing mechanism, share assets operation rules, community objective, etc).	CREATE	DER (HEMS)	Transactions microservice	I-1, I-2, I-3, I-4, I-5, I-6, I-7, I-8, I-9	F-1, F-2, F-3, F-5 C-2 D-1, D-2 O-X QoS-1, QoS-2 Sec-1, Sec-2
2.2	Occurs periodically (daily)	Get Operation Data	Receive price signals and DER forecasts	GET	DER (HEMS)	Transactions microservice	I-10, I-11	F-4, F-6, F-7, F-8, F-9 D-1, D-2 O-X QoS-1, QoS-2 Sec-1, Sec-2
2.3	Occurs periodically (daily)	Get transactions	Compute internal market clearing, determine market-based transactions and communicate it to settlement	CREATE	Transactions microservice	Settlement microservice	TransactionID	F-10, F-13 O-X Sec-1, Sec-2
2.4	Occurs periodically (daily)	Share AC with DSO	Provide allocation coefficients (AC) to DSO	CREATE	Settlement microservice	DSO	ACFlexID	O-X Sec-1, Sec-2

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2.5	Occurs periodically (daily)	Validate AC	Validate AC for the calculation of DER supply, surplus and self-consumption	CREATE	DSO	Settlement microservice	Settl-1, Settl-2, Settl-3, Settl-4	F-14 O-X Sec-1, Sec-2
2.6	Occurs periodically (daily)	Share internal settlement with members	Compute the financial compensations (settlement) among the community members	CREATE	Settlement microservice	EC Management Platform	Settl-1, Settl-2, Settl-3, Settl-4	F-14 D-2 O-X Sec-1, Sec-2
2.7	Occurs periodically (daily)	Share billing guide	Compute billing guide based on the compensations	CREATE	EC Management Platform	Billing System	Settl-1, Settl-2, Settl-3, Settl-4	F-14 O-X QoS-2 Sec-1, Sec-2
2.8	Occurs periodically (monthly)	Share final billing	Provide final billing to DER	GET	Billing System	DER (HEMS)	Settl-1, Settl-2, Settl-3, Settl-4	F-14 D-1, D-2 O-X QoS-2 Sec-1, Sec-2
2.9	Prosumers request	Share performance indicators	Provide indicators to show the individual and community performances.	CREATE	EC Management Platform	Prosumers	O-1, O-2, O-3, O-4, O-5, O-6, O-7	F-15 D-1, D-2 O-X QoS-1 Sec-1, Sec-2

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5 Information exchanged

Information exchanged			
Information exchanged (ID)	***Name of information***	***Description of information exchanged***	***Requirement, R-IDs***
I-1	Community size	Minimum size of the community	F-1
I-2	EC member number	Unique key that characterizes the EC member	F-1
I-3	EC DER number	Unique key that characterizes the EC resource	F-1
I-4	DER technologies	Generation technologies and DER assets and capacity constraints	F-3
I-5	DER Ownership	DER ownership that can be 100% to only one EC member or a sharing between multiple EC members	F-1
I-6	Community type	Type of community (REC/CEC)	F-1
I-7	Community Tariffs	Retail selling and buying tariffs defined for the EC Grid tariffs for self-consumption Grid tariffs for electricity buying	F-5
I-8	Business model	Business model that determines the objective function to optimize (e.g., total energy costs minimization, profit of specific members maximization, self-consumption maximization)	F-2
I-9	Pricing mechanism	Pricing mechanism for the internal transactions and can be: 1) mid-market rate, 2) intermediate market rate, 3) based on the supply-demand ratio, 4) based on a post-delivery pool	F-1
I-10	DER consumption and generation forecasts	A forecast of the DER electricity consumption and generation based on historical and meteorological data	F-8 F-9
I-11	DER price signals	Initial approach for the DER bids that will be submitted in the future	F-4 F-9
I-12	Consent	Explicit consent for data use	O-X
ScheduleID	DER schedule and setpoints	Consumption or generation levels that DER should be regulated to provide the necessary amount of flexibility and respective time-window	F-10
DSOFlexID	DSO Flexibility needs	Amount of flexibility that DSO needs in that session, after realizing a congestion analysis	F-11
SM-1	Generation measured at smart meters	Generation measured by SM for the day whose operation is being addressed with the resolution corresponding to the regulation applicable. Part of DSO measurements used for verification purposes.	F-12 O-X

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SM-2	Consumption measured at smart meters	Consumption measured by SM for the day whose operation is being addressed with the resolution corresponding to the regulation applicable. Part of DSO measurements used for verification purposes.	F-12 O-X
SM-3	Grid injection measured at smart meters	Injection of electricity on the grid by the DER and measured by SM. Part of DSO measurements used for verification purposes.	F-12 O-X
SM-4	Storage injection measured at smart meters	Injection of electricity on storage system by the DER and measured by SM. Part of DSO measurements used for verification purposes.	F-12 O-X
SM-5	Energy shared measured at smart meters	Energy shared inside EC by DER and measured by SM. Part of DSO measurements used for verification purposes.	F-12 O-X
SM-6	Imputed energy measured at smart meters	Imputed energy by DER and measured by SM. Part of DSO measurements used for verification purposes.	F-12 O-X
SM-7	Energy surplus measured at smart meters	Energy surplus by DER and measured by SM. Part of DSO measurements used for verification purposes.	F-12 O-X
SM-8	Self-consumed energy measured at smart meters	Self-consumption energy by DER and measured by SM. Part of DSO measurements used for verification purposes.	F-12 O-X
Bid-1	Flexibility bid volume	Volume associated to the flexibility bid.	F-13
Bid-2	Flexibility bid price	Price associated to the flexibility bid.	F-13
TransactionID	EC transactions between members	Energy sharing inside the EC and resulting transactions	O-X
ACFlexID	Allocation coefficients and flexibility bids	Allocation coefficients that specify how the energy is shared withing the EC and flexibility bids to provide the DSO flexibility requirements	O-X
Settl-1	Compensations for supply	Compensations to DER for the energy provided by retailers (€). Part of settlement results.	F-14 O-X
Settl-2	Compensation for surplus	Compensations to DER for sell energy to retailers (€). Part of settlement results.	F-14 O-X
Settl-3	Compensation for self-consumption	Self-consumption tariffs cost (€). Part of settlement results.	F-14 O-X
Settl-4	Compensation for internal transactions.	Compensations to DER for the EC internal transactions. Part of settlement results.	F-14 O-X
O-1	Energy savings	Indicator that represents the EC member energy savings for participating in a EC. Part of indicators.	F-15
O-2	Money savings	Indicator that represents the EC member money savings for participating in a EC. Part of indicators.	F-15

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O-3	Shared energy	Indicator that represents the amount of energy shared by an EC member with other members. Part of indicators.	F-15
O-4	Emissions reduction	Indicator that represents the reduction on emissions by an EC member for participating in a EC. Part of indicators.	F-15
O-5	Money savings for provide flexibility	Indicator that represents the EC member money savings for provide flexibility to the grid. Part of indicators.	F-15
O-6	Average buying rate	Indicator that represents the average price of buying the energy within the EC. Part of indicators.	F-15
O-7	EC member self-sufficiency	Indicator that represents the energy consumed by an EC member that comes from the EC as a percentage of the total energy consumption. Part of indicators.	F-15

6 Requirements

Configuration Requirements		
Categories ID	**Category name for requirements**	**Category description**
C	Configuration	Reflect the typical, probable, or envisioned communication configurations that are relevant to the use case step. These configuration issues include numbers of devices and/or systems, expected growth of the system over time, locations, distances, communication types, network bandwidth, existing protocols, etc.
Requirement R-ID	**Requirement name**	**Requirement description**
C-1	Data exchange methods	The exchange of data follows a peer-to-peer method.
C-2	Growth	Growth perspective in the number of participating devices, but not defined.

Data Management Requirements		
Categories ID	**Category name for requirements**	**Category description**
D	Data Management	Type of source of data, correctness or validity of data, timeliness or time stamping of data, volume of data, synchronization, or consistency of data across systems, timely access to data, validation of data across organizational boundaries, transaction management, data naming, identification, formats across disparate systems, maintenance of data and databases
Requirement R-ID	**Requirement name**	**Requirement description**
D-1	Type of source data	How the source data were acquired: source data was previously automatically stored in a database.

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D-2	Validation of data exchanges	Requirements for the validity of data: Data can be assumed as valid (or validity checking is handled elsewhere)

Functional Requirements		
Categories ID	**Category name for requirements**	**Category description**
F	Functional	Essential functionalities that build the core concept of the service/SUC.
Requirement R-ID	**Requirement name**	**Requirement description**
F-1	Access to the EC characterization	Request the main characteristics of the EC, including its type (REC or CEC), size, maximum distance between EC Members, asset sharing, and pricing for transactions inside the EC
F-2	Access to the BM definition	Request information on the BM of the EC
F-3	Identification and characterization of Consumer assets	Request information on Consumer flexible assets, including technical specifications
F-4	Costs related to each DER technology	Collect CAPEX and OPEX of different DER technologies, and determine opportunity costs
F-5	Collect electricity prices offered by retailers	Get electricity prices from the regulated market and from retailers in the deregulated/free market
F-6	Consumer historic metering data is made available	Request the consumers' consumption data
F-7	Information on weather-based generation is collected	Request weather conditions or typical generation profiles of renewable generators
F-8	Complete incomplete consumption profiles	Complete consumption profiles where data is missing
F-9	Forecast weather-based generation	Perform forecasts of weather-based DER generation
F-10	Define and communicate scheduled DER setpoints	Request DER setpoints in order to provide flexibility to the DSO during a certain time window
F-11	DSO specifies flexibility needs	Request the flexibility required by the DSO
F-12	Collect readings from smart meters	Request smart meter readings to verify consumption and generation
F-13	Bids parameters	Get price and volume of each bid
F-14	Settlement results are communicated to the EC Members	Request compensation to be paid to the EC Members as part of the settlement
F-15	EC performance indicators are calculated	The performance of the EC is evaluated using a set of predefined indicators related to savings, energy sharing, reduction of emissions, energy price and self-sufficiency

Other Requirements		
Categories ID	**Category name for requirements**	**Category description**
O	Regulatory obligation related to privacy	2016/679 (General Data Protection Regulation)
Requirement R-ID	**Requirement name**	**Requirement description**
O-1	Data processing consent	Personal data may not be processed unless there is at least one legal basis to do so.
O-2	Data retention policy	Data retention policy outlines the specific sensitive time period data can be retained, plus how it will be disposed of when the time to do so comes.
O-3	Right to access, rectify, erasure, restriction	The data subject shall have the right to obtain from the controller without undue

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		delay the access/rectification/erasure/restriction of inaccurate personal data concerning him or her.
O-4	Data transfer consent	Personal data may not be transferred to a third-party if the data subject did not agree and the third party provide appropriate safeguard.
O-X	All constraints also apply.	All requirements in this category.

	Quality of Service Requirements	
Categories ID	**Category name for requirements**	**Category description**
QoS	Quality of Service	Address availability of the system, such as acceptable downtime, recovery, backup, rollback, etc. QoS issues also address accuracy and precision of data, the frequency of data exchanges, and the necessary flexibility for future changes.
Requirement R-ID	**Requirement name**	**Requirement description**
QoS-1	Frequency of data exchanges	How frequently data is exchanged: Upon request
QoS-2	Availability of information flows	Requirements for the availability of information flow: Continuous availability not required but must be available at specific times or under specific conditions

	Security Requirements	
Categories ID	**Category name for requirements**	**Category description**
Sec	Security	Assess how different security measures applied to different items can potentially interact and either leave security holes or make user interfaces very laborious and possibly unworkable. Security must not only protect against the very harmful but quite rare deliberate attacks, but also against the far more likely inadvertent mistakes, failures, and errors. At the same time, it is necessary to try to identify the requirements and the concerns for implementing security measures.
Requirement R-ID	**Requirement name**	**Requirement description**
Sec-1	Eavesdropping	Ensuring confidentiality, avoiding illegitimate use of data, and preventing unauthorized reading of data, is crucial
Sec-2	Authentication	Masquerade and/or spoofing: Ensuring that data comes from the stated source or goes to authenticated receiver is crucial

7 Common Terms and Definitions

Common Terms and Definitions	
Term	**Definition**
Renewable Energy Community (REC)	A legal entity: (a) which, in accordance with the applicable national law, is based on open and voluntary participation, is autonomous, and is effectively controlled by shareholders or members that are located in the proximity of the renewable energy projects that are owned and developed by that legal entity. (b) the shareholders or members of which are natural persons, SMEs or local authorities, including municipalities. (c) the primary purpose of

	which is to provide environmental, economic or social community benefits for its shareholders or members or for the local areas where it operates, rather than financial profits.
Citizen Energy Community (CEC)	A legal entity that: (a) is based on voluntary and open participation and is effectively controlled by members or shareholders that are natural persons, local authorities, including municipalities, or small enterprises. (b) has for its primary purpose to provide environmental, economic or social community benefits to its members or shareholders or to the local areas where it operates rather than to generate financial profits. (c) may engage in generation, including from renewable sources, distribution, supply, consumption, aggregation, energy storage, energy efficiency services or charging services for electric vehicles or provide other energy services to its members or shareholders.
GDPR	General Data Protection Regulation
Mid-market rate	Pricing mechanism based on computing the average between the price of buying price from the retailer and the price of selling energy back to the retailer. When different community members have different retailers and tariffs, we propose to use the maximum selling price and minimum buying price. It is necessary to determine, for each consumer, its net balance, to know if it is consuming, therefore buying, or generating, therefore selling energy.
Intermediate market rate	Based on the mid-market rate, but instead of a simple average, we propose a weighted average to allow giving more weight to the buying or to the selling prices. It is again necessary to determine, for each consumer, its net balance, to know if it is consuming, therefore buying, or generating, therefore selling energy.
QoS	Quality-of-Service

7.3. SUC03.1 – Retrofit of thermoelectric water heaters

1 Description of the use case

1.1 Name of the use case

ID	*Area / Domain(s)*	*Name of Use Case*
SUC 3.1	Select from: **(1) Local energy sharing and flexibility market**; (2) Grid-centric flexibility; (3) TSO-DSO flexibility coordination; **(4) Cross-sector**	Retrofit of thermoelectric water heater

1.2 Version management

Version Management			
Version No.	*Date*	*Name of Author(s)*	*Changes*
0.1	12.07.2023	Pau Lloret	First Draft

1.3 Scope and objectives of use case

Scope and Objectives of Use Case

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Scope	This UC describes the service to retrofit not smart thermoelectric water heaters to unlock flexibility provision.
Objective(s)	• Increase the controllability of already installed water heaters • Enable the provision of flexibility services with already installed water heaters
Related business case(s)	BUC 03 - Optimize domestic thermal loads to reduce costs and boost flexibility

1.4 Narrative of use case

Narrative of Use Case
Short description
This SUC gathers all the needed processes needed to retrofit a thermoelectric water heater to unlock flexibility provision. It covers the registration and installation of devices to monitor and control water heaters. Once retrofitted, the water heater can be externally managed following energy efficiency orders and following aggregated flexible activations.
Complete description
This SUC describes the following service: • Service 12: Thermal appliances retrofit and efficient control The following service is a prerequisite for this SUC: • Service 4: Identification of customers for retrofit This Use Case has the following steps: 1. Register the devices to be installed. Using the Installation App, the devices to be installed (e.g., communication module, controller module…) are registered in the system and linked to the consumer. Tools called by the step: Installation App 2. Install the modules and sensors Depending on the use case, several modules and sensors need to be installed to retrofit a water heater. The installer, previously trained, follow all the installation steps to install the communication and controller modules and its sensors. Additionally, a meter can be installed to monitor the consumption of all the household. 3. Installation success test With the help of the Installation App, check that the retrofit modules are properly connected and registered. It also checks if the monitored values are properly received and stored in the system from the consumption meters and the temperature probes. Tools called by the step: Installation App 4. Collect consent from the consumer Using the Installation App, collect the personal information from the consumers and get the signature for the approval of the external control of their thermal devices. Additionally, the consumer may receive and keep a hard copy of the contracts. Tools called by the step: Installation App

1.5 Use case conditions

Use case conditions
Assumptions

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Consumers want to give permission for externally controlling their water heaters and collect their consumption data.
Prerequisites
A thermoelectric water heater is already installed and ready to be retrofitted. There is no other incompatible control applied to the same water heater (e.g., exclusive night clocks). 4G network coverage is available where the water heater is installed. Controllers are configured and ready to be installed. End-users are already recruited, and the installation is already scheduled.

1.6 Further Information to the use case for classification / mapping

Classification Information
Relation to other use cases
BUC03 - Optimize domestic thermal loads to reduce costs and boost flexibility SUC03.2 - Optimize thermal loads to reduce energy use and costs
Level of depth
System use case (SUC) use case which describes in detail the functionality/technological solutions of (a part of) a business process.
Prioritisation
To be demonstrated in Spain (pilots 3.2 and 3.4).
Generic, regional or national relation
Generic.
Nature of the use case
Cross-Sector Services: Smart buildings and heating/cooling (CC-CS-HC)
Further keywords for classification
Water heater, thermal load, retrofit, optimization, flexibility.

1.7 General Remarks

General Remarks

2 Diagrams of use case

Diagram(s) of use case
Use Case Diagram:

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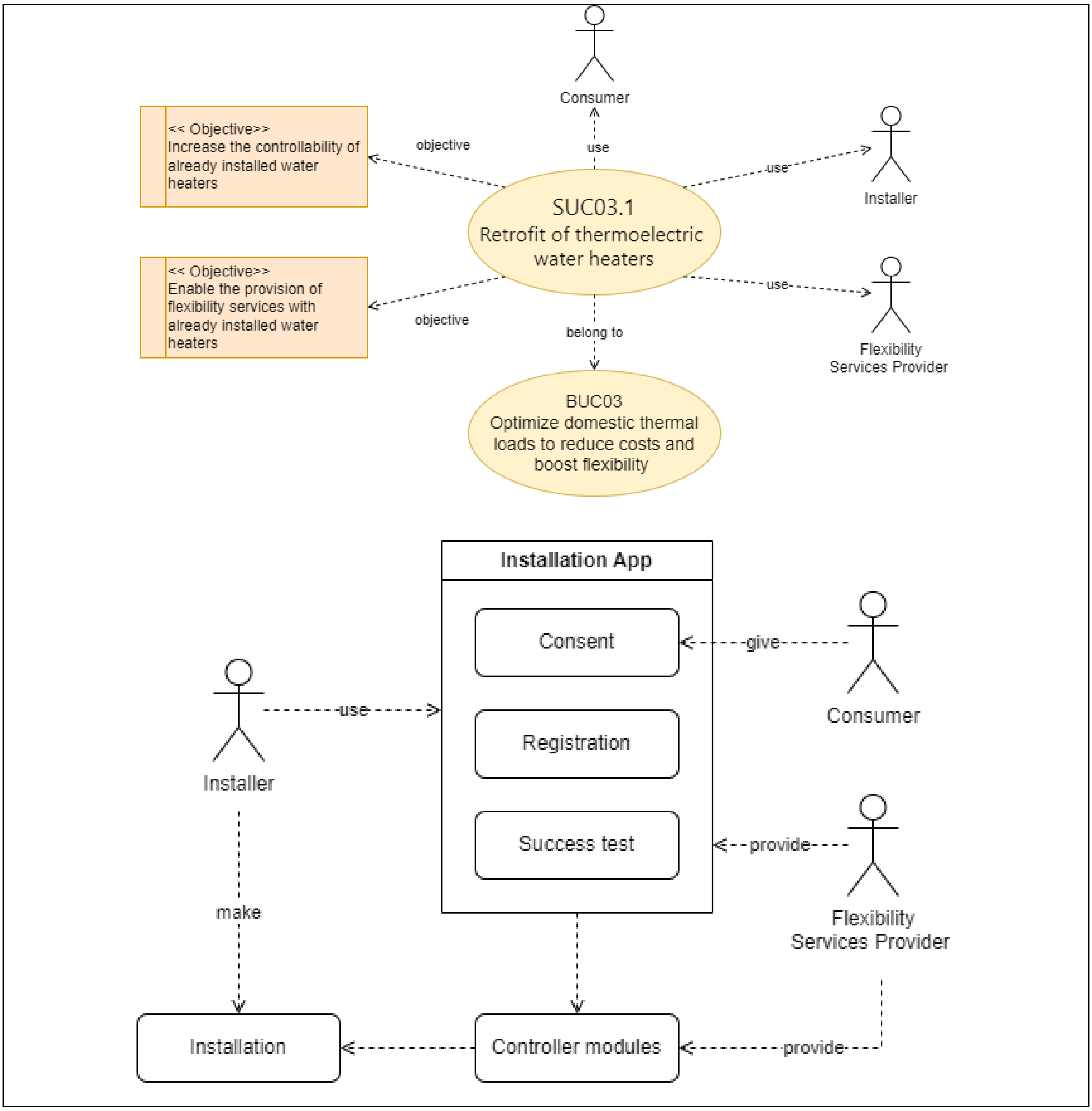

3 Technical details

3.1 Actors

Actors		
Actor Name	*Actor Type*	*Actor Description*
Installer		Person in charge of connecting the needed physical equipment to control an asset.
Installation App	Tool	Tool to help the installer to make the registration of the installed controllers to retrofit water heaters.
Consumer	Business Role (BRIDGE HEMRM)	A party that consumes electricity.

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Flexibility Services Provider	Business Role (BRIDGE HEMRM)	A party providing flexibility services to energy stakeholders via bilateral agreements or flexibility markets.

3.2 References

References						
No.	***References Type***	***Reference***	***Status***	***Impact on use case***	***Originator / organisation***	***Link***

4 Requirements

Requirements		
Categories ID	**Category name for requirements**	**Category description**
GDPR	Regulatory obligation related to privacy	2016/679 (General Data Protection Regulation)
Requirement R-ID	**Requirement name**	**Requirement description**
GDPR-1	Data processing consent	Personal data may not be processed unless there is at least one legal basis to do so.
GDPR-2	Data retention policy	Data retention policy outlines the time period specific sensitive data can be retained, plus how it will be disposed of when the time to do so comes.
GDPR-3	Right to access, rectify, erasure, restriction	The data subject shall have the right to obtain from the controller without undue delay the access/rectification/erasure/restriction of inaccurate personal data concerning him or her.
GDPR-4	Data transfer consent	Personal data may not be transferred to a third-party if the data subject did not agree and the third party provide appropriate safeguard.
GDPR-X	All GDPR constraints also apply to this SUC.	e.g., proportional measures of protection, communication of data breach, among others

5 Common Terms and Definitions

Common Terms and Definitions	
Term	**Definition**

7.4. SUC03.2 – Optimize thermal loads to reduce energy use and costs

1 Description of the use case

1.1 Name of the use case

ID	***Area / Domain(s)***	***Name of Use Case***
SUC03.02	Select from: **(1) Local energy sharing and flexibility market**; (2) Grid-centric flexibility; (3) TSO-DSO flexibility coordination; **(4) Cross-sector**	Optimize thermal loads to reduce energy use and costs

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1.2 Version management

Version Management			
Version No.	**Date**	**Name of Author(s)**	**Changes**
0.1	13.07.2023	Pau Lloret	First Draft

1.3 Scope and objectives of use case

Scope and Objectives of Use Case	
Scope	Optimal control of thermal loads to reduce energy consumption and costs.
Objective(s)	• Reduce the energy consumption of the controlled thermal loads • Reduce the energy bill associated with the consumption of the controlled thermal loads
Related business case(s)	It is part of: • BUC 03 - Optimize domestic thermal loads to reduce costs and boost flexibility It is a pre-requisite for the aggregation of thermal loads for TSO and DSO grid services. • BUC 05 - Aggregation for TSO and DSO grid services

1.4 Narrative of use case

Narrative of Use Case
Short description
Optimal control of domestic thermal loads refers to the application of advanced technology and data analytics to manage energy consumption to optimize the usage of domestic thermal loads, such as electric water heaters, to reduce costs and increase flexibility. By leveraging advanced technology and data analytics, thermal loads can be controlled to reduce their energy usage and reduce energy costs by combining several services like: • Increasing self-consumption (SC) • Peak-shaving (PS) • Dynamic tariff (DT) or Time-of-use (ToU) tariff optimization
Complete description
This SUC describes the following services: • Service 12: Thermal appliances retrofit and efficient control • Service 1: Optimization of thermal consumption considering self-consumption, peak shaving and ToU tariffs The following service is a prerequisite for this SUC: • Service 4: Identification of customers for retrofit This Use Case has the following steps: 1. Monitoring Once the thermal load can be remotely controlled, the local controller sends monitoring and performance data to the EMS. In this case, no feedback or constraints from the end-user are received to ensure the comfort. Tools and systems called by the step: EMS, controller modules 2. Training of the model Based on the received monitored data, the EMS characterize the thermal load model. This model includes parameters like heating needs and heating loses. This thermal load model is used in the next optimization step, and it is updated every day.

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Tools and systems called by the step: EMS 3. Optimization After the training phase, based on the received monitored data and combining machine learning prediction algorithms and consumption optimization, the EMS can provide energy efficiency (EE) by optimizing thermal loads' energy consumption. The EMS optimization is virtually located in the cloud. Tested savings of around 20% of energy consumption can be achieved in the case of retrofitted water heaters. In addition to energy efficiency, the following services can be combined to reduce the energy bill costs: ● Increased self-consumption (SC) includes the decision of concentrating consumption during sunny hours and reducing the cost of electricity and the CO2 emissions in the case of behind-the-meter renewable energy sources. ● Peak-shaving (PS). It includes the capability of limiting thermal loads consumption in case of detecting excessive consumption in the smart meter. The definition of power limitation could vary, and the service must be adapted to each regulatory framework. ● Dynamic tariff (DT) or Time-of-use (ToU) tariff optimization for electricity bill reduction without comfort loss. It adapts the consumption to the hourly electricity prices to reduce the heating cost. This service needs to know the tariff of each customer. Tools and systems called by the step: EMS 4. Activation As a result of the optimization carried out by the EMS, control signals are sent to control the thermal device following the optimization results. In this case, these control signals are ON/OFF signals to control a water heater through the retrofit controller module relay. Tools and systems called by the step: EMS, controller modules

1.5 Use case conditions

Use case conditions
Assumptions
The water heater can be externally controlled, either with a retrofit controller or with a factory ready device.
Prerequisites
Customers gave permission for controlling their water heaters and collect their consumption data. For the DT or ToU service, knowing the tariff of each customer is needed. For the SC service, installed individual or shared PV panels are needed. For the SC and PS services, at least a household meter needs to be installed.

1.6 Further Information to the use case for classification / mapping

Classification Information
Relation to other use cases
BUC03 - Optimize domestic thermal loads to reduce costs and boost flexibility SUC03.1 - Retrofit of thermoelectric water heater BUC05 - Aggregation for TSO and DSO grid services BUC05.02 - Aggregation for TSO and DSO grid services
Level of depth
System use case (SUC) use case which describes in detail the functionality/technological solutions of (a part of) a business process.
Prioritisation

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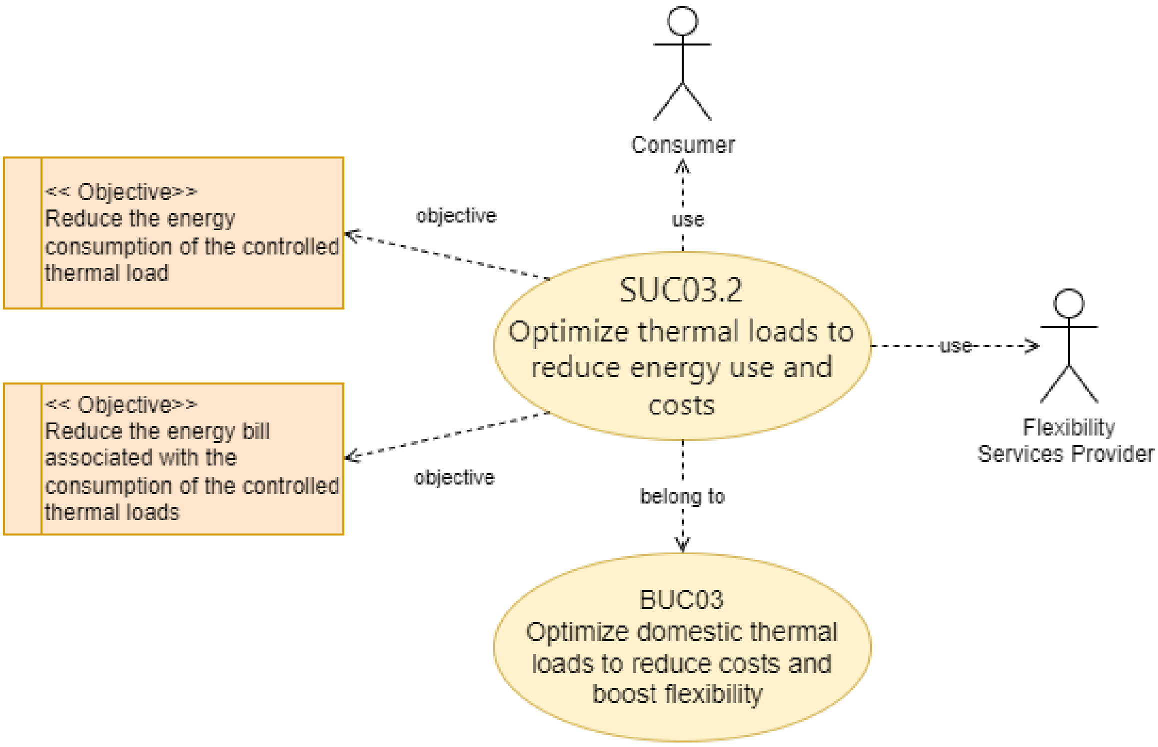
To be demonstrated in France (pilots 3.5 and 3.6) and Spain (pilots 3.1 or 3.2 and 3.4).
Generic, regional or national relation
Generic.
Nature of the use case
Cross-Sector Services: Smart buildings and heating/cooling (CC-CS-HC)
Further keywords for classification
Water heater, thermal loads, energy efficiency, optimization, flexibility.

1.7 General Remarks

General Remarks

2 Diagrams of use case

Diagram(s) of use case
Use Case Diagram: 

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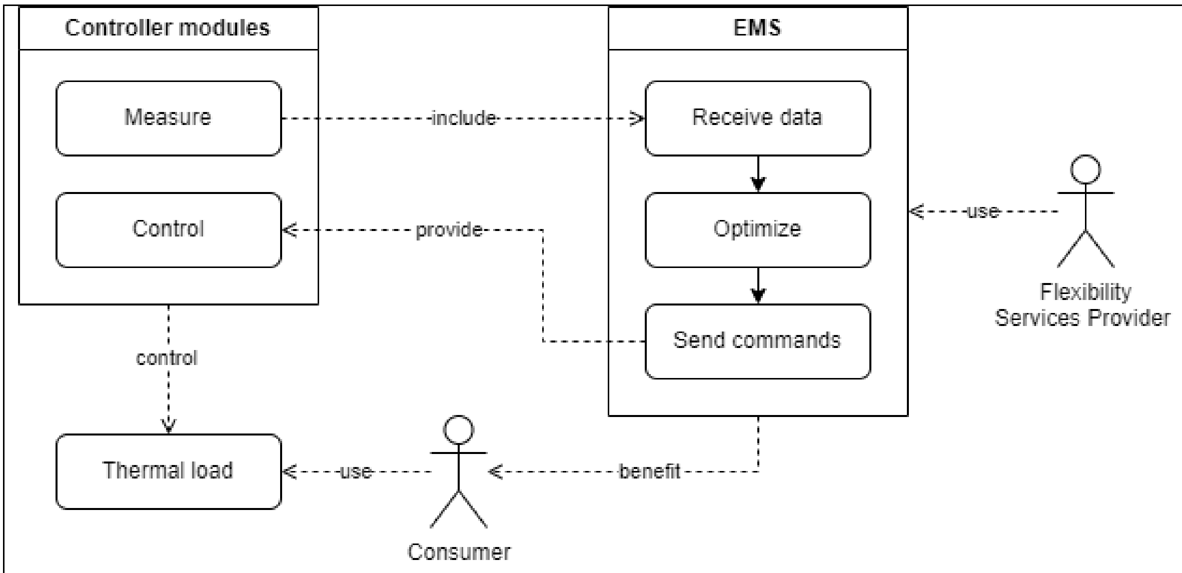
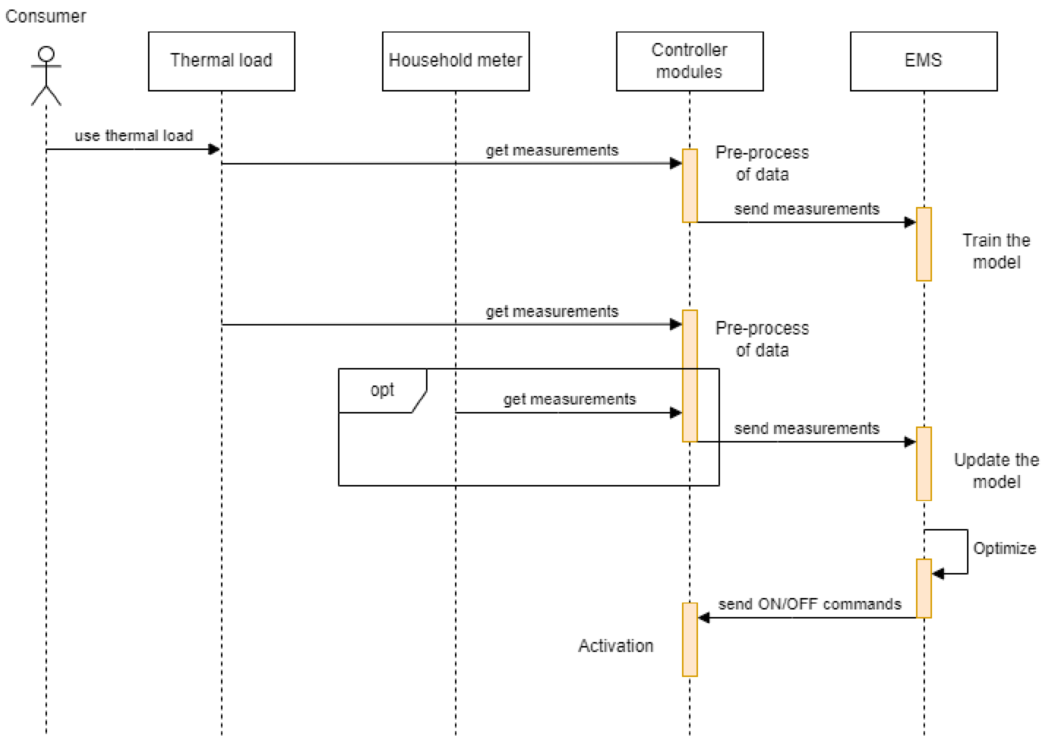


Sequence Diagram:



3 Technical details

3.1 Actors

Actors		
Actor Name	***Actor Type***	***Actor Description***
Consumer	Business Role (BRIDGE HEMRM)	A party that consumes electricity.

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EMS	Tool	The Energy Management System is a software in the cloud that process all the monitored data to optimize the control of flexible loads to reduce their consumption, reduce their energy costs and provide flexibility services.
Flexibility Services Provider	Business Role (BRIDGE HEMRM)	A party providing flexibility services to energy stakeholders via bilateral agreements or flexibility markets.
Controller modules	Device	They are the modules that allow to monitor and control the thermal loads
Household meter	Device	Meter to monitor the household consumption
Thermal load	Device	

3.2 References

References						
No.	***References Type***	***Reference***	***Status***	***Impact on use case***	***Originator / organisation***	***Link***

4 Step by step analysis of use case

4.1 Overview of scenarios

Scenario conditions						
No.	**Scenario name**	**Scenario description**	**Primary actor**	**Triggering event**	**Pre-condition**	**Post-condition**
1	Training	Training phase to characterize all the model parameters	EMS	After installation and/or activation of the optimized control	External control allowed	Model trained
2	Operation	Optimized operation of the thermal load	EMS	After finishing the training	Model trained	Optimal control of the thermal load

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4.2 Steps – Scenarios

Scenario								
Scenario name:		***No. 1 -*** **Training**						
Step No.	***Event***	***Name of process/ activity***	***Description of process/ activity***	***Service***	***Information producer (actor)***	***Information receiver (actor)***	***Information exchanged (IDs)***	***Requirement, R-IDs***
1	Get measurements	Pre-process of thermal load data	Get measurements from the sensors or activators of the thermal load to the controller modules and pre-process them.	GET	Thermal load	Controller modules	Consumption, temperatures, status	GDPR-[1-4]
2	Send measurements	Train the model	Train the thermal load model with the sent measurements from the controller modules.	EXECUTE	Controller modules	EMS	Consumption, temperatures, status	GDPR-[1-4]

Scenario								
Scenario name:		***No. 2 -*** **Operation**						
Step No.	***Event***	***Name of process/ activity***	***Description of process/ activity***	***Service***	***Information producer (actor)***	***Information receiver (actor)***	***Information exchanged (IDs)***	***Requirement, R-IDs***
1	Get measurements	Pre-process of thermal load data	Get measurements from the sensors or activators of the thermal load to the controller modules and pre-process them.	GET	Thermal load	Controller modules	Consumption, temperatures, status	GDPR-[1-4]
2	Get measurements	Pre-process of household data	Get measurements from the household meter to the controller modules and pre-process them.	GET	Household meter	Controller modules	Consumption	GDPR-[1-4]
3	Send measurements	Update the model	Update the thermal load model with the sent measurements from the controller modules.	CHANGE	Controller modules	EMS	Consumption, temperatures, status	GDPR-[1-4]
4	Updated model	Optimization	Optimizing thermal loads' energy consumption.	EXECUTE	EMS	EMS	-	GDPR-[1-4]

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5	Send ON/OFF commands	Activation	Activation of the commands result of the optimization.	EXECUTE	EMS	Controller modules	ON/OFF commands	GDPR-[1-4]

5 Information exchanged

Information exchanged			
Information exchanged (ID)	*Name of information*	*Description of information exchanged*	*Requirement, R-IDs*
1	Temperatures	Temperature/s of the water tank of the water heater.	GDPR-[1-4]
2	Water heater consumption	Consumption measurements from the water heater meter.	GDPR-[1-4]
3	Status	Status of the water heater and the controller modules (online/offline)	GDPR-[1-4]
4	Household consumption	Consumption measurements from the household meter.	GDPR-[1-4]
5	ON/OFF commands	ON/OFF commands result of the optimization.	GDPR-[1-4]

6 Requirements

Requirements		
Categories ID	**Category name for requirements**	**Category description**
GDPR	Regulatory obligation related to privacy	2016/679 (General Data Protection Regulation)
Requirement R-ID	**Requirement name**	**Requirement description**
GDPR-1	Data processing consent	Personal data may not be processed unless there is at least one legal basis to do so.
GDPR-2	Data retention policy	Data retention policy outlines the time period specific sensitive data can be retained, plus how it will be disposed of when the time to do so comes.
GDPR-3	Right to access, rectify, erasure, restriction	The data subject shall have the right to obtain from the controller without undue delay the access/rectification/erasure/restriction of inaccurate personal data concerning him or her.
GDPR-4	Data transfer consent	Personal data may not be transferred to a third-party if the data subject did not agree and the third party provide appropriate safeguard.
GDPR-X	All GDPR constraints also apply to this SUC.	e.g., proportional measures of protection, communication of data breach, among others

7 Common Terms and Definitions

Common Terms and Definitions	
Term	**Definition**

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union. Neither the European Union nor the granting authority can be held responsible for them.

8. Annex III – Grid-centric flexibility

8.1. SUC04.1 – Load forecasts for long-term grid demand and quantification of flexibility needs

1 Description of the use case

This SUC will demonstrate how to properly forecast distribution grid congestions on long-term and how to quantify the flexibility needs, in an already detected congested grid point, in order to procure local flexibility products to manage these grid congestions by the DSO. Only for DEMO 1, the activity of forecasting and quantification described in this SUC can consider also voltage constraints.

1.1 Name of the use case

ID	*Area / Domain(s)*	*Name of Use Case*
SUC04.1	Grid-centric flexibility	Load forecasts for long-term grid demand and quantification of flexibility needs

1.2 Version management

Version Management			
Version No.	*Date*	*Name of Author(s)*	*Changes*
01	01/09/2023	Serena Cianotti	First draft version
02	15/09/2023	Serena Cianotti; Carolina Manaresi; Alessandro Minzolini	Revision of short and complete description; add use case diagram
03	14/11/2023	Carolina Manaresi; Adam Christensson	Added Voltage Constraints management Added Quantification of flexibility needs
04	07/12/2023	Serena Cianotti; Carolina Manaresi; Alessandro Minzolini	Diagram update and final review

1.3 Scope and objectives of use case

Scope and Objectives of Use Case	
Scope	Perform long-term electricity load forecasts and quantification of flexibility needs in a constrained grid point.
Objective(s)	Integrate flexibility into DSO grid planning processes and procure adequate long-term active power products to manage congestions (and voltage constraints, only for Demo1)
Related business case(s)	BUC04 Long-term distribution grid congestion (and voltage constraints) management

1.4 Narrative of use case

Narrative of Use Case
Short description
The main functionality of DSO 'long-term load forecast' is a *grid simulation module* for the calculation of grid elements load conditions focused on the quantification of flexibility needs to solve grid congestions (and voltage constraints, only for Demo1) as an alternative to grid reinforcement.

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Complete description
Services from the DoA: - Service 19: Congestion forecasting service (E.ON) - Service 24: Congestion Technical grid constraints forecasting service for local flexibility service activation (ENEL/EDI) - Service 25: Voltage Technical grid constraints forecasting for local flexibility service activation (ENEL/EDI) The solution for 'long-term load and distribution grid congestions forecast' shall support the Network Development Plan that the DSO Grid Planner has to submit to the Regulatory Authority on the medium and long-term, including flexibility services as an alternative to system infrastructures expansion. **1. Long-term scenario forecast** The first step relies on the creation of load/generation scenarios by means of: • Historical data of energy/power flows by means of measured – estimated values shared by DSO O&M with the Forecast Provider; • Identification of different generation clustering (change of generation profiles and injection points due to specific dynamics of the Country); • Correction/cleaning of historical data and creation of specific time series; • Forecast on new consumption/production connections (standard new connections + specific plans about electric mobility, electrification of consumptions, distributed generation); • Check of scenarios results comparing them with reference country values; • Evaluate scenarios and their sensitivity based on risk assessment criteria. *Tools called by the step*: Forecast provider **2. Perform long term load forecast and identify network constraints** The second step relies on the utilization, as input of the DSO Load flow calculation tool, of the long-term scenario forecasts (step 1) and the information of planned network development and maintenance, in particular: • the information concerning the network topology evolution over plan horizon and the grid elements capacity (i.e. substations, cables) received by the DSO Grid Planner; • the information concerning the operation and maintenance plan and grid failure statistics received by the DSO O&M. The DSO Load flow calculation tool shall consider multiple configuration: • in full availability of the network (N condition) • in reconfiguration layout due to out of service of grid elements (N-1 condition) The output shall be the time series of load profile on grid element / node: • Quantity of identified load constraint • Timing of occurrence (i.e. month / weekly day / hour) • Probability of occurrence This output will be provided to the Grid Planner in data format useful to manage the Cost – Benefit Analysis and define the best options as network reinforcement investment and flexibility services to be procured. **3. Quantify flexibility volumes needed.** Based on the decision of the Grid Planner about the identified network constraints to be solved with flexibility, the flexibility volumes needed to avoid the congestion and voltage problems are quantified. *Tools called by the step*: DSO Load flow calculation tool

1.5 Use case conditions

Use case conditions
Assumptions

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The input data of the calculation tool must be format-aligned and consistent with the requirements
Prerequisites
Specifications for the flexibility services to be procured (to get outcomes consistent with flexibility product attributes, to calculate the flexibility needs for the 'load-constrained' grid node).

1.6 Further Information to the use case for classification / mapping

Classification Information
Relation to other use cases
BUC04 Long-term distribution grid congestion (and voltage constraints) management BUC06 Short-term congestion constraints forecasting and management for local flexibility service activation BUC07 Short-term voltage constraints forecasting and management for local flexibility service activation BUC10 Dynamic constraints management for global flexibility activation in transmission system operation
Level of depth
System use case (SUC)
Prioritisation
To be demonstrated in Italy (pilots 1.2 and 1.3) and in Sweden
Generic, regional or national relation
Generic
Nature of the use case
Technical/system use case
Further keywords for classification
Energy transition scenario, prosumers, network planning, grid constraints

1.7 General Remarks

General Remarks
Is used for further comments which are not considered elsewhere.

2 Diagrams of use case

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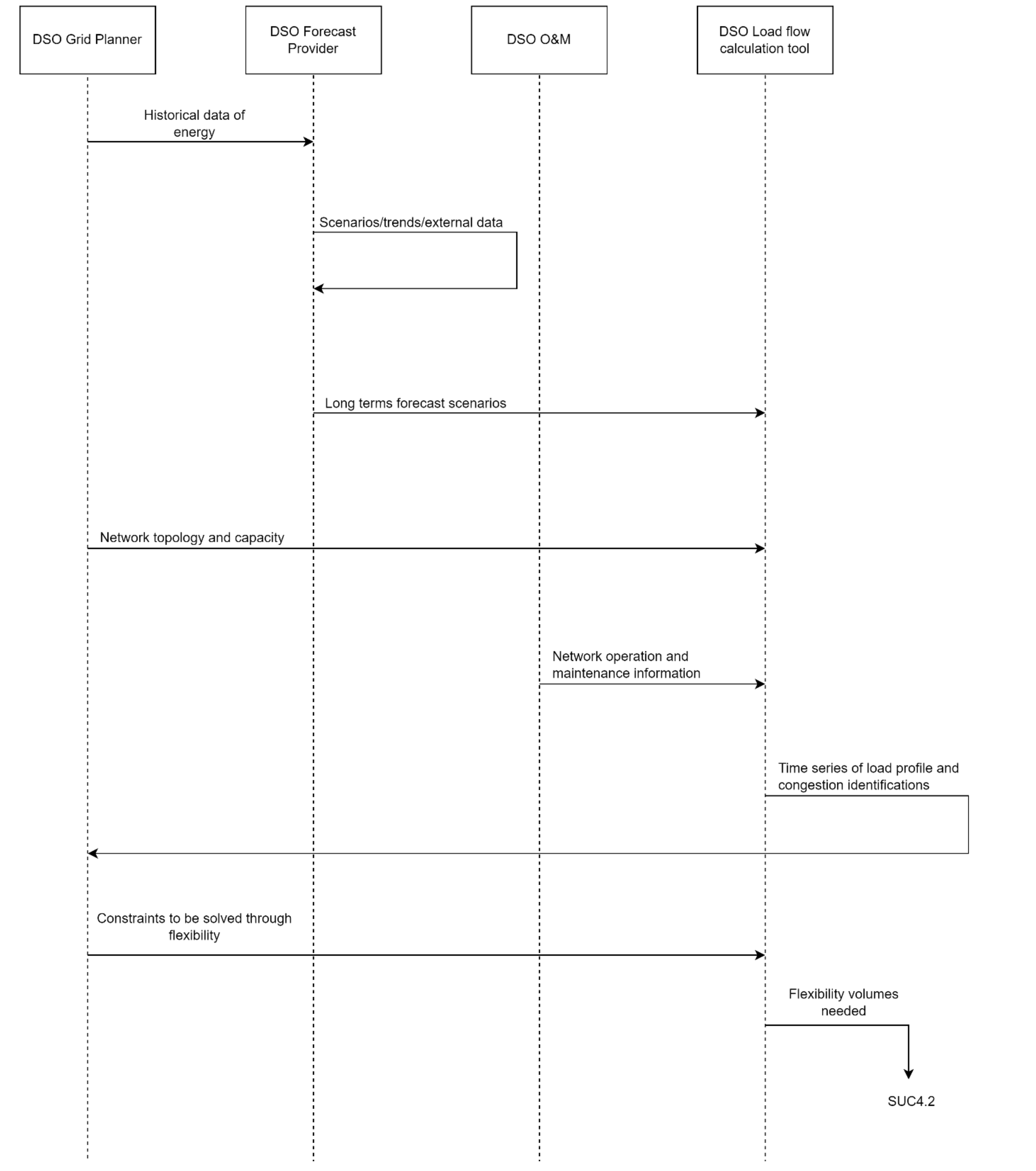
Diagram(s) of use case


3 Technical details

3.1 Actors

Actors		
Actor Name	***Actor Type***	***Actor Description***

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DSO Grid planner	Business Role	He is in charge for network development plan to be submit to the regulatory authority.
DSO O&M	Business Role	He is in charge for distribution infrastructure operation and maintenance.
DSO Forecast Provider	System/ Business Role	He is in charge for assessing scenario and sharing information on consumption and production load curves.
DSO Load flow calculation tool	System	It runs the Optimal Power Flows algorithms to get the long-term load forecast and identify the congestion grid points.

3.2 References

References						
No.	***References Type***	***Reference***	***Status***	***Impact on use case***	***Originator / organisation***	***Link***
1	Regulatory	Directive 2019/944 on common rules for the internal market for electricity	public	DSO role and network plans content	EC	

4 Requirements

Requirements		
Categories ID	**Category name for requirements**	**Category description**
D	Data Management	Covers both the management of the data exchanges and the management of data at either end if that management is impacted by data exchanges (e.g. the initial setting up of what data needs to be exchanged, the need to backup data or ensure consistency of data whenever it is exchanged).
SEC	Security	Security measures applied to items that can potentially interact and either leave security holes or make user interfaces very laborious and possibly unworkable.
Requirement R-ID	**Requirement name**	**Requirement description**
D-1	Type of source data	How the source data were acquired: source data was previously automatically stored in a database
D-2	Correctness of source data	Correctness of source data
D-3	Data consistency	Data consistency and synchronization management across systems
D-4	Data format requirements	Data format is a choice of smart-meters owners, most of the time DSO.
SEC-1	Eavesdropping	Ensuring confidentiality, avoiding illegitimate use of data, and preventing unauthorized reading of data
SEC-2	Network security	Network security measures commonly used with this data exchange

5 Common Terms and Definitions

Common Terms and Definitions	
Term	**Definition**

DSO	Distribution System Operator
O&M	Operation & Maintenance

8.2. SUC04.2 – Procure availability contracts

1 Description of the use case

1.1 Name of the use case

ID	*Area / Domain(s)*	*Name of Use Case*
SUC04.2	(2) Grid-centric flexibility	Procure availability contracts

1.2 Version management

Version Management			
Version No.	*Date*	*Name of Author(s)*	*Changes*
1.0	14.07.2023	Maja Johansson, Rebecca Samuelsson, David Bjarup	First draft.
1.1	04.10.2023	Maja Johansson	Completion of full description

1.3 Scope and objectives of use case

Scope and Objectives of Use Case	
Scope	This use case describes the procurement of availability contracts to be used for long-term congestion management.
Objective(s)	• Define mix of products to be used to manage the flexibility needs defined in SUC04.1 • Specify identified availability needs as requirements in procurement documents. • Procure availability contracts from flexibility service providers.
Related business case(s)	It is part of: BUC04: Long-term distribution grid congestion (and voltage constraints) management

1.4 Narrative of use case

Narrative of Use Case
Short description
This use case describes the procurement of availability contracts to be used for long-term congestion management.
Complete description
Services from the DoA: Service 2 (DSO-G-CM). Aggregation for TSO and DSO grid services (i-DE/EDE/EON) This use case describes the procurement of availability contracts to be used for long-term congestion management. It consists of the following steps: 1. Define mix of products and specify identified needs 2. Find and engage potential FSPs 3. Determine procurement method and ensure compliance

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4. Perform procurement 5. Sign contracts **1. Define mix of products and specify identified needs** In this step, the Flexibility planner defines a mix of products that can be used to manage the flexibility needs defined in SUC04.1. Based on the product mix the KAM specifies identified availability needs in procurement documents. The specifications include the location of the availability needed, the amount of availability (in MW), what hours that the flexibility should be available, a potential fixed remuneration for the availability, as well as criteria for how FSPs will be selected. **2. Find and engage potential FSPs** In this step, the KAM reaches out to potential FSPs and engage them in the topic of flexibility. The KAM informs them about the upcoming procurement and helps the FSP to prequalify their resource(s) to the market. **3. Determine procurement method and ensure compliance** In this step, the Flexibility Procurer use the specifications in the procurement documents to determine procurement method and the criteria for selection. The method is chosen based on the value of the identified needs in the specifications. The Flexibility Procurer controls that the procurement method and market procedures for the proposed products are compliant with national procurement laws. **4. Perform procurement** In this step, the Flexibility Procurer performs the procurement of the availability contracts. Depending on the value of the procurement, the procurement can be sent directly to interested FSPs (direct procurement) or be published on a public procurement platform. The FSP answers the procurement by sending in bids according to the procurement method. When the procurement time period ends, the Flexibility Procurer opens and evaluates the bids from the FSPs according to the procurement method. The Flexibility Procurer notifies all FSPs participating in the procurement on the procurement results. **5. Sign contracts** In this step, the KAM signs contracts with the FSPs selected in the procurement process. The terms of the contract follows what was stated in the procurement documents.

1.5 Use case conditions

Use case conditions
Assumptions
• The DSO has grid areas with long-term congestion challenges. • The DSO is allowed and remunerated for the procurement of flexibility services by regulation. • Individual DERs and aggregators are allowed by regulation to provide flexibility to the DSO. • There are flexibility service providers that are willing to provide flexibility.
Prerequisites
The DSO has determined flexibility volumes to procure.

1.6 Further Information to the use case for classification / mapping

Classification Information
Relation to other use cases
• SUC04.1 Load forecasts for long-term grid demand and quantification of flexibility needs • SUC04.3 Activate market-based and non-market-based availability contracts
Level of depth
System use case (SUC) use case which describes in detail the functionality/technological solutions of (a part of) a business process.
Prioritisation
To be demonstrated Sweden (pilots 2.1 and 2.2) and Spain (pilots 3.1 and 3.4).
Generic, regional or national relation

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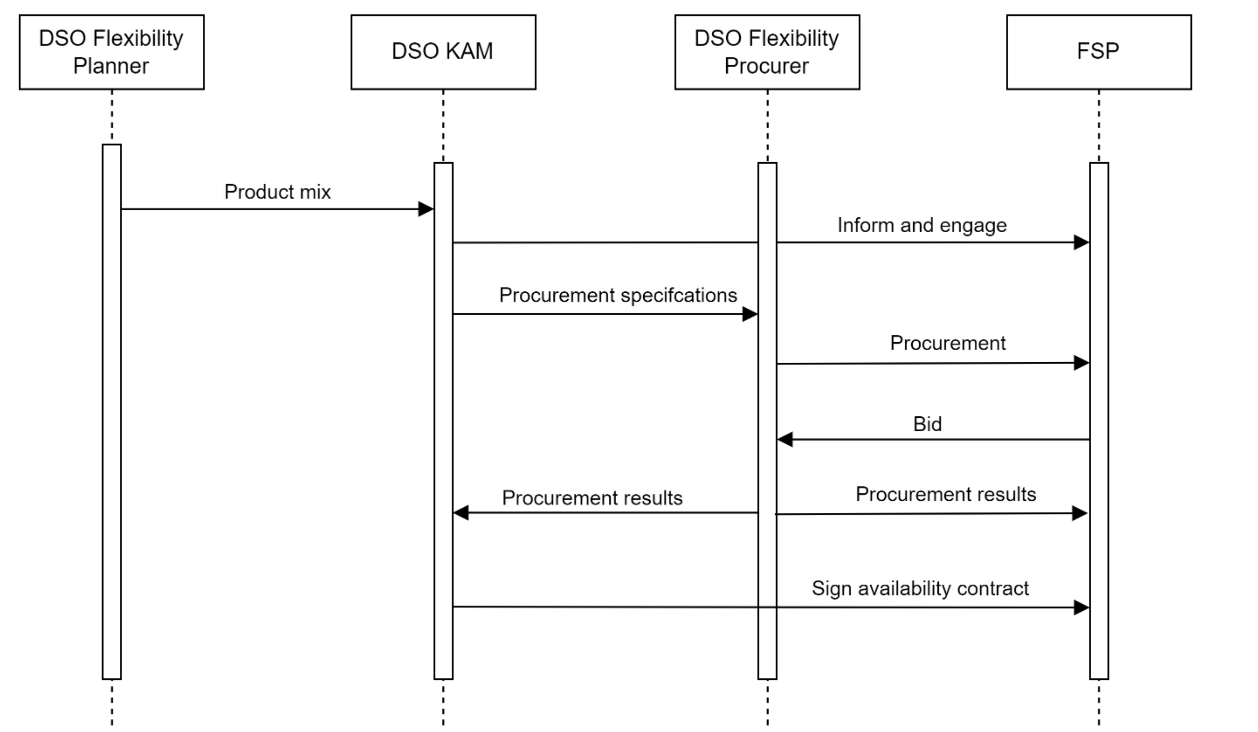
Generic
Nature of the use case
Technical/system use case
Further keywords for classification
Local congestion management, grid constraints, distributed energy resources, flexibility service providers, FSP, aggregators, long-term, flexibility, availability, procurement, engagement, demand response, distribution system operator, DSO.

1.7 General Remarks

General Remarks
Is used for further comments which are not considered elsewhere.

2 Diagrams of use case

Diagram(s) of use case



3 Technical details

3.1 Actors

Actors		
Actor Name	***Actor Type***	***Actor Description***
DSO Flexibility planner	Business Role	Responsible for defining product mix.
DSO Flexibility KAM	Business Role	Responsible for dialogue and signing contracts with FSPs.

DSO Flexibility Procurer (Specialist/Legal expert)	Business Role	Responsible for choosing procurement method and performing the procurement. In addition, the role also include responsible for guidance on procurement/legal issues.
Distribution System Operator (DSO)	Role (HEMRM)	A DSO is a System Operator. DSO is responsible for security of supply and reliability of the distribution grid. For this reason, it monitors the grid in order to identify possible arising issues and, if there is a need, it makes use of resources to solve such problems, by network reconfiguration and/or by requests to market operators or directly to properly contracted customers. In addition to the above and more in detail: • is responsible for the access of the customers to the grid; • operates, maintains, develops and is fully responsible of the part of the electricity system, named "Distribution Network", typically starting from the HV/MV transformers (or vHV/HV transformers depending upon Member State Regulation) down to the customer's POD; • acts on Local Flexibility Market requiring Local Flexibility Services to solve distribution grids issues; • ensures a transparent and non-discriminatory access to the distribution network for each users; • assess network status of the distribution grid and broadcasts selected information of the network status to eligible actors (e.g. aggregators, other system operators); • in critical situations, implements dedicated actions and deliver alerts during stress events If necessary, implement emergency measures including load shedding and DER curtailment; cooperates with the Transmission System Operator in carrying out their responsibilities (e.g. load shedding).
Flexibility Service Provider (FSP)	Role (HEMRM)	A party providing flexibility services to energy stakeholders via bilateral agreements or flexibility markets. An FSP can also be a BSP if enabled to the LFC services. In the Bridge HEMRM, FSP is an extension of FBSP. FSP offer services potentially to all the system operators, directly or through market operators. A part of the FSP is the Distribution Energy Resources (DER). Which is resources connected at the distribution grid capable of providing active power flexibility, either upward/downward or both. It can include several different roles and devices such as demand response (actor/role), distributed generation, electric vehicles, and storage systems.

3.2 References

References						
No.	***References Type***	***Reference***	***Status***	***Impact on use case***	***Originator / organisation***	***Link***
			The status of the referenced document.	e.g. copy right, IPR		

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4 Requirements

Requirements		
Categories ID	**Category name for requirements**	**Category description**
GDPR	Regulatory obligation related to privacy	2016/679 (General Data Protection Regulation)
SM	Security Management	Evaluate the interplay of various security measures applied to different elements, understanding how they might create vulnerabilities or result in cumbersome and potentially impractical user interfaces. Security solutions should guard against not only the less frequent but severe targeted attacks, but also the more common accidental missteps, malfunctions, and blunders. It is crucial to recognize the needs and considerations involved in the deployment of these security safeguards.
Requirement R-ID	**Requirement name**	**Requirement description**
GDPR-1	Data processing consent	Personal data may not be processed unless there is at least one legal basis to do so.
GDPR-2	Data retention policy	Data retention policy outlines the time period specific sensitive data can be retained, plus how it will be disposed of when the time to do so comes.
GDPR-3	Right to access, rectify, erasure, restriction	The data subject shall have the right to obtain from the controller without undue delay the access/rectification/erasure/restriction of inaccurate personal data concerning him or her.
GDPR-4	Data transfer consent	Personal data may not be transferred to a third-party if the data subject did not agree and the third party provide appropriate safeguard.
GDPR-X	All GDPR constraints also apply to this SUC.	e.g., proportional measures of protection, communication of data breach, among others
SM	Safeguarding Information Integrity	Implement strategies and systems to maintain the integrity of information, ensuring that data is neither altered nor destroyed, and remains reliable and accurate throughout its lifecycle.

5 Common Terms and Definitions

Common Terms and Definitions	
Term	**Definition**

8.3. SUC04.3 – Activate market-based and non-market-based long-term availability contracts

1 Description of the use case

1.1 Name of the use case

ID	*Area / Domain(s)*	*Name of Use Case*
SUC04.3	(2) Grid-centric flexibility	Activate market-based and non-market-based long-term availability contracts

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1.2 Version management

Version Management			
Version No.	**Date**	**Name of Author(s)**	**Changes**
1.0	14.07.2023	Maja Johansson, Rebecca Samuelsson, David Bjarup	First draft.
1.1	04.10.2023	Adam Christensson Maja Johansson	Second draft
1.2	17.10.2023	Adam Christensson	Third draft
1.3	23.10.2023	Adam Christensson	Final Draft

1.3 Scope and objectives of use case

Scope and Objectives of Use Case	
Scope	This use case describes the activation of market-based and non-market-based long-term availability contracts
Objective(s)	• Develop and implement trading strategy • Monitor grid situation based on short-term load forecasts • Activate suitable availability contracts according to trading strategy • Validate flexibility delivery using baseline and metering data from contracted service provider
Related business case(s)	It is part of: BUC04: Long-term distribution grid congestion (and voltage constraints) management It relates to: BUC06: Short-term congestion constraints forecasting and management for local flexibility service activation BUC07 Short-term voltage constraints forecasting and management for local flexibility service activation BUC05: Aggregation for TSO and DSO grid services BUC09: Local and global market coordination for distributed resources system service provision

1.4 Narrative of use case

Narrative of Use Case
Short description
This use case describes the activation of market-based and non-market-based long-term availability contracts.
Complete description
Services from the DoA: Service 2 (DSO-G-CM). Aggregation for TSO and DSO grid services (i-DE/EDE/EON) Service 24: Congestion Technical grid constraints forecasting service for local flexibility service activation (ENEL/EDI) Service 25: Voltage Technical grid constraints forecasting for local flexibility service activation (ENEL/EDI) The use case, "Activation of Long-Term Availability Contracts", focuses on the execution of both market-based and non-market-based long-term availability contracts. This systematic approach is vital for managing grid flexibility and maintaining stability in the power distribution network. Here is a detailed breakdown: **Development and Implementation of Trading Strategy:** • **Load Limitation Decision:** The first step involves the Flexibility Planner determining the limit of the grid to be used for the market. It can be based on an actual technical limit, a subscription limit, or in

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the case of a proactive market build-up, a fictional limit. The Flexibility Planner sends information about the limit to the LFMO. • **Merit Order Decision:** The Flexibility Planner decides the merit order, prioritizing between market-based and non-market-based contracts, ensuring alignment with existing regulations. This decision is communicated to LFMO. • **Intra-Category Merit Order Decision**: The merit order within the categories of contracts, be it market-based or non-market-based, is determined by the Flexibility Planner and conveyed to the LFMO. • **Trading instructions:** Planning for potential activations is done to secure the process of activating the availability of the FSP as per the contracts. This information flows from the Flexibility Planner to the Grid Operations. **Grid Monitoring and Activation of Availability Contracts:** • **Grid monitoring:** This is done based on short-term load forecasts. Forecasts are provided by the Forecast Provider to the Flexibility Platform. The Decision Support Tool within the Flexibility Platform gives the Grid Operations information on grid status and recommended actions. • **Market Clearing:** Grid Operations use the Flexibility Platform to place activation orders, based on the trading strategy, to the LFMO. The LFMO matches FSP bids with activation orders, hence clearing the market. • **Sending Activation Signals:** After clearing, the LFMO sends an activation signal to the FSP through the flexibility platform. **Validation and Settlement:** • **Validation of Flexibility Delivery:** The actual flexibility delivery is validated using baseline data and metering information obtained from the FSP. This information flows from the FSP to the LFMO. • **Confirmation of Flexibility Delivery:** Once validated, the LFMO confirms the flexibility delivery to the Flexibility Controller through the flexibility platform. The Flexibility Controller ensures that the delivery meets the required criteria. • **Settlement Data Transfer:** The final phase involves sending the settlement data. The LFMO processes the data and forwards it to the FSP for remuneration.

1.5 Use case conditions

Use case conditions
Assumptions
• The DSO has grid areas with long-term congestion challenges. • The DSO is allowed and remunerated for the procurement of flexibility services by regulation. • Individual DERs and aggregators are allowed by regulation to provide flexibility to the DSO. • There are flexibility service providers that are willing to provide flexibility.
Prerequisites
The DSO has procured availability contracts based on flexibility need and/or signed non-market-based availability contracts.

1.6 Further Information to the use case for classification / mapping

Classification Information
Relation to other use cases
• BUC06 Short-term congestion constraints forecasting and management for local flexibility service activation • BUC07 Short-term voltage constraints forecasting and management for local flexibility service activation • BUC05 Aggregation for TSO and DSO grid services • BUC09 Local and global market coordination for distributed resources system service provision • SUC04.2 Procure availability contracts

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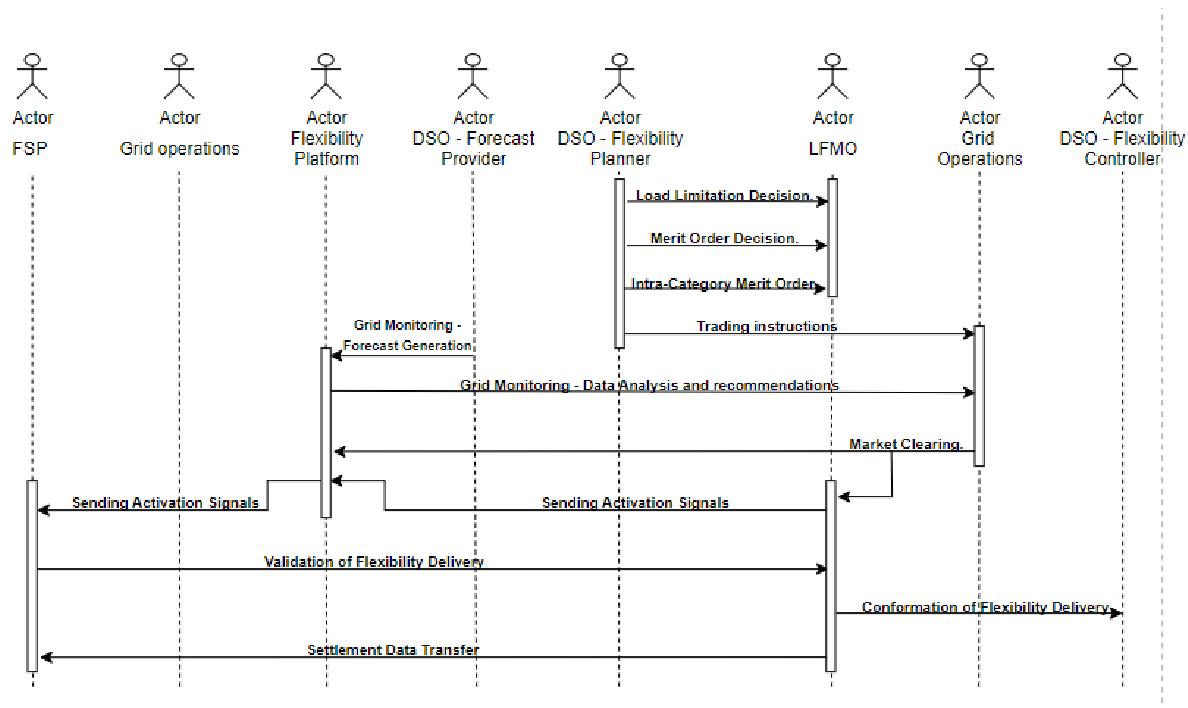
• SUC06.2 Short term flexibility activation for DSO congestion management • SUC06.3 Settlement of flexibility services from DER participating to local market • SUC05.1 Aggregate controllable assets to solve congestion problems to the DSO •
Level of depth
System use case (SUC) use case which describes in detail the functionality/technological solutions of (a part of) a business process.
Prioritisation
To be demonstrated in Italy (pilots 1.2 and 1.3), Sweden (pilots 2.1 and 2.2) and Spain (pilots 3.1 and 3.4).
Generic, regional or national relation
Generic
Nature of the use case
Technical/system use case
Further keywords for classification
Local congestion management, grid constraints, distributed energy resources, flexibility service providers, FSP, aggregators, flexibility, availability, demand response, distribution system operator, DSO.

1.7 General Remarks

General Remarks
Is used for further comments which are not considered elsewhere.

2 Diagrams of use case

Diagram(s) of use case


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3 Technical details

3.1 Actors

Actors		
Actor Name	**Actor Type**	**Actor Description**
Distribution System Operator (DSO)	Role (HEMRM)	A DSO is a System Operator. DSO is responsible for security of supply and reliability of the distribution grid. For this reason, it monitors the grid in order to identify possible arising issues and, if there is a need, it makes use of resources to solve such problems, by network reconfiguration and/or by requests to market operators or directly to properly contracted customers. In addition to the above and more in detail: • is responsible for the access of the customers to the grid; • operates, maintains, develops and is fully responsible of the part of the electricity system, named “Distribution Network”, typically starting from the HV/MV transformers (or vHV/HV transformers depending upon Member State Regulation) down to the customer’s POD; • acts on Local Flexibility Market requiring Local Flexibility Services to solve distribution grids issues; • ensures a transparent and non-discriminatory access to the distribution network for each users; • assess network status of the distribution grid and broadcasts selected information of the network status to eligible actors (e.g. aggregators, other system operators); • in critical situations, implements dedicated actions and deliver alerts during stress events If necessary, implement emergency measures including load shedding and DER curtailment; cooperates with the Transmission System Operator in carrying out their responsibilities (e.g. load shedding).
Flexibility Service Provider (FSP)	Role (HEMRM)	A party providing flexibility services to energy stakeholders via bilateral agreements or flexibility markets. An FSP can also be a BSP if enabled to the LFC services. In the Bridge HEMRM, FSP is an extension of FBSP. FSP offer services potentially to all the system operators, directly or through market operators. The device Distributed Energy Resource (DER) is a part of the FSP. Resources connected at the distribution grid capable of providing active power flexibility, either upward/downward or both. It can include several different roles and devices such as demand response (actor/role), distributed generation, electric vehicles, and storage systems.
Local Flexibility Market Operator (LFMO)	Role (HEMRM)	Responsible for the local flexibility market services. Responsible for calling, clearing, communicating results and possibly settling the provision of distributed flexibility. This role can be taken by an Independent Market Operator, an existing one (e.g. a NEMO) or a system operator (e.g. DSO, TSO)
Flexibility Platform	Tool	The Flexibility Platform is a tool used in energy grids to manage and optimize the supply and demand of flexibility. It centralizes forecasts, orders, and acts as a decision-support system for grid operations, enabling

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		real-time responses to the changing energy market conditions.
DSO Grid Operations	Business Role	Grid operations involve managing and maintaining an electrical grid for a reliable and efficient electricity supply. This includes balancing supply and demand, ensuring system stability, coordinating with stakeholders, and adapting to changing energy conditions.
DSO Flexibility Controller	Business Role	A "DSO Flexibility Controller" oversees the transfer of data necessary for settling and compensating flexibility services in the energy grid, ensuring that transactions are accurate and stakeholders are remunerated appropriately for their contributions to grid flexibility and reliability.

3.2 References

References						
No.	***References Type***	***Reference***	***Status***	***Impact on use case***	***Originator / organisation***	***Link***
			The status of the referenced document.	e.g. copy right, IPR		

4 Step by step analysis of use case

4.1 Overview of scenarios

Scenario conditions						
No.	**Scenario name**	**Scenario description**	**Primary actor**	**Triggering event**	**Pre-condition**	**Post-condition**
			Refers to the actor that triggers the scenario. For instance, a function called “Protection” would probably be triggered by an “Intelligent Electronic Device (IED)”. It is worth pointing out that the names of the Actors should be consistent with Actors List in all sections of the Use Case description.	Event that triggers the scenario. It can be a real event (such as, “a fault occurs in the grid”), or it is also possible to define scenarios that occur “periodically”.	Describes the state of the system before the scenario starts.	Describes the expected state of the system after the scenario is realized.

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No.1	Successful Activation.	This scenario describes fulfilment of a successful activation of an availability contract.	DSO Flexibility planner.	The forecast of a congested, or in other way limited grid.	The pre-condition is a congested, or in other way limited grid.	The post-condition is a grid that operates within capacity limits.

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4.2 Steps – Scenarios

Scenario								
Scenario name: Successful Activation.		No. 1 - Reference scenario						
Step No.	Event	Name of process/ activity	Description of process/ activity	Service	Information producer (actor)	Information receiver (actor)	Information Exchanged (IDs)	Requirement, R-IDs
	Event that triggers the activity. This triggering event can be an event, such as “a fault that occurs in the grid”, or it may refer to an activity that occurs “periodically”.	Label that would appear in a process diagram. Action verbs should be used when naming activity. EXAMPLE: “Fault occurs in the grid”.	This describes what action takes place in this step. The focus should be less on the algorithms of the applications and more on the interactions and information flows between actors.	Identifies the nature of flow of information and the originator of the information (*).	Name of the actor that produces the information. When the activity is an internal process, the information producer is the actor that carries out the internal process. For instance, when the activity is an internal algorithm within an Intelligent Electronic Device (IED), then the information producer is the actor “Intelligent	Name of the actor that receives the information. When the activity is an internal process, the information receiver is the same actor as the information producer.	Here the information can use a short ID referring to template section 5 for further details. Several information exchanged IDs can be listed, comma separated.	Refer to the identifiers (R-ID) of the detailed requirements that apply for each activity. These R-ID should be obtained from the BeFlexible Requirements List, which is based in the IEA PAS 62559 list of requirements/issues, and revised in the project. Refer to template Clause 7 “Definition of a list for requirements” for further details.

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					Electronic Device (IED)”.			
1.	Anticipation of market needs.	Load Limitation Decision.	Flexibility Planner determines the grid's load limits and communicates them to the LFMO for market usage planning.	Create	Flexibility planner (DSO).	LFMO.	INF01	GDPR-X
2.	Strategy Optimization	Merit Order Decision	Prioritization of market and non-market-based contracts.	Create	Flexibility Planner	LFMO	INF02	GDPR-X
3.	Refinement of Strategy	Intra-Category Merit Order	Determining the merit order within contract categories.	Create	Flexibility Planner	LFMO	INF02	GDPR-X
4.	Preparatory Phase	Trading Instructions	Planning, execute, and communicating activation testing.	Create	Flexibility Planner	Grid Operations	INF03	GDPR-X
5	Requested Short-term Load Forecasts	Grid Monitoring - Forecast Generation	The Forecast Provider generates short-term load forecasts and transmits this data to the Flexibility Platform for anticipated grid demands and potential issue analysis.	Create	Forecast Provider	Flexibility Platform	INF04	GDPR-X
6	Short-term forecast Generation	Grid Monitoring - Data Analysis and recommendation	The Flexibility Platform, utilizing its Decision Support Tool, analyzes the forecast data and recommends Grid Operations regarding the current grid status and necessary immediate actions	Executes and Reports	Flexibility Platform	Grid Operations	INF04	GDPR-X

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7	Order Fulfilment	Market Clearing	Execution of activation orders and market clearing.	Execute	Grid Operations	LFMO and FSP	INF05	GDPR-X
8	Market Operation	Sending Activation Signals	Sending activation signals post-market clearing.	Execute	LFMO	FSP Through Flexibility Platform.	INF06	GDPR-X
9	Confirmation of Delivery	Validation of Flexibility Delivery	Validation of Flexibility Delivery	Execute and Report	FSP	LFMO	INF07	GDPR-X
10	Quality Assurance	Confirmation of Flexibility Delivery	Confirming the success and quality of the flexibility delivery.	Report	LFMO	Flexibility Controller	INF08	GDPR-X
11	Confirmation of Delivery	Settlement Data Transfer	Transferring data for settling and remunerating the flexibility services.	Report	LFMO	FSP	INF09	GDPR-X

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5 Information exchanged

Information exchanged			
Information exchanged (ID)	*Name of information*	*Description of information exchanged*	*Requirement, R-IDs*
Refers to an identifier used in the field "Information Exchanged" of Table 4.2.	Is a unique ID which identifies the selected information in the context of the use case.	Brief description, in case a reference to existing data models/information classes should be added. Using existing canonical data models is recommended.	Can be used to define requirements referring to the information and not to the step as in the step by step analysis (see template section 6 below): EXAMPLE: Data protection class corresponding to this information object.
INF01	Grid Load Limit Data	Detailed load limitations of the grid to plan market usage effectively, likely including actual technical limits and possible strategic constraints.	GDPR-X, SM-X
INF02	Contract Merit List	Prioritized list of market and non-market-based contracts, ensuring alignment with strategies and regulations.	GDPR-X, SM-X
INF03	Test Activation Schedules	Planned schedules and details of potential test activations to prepare the grid operations	GDPR-X, SM-X
INF04	Short-term Load Forecasts	Predictive data and analysis results focusing on anticipated grid demands and status assessments.	GDPR-X, SM-X
INF05	Activation Orders and Market Status	Details on the placement of activation orders, market matching results, and clearing status.	GDPR-X, SM-X
INF06	Activation Signals	Signals indicating the activation status and instructions following market clearing procedures.	GDPR-X, SM-X
INF07	Flexibility Delivery Data	Data pertaining to the actual delivery of flexibility, including baseline and metering information.	GDPR-X, SM-X
INF08	Delivery Confirmation Status	Confirmation data verifying the success and validity of the flexibility delivery process.	GDPR-X, SM-X
INF09	Settlement and Remuneration	Financial and transactional data required for the settlement and remuneration of flexibility services.	GDPR-X, SM-X

6 Requirements

Requirements		
Categories ID	**Category name for requirements**	**Category description**
GDPR	Regulatory obligation related to privacy	2016/679 (General Data Protection Regulation)

SM	Security Management	Evaluate the interplay of various security measures applied to different elements, understanding how they might create vulnerabilities or result in cumbersome and potentially impractical user interfaces. Security solutions should guard against not only the less frequent but severe targeted attacks, but also the more common accidental missteps, malfunctions, and blunders. It is crucial to recognize the needs and considerations involved in the deployment of these security safeguards.
Requirement R-ID	**Requirement name**	**Requirement description**
GDPR-1	Data processing consent	Personal data may not be processed unless there is at least one legal basis to do so.
GDPR-2	Data retention policy	Data retention policy outlines the time period specific sensitive data can be retained, plus how it will be disposed of when the time to do so comes.
GDPR-3	Right to access, rectify, erasure, restriction	The data subject shall have the right to obtain from the controller without undue delay the access/rectification/erasure/restriction of inaccurate personal data concerning him or her.
GDPR-4	Data transfer consent	Personal data may not be transferred to a third-party if the data subject did not agree and the third party provide appropriate safeguard.
GDPR-X	All GDPR constraints also apply to this SUC.	e.g., proportional measures of protection, communication of data breach, among others
SM-1	Platform Authentication	Implement secure login mechanisms within the platform for enabling various exchanges, utilizing robust authentication and access control systems to safeguard data exchange.
SM-2	Secure Data Exchange	Establish stringent network security protocols to ensure the safe exchange of information between assets, protecting against potential vulnerabilities and threats.
SM-3	Safeguarding Information Integrity	Implement strategies and systems to maintain the integrity of information, ensuring that data is neither altered nor destroyed, and remains reliable and accurate throughout its lifecycle.
SM-X	Complete Security Management Integration	Including a Complete Security Management ensuring every aspect of security management is addressed. This includes robust platform authentication, stringent data exchange security, and unwavering protection of information integrity, covering every security facet in a unified approach.

7 Common Terms and Definitions

Common Terms and Definitions	
Term	**Definition**

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8.4. SUC04.4 – Integrate flexibility into DSO grid planning processes and tools

1 Description of the use case

This SUC will demonstrate how to properly make the procurement of short-term flexibility needs to deal with congestion forecasting by the DERMS (Distributed Energy Resources Management System).

1.1 Name of the use case

ID	*Area / Domain(s)*	*Name of Use Case*
SUC4.5	Grid-centric flexibility	Integrate flexibility into DSO grid planning processes and tools

1.2 Version management

Version Management			
Version No.	*Date*	*Name of Author(s)*	*Changes*
0.1	28.07.2023.	Nikola Vucicevic Branislav Brbaklic	First Draft
0.2	30.10.2023.	Nikola Vucicevic Nerea del Rocio Ramirez Maria Ruiz Branislav Brbaklic	Update

1.3 Scope and objectives of use case

Scope and Objectives of Use Case	
Scope	Integration of flexibility services into network planning process.
Objective(s)	1-Integrate flexibility into DERMS to exploit its potential in planning distribution network. 2-Demonstrates business potential of demand side products for DERs. 3- Demonstrates the ability of the DERMS in planning of the right amount of flexibility for forecasted congestions.
Related business case(s)	BUC 04 – Long-term distribution grid congestion (and voltage constraints) management

1.4 Narrative of use case

Narrative of Use Case
Short description
The main functionality of DSO in integrated network planning is to speed up DER connection process and to use flexibility services to address network overloads previously forecasted. This use case covers the integration of flexibility services into network planning process. DERMS will calculate the conditions of the grid during network planning and use the data from Flexibility Service Providers, FSPs, or aggregators to enable planning of the network using non-wire alternative.
Complete description
To make the distribution network more flexible and resilient, one of the most prominent solutions for the DSO is to use flexibility provided by the FSP, which is the alternative to conventional scenario of network reinforcement.

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This SUC includes the next steps:

- New DER wants to connect to the network.
- DSO should calculate feasibility and technical conditions.
- DERMS forecasts the future congestions in the long-term period network planning process.
- DERMS receives the data from FSP about future available flexibility and integrates the FSP data in network planning.
- For these needs, it is necessary to integrate flexibility into the process of planning the distribution network.
- DERMS leverages FSP data in network planning.
- DSO can use flexibility for congestion management

Services from the DoA:

Service 2. (DSO-G-CM) Aggregation for TSO and DSO grid services

The role of the Distribution System Operator (DSO) in integrated network planning is crucial for ensuring the effective and efficient operation of the overall electricity network. Based on the forecasted demand and identified areas of network constraints, DSOs play a vital role in planning grid expansions and reinforcements. They assess the need for new substations, transformers, or other infrastructure upgrades to ensure the grid can handle the increased load and maintain reliability. Timely connection of DER helps optimize grid operations, promote renewable energy adoption, drive cost savings, and improve energy resilience, but existing grid infrastructure may not have the necessary capacity to accommodate the DER. Upgrading or modifying the infrastructure takes time and resources, leading to delays in connecting DER. Flexibility can play a significant role in speeding up the integration of DERs, so that is reason why it is important to integrate flexibility into DSO grid planning.

1. Feasibility analysis for connection of new distributed energy resources or loads

Tools called by the step
Network planning application – Customer Connection

New DER send request for new connection to the grid. DSO should calculate feasibility of new connection. DSO should perform feasibility analysis for connection of new distributed energy resources or loads, in medium or low voltage networks. This analysis shall provide an insight into the network state when new customers are connected to the network.
By analysing various potential locations, a planning engineer can find the most appropriate location to install new customers.
DSO should check: overloads of lines and transformers and voltage violations on customers' locations.

2. Use flexibility in constraint management

Tools called by the step
Constraint Management application – Load Relief

Flexibility allows for more effective planning to accommodate future growth and changing demand patterns. By incorporating flexible assets during network planning, distribution networks can proactively manage constraints and optimize system capacity.
DSO should provide the optimal plan to neutralize unwanted conditions in the network. This can be achieved by adjusting the contribution/output of the available energy storage units, distributed generators, microgrids, demand response (DR) programs or DER aggregators to the network and\or transferring a minimal amount of the circuit loading to\from the adjacent circuits in order to neutralize the overload or reverse flow condition.
By leveraging flexibility in constraint management, DSO can enhance grid reliability, optimize asset utilization, and effectively address limitations and bottlenecks.

1.5 Use case conditions

Use case conditions
Assumptions
• Flexibility is a cost effective- solution (with respect to network traditional solutions). • DSO is allowed to sign flexible contract with customers • Individual DERs and aggregators are allowed by regulation to provide flexibility.
Prerequisites
• DERMS forecasts congestions and monitor conditions in long-term period in network planning. • FSPs contains the data about contracted resources and their availability in long-term period.

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1.6 Further Information to the use case for classification / mapping

Classification Information
Relation to other use cases
BUC 04 – Long-term distribution grid congestion (and voltage constraints) management
Level of depth
System use case (SUC) use case which describes in detail the functionality/technological solutions of (a part of) a business process.
Prioritisation
It is considered of high priority to implement the use of flexibility resources.
Generic, regional or national relation
Generic
Nature of the use case
Technical/system use case
Further keywords for classification
Network planning, long-term congestion management, DERMS, DER flexibility, FSP

1.7 General Remarks

General Remarks
No further comments which are not considered elsewhere.

2 Diagrams of use case

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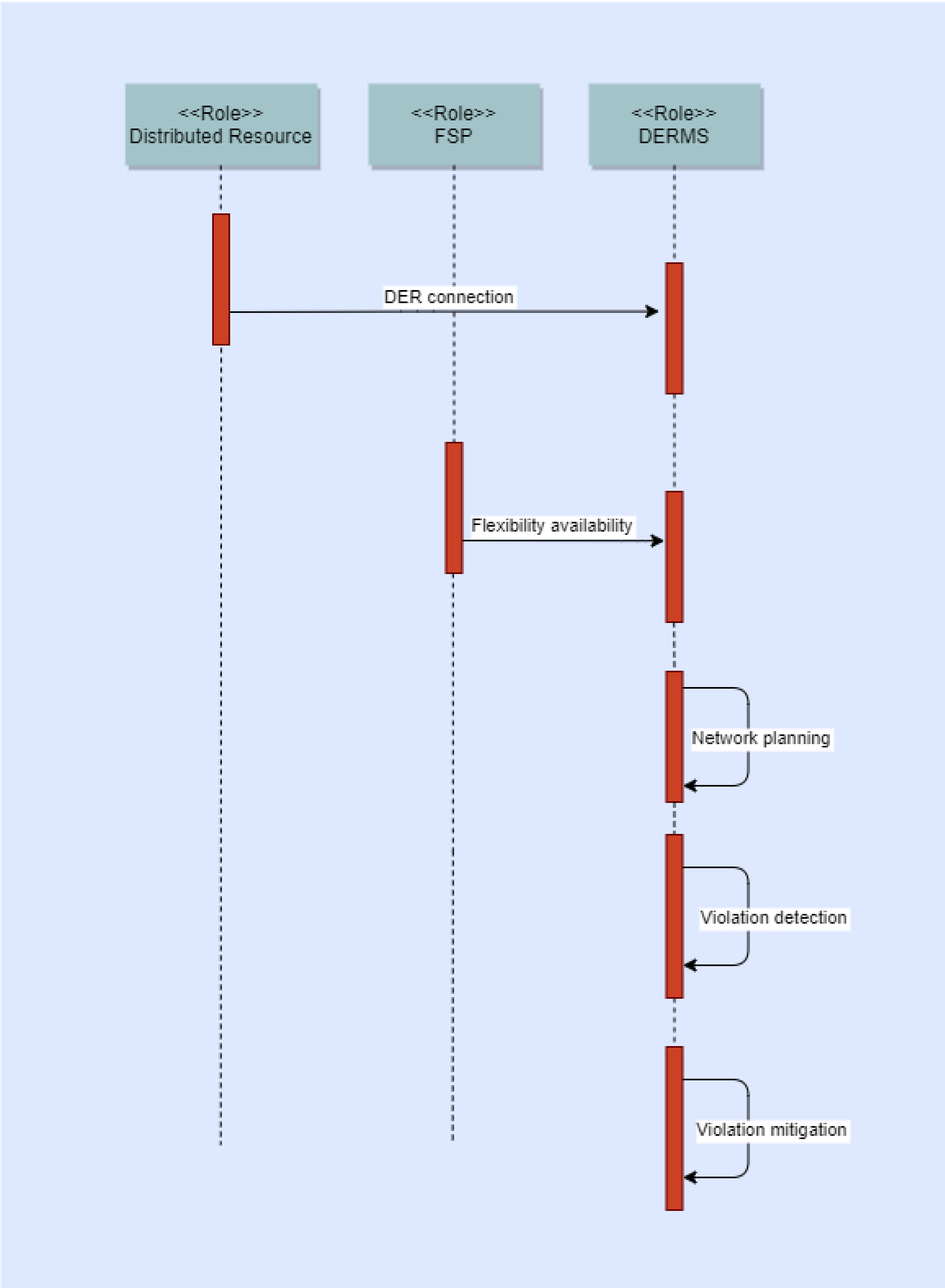
Diagram(s) of use case


3 Technical details

3.1 Actors

Actors		
Actor Name	***Actor Type***	***Actor Description***
Distribution System Operator (DSO)	Business Role	According to the Article 2.6 of the Directive: "a natural or legal person responsible for operating, ensuring the maintenance of and, if necessary, developing the distribution system in a given area and, where applicable, its interconnections with other systems and for ensuring the long-term ability of the system to meet reasonable demands for the distribution of electricity". Moreover, the DSO is responsible for connection of all grid users at the distribution level.
Distributed Energy Resources Management System (DERMS)	System	DERMS is a software package specifically tailored for utilities to support them in overcoming DER-imposed challenges and for using DERs to plan and operate the grid in most efficient and economical way. DERMS provides long-term forecast in network planning module, as well as a comprehensive set of advanced applications for constraint management, grid optimization, and planning of distribution systems with high DER penetration.
Flexibility Services Provider (FSP)	Business Role	The role could be taken by many stakeholders, such as an aggregator or individual distributed energy resources.
Distributed Energy Resource (DER)	System	Resources connected at the distribution grid capable of providing active power flexibility, either upward/downward or both. It can include several different roles and devices such as demand response (actor/role), distributed generation, electric vehicles, and storage systems.

3.2 References

References						
No.	***References Type***	***Reference***	***Status***	***Impact on use case***	***Originator / organisation***	***Link***

4 Step by step analysis of use case

4.1 Overview of scenarios

Scenario conditions						
No.	**Scenario name**	**Scenario description**	**Primary actor**	**Triggering event**	**Pre-condition**	**Post-condition**

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4.2 Steps – Scenarios

Scenario								
Scenario name :		**No. 1 - Reference scenario**						
Step No.	**Event**	**Name of process/ activity**	**Description of process/ activity**	**Service**	**Information producer (actor)**	**Information receiver (actor)**	**Information Exchanged (IDs)**	**Requirement, R-IDs**
1.1	New DER connection	DER connection	New DER (prosumer) wants to connect to the network.	REPORT	Distributed resource	DERMS	Info-3	
1.2	FSP sends available flexibility	Flexibility availability	FSP (DER, prosumer, etc.) sends data about the available flexibility in the long-term period.	REPORT	FSP	DERMS	Info-1	
1.3	Network planning process using FSP data	Network planning	DERMS network planning module enables planning the distribution network. New DER connection is considered in Customer Connection application.	GET	DERMS	DERMS	Info-2	
1.4	Identifying network problems	Violation detection	Violation(s) like overload and voltage problems are detected in the network planning process.	GET	DERMS	DERMS	Info-2	
1.5	Planner analysis violation	Violation mitigation	The planner can leverage the network planning module to generate various scenarios to enhance capacity. Planner, using Constraint Management application, concludes that flexible contract limits can be defined in	GET	DERMS	DERMS	Info-2	

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			the way that network constraints are not violated. The new contract limits are defined for DER connection.					

5 Information exchanged

Information exchanged			
Information exchanged (ID)	*Name of information*	*Description of information exchanged*	*Requirement, R-IDs*
INFO 1	Flexibility	Based on DERMS information, flexibility availability is exchanged.	DMI-1
INFO 2	DERMS advanced functionalities	DERMS advanced functionalities regarding monitoring of the state, violation, and network problem mitigation	DMI-1
INFO 3	DER connection	Data that is relevant to new DER connection	DMI-1

6 Requirements

Requirements		
Categories ID	**Category name for requirements**	**Categories ID**
GDPR	Regulatory obligation related to privacy	2016/679 (General Data Protection Regulation)
SI	Security Issues	Assess how different security measures applied to different items can potentially interact and either leave security holes or make user interfaces very laborious and possibly unworkable. Security must not only protect against the very harmful but quite rare deliberate attacks, but also against the far more likely inadvertent mistakes, failures, and errors. At the same time, it is necessary to try to identify the requirements and the concerns for implementing security measures.
DMI	Data management	Covers both the management of the data exchanges in each Use Case step and the management of data at either end if that management is impacted by data exchanges. An example of the first type of data management is the initial setting up and on-going maintenance of what data needs to be exchanged, say between a Geographic Information System and the many different applications that use its data. An example of the second type of data management is the need to backup data or ensure consistency of data whenever it is exchanged, such as if new protection settings are issued to multiple field devices, these settings need to be reflected in Contingency Analysis functions. It should not address database design but should concentrate on the user requirements for the interfaces to databases and other data handling applications.
CI	Configuration issues	Reflect the typical, probable, or envisioned communication configurations that are relevant to the use case step. These configuration issues include numbers of devices and/or systems, expected growth of the system over time, locations, distances, communications types, network bandwidth, existing protocols, etc., but only from the user's point of view. In some cases, only one of the possible choices is reasonable, while for other situations, more than one choice is reasonable.

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Requirement R-ID	Requirement name	Requirement description
GDPR-1	Data processing consent	Personal data may not be processed unless there is at least one legal basis to do so
SI-2	Exchange information from assets and the cloud	Network security measures commonly used with this data exchanged
SI-3	Eavesdropping	Ensuring confidentiality, avoiding illegitimate use of data, and preventing unauthorized reading of data
SI-4	Information integrity violation	Ensuring that data is not changed or destroyed
CI-1	Assets should have good communication quality	Communication configuration
CI-3	Data exchange methods	Data exchange methods
DMI-1	Management of accessing different types of data to be exchanged	Management of accessing different types of data to be exchanged

7 Common Terms and Definitions

Common Terms and Definitions	
Term	Definition

8.5. SUC05.1 – Aggregate controllable assets to solve congestion problems to the DSO

1 Description of the use case

1.1 Name of the use case

ID	*Area / Domain(s)*	*Name of Use Case*
SUC05.1	Cross-sector flexibility aggregation.	Aggregate controllable assets to solve congestion problems to the DSO.

1.2 Version management

Version Management			
Version No.	*Date*	*Name of Author(s)*	*Changes*
0.1	12/07/2023	Ione Lopez	First complete draft.

1.3 Scope and objectives of use case

Scope and Objectives of Use Case	
Scope	Use aggregation services to offer flexibility in order to solve congestion management problems to the DSO.
Objective(s)	Aggregate distributed energy resources DERs to participate in DSO congestion management problems.

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Related business case(s)	BUC05 _ Aggregation for TSO and DSO grid services.

1.4 Narrative of use case

Narrative of Use Case
Short description
In this system use case, an aggregator harnesses the flexible power of Distributed Energy Resources (DERs) to tackle congestion issues faced by Distribution System Operators (DSOs). By integrating diverse energy sources such as solar panels, load, and energy storage systems, the aggregator optimizes the utilization and management of DERs. Aggregator intelligently orchestrates the DERs to dynamically balance supply and demand, alleviating grid bottlenecks and reducing strain on the DSO infrastructure. This holistic approach not only enhances the reliability and stability of the grid but also promotes the efficient use of renewable energy resources. By leveraging DERs, the system reduces dependency on traditional fossil fuel-based power plants, facilitating a sustainable energy transition. With its ability to mitigate DSO congestion problems, this innovative system contributes to the optimization of grid operations and supports the integration of renewable energy, ensuring a more resilient and eco-friendly energy landscape.
Complete description
DoA service(s): - Service 2: Aggregation for TSO and DSO grid services (IBESPANA) - Service 2: Aggregation for TSO and DSO grid services (EONEIS) - Service 2: Energy management for building heating/cooling (EONEIS) - Service 9: Aggregation (VPP) of thermal flexibility for DSO congestion management & voltage control (TV) - Service 11: Battery-agnostic energy optimization (INESC TEC) This use case focuses on the process of managing and optimizing controllable assets within an aggregator environment. -The DSO provides management control requirements, specifying volumes, prices, and event durations. -These requirements are communicated to the aggregator and DERs using robust communication protocols. -The VPP continuously monitors assets in real-time, receiving signals such as active power (P), reactive power (Q), voltage (V), connectivity status, and communication status through a standard protocol. - Load and generation forecasting is performed based on historical data uploaded to the VPP platform or given directly by DERs. - Communicate activation and feedback signals to the VPP within DSO time constrains. -DERs have the authority to manually activate control measures, specifically in terms of active power (P) control signals. -The VPP aggregates controllable assets to address congestion problems faced by the DSO. Planning tools within the VPP platform enable flexibility evaluation, and the VPP acts as the central aggregator of controllable assets. Use Case Description: 1.DSO: The DSO provides congestion requirements. DERs provide information about volumes, prices, and event durations for their assets. This information is necessary for effective asset management and optimization. 2.Communication to VPP: The DSO communicates the management congestion requirements to the VPP using robust communication protocols. This ensures the seamless transfer of requirements, allowing for accurate implementation and coordination. 3.Real-time Asset Monitoring: The aggregator (VPP) continuously monitors the assets in real-time to ensure efficient and reliable operation. The assets communicate signals such as active power (P), reactive power (Q), voltage (V), connectivity status, and communication status to the VPP through a standard protocol. This real-time monitoring allows for immediate response and effective decision-making.

4.Load and Generation Forecasting: The VPP platform utilizes historical data uploaded by market participants to generate load and generation baselines. Through multi-regression methods, the VPP predicts future load and generation patterns. This forecasting capability enables asset owners and the VPP to plan and optimize asset utilization based on anticipated energy demands. DERs can provide forecasted baselines directly. 5.Activation and Feedback Signal Communication: Assets need to communicate activation and feedback signals to the VPP within DSO requirements. The assets transmit these signals through a standard protocol to ensure compatibility and timely response. Adhering to the DSO's communication quality and time constraints allows for efficient coordination and synchronization between the assets and the aggregator. 6.Manual Control Activation: DERS have the authority to manually activate control measures for their assets. Specifically, they can adjust the active power (P) control signals. This control mechanism empowers asset owners to optimize the performance and output of their assets, aligning them with DSO requirements and their own objectives. 7.Aggregate Controllable Assets: The VPP utilizes the flexibility of controllable assets to address congestion problems faced by the DSO. The VPP aggregates and optimizes the operation of these assets to ensure efficient energy flow and minimize congestion. This aggregation provides a reliable and stable energy supply to the distribution grid. 8.Planning Tools: The VPP platform offers planning tools that enable asset owners to evaluate and identify the potential flexibility of their assets. These tools facilitate data-driven decision-making, allowing asset owners to optimize their asset utilization, respond to market dynamics, and maximize their returns. Conclusion: The aggregator platform provides a comprehensive solution for the management and optimization of controllable assets within the energy ecosystem. By leveraging the capabilities of the VPP, DERs can effectively manage their assets, respond to DSO demands, and contribute to a reliable and sustainable energy system. The platform's features, including marketplace integration, real-time monitoring, load and generation forecasting, activation and feedback signal communication, manual control activation, congestion problem-solving, and planning tools, empower asset owners to make informed decisions, optimize asset utilization, and maximize the value generated from their controllable assets. Through the VPP's aggregation capability, the system can address congestion issues and ensure efficient energy distribution. The VPP acts as a central aggregator, providing a seamless integration of controllable assets and facilitating a resilient and optimized energy network.

1.5 Use case conditions

Use case conditions
Assumptions
Aggregator platform should be able to connect and match contractual needs and arrangements between DSO and DERs.
Prerequisites
DSO should predefine congestion management constrains. -DERs baseline horizon. -Flexibility volume. -Event activation horizon -Event activation timing. DERS should -Provide baselines or historical load data. -Calculate potential flexibility. Aggregator Should -Communicate with DERs and DSO. - Match DSO needs with DERs flexibility

1.6 Further Information to the use case for classification / mapping

Classification Information
Relation to other use cases

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BUC05 _ Aggregation for TSO and DSO grid services. SUC05.2 – Aggregate controllable energy assets to provide flexibility services to the TSO.
Level of depth
Use case will describe in detail the functionality/technological solution for aggregation of Distributed Energy Resources to solve congestion problems for the DSO.
Prioritisation
High Level of Priority - Solutions will be implemented in Spain Pilot (3.1 Madrid, 3.2 Benidorm and 3.3 Bilbao)
Generic, regional or national relation
Regional- DSO will provide regional congestion management constrains for the DER's to solve through aggregation.
Nature of the use case
Aggregation has to put in front of DSO necessities to solve congestions all of the potential flexibility Distributed Energy Resources can provide.
Further keywords for classification
Flexibility, aggregation, Virtual Power Plant (VPP)

1.7 General Remarks

General Remarks
Implementation considers the support of a cloud service provider and hardware connectivity.

2 Diagrams of use case

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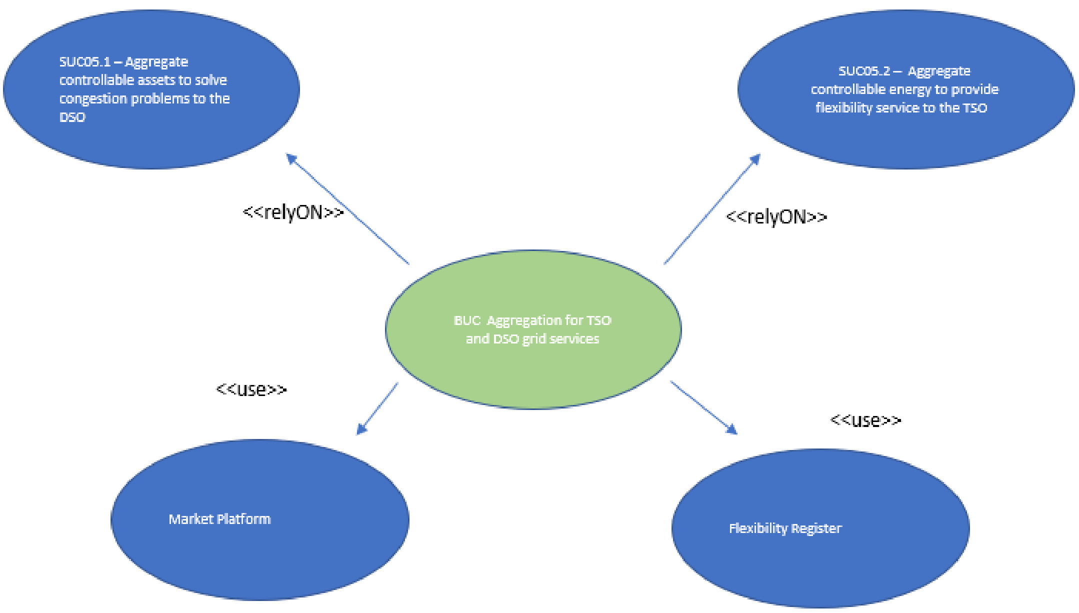
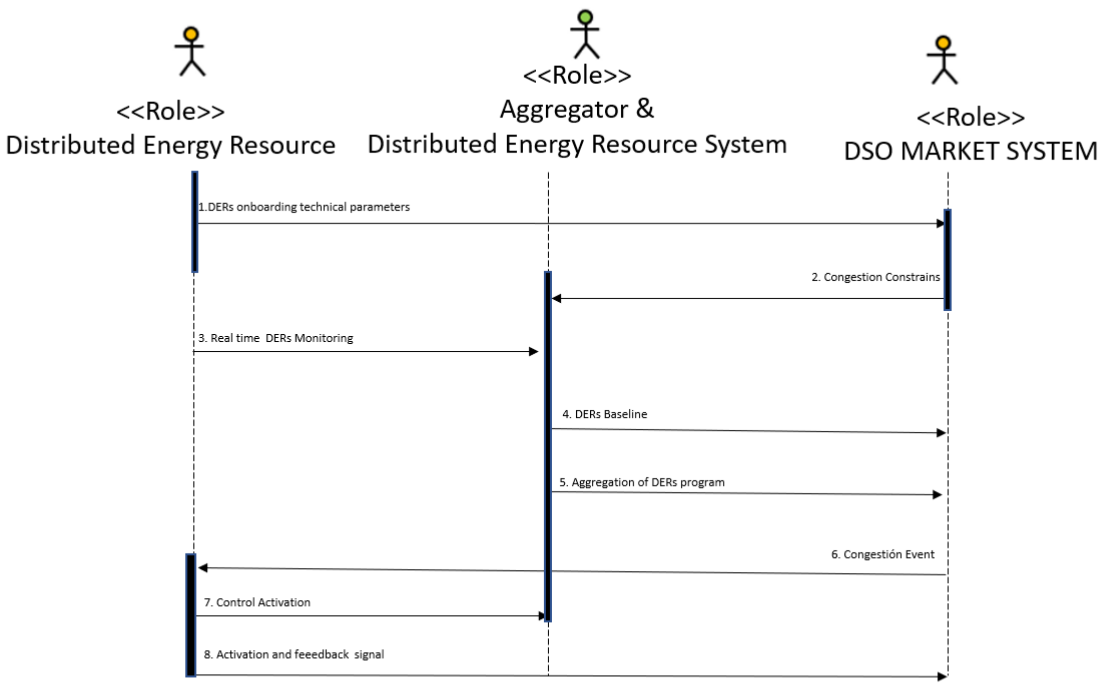
Diagram(s) of use case





3 Technical details

3.1 Actors

Actors		
Actor Name	*Actor Type*	*Actor Description*

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DSO	System Role	Responsible for the security of supply and reliability of the distribution network. It continuously monitors the grid to detect potential issues and, whenever necessary, it uses multiple resources to solve such problems, including network reconfiguration and/or requesting assistance from market operators or directly from contracted customers.
NMF	(BeFlexible role model)	Operates a transparent and non-discriminatory platform to automate the exchange of flexibility among different parties.
Resource Aggregator	System Role	Aggregates (i.e., collects and combines) multiple resources for usage by a service provider for energy market services.
DER Provider	BeFlexible role model	Responsible for installing and/or maintaining assets related with distributed energy equipment, which are provided/sold to other market agents.
Consumer	Business Role (BeFlexible role model, BRIDGE HEMRM)	Party connected to the grid which purchases and consumes electricity.
ESCo	Business Role (BeFlexible role model, BRIDGE HEMRM)	Offers energy related services. Can provide insights and energy management services as well as implementing energy efficiency and renewable energy projects.
Production Responsible Party	System Role	A Production Responsible Party is responsible for its imbalances, meaning the difference between the energy volume physically injected to the system and the final nominated energy volume, including any imbalance adjustment within a given imbalance settlement period
Consumer	System Actor	Interface where the consumer requests actions trough functions on a web browser or mobile application.

3.2 References

References						
No.	***References Type***	***Reference***	***Status***	***Impact on use case***	***Originator / organisation***	***Link***
1	Technical Report	Harmonized Electricity Market Role Model (HEMRM)	Public	Role Model	BRIDGE	https://energy.ec.europa.eu/system/files/2021-06/bridge_wg_regulation_eu_bridge_hemrm_report_2020-2021_0.pdf

4 Step by step analysis of use case

4.1 Overview of scenarios

Scenario conditions						
No.	**Scenario name**	**Scenario description**	**Primary actor**	**Triggering event**	**Pre-condition**	**Post-condition**

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1	Connect DSO congestion constrains with DERs potential flexibility	Concerns the inclusion and supply of flexible DER as a service subscription.	Digital Platform Provider	Occurs periodically (short term)	-Connectivity. DERs/DSO Resource availability.	DERs contribute with flexibility towards DSO congestion problem.
2	Connect DSO congestion constrains with DERs potential flexibility (not enough flexibility to solve congestion problems)	Concerns the inclusion and supply of flexible DER as a service subscription.	Digital Platform Provider	Occurs periodically (short term)	-Connectivity. DERs/DSO Resource availability.	DSO can ask for more flexibility.

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4.2 Steps – Scenarios

Scenario								
Scenario name :		No. 1 - Reference scenario						
Step No.	Event	Name of process/ activity	Description of process/ activity	Service	Information producer (actor)	Information receiver (actor)	Information Exchanged (IDs)	Requirement, R-IDs
1	Onboard DERs in the DSO congestion management problem solving	Onboard DERs	Registered DERs are onboarded on the but going through the Flex capacitation stage of the flexibility aggregation. DERS and their underlying flexible assets become discoverable.	CREATE	DERs	DSO/Aggregator	Baseline, potential flexibility.	GDPR-[1-4]
2	The DSO provides congestion requirements.	DSO Congestion constraints	The DSO communicates management congestion requirements to the aggregator using robust communication protocols.	CREATE	DSO	Aggregator/DERs	Baseline, potential flexibility.	GDPR-[1-4]
3	Real-time Asset Monitoring: power (P),	DERs monitorization	The aggregator continuously monitors the assets in real-time to ensure efficient and reliable operation.	CREATE	DERs	Aggregator /DSO	The assets communicate signals such as active power.	GDPR-[1-4]
4	Load and Generation Forecasting-	DERs Baseline	The aggregation platform utilizes historical data uploaded by market participants to generate load and generation baselines. Baseline can be provided by DERs.	EXECUTE	Aggregator	DSO	Active power baseline	GDPR-[1-4]
5	Aggregation	Aggregate available flexibility	Aggregates the flexibility potential of consumers that subscribed its services	CREATE	Aggregator	DERs/DSO		GDPR-[1-4]
6	Occurs periodically (congestion	Share available flexibility	Computed flexibility is communicated to the DSO.	CREATE	Aggregator	DSO		GDPR-[1-4]

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	events)							
7	Control activation	Manual Control Activation	DERS have can manually activate control measures for their assets	GET	DERs			GDPR-[1-4]
8	Activation and Feedback Signal	Activation feedback	Assets need to communicate activation and feedback signals to the VPP within DSO requirements.	EXECUTE	DERs	Aggregator/DSO	Flexibility activation	GDPR-[1-4]

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5 Information exchanged

Information exchanged			
Information exchanged (ID)	***Name of information***	***Description of information exchanged***	***Requirement, R-IDs***
INFO 1	Flexibility need	Based on DSO SCADA system information, load forecast and simulation, DSO predicts the state of the distribution grid and if some contracted flexibility is needed	GDPR-[1-4]
INFO 2	Baseline	The aggregator continuously monitors assets baseline in real-time to ensure efficient and reliable operation.	GDPR-[1-4]
INFO 3	Flexibility potential	Aggregator calculates the flexibility potential of consumers that subscribed its services	GDPR-[1-4]
INFO 4	Activation acknowledges	Based on DSO SCADA system information DSO detects flexibility activation	GDPR-[1-4]
INFO 5	Activation and Feedback Signal	Assets need to communicate activation and feedback signals to the VPP within DSO requirements.	GDPR-[1-4]

6 Requirements

Requirements		
Categories ID	**Category name for requirements**	**Category description**
GDPR	Regulatory obligation related to privacy	2016/679 (General Data Protection Regulation)
Requirement R-ID	**Requirement name**	**Requirement description**
GDPR-1	Data processing consent	Personal data may not be processed unless there is at least one legal basis to do so.
GDPR-2	Data retention policy	Data retention policy outlines the time period specific sensitive data can be retained, plus how it will be disposed of when the time to do so comes.
GDPR-3	Right to access, rectify, erasure, restriction	The data subject shall have the right to obtain from the controller without undue delay the access/rectification/erasure/restriction of inaccurate personal data concerning him or her.
GDPR-4	Data transfer consent	Personal data may not be transferred to a third-party if the data subject did not agree and the third party provide appropriate safeguard.
GDPR-X	All GDPR constraints also apply to this BUC.	e.g., proportional measures of protection, communication of data breach, among others

Quality of Service Requirements		
Categories ID	**Category name for requirements**	**Category description**
QoS	Quality of Service – Non-Functional requirements	Generic properties that service/SUC should provide – quality attributes.
Requirement R-ID	**Requirement name**	**Requirement description**
QoS-1	Frequency of data exchanges.	Upon request by at least the frequency of the related event.
QoS-2	Elapsed Time response	Messages are conveyed in 1-2 seconds.

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Security Requirements		
Categories ID	**Category name for requirements**	**Category description**
SEC	Security	Authentication of user, confidentiality, integrity, prevention of denial of service, non-repudiation or accountability, error management
Requirement R-ID	**Requirement name**	**Requirement description**
SEC-1	Service authentication	All parties should be trusted.
SEC-2	Eavesdropping	Ensuring confidentiality, avoiding illegitimate use of data, and preventing unauthorized reading of data, is crucial. • Web services should run over Transport Socket Layer (TSL) File sharing between two machines should occur over FTPS or using pre-agreed encrypted format
SEC-3	Acknowledge timeout	One minute for any M2M communication.

Data Management Requirements		
Categories ID	**Category name for requirements**	**Category description**
D	Data Management	Type of source of data, correctness or validity of data, timeliness or time stamping of data, volume of data, synchronization, or consistency of data across systems, timely access to data, validation of data across organizational boundaries, transaction management, data naming, identification, formats across disparate systems, maintenance of data and databases
Requirement R-ID	**Requirement name**	**Requirement description**
D-1	Data validation from multiple sources	Mapping of data items is required for data from different sources
D-2	Management of data across organizational boundaries	Data exchanges go across organizational boundaries.
D-3	Management of data formats in data exchanges	Conversion of data format handled by a “converter” at Information receiver site.

Functional Requirements		
Categories ID	**Category name for requirements**	**Category description**
F	Functional	Essential functionalities that build the core concept of the service/SUC.
Requirement R-ID	**Requirement name**	**Requirement description**
F-1	Aggregator takes consumer’s flexibility capacity to market	Consumer’s flexibility capacity is grouped by an aggregator and is included as part of a bid that is taken to market.

7 Common Terms and Definitions

Common Terms and Definitions	
Term	**Definition**

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8.6. SUC05.2 – Aggregate controllable energy assets to provide flexibility services to the TSO

1 Description of the use case

1.1 Name of the use case

ID	Area / Domain(s)	Name of Use Case
SUC05.2	Select from: (1) Local energy sharing and flexibility market; **(2) Grid-centric flexibility**; (3) TSO-DSO flexibility coordination; (4) Cross-sector	Aggregate controllable energy assets to provide flexibility services to the TSO

1.2 Version management

Version Management			
Version No.	Date	Name of Author(s)	Changes
0.1	13.07.2023	Pau Lloret	First Draft

1.3 Scope and objectives of use case

Scope and Objectives of Use Case	
Scope	This UC describes the aggregation of flexibility from several energy assets to provide flexibility services to the TSO.
Objective(s)	• Aggregate flexibility from several assets to offer flexibility services • Offer aggregated flexibility services to the TSO
Related business case(s)	It is part of: BUC 05 - Aggregation for TSO and DSO grid services It is a complement of: • BUC 03 - Optimize domestic thermal loads to reduce costs and boost flexibility

1.4 Narrative of use case

Narrative of Use Case
Short description
Flexibility can be offered for different kind of services to the TSO: • Balancing: FCR, aFRR, mFRR... • Grid management: voltage control, congestion management... • Adequacy: capacity market, strategic reserve... Although each of them and the regulation in each country make the provision of each flexibility service slightly different, this SUC is focused on the previous step. In this step, the Resource Aggregator or the Flexibility Services Provider is in

charge of the aggregation of flexibility from several energy assets to provide different kind of flexibility services to the TSO. Optionally, between the Flexibility market platform managed by the TSO and the VPP managed by the Flexibility Service Provider, an intermediate Aggregator platform managed by a Resource Aggregator can be in place to facilitate the integration of FSPs that do not reach the minimum pool size to directly participate in the Flexibility market. The control and monitoring of the energy assets are out of the scope of this SUC (see SUC03.2 as an example of how these tasks can be defined). On the other extreme of the flexibility chain, the definition of the flexibility needs by the TSO, the flexibility offers matching, or the market settlement of the provided flexibility are also out of the scope of this SUC.
Complete description
This SUC describes the following service: • Service 2: Aggregation for TSO and DSO grid services The following services are a prerequisite for this SUC: • Service 12: Thermal appliances retrofit and efficient control • Service 1: Optimization of thermal consumption considering self-consumption, peak shaving and ToU tariffs This Use Case has the following steps: 1. Aggregate data from energy assets The EMS sends monitoring and performance data to the VPP of all the energy assets in the pool to be aggregated. The data from those assets is aggregated to perform as a virtual unique energy asset. Tools and systems called by the step: EMS, VPP 2. Baseline As a result of the aggregation of the data from the energy assets and based on forecast techniques, the VPP creates the aggregated baseline of the pool under control. Depending on the flexibility service, the baseline may be calculated taking into account different considerations and it may need to be shared with the Flexibility market platform or Aggregator platform. Tools and systems called by the step: VPP, Flexibility market platform, Aggregator platform 3. Optimize The VPP can provide aggregated flexibility by optimizing the answer to the flexibility needs among the several energy assets inside a pool. It takes the baseline and the flexibility needs as inputs. The EMS also sends constraints to the VPP from the energy assets to ensure that their safety or comfort margins are not reached. Tools and systems called by the step: EMS, VPP 4. Flexibility offers As a result of the optimization, the VPP creates the flexibility offers based on the previously defined baseline and the available flexibility of the assets integrated into the controlled pool. It needs to be shared with the Flexibility market platform or Aggregator platform. Tools and systems called by the step: VPP, Flexibility market platform, Aggregator platform 5. Activate As a result of the optimization carried out by the VPP, constraints are sent to the EMS to be included into the optimization and control of the assets under its control. Tools and systems called by the step: EMS, VPP 6. Report and settlement

Once the flexibility service has been satisfied, the amount and duration of the flexibility provision is reported and a settlement of the provision occurs. This process is different for each kind of flexibility service. Tools and systems called by the step: VPP, Flexibility market platform, Aggregator platform

1.5 Use case conditions

Use case conditions
Assumptions
TSO flexibility balancing or grid constraint services are open for the aggregation of low-voltage assets.
Prerequisites
Energy assets and its steering mechanism are certified and qualified to provide flexibility services by the TSO or the intermediate Resource Aggregator.

1.6 Further Information to the use case for classification / mapping

Classification Information
Relation to other use cases
BUC03 - Optimize domestic thermal loads to reduce costs and boost flexibility SUC03.1 - Retrofit of thermoelectric water heater BUC05. Aggregation for TSO and DSO grid services BUC05.02. Aggregation for TSO and DSO grid services
Level of depth
System use case (SUC) use case which describes in detail the functionality/technological solutions of (a part of) a business process.
Prioritisation
To be demonstrated in France (pilots 3.5 and 3.6).
Generic, regional or national relation
Generic.
Nature of the use case
TSO Grid Services: Balancing services (TSO-G-BL).
Further keywords for classification
Water heater, thermal loads, optimization, flexibility, TSO, aggregation, virtual power plant (VPP).

1.7 General Remarks

General Remarks

2 Diagrams of use case

Diagram(s) of use case
Use Case Diagram:

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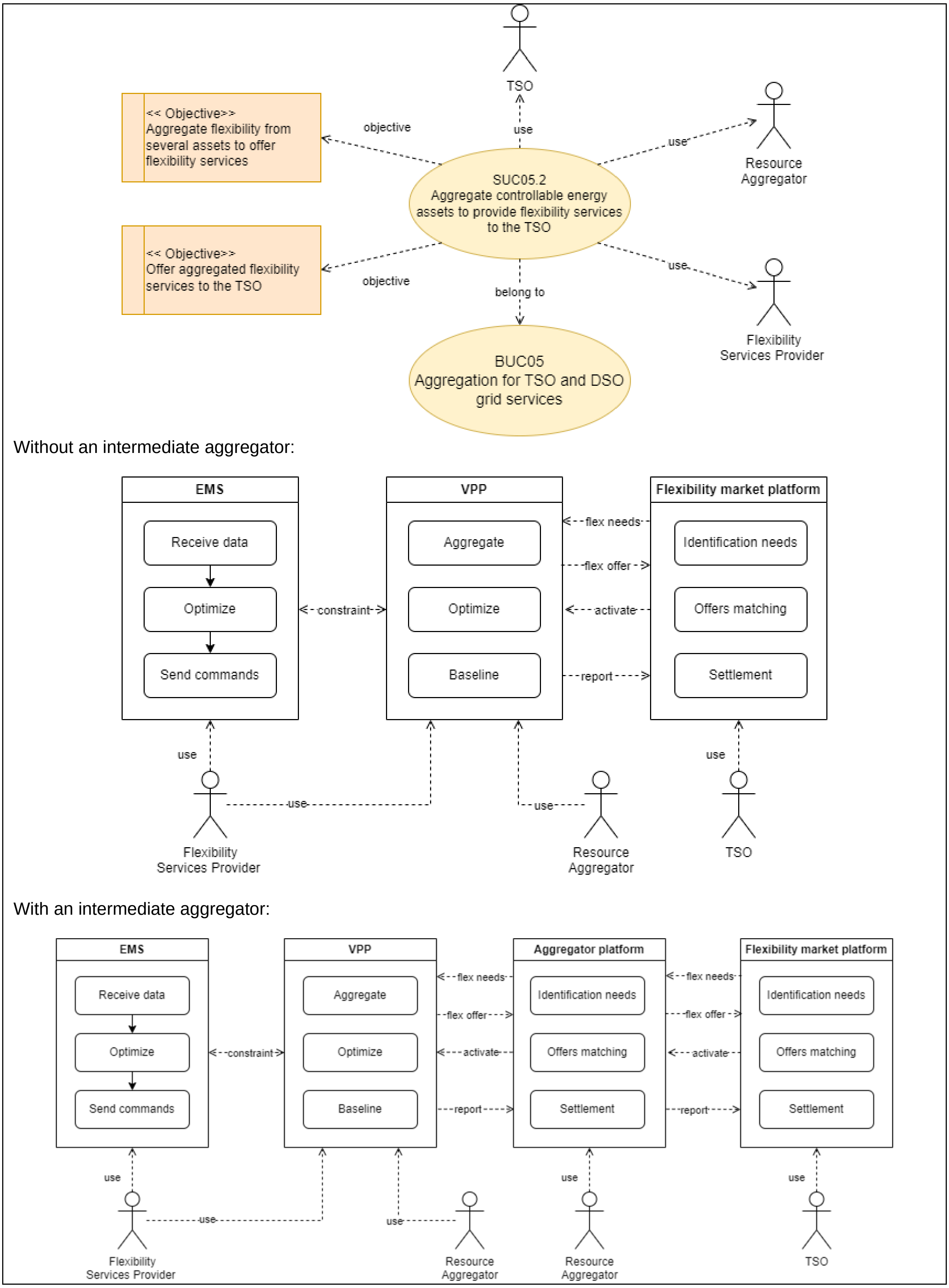

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3 Technical details

3.1 Actors

Actors		
Actor Name	**Actor Type**	**Actor Description**
EMS	Tool	The Energy Management System is a software in the cloud that processes all the monitored data to optimize the control of flexible loads to reduce their consumption, reduce their energy costs and provide flexibility services. It is typically operated by the Flexibility Services Provider.
VPP	Tool	Platform to monitor and control flexible assets of a confined portfolio in an aggregated way, possibly combining several control objectives. It is typically operated by the Resource Aggregator or the Flexibility Services Provider.
Aggregator platform	Tool	It is typically operated by the Resource Aggregator.
Flexibility market platform	Tool	Place where buyers and sellers of flexibility meet to trade flexibility. It is typically operated by the TSO.
Resource Aggregator	Business Role (BRIDGE HEMRM)	A party that aggregates resources for usage by a service provider for energy market services.
TSO	Business Role (BRIDGE HEMRM)	TSO is responsible for security of supply and reliability of the transmission grid.
Flexibility Services Provider	Business Role (BRIDGE HEMRM)	A party providing flexibility services to energy stakeholders via bilateral agreements or flexibility markets.

3.2 References

References						
No.	**References Type**	**Reference**	**Status**	**Impact on use case**	**Originator / organisation**	**Link**

4 Requirements

Requirements		
Categories ID	**Category name for requirements**	**Category description**
GDPR	Regulatory obligation related to privacy	2016/679 (General Data Protection Regulation)
Requirement R-ID	**Requirement name**	**Requirement description**
GDPR-1	Data processing consent	Personal data may not be processed unless there is at least one legal basis to do so.
GDPR-2	Data retention policy	Data retention policy outlines the time period specific sensitive data can be retained, plus how it will be disposed of when the time to do so comes.
GDPR-3	Right to access, rectify, erasure, restriction	The data subject shall have the right to obtain from the controller without undue delay the access/rectification/erasure/restriction of inaccurate personal data concerning him or her.
GDPR-4	Data transfer consent	Personal data may not be transferred to a third-party if the data subject did not agree and the third party provide appropriate safeguard.

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GDPR-X	All GDPR constraints also apply to this BUC.	e.g., proportional measures of protection, communication of data breach, among others

5 Common Terms and Definitions

Common Terms and Definitions	
Term	**Definition**

8.7. SUC06.1 – Short term Flexibility procurement based on congestion forecasting

1 Description of the use case

This SUC will demonstrate how to properly make the procurement of short-term flexibility needs to deal with congestion and voltage violations using forecasting by the DSO and the DERMS (Distributed Energy Resources Management System).

1.1 Name of the use case

ID	*Area / Domain(s)*	*Name of Use Case*
SUC6.1	Grid-centric flexibility	Short-term flexibility procurement based on congestion and voltage constraints forecasting

1.2 Version management

Version Management			
Version No.	*Date*	*Name of Author(s)*	*Changes*
0.1	28.07.2023.	Daniel Davi-Arderius Natalia Bonet Ramon	First Draft
0.2	18.10.2023	Daniel Davi-Arderius Natalia Bonet Ramon Nikola Vucicevic Branislav Brbaklic	Second Draft
0.3	25.10.2023	Daniel Davi-Arderius Natalia Bonet Ramon Nikola Vucicevic Branislav Brbaklic Nerea del R. Ramírez María Ruíz	Third Draft

1.3 Scope and objectives of use case

Scope and Objectives of Use Case	
Scope	Short term flexibility procurement on based forecasted congestion and voltage violations.
Objective(s)	1-Integrate flexibility into DERMS to exploit its potential in solving possible congestions and voltage violations. 2-Demonstrates business potential of demand side products for DERs

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	3- Demonstrates the ability of the DERMS in procuring the right amount of flexibility for occurring congestions or violations.
Related business case(s)	BUC 06 – Short term congestion constraints forecasting and management for local flexibility service activation.

1.4 Narrative of use case

Narrative of Use Case
Short description
The main functionality of DSO 'Short term flexibility procurement' is the procurement of flexibility services to address network overloads previously estimated. DERMS will monitor the conditions of the grid in look ahead (short-term) period and send the activation signals to the Flexibility Service Providers, FSPs, or aggregators committed in the market phase, in accordance with the type of procured product. Only for DEMO 1, the activity of forecasting described in this SUC can consider also voltage constraints (treated in BUC07). Since the activities and the systems involved are the same to detect both congestions and voltage violations this SUC will be considered also applicable to BUC07.
Complete description
Services from the DoA: - Service 19: Congestion forecasting service (RWTH) - Service 2: (DSO-G-CM) Aggregation for TSO and DSO grid services (i-DE/EDE) - Service 21: (DSO-G-VC) Voltage control (day ahead, intra-day, real-time) (RWTH) In the operation of the distribution grids, some contingences cannot be identified in advance (long-term), i.e. scheduled maintenance tasks, unforeseen events, disconnection of lines, disconnection of transformers, etc. Moreover, these contingences could not be solved with traditional resources like network reconfiguration or similar. As solution, the procurement of flexibility services can be a valid and alternative solution to reduce electricity flows below the operational security criteria. This SUC includes the next steps: • DERMS forecasts the future congestions and voltage violations in the short-term period through forecast module to quantify future flexibility needs. • DERM periodically receives data from FSP. • DSO can communicate the flexibility needs to the Local Market Operator. This point does not concern DERMS test case since there is not Local Market Operator in our Viesgo test cases. • LMO publishes the flexibility needs. • LMO performs the market clearing about available flexibility. • DERMS integrates the market clearing results • DERMS engages FSP to resolve network constraints. ***Tools called by the step***: Forecasting module The Forecasting module is used for assessing the electrical power loads in equal time intervals (for instance, 60 minutes) for short-term period ahead, accounting for the historical estimated or measured electrical data (data source), historical metering data, historical weather data, time encoding data (hours of the day, days of the week and months of the year) and the external impacts such as the upcoming weather conditions. The Forecasting module is used for the assessment of the network states and violations in the network, on feeder and transformer area levels, in equal time intervals (for instance, 60min) up to several days ahead (for periodical executions), accounting for the forecast results if available, and if not, accounting for the load profiles (from the model) associated to the customers in the distribution power grid, day types (from the model), seasons (from the model) and the external impacts such as the upcoming weather conditions if available (optional). The approved switching plans are used as an additional input (optional). ***Tools called by the step***: Constraint Management application (Watt Flexibility)

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This tool enables near real-time and forecasting of the demand, using the available flexibility from DERs. The term "electric power demand" refers to the injected power from the transmission to the distribution network. The demand flexibility is the available possibility to increase and decrease demand that is provided by the flexible output of DERs. These applications enable the utility to: • Adopt new renewable low-carbon, but variable, generation such as solar and wind power, into the electricity network. • Avoid or defer the capital investments required for expanding the network of the overhead lines, underground cables and substations. • Engage customers that are opting for more control over the energy.

1.5 Use case conditions

Use case conditions
Assumptions
• Congestions and voltage violations forecasted with the DERMS forecast module. • Flexibility should be a cost-effective- solution (with respect to network traditional solutions, at least in the short-term timeframe). • FSP, within the timeframe requested for providing services to the DSO, has no other flexibility provision contracts except the one with the DSO itself. • Individual DERs and aggregators are allowed by regulation to provide flexibility.
Prerequisites
• Attributes for short-term services are previously defined. • DERMS forecasts congestions or violations and monitor conditions in short-term period. • Communication link between DERMS, LMO and FSP is established and running. • FSPs effectively control the contracted resources to respond activations as contracted in the flexibility local market.

1.6 Further Information to the use case for classification / mapping

Classification Information
Relation to other use cases
BUC 06 – Short-term congestion constraints forecasting and management for local flexibility service activation. BUC 07 - Short-term voltage constraints forecasting and management for local flexibility service activation
Level of depth
System use case (SUC) use case which describes in detail the functionality/technological solutions of (a part of) a business process.
Prioritisation
It is considered of high priority to implement the use of flexibility resources.
Generic, regional or national relation
Generic
Nature of the use case
Technical/system use case
Further keywords for classification
Local market, Short-term congestion management, Voltage violations, DSO, DERMS, DER flexibility, FSP, TSO-DSO coordination

1.7 General Remarks

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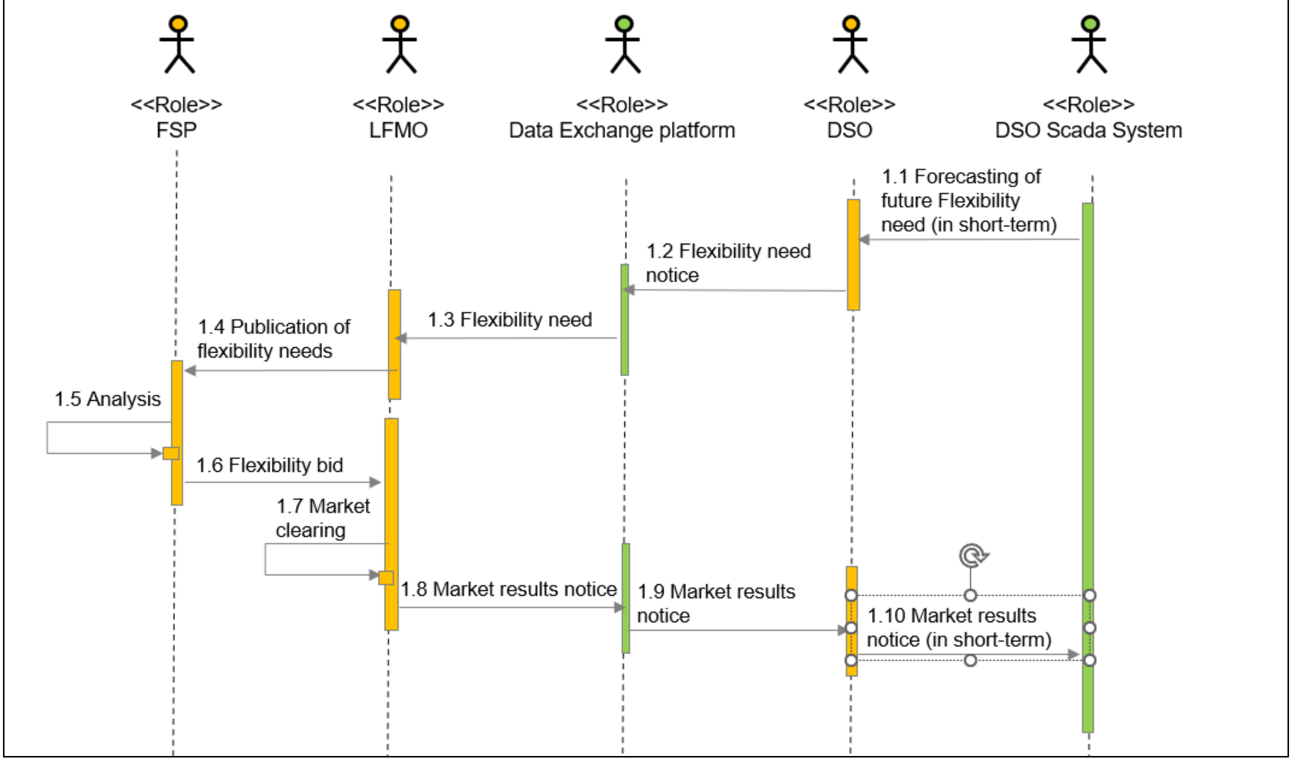
General Remarks
No further comments which are not considered elsewhere.

2 Diagrams of use case

Diagram(s) of use case


3 Technical details

3.1 Actors

Actors		
Actor Name	***Actor Type***	***Actor Description***
Distribution System Operator (DSO)	Role (HEMRM)	A DSO is a System Operator. DSO is responsible for security of supply and reliability of the distribution grid. For this reason, it monitors the grid to identify possible arising issues and, if there is a need, it makes use of resources to solve such problems, by network reconfiguration and/or by requests to market operators or directly to properly contracted customers. In addition to the above and more in detail: • is responsible for the access of the customers to the grid; • operates, maintains, develops and is fully responsible of the part of the electricity system, named “Distribution Network”, typically starting from the HV/MV transformers (or vHV/HV transformers depending upon Member State Regulation) down to the customer’s POD;

		• acts on Local Flexibility Market requiring Local Flexibility Services to solve distribution grids issues; • ensures a transparent and non-discriminatory access to the distribution network for each users; • assess network status of the distribution grid and broadcasts selected information of the network status to eligible actors (e.g. aggregators, other system operators); • in critical situations, implements dedicated actions and deliver alerts during stress events If necessary, implement emergency measures including load shedding and DER curtailment; cooperates with the Transmission System Operator in carrying out their responsibilities (e.g. load shedding).
Distributed Energy Resources Management System (DERMS)	System	DERMS is a software package specifically tailored for utilities to support them in overcoming DER-imposed challenges and for using DERs to plan and operate the grid in most efficient and economical way. DERMS provides real-time monitoring, near-term and medium-term forecast, as well as a comprehensive set of advanced applications for constraint management, grid optimization, and planning of distribution systems with high DER penetration.
Flexibility Services Provider (FSP)	Business role	The role could be taken by many stakeholders, such as an aggregator or individual distributed energy resources.
Distributed Energy Resource (DER)	System	Resources connected at the distribution grid capable of providing active power flexibility, either upward/downward or both. It can include several different roles and devices such as demand response (actor/role), distributed generation, electric vehicles, and storage systems.
Local Flexibility Market Operator (LFMO)	Role (HEMRM)	Responsible for the local flexibility market services. Responsible for calling, clearing, communicating results and possibly settling the provision of distributed flexibility. This role can be taken by an Independent Market Operator, an existing one (e.g. a NEMO) or a system operator (e.g. DSO, TSO)
Data exchange platform	System	System for sending activation signal to the flexibility service provider, FSP

3.2 References

References						
No.	***References Type***	***Reference***	***Status***	***Impact on use case***	***Originator / organisation***	***Link***
1	Technical Report	Harmonized Electricity Market Role Model (HEMRM)	Public	Role Model	BRIDGE	https://energy.ec.europa.eu/system/files/2021-06/bridge_wg_regulation_eu_bridge_hemrm_report_2020-2021_0.pdf

4 Step by step analysis of use case

4.1 Overview of scenarios

Scenario conditions

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No.	Scenario name	Scenario description	Primary actor	Triggering event	Pre-condition	Post-condition
1	Procurement	Procurement of flexibility services to alleviate network overloads	DERMS	A short term flexibility need is detected on the DERMS system	DERMS is communicating with FSP	

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4.2 Steps – Scenarios

Scenario								
Scenario name :		No. 1 - Reference scenario						
Step No.	Event	Name of process/ activity	Description of process/ activity	Service	Information producer (actor)	Information receiver (actor)	Information Exchanged (IDs)	Requirement, R-IDs
1.1	FSP sends available flexibility	Flexibility availability	FSP (Aggregator, DER, prosumer, etc.) periodically sends data about the available flexibility in the following 24 hours.	REPORT	FSP	DERMS	Info-1	
1.2	DERMS monitors short-term period	Forecast	DERMS incorporates FSP data and monitors short-term period by using forecast and look ahead calculations and constraint management applications.	GET	DERMS	DERMS	Info-2	
1.3	DERMS violation detection	Violation detection	Look ahead application detects violation(s) like overload and reports an alarm.	GET	DERMS	DERMS	Info-2	
1.4	Operator analysis violation	Violation mitigation	Operator using Constraint Management application concludes that dispatch of flexibility from FSP is needed in some time interval in the future to resolve the violation, set desired value and time interval.	GET	DERMS	DERMS	Info-2	
1.5	DERMS initiates	Flexibility needs	DERMS sends the new request to FSP.	REPORT	DERMS	FSP	Info-3	

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	flexibility activation							
1.6	FSP receives request	Dispatch notice	FSP receives new request. FSP arranges its schedule according to the request obtained from DERMS.	GET	FSP	FSP	Info-3	
1.7	FSP sends activation signal	Activation signal	FSP sends activation signals to the selected resources.	REPORT	FSP	Distributed resource	Info-3	
1.8	Resources activation		The resource proceeds with the activation	EXECUTE	Distributed resource	Distributed resource	Info-3	
1.9	FSP update	Flexibility update	FSP updates available flexibility.	CHANGE	FSP	DERMS	Info-1	

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5 Information exchanged

Information exchanged			
Information exchanged (ID)	***Name of information***	***Description of information exchanged***	***Requirement, R-IDs***
Info-1	List of potential FSP	List of all the potential FSP that can submit a bid because can contribute to alleviate the congestion issue.	GDPR-X
Info-2	Generic attributes	Composed of generic parameters concerning the market session being requested. E.g.: • Auction identifier • Associated DSO • Product Type: Flexibility Product • Type of negotiation: Auction Area: Basic or aggregated.	GDPR-X
Info-3	Product parameters	Composed of product parameters concerning the market session being requested. E.g.: • Service window: Selection of the required date and duration of the service • Availability: Selection of the capacity, the direction, and the estimated hours of activation. • Activation window (in case of activation product): Specific subperiod in an activation window when a particular DER could be activated and thus it must be available. Multiple sets of activation windows can be defined. • Local area: Selection of the trading area. Choice by postal code, connection point, lines… (to be determined). • Activation Announcement: Time in advance that a DSO informs a DER that its activation is programmed confirmed. Form of Remuneration: It establishes form of payment to winner DERs Two different terms are defined availability and activation (depending on the product).	GDPR-X
Info-4	Submitted bids	Composed of bidding information • General attributes (FSP identifier) • Price and quantity offered in the markets.	
Info-5	Cleared bids	Composed of bidding information • General attributes (FSP identifier)	GDPR-X

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		• Availability: Selection of the capacity, the direction and the estimated hours of activation (period of availability and price). • Price and quantity cleared in the markets.	
Info-6	Market participant prequalification information	Contact information; Fiscal data; Access contract; bank details; power of representation; confidentiality agreement; declaration of non-collusion	GDPR-X

6 Requirements

Requirements		
Categories ID	**Category name for requirements**	**Category description**
GDPR	Regulatory obligation related to privacy	2016/679 (General Data Protection Regulation)
SI	Security Issues	Assess how different security measures applied to different items can potentially interact and either leave security holes or make user interfaces very laborious and possibly unworkable. Security must not only protect against the very harmful but quite rare deliberate attacks, but also against the far more likely inadvertent mistakes, failures, and errors. At the same time, it is necessary to try to identify the requirements and the concerns for implementing security measures.
DMI	Data management	Covers both the management of the data exchanges in each Use Case step and the management of data at either end if that management is impacted by data exchanges. An example of the first type of data management is the initial setting up and on-going maintenance of what data needs to be exchanged, say between a Geographic Information System and the many different applications that use its data. An example of the second type of data management is the need to backup data or ensure consistency of data whenever it is exchanged, such as if new protection settings are issued to multiple field devices, these settings need to be reflected in Contingency Analysis functions. It should not address database design, but should concentrate on the user requirements for the interfaces to databases and other data handling applications.
CI	Configuration issues	Reflect the typical, probable, or envisioned communication configurations that are relevant to the use case step. These configuration issues include numbers of devices and/or systems, expected growth of the system over time, locations, distances, communications types, network bandwidth, existing protocols, etc., but only from the

		user's point of view. In some cases, only one of the possible choices is reasonable, while for other situations, more than one choice is reasonable.
Requirement R-ID	**Requirement name**	**Requirement description**
GDPR-1	Data processing consent	Personal data may not be processed unless there is at least one legal basis to do so
SI-1	Login in the platform of the aggregator to any exchange with the aggregator cloud	Authentication and Access Control mechanisms commonly used with this data exchange
SI-2	Exchange information from assets and the cloud	Network security measures commonly used with this data exchanged
SI-3	Eavesdropping	Ensuring confidentiality, avoiding illegitimate use of data, and preventing unauthorized reading of data
SI-4	Information integrity violation	Ensuring that data is not changed or destroyed
CI-1	Assets should has good communication quality	Communication configuration
CI-2	Only devices in Automatic mode will response for flexible and energy efficiency orders	Operation mode
CI-3		Data exchange methods
DMI-1		Management of accessing different types of data to be exchanged

7 Common Terms and Definitions

Common Terms and Definitions	
Term	**Definition**

8.8. SUC06.2 – Short term Flexibility activation for DSO congestion management

1 Description of the use case

1.1 Name of the use case

ID	*Area / Domain(s)*	*Name of Use Case*
SUC06.2	(2) Grid-centric flexibility	Short term flexibility activation for DSO congestion and voltage constraints management

1.2 Version management

Version Management			
Version No.	*Date*	*Name of Author(s)*	*Changes*
V1	14.07.2023	Beatriz Alonso (i-DE)	First draft

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V2	26.10.2023	Luis Rodrigues, Diogo Faria, José Villar, Fábio Coelho, Kamalanathan Ganesan (INESC TEC)	Revision of the SUC in-line with the data exchange platforms.

1.3 Scope and objectives of use case

Scope and Objectives of Use Case	
Scope	Process for short-term activation of committed flexibility services for DSO congestion and voltage violations management
Objective(s)	1. Monitoring conditions on the grid on real time 2. Send the activation signals and verify information exchange between stakeholders 3. Check the reception of the flexibility activation signal.
Related business case(s)	BUC06: Short-term congestion constraints forecasting and management for local flexibility service activation BUC05: Aggregation for TSO and DSO grid services

1.4 Narrative of use case

Narrative of Use Case
Short description
In this use case, the Distribution System Operator (DSO) activates flexibility products to manage grid congestions and voltage violations. These products, pre-reserved in a flexibility market, can be supported by a Market Platform connected/integrated to the Grid and Data Business Network (GDBN), are activated through the GDBN or directly in real-time or close to real-time. This SUC includes the flexibility activation of flexibility resources in the distribution grid, the verification of the reception of activation signal (which should not be confused with the computation of the actual flexibility delivered), and the information exchange between all stakeholders in this process, enabling data as well as communication interoperability. Only for DEMO 1, the activation of flexibility services described in this SUC can be implemented also to avoid voltage constraints violation (as defined in BUC07). Since the activities and the systems involved for the activation are the same for both congestions and voltage constraint violations this SUC will be considered also applicable to BUC07.
Complete description
Services from the DoA: - Service 2. (DSO-G-CM) Aggregation for TSO and DSO grid services (i-DE/EDE) - Service 20: Technical grid constraints validation and local markets clearing (E-ON) - Service 23: (E.ON) - Service 21: (DSO-G-VC) Voltage control (day ahead, intra-day, real-time) (RWTH) The main goal of this SUC is for the DSO to activate flexibility products that were previously reserved in a flexibility market, supported by a Market Platform. When the DSO is monitoring the grid in real-time and detects the need to active pre-reserved flexibility, it issues a flexibility dispatch notice, which is forwarded to the FSP via the GDBN or directly. The FSP will then proceed with the activation of the reserved flexible DER, by sending an activation signal, and confirming to the DSO that the activation signal was received. The description of key steps follows: **1. Grid monitoring** The DSO is monitoring the distribution grid in real-time, through its SCADA system, when it detects the need to proceed with the activation of contracted flexibility. *Tools called by the step*

DSO SCADA System

2. Flexibility dispatch notice

Upon detecting the need to active flexibility, the DSO sends activation signal directly or through the GDBN, issuing the flexibility dispatch notices, considering the procured activation characteristics (energy/capacity amount, time of activation, duration, ramping periods, etc). The dispatch notice will depend on the contracted product. Activation signal may be sent in tighter timing based on most update information, even if flexibility service needs were calculated in advance.

Tools called by the step
DSO activation system

3. Flexibility activation requests

In the case of using GDBN, the flexibility dispatch notices are forwarded from GDBN to the FSP with those bids selected by the DSO, with contracted flexibility activation

Tools called by the step
GDBN

4. Flexibility activation

The FSP/aggregator sends the dispatch setpoints to the distributed energy resources, DER.
The flexibility of the DER is activated, either by increasing or decreasing the power they are consuming or generating.

Tools called by the step
Aggregator/FSP system (Technical platform)

1.5 Use case conditions

Use case conditions
Assumptions
• FSP, within the timeframe requested for providing service to the DSO, doesn´t have other flexibility provision contracts except the one with the DSO itself. • There is TSO/DSO coordination for what concern flexibility activations for local services. • A proper regulatory framework that allows and incentivize a cost-effective use of flexibility for the grid planning and operation is in place. • The regulatory framework also allows individual DERs and aggregators to provide flexibility to the DSO.
Prerequisites
• DSO forecasts congestions and voltage violations and monitor the grid condition in real time. • GDBN is accessible to the FSP and DSO respective platforms. • FSPs effectively control its portfolio resources to activate their flexibility as contracted in the flexibility local market and activated by the DSO according to the flexibility products definition.

1.6 Further Information to the use case for classification / mapping

Classification Information
Relation to other use cases
SUC04.4 (Activate market-based and non-market-based long-term availability contracts) BUC06: Short-term congestion constraints forecasting and management for local flexibility service activation BUC05: Aggregation for TSO and DSO grid services SUC06.1 – Short term Flexibility procurement based on congestion forecasting SUC06.3 – Settlement of flexibility services from DER participating to local market BUC07: Short-term voltage constraints forecasting and management for local flexibility service activation

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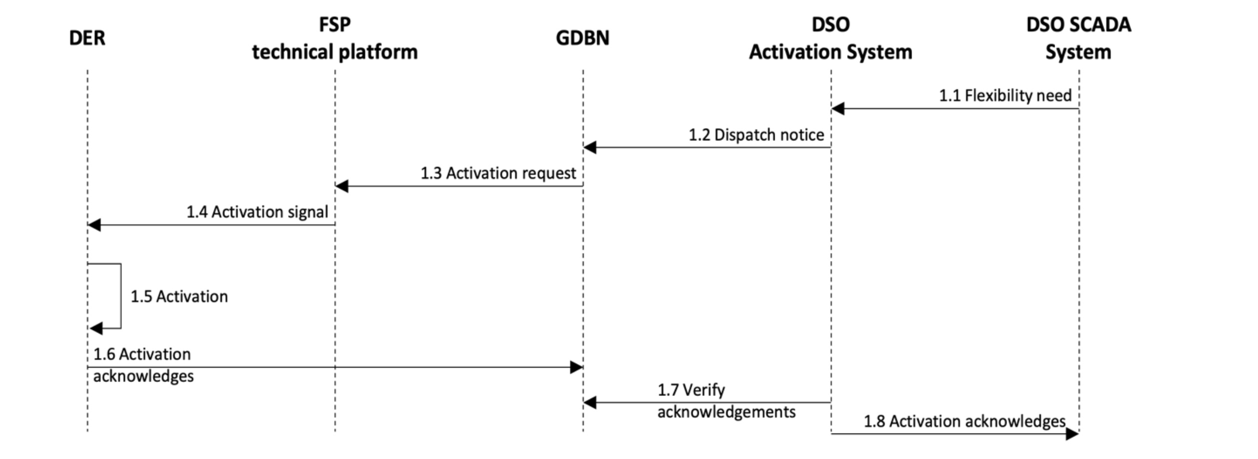
Level of depth
System use case (SUC) use case which describes in detail the functionality/technological solutions of (a part of) a business process.
Prioritisation
The solution will be implemented in the Italian, Swedish and Spanish demos.
Generic, regional or national relation
Generic
Nature of the use case
Technical/system use case
Further keywords for classification
Activation, Flexibility service provider, FSP, Aggregator, local market, Distribution System Operator, DSO, DER, GDBN.

1.7 General Remarks

General Remarks
For the BeFlexible project, this SUC has been defined only for DSOs activations for short-term congestion and voltage violations management. However, SUC04.4 (Activate market-based and non-market-based long-term availability contracts) deals with the flexibility activation for long term congestion management.

2 Diagrams of use case

Diagram(s) of use case



3 Technical details

3.1 Actors

Actors		
Actor Name	*Actor Type*	*Actor Description*
DSO Scada System	System	System responsible for displaying grid measurements, which serve as input for DSO activation system
DSO Activation system	System	Automatic system that, according to the measurements, proceeds with the dispatch of flexibility products

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GDBN	System	The GDBN is a facilitator of all the activities withing the flexibility provision value chain
FSP technical platform	System	System responsible for real-time information exchange to perform activations.
DER	System	Resources connected to the distribution grid and capable of providing active power flexibility, either upward/downward or both. Different technologies or resources are included, such as demand response, distributed generation, electric vehicles, and storage systems.

3.2 References

References						
No.	***References Type***	***Reference***	***Status***	***Impact on use case***	***Originator / organisation***	***Link***
1	Technical Report	Harmonized Electricity Market Role Model (HEMRM)	Public	Role Model	BRIDGE	https://energy.ec.europa.eu/system/files/2021-06/bridge_wg_regulation_eu_bridge_hemrm_report_2020-2021_0.pdf

4 Step by step analysis of use case

4.1 Overview of scenarios

Scenario conditions						
No.	**Scenario name**	**Scenario description**	**Primary actor**	**Triggering event**	**Pre-condition**	**Post-condition**
1	Activation	Activation of flexibility service procured on the flexibility market to solve congestion management and voltage violations	DSO	A real-time flexibility need is detected on the DSO SCADA system	Flexibility has been acquired by the DSO by means of the flexibility service through the flexibility market platform. Real-time for the provision of a flexibility service procured to manage a problem approached	FSP successfully receives the activation order and provide the contracted service helping to avoid network problem

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4.2 Steps – Scenarios

Scenario								
Scenario name :		***No. 1 - Reference scenario***						
Step No.	***Event***	***Name of process/ activity***	***Description of process/ activity***	***Service***	***Information producer (actor)***	***Information receiver (actor)***	***Information Exchanged (IDs)***	***Requirement, R-IDs***
1.1	Punctual	Flexibility need	The DSO detects the need of provision of a flexibility service procured to manage a congestion problem approached	GET	DSO SCADA system	DSO Activation system	I1	QoS-1, QoS-2, SEC-1, SEC-2, SEC-3, D-1,D-2, D-3
1.2	Punctual	Dispatch notice	The DSO sends the dispatch notice to the data exchange platform (GDBN) or directly to the FSP if not external platform is used	CREATE	DSO Activation system	GDBN	I2	QoS-1, QoS-2, SEC-1, SEC-2, SEC-3, D-1,D-2, D-3
1.3	Punctual	Activation request	GDBN sends activation request to the selected FSP	REPORT	GDBN	FSP technical platform	I2	QoS-1, QoS-2, SEC-1, SEC-2, SEC-3, D-1,D-2, D-3
1.4	Punctual	Activation signal	FSP send activation signal to the selected DER	REPORT	FSP technical platform	DER	I3	QoS-1, QoS-2, SEC-1, SEC-2, SEC-3, D-1,D-2, D-3
1.5	Punctual	Activation	Selected DER is activated to provide flexibility	EXECUTE	DER	DER	-	QoS-1, QoS-2, SEC-1, SEC-2, SEC-3, D-1,D-2, D-3
1.6	Punctual	Activation acknowledges	Resources flexibility delivered	GET	DER	DSO Scada System	I4	QoS-1, QoS-2, SEC-1, SEC-2, SEC-3, D-1,D-2, D-3
1.7	Punctual	Activation acknowledges	The DSO monitors the state of the grid in real-time to check flexibility delivered	GET	DSO Scada system	DSO	I4	QoS-1, QoS-2, SEC-1, SEC-2, SEC-3, D-1,D-2, D-3
1.8	Punctual	Activation verification	Push information about verification	REPORT	DSO	GDBN	I5	

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5 Information exchanged

Information exchanged			
Information exchanged (ID)	*Name of information*	*Description of information exchanged*	*Requirement, R-IDs*
I1	Flexibility need	Need to activate a certain amount of flexibility during a certain period	D-1,D-2,D-3
I2	Activation request	Request to activate reserved flexibility (e.g., API call) It includes start of activation, end of activation and amounts of energy/capacity in accordance with the type of procured product	D-1,D-2,D-3
I3	Activation signal	Signal for DER to deploy flexibility (increase or decrease consumption or generation) (e.g., API call)	D-1,D-2,D-3
I4	Activation acknowledges	Based on DSO SCADA system information DSO detects flexibility activation	
I5	Activation report	Flexibility Activation report including node identifier and volume (API call)	D-1,D-2,D-3

6 Requirements

Requirements		
Categories ID	**Category name for requirements**	**Category description**
GDPR	Regulatory obligation related to privacy	2016/679 (General Data Protection Regulation)
Requirement R-ID	**Requirement name**	**Requirement description**
GDPR-X	All GDPR constraints apply to this SUC.	e.g., proportional measures of protection, communication of data breach, among others

Quality of Service Requirements		
Categories ID	**Category name for requirements**	**Category description**
QoS	Quality of Service – Non-Functional requirements	Generic properties that service/SUC should provide – quality attributes.
Requirement R-ID	**Requirement name**	**Requirement description**
QoS-1	Frequency of data exchanges.	Upon request by at least the frequency of the related event.
QoS-2	Elapsed Time response	Messages are conveyed in 1-2 seconds.

Security Requirements		
Categories ID	**Category name for requirements**	**Category description**
SEC	Security	Authentication of user, confidentiality, integrity, prevention of denial of service, non-repudiation or accountability, error management

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Requirement R-ID	Requirement name	Requirement description
SEC-1	Service authentication	All parties should be trusted.
SEC-2	Eavesdropping	Ensuring confidentiality, avoiding illegitimate use of data, and preventing unauthorized reading of data, is crucial. • Web services should run over Transport Socket Layer (TSL) File sharing between two machines should occur over FTPS or using pre-agreed encrypted format
SEC-3	Acknowledge timeout	One minute for any M2M communication.

	Data Management Requirements	
Categories ID	**Category name for requirements**	**Category description**
D	Data Management	Type of source of data, correctness or validity of data, timeliness or time stamping of data, volume of data, synchronization, or consistency of data across systems, timely access to data, validation of data across organizational boundaries, transaction management, data naming, identification, formats across disparate systems, maintenance of data and databases
Requirement R-ID	**Requirement name**	**Requirement description**
D-1	Data validation from multiple sources	Mapping of data items is required for data from different sources
D-2	Management of data across organizational boundaries	Data exchanges go across organizational boundaries.
D-3	Management of data formats in data exchanges	Conversion of data format handled by a “converter” at Information receiver site.

7 Common Terms and Definitions

Common Terms and Definitions	
Term	**Definition**
GDPR	General Data Protection Regulation
QoS	Quality of Service
DER	Distributed Energy Resource
GDBN	Grid Data and Business Network
HEMRM	Harmonized Electricity Market Role Model
DSO	Distribution System Operator
API	Application Programming Interface
FSP	Flexibility Service Provider
TSO	Transmission System Operator

8.9. SUC06.3 – Settlement of flexibility services from DER participating to local market

1 Description of the use case

1.1 Name of the use case

ID	*Area / Domain(s)*	*Name of Use Case*

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SUC06.3	(2) Grid-centric flexibility	Settlement of flexibility services from DER participating to local market

1.2 Version management

Version Management			
Version No.	***Date***	***Name of Author(s)***	***Changes***
V1	14.07.2023	Beatriz Alonso (i-DE)	First Draft
V2	27.10.2023	Luis Rodrigues, Diogo Faria, José Villar, Fábio Coelho, Kamalanathan Ganesan (INESC TEC)	Revision of the SUC in-line with the data exchange platforms.

1.3 Scope and objectives of use case

Scope and Objectives of Use Case	
Scope	Process for settlement of flexibility products from Distributed Energy Resources (DER) participating in local flexibility markets
Objective(s)	1. Quantify the delivered flexibility as response to activation request 2. Calculate financial settlement based on the delivered results in comparison with requested quantity
Related business case(s)	BUC06: Short-term congestion constraints forecasting and management for local flexibility service activation BUC05: Aggregation for TSO and DSO grid services

1.4 Narrative of use case

Narrative of Use Case
Short description
Quantification of the delivered flexibility as response to activation request of a product procured in the short-term local market. In this use case, the flexibility delivered by each Flexibility Service Provider (FSP) is calculated and settled between them and the Distribution System operator (DSO). Two alternatives are considered: - Settlement is done by the DSO, independently, and outside the GDBN - Settlement is done within the Grid Data and Business Network (GDBN) Depending on the chosen alternative, the main processes that can performed by the GDBN include: - Storing baselines - Calculating delivered flexibility - Computing remunerations and penalties - Sending invoices Only for DEMO 1, the settlement described in this SUC can be calculate also for flexibility delivered to avoid voltage constraints violation (as defined in BUC07). Since the activities and the systems involved for the settlement are the same for both congestions and voltage constraint violations this SUC will be considered also applicable to BUC07.
Complete description
Services from the DoA: - Service 2. (DSO-G-CM) Aggregation for TSO and DSO grid services (i-DE/EDE) - Service 20: Technical grid constraints validation and local markets clearing (E-ON) - Service 21: (DSO-G-VC) Voltage control (day ahead, intra-day, real-time) (RWTH) - Service 25: (DSO-G-VC) Voltage Technical grid constraints forecasting for local flexibility service activation (ENEL/EDI)

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This **SUC** use available monitoring information (from SCADA and smart meters) to evaluate the response of the FSPs after the provision of flexibility service procured in a local market. The objective of the SUC is to determine if the response of the FSPs corresponds to the awarded bids cleared by the short-term local market. This is done by gathering metering data and comparing it to a baseline.
Financial settlement is calculated based on the delivered results, comparing the actual delivered flexibility and requested flexibility. In some cases, penalties may apply if these are described within the product specification.

Two alternatives are considered:

- Settlement is done by the DSO, independently, and outside the GDBN
- Settlement is done within the Grid Data and Business Network (GDBN)

In the second alternative, the GDBN fully supports the DSO with in-built services related to the verification and settlement of the flexibility delivered by the FSP. For that, it is important that the baselines (specified by the FSP at bidding time) are stored in the GDBN. This approach can be suitable to smaller/regional DSO with limited resources to develop their own tools.

Calculate delivered flexibility

Actual delivered flexibility is calculated as the difference between baseline and metered consumption/generation of that Flexibility Service Provider.
A baseline must be previously defined, to which the actual metered data of the FSP can be compared with.

For the second alternative, the GDBN gets consumers' metering data from the DSO and retrieves (from its own database) the baselines submitted by the FSP in a previous step (at bidding time, which is outside this SUC). With these data, the GDBN computes the deviation between the baselines and actual delivery, thus calculating the flexibility actually delivered by each FSP.

Tools called by the step
DSO tools/GDBN

Verify that delivered flexibility matches with requested flexibility
The verification takes place by comparing the actual delivered flexibility and requested flexibility by the System Operator.

Tools called by the step
DSO tools/GDBN

Settlement
Monetarized delivery including penalty calculation if delivered flexibility is less than requested flexibility.
If the FSP is not able to deliver the flexibility in accordance with the predefined market conditions and agreed baseline, penalties may apply, which would decrease the remuneration received by FSP.

For the second alternative, the GDBN calculates the remuneration and penalisations awarded to each FSP according to pre-defined rules.

Tools called by the step
DSO tools/GDBN

Sending invoices and financial settlement
Sending the invoice and payment

1.5 Use case conditions

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Use case conditions
Assumptions
• A proper regulatory framework that allows and incentivize a cost-effective use of flexibility for the grid planning and operation is in place. • The regulatory framework also allows individual DERs and aggregators to provide flexibility to the DSO. • The computation methodology for FSP (aggregators, individual consumers, individual generators) baselines has been previously agreed, and baselines are stored at bidding time. • Market participant baselines (i.e. from any FSP: aggregator, individual consumer, individual generator) have been previously defined.
Prerequisites
• For the computation of the flexibility delivered for settlement purposes, energy measurements must come from accurate, reliable, and certified instruments (metering data). • Meter data, baselines, committed flexibility in the flexibility market and activation requests are needed. • For the second alternative, the GDBN must implement all the services needed for settlement.

1.6 Further Information to the use case for classification / mapping

Classification Information
Relation to other use cases
BUC06: Short-term congestion constraints forecasting and management for local flexibility service activation BUC05: Aggregation for TSO and DSO grid services SUC06.1 – Short term Flexibility procurement based on congestion forecasting SUC06.2 – Short term flexibility activation for DSO congestion management BUC07: Short-term voltage constraints forecasting and management for local flexibility service activation
Level of depth
System use case (SUC) use case which describes in detail the functionality/technological solutions of (a part of) a business process.
Prioritisation
High Level of Priority – To be demonstrated in Spain
Generic, regional or national relation
Generic
Nature of the use case
Technical/system use case
Further keywords for classification
Settlement, Flexibility service provider, Aggregator, FSP, local market, Distribution System Operator, DSO, DER, delivered flexibility, requested flexibility, baseline, GDBN

1.7 General Remarks

General Remarks

2 Diagrams of use case

Diagram(s) of use case

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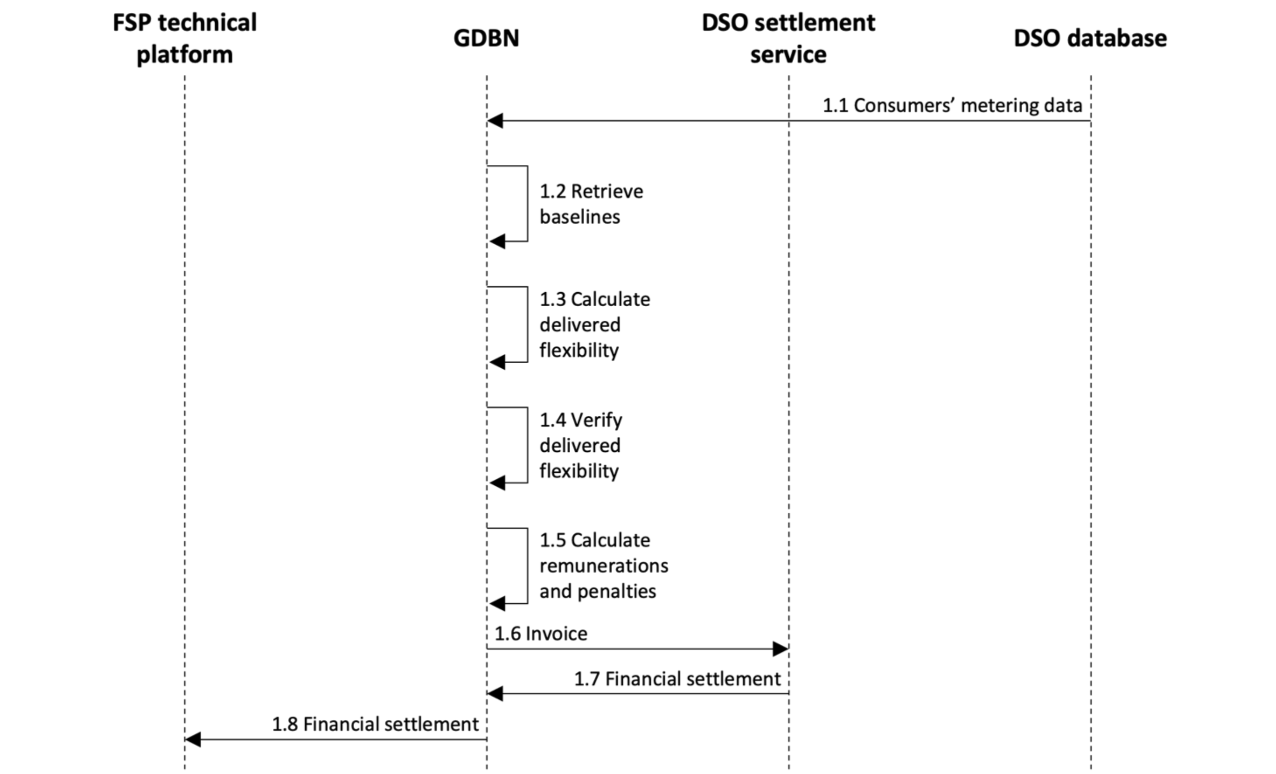

Figure - GDBN settlement (scenario 1)

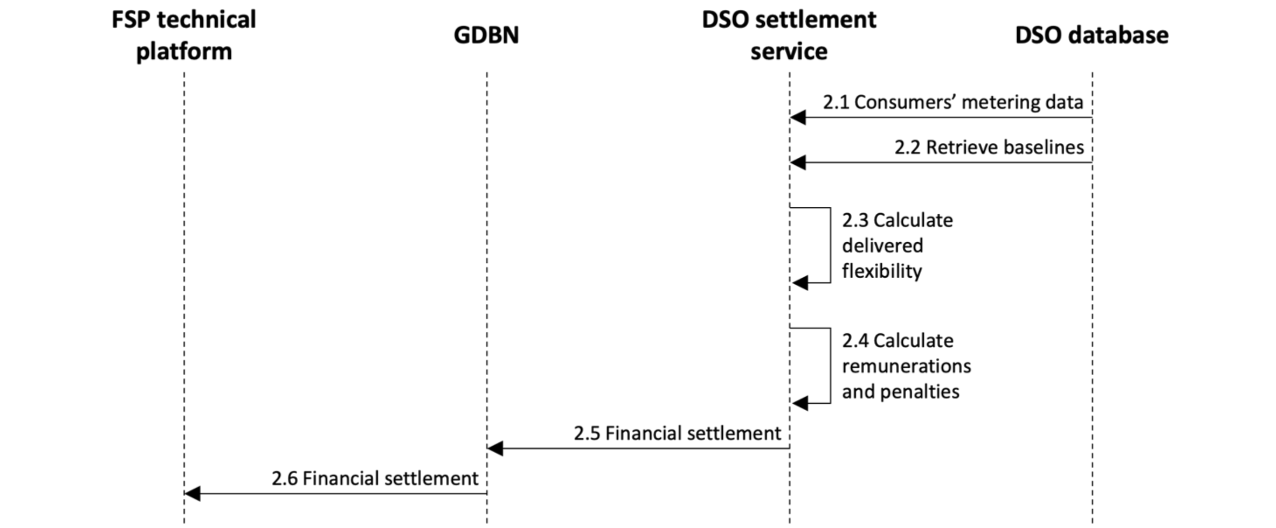

Figure - DSO settlement (scenario 2)

3 Technical details

3.1 Actors

Actors		
Actor Name	***Actor Type***	***Actor Description***
DSO database	System	System responsible for storing DSO's data (energy meters' readings, baselines…)
DSO settlement service	System	System responsible for handling invoices and financial settlement with FSP

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GDBN	System	The GDBN is a facilitator of all the activities withing the flexibility provision value chain
FSP technical platform	System	System responsible for taking care of business files exchange, bids, and financial settlement

3.2 References

References						
No.	***References Type***	***Reference***	***Status***	***Impact on use case***	***Originator / organisation***	***Link***
1	Technical Report	Harmonized Electricity Market Role Model (HEMRM)	Public	Role Model	BRIDGE	https://energy.ec.europa.eu/system/files/2021-06/bridge_wg_regulation_eu_bridge_hemrm_report_2020-2021_0.pdf

4 Step by step analysis of use case

4.1 Overview of scenarios

Scenario conditions						
No.	**Scenario name**	**Scenario description**	**Primary actor**	**Triggering event**	**Pre-condition**	**Post-condition**
1	GDBN Settlement	GDBN is responsible for calculating financial settlement based on the delivered results in comparison with requested quantity	GDBN	Finalization of resource response to activation request	The flexibility committed has been activated and the delivery measurement are available	Settlement
2	DSO Settlement	DSO is fully responsible for calculating financial settlement based on the delivered results in comparison with requested quantity	DSO	Finalization of resource response to activation request	The flexibility committed has been activated and the delivery measurement are available	Settlement

4.2 Steps – Scenarios

Scenario								
Scenario name:		No. 1 - GDBN Settlement						
Step No.	Event	Name of process/ activity	Description of process/ activity	Service	Information producer (actor)	Information receiver (actor)	Information Exchanged (IDs)	Requirement, R-IDs
1.1	On request	Consumers' metering data	Acquire consumption data from energy meters.	GET	DSO database	GDBN	I1	QoS-1, QoS-2, SEC-1, SEC-2, SEC-3, D-1,D-2, D-3, GDPR-X
1.2	On request	Retrieve baselines	Recover baselines, previously stored in the GDBN.	GET	GDBN	GDBN	I2	QoS-1, QoS-2, SEC-1, SEC-2, SEC-3, D-1,D-2, D-3
1.3	On request	Calculate delivered flexibility	Metering data and baselines are compared to flexibility delivered by each FSP.	CREATE	GDBN	GDBN	I3	QoS-1, QoS-2, SEC-1, SEC-2, SEC-3, D-1,D-2, D-3
1.4	On request	Verify delivered flexibility	Validate if deliverable flexibility was in line with requested activation.	GET	GDBN	GDBN		QoS-1, QoS-2, SEC-1, SEC-2, SEC-3, D-1,D-2, D-3
1.5	On request	Calculate remunerations and penalties	Calculate remunerations and penalties for each FSP based on flexibility provided and baselines.	CREATE	GDBN	GDBN	I4	QoS-1, QoS-2, SEC-1, SEC-2, SEC-3, D-1,D-2, D-3
1.6	On request	Invoice	Remuneration and penalty values are sent to the DSO	GET	GDBN	DSO settlement service	I4	QoS-1, QoS-2, SEC-1, SEC-2, SEC-3, D-1,D-2, D-3
1.7	On request	Financial settlement	DSO approves (or not) financial settlement done in the GDBN	GET	DSO settlement service	GDBN	I4	QoS-1, QoS-2, SEC-1, SEC-2, SEC-3, D-1,D-2, D-3

Scenario								
Scenario name:		No. 2 – DSO Settlement						
Step No.	Event	Name of process/ activity	Description of process/ activity	Service	Information producer (actor)	Information receiver (actor)	Information Exchanged (IDs)	Requirement, R-IDs
2.1	On request	Retrieve consumers'	Access consumers' metering data.	GET	DSO database	DSO settlement	I1	QoS-1, QoS-2, SEC-1, SEC-2, SEC-3, D-1,D-2,

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		metering data				service		D-3
2.2	On request	Retrieve baselines	Recover baselines, stored by the DSO in a previous step.	GET	DSO database	DSO settlement service	I2	QoS-1, QoS-2, SEC-1, SEC-2, SEC-3, D-1,D-2, D-3
2.3	On request	Calculate delivered flexibility	Metering data and baselines are compared to flexibility delivered by each FSP.	EXECUTE	DSO settlement service	DSO settlement service	I3	QoS-1, QoS-2, SEC-1, SEC-2, SEC-3, D-1,D-2, D-3
2.4	On request	Calculate remunerations and penalties	Calculate remunerations and penalties for each FSP based on flexibility provided and baselines.	CREATE	DSO settlement service	DSO settlement service	I4	QoS-1, QoS-2, SEC-1, SEC-2, SEC-3, D-1,D-2, D-3
2.5	On request	Financial settlement	DSO sends financial settlement (remuneration and penalties) to GDBN	GET	DSO settlement service	GDBN	I4	QoS-1, QoS-2, SEC-1, SEC-2, SEC-3, D-1,D-2, D-3
2.6	On request	Financial settlement	GDBN communicates settlement to FSP	GET	GDBN	FSP business channel	I4	QoS-1, QoS-2, SEC-1, SEC-2, SEC-3, D-1,D-2, D-3

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5 Information exchanged

Information exchanged			
Information exchanged (ID)	***Name of information***	***Description of information exchanged***	***Requirement, R-IDs***
I1	Consumers' metering data	Historical metering data of flexible consumers	GDPR-X,D-1,D-2,D-3
I2	Baselines	Baselines provided by each FSP	
I3	Flexibility results	Amount of flexibility provided by each FSP	
I4	Remuneration and penalties	Financial value of the remuneration and penalties awarded to each FSP	

6 Requirements

Requirements		
Categories ID	**Category name for requirements**	**Category description**
GDPR	Regulatory obligation related to privacy	2016/679 (General Data Protection Regulation)
Requirement R-ID	**Requirement name**	**Requirement description**
GDPR-X	All GDPR constraints apply to this SUC.	e.g., proportional measures of protection, communication of data breach, among others

Quality of Service Requirements		
Categories ID	**Category name for requirements**	**Category description**
QoS	Quality of Service – Non-Functional requirements	Generic properties that service/SUC should provide – quality attributes.
Requirement R-ID	**Requirement name**	**Requirement description**
QoS-1	Frequency of data exchanges.	Upon request by at least the frequency of the related event.
QoS-2	Elapsed Time response	Messages are conveyed in 1-2 seconds.

Security Requirements		
Categories ID	**Category name for requirements**	**Category description**
SEC	Security	Authentication of user, confidentiality, integrity, prevention of denial of service, non-repudiation or accountability, error management
Requirement R-ID	**Requirement name**	**Requirement description**
SEC-1	Service authentication	All parties should be trusted.
SEC-2	Eavesdropping	Ensuring confidentiality, avoiding illegitimate use of data, and preventing unauthorized reading of data, is crucial. • Web services should run over Transport Socket Layer (TSL) File sharing between two machines should occur over FTPS or using pre-agreed encrypted format
SEC-3	Acknowledge timeout	One minute for any M2M communication.

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Data Management Requirements		
Categories ID	**Category name for requirements**	**Category description**
D	Data Management	Type of source of data, correctness or validity of data, timeliness or time stamping of data, volume of data, synchronization, or consistency of data across systems, timely access to data, validation of data across organizational boundaries, transaction management, data naming, identification, formats across disparate systems, maintenance of data and databases
Requirement R-ID	**Requirement name**	**Requirement description**
D-1	Data validation from multiple sources	Mapping of data items is required for data from different sources
D-2	Management of data across organizational boundaries	Data exchanges go across organizational boundaries.
D-3	Management of data formats in data exchanges	Conversion of data format handled by a “converter” at Information receiver site.

7 Common Terms and Definitions

Common Terms and Definitions	
Term	**Definition**
GDPR	General Data Protection Regulation
QoS	Quality of Service
DER	Distributed Energy Resource
GDBN	Grid Data and Business Network
HEMRM	Harmonized Electricity Market Role Model
DSO	Distribution System Operator
API	Application Programming Interface
FSP	Flexibility Service Provider
TSO	Transmission System Operator

8.10. SUC07.1 – Flexibility procurement based on voltage forecasting

1 Description of the use case

1.1 Name of the use case

ID	*Area / Domain(s)*	*Name of Use Case*
SUC07.1	Select from: (2) Grid-centric flexibility; (3) TSO-DSO flexibility coordination;	Online monitoring and observability enhancement to quantify the actual voltage condition

1.2 Version management

Version Management			
Version No.	*Date*	*Name of Author(s)*	*Changes*
V0.1	01.09.2023	Gabriele Fedele, Antonio Bruni	

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V0.2	09.11.2023	Olivia Cicala	Services from the DoA &Requirements

1.3 Scope and objectives of use case

Scope and Objectives of Use Case	
Scope	Improve grid observability
Objective(s)	- Increase the LV nodes monitoring in real time; - Increase the MV nodes monitoring in real time; - use the real time measurements to improve the grid simulation.
Related business case(s)	BUC 07: Short-term voltage constraints forecasting and management for local flexibility service activation; BUC06: Short-term congestion constraints forecasting and management for local flexibility service activation BUC09: Local and global market coordination for distributed resources system service provision

1.4 Narrative of use case

Narrative of Use Case
Short description
This use case outlines the methods and technologies employed to enhance the observability of the low and medium-voltage network. To increase the grid observability, several nodes of the distribution grid will be equipped with devices able to gather, collect and send the data to Distribution Management System (DMS). Moreover, exploiting the synergy with the experimentations ongoing, the resources involved into flexibility market and the distributed power plants connected in MV level, will be equipped with devices for the real-time data collection at the Point of Delivery (PoD). An innovative measurement device, named Phasor Measurement Unit (PMU), will be test to increase grid observability with a very high time-resolution and accuracy. The PMU is an open source low-cost device and relatively easy to integrate. The flexible resource real-time data will be collected in the Flexibility Register (FR) and transfer to DMS. Instead, the data coming from producers will be sent directly to the DMS. The DSO uses all real-time data collected to enhance its estimations and optimize network management.
Complete description
A measurement set, composed of actual and historical measurement data obtained from the dispersed metering devices (AMR, GIS, SCADA) installed throughout the network, is available to the DSO for real-time operation purposes. The aforementioned data refer to a) synchronised measurements of bus voltage phasors and line current phasors (magnitude and angle) and b) conventional measurements of power flows and voltage magnitudes at the top of distribution feeders, power injections from distributed generation units, and load pseudo-measurements for aggregated consumer demand at MV/LV transformer level. To enhance the grid observability, new measurement data obtained from the measurement devices will be integrated in the DMS State Estimation tool (SE tool). This data coming from the Power Grid User Interface installed at PoD of flexibility resources, from the Controllore Centrale di Impianto (CCI) a measurement device installed at PoD of distributed power plants connected in MV and from the PMU installed in the secondary substations. In detail the installation of PMUs at selected buses is sure to upgrade the overall metering infrastructure of the network, since they record synchronized measurements of bus voltage phasors as well as a number of line current phasors—all of which are independent of each other and count as individual measurements. Their utilization via the SE tool is a challenging task due to a) the discrepancies in update rates between conventional and PMU measurements, b) the provision of current measurements which often lead to various numerical problems. The goal is to ensure that the integration of PMU data will be smooth and all the aforesaid problems will be circumvented. Given that the network model (topology) is known with a good degree of certainty, the state estimation tool ensures that the network is observable based on the available measurement set, reconciles the PMU data with the conventional measurements, and, subsequently, calculates the estimated state vector, that is, the voltage magnitudes and angles of all network buses. Given the successful integration and use of the PMU data in the SE

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tool, the overall performance of the SE tool will be enhanced; the network state will be calculated with increased precision compared to conventional-measurements-only scenarios, and high quality real-time operational standards for distribution management applications will be met. This use case involves various actors and systems within the electrical sector. The following sequence of activities characterizes the use case: MV producers: • Installs the CCI to enable real-time data collection. • Performs the accreditation and registration procedures. • Executes the communication testing procedure. • Initiates real-time data collection. • Transfers the measurements to the DMS flexible resource : • Installs the PGUI to enable real-time data collection. • Performs the accreditation and registration procedures. • Executes the communication testing procedure. • Initiates real-time data collection. • Transfers the measurements to Flexibility Register Flexibility Register: • Collects and organizes the data. • Performs reconstruction processing for missing measurement values. • Makes the data available to DMS. DSO substation: • Installs the PMU to enable real-time data collection. • Performs the accreditation and registration procedures. • Executes the communication testing procedure. • Initiates real-time data collection. • Transfers the measurements to DMS The DMS: • Acquires the real-time measurements. • Retrieves the measurements from the Flexibility Register. • Performs the SE tool. Services from the DoA: • Service 23: Real-time monitoring for system awareness (RWTH) • Service 27: Improved grid observability service (ENEL / EDI)

1.5 Use case conditions

Use case conditions
Assumptions
The network model (topology) is known with a good degree of certainty; DSO systems (e.g. AMR, GIS, SCADA) being operational; New measurement devices are installed and data is available for SE tool
Prerequisites
The LV flexibility resources have been equipped with the new smart meter

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1.6 Further Information to the use case for classification / mapping

Classification Information
Relation to other use cases
SUC08.1 – Flexibility Register
Level of depth
System use case (SUC) use case which describes in detail the functionality/technological solutions of (a part of) a business process.
Prioritisation
The solution will be implemented in the Italian demo.
Generic, regional or national relation
Generic
Nature of the use case
Technical/system use case.
Further keywords for classification
DMS, PMU, Flexibility Register, DER,PGUI, flexibility, producer

1.7 General Remarks

General Remarks
Is used for further comments which are not considered elsewhere.

2 Diagrams of use case

Diagram(s) of use case

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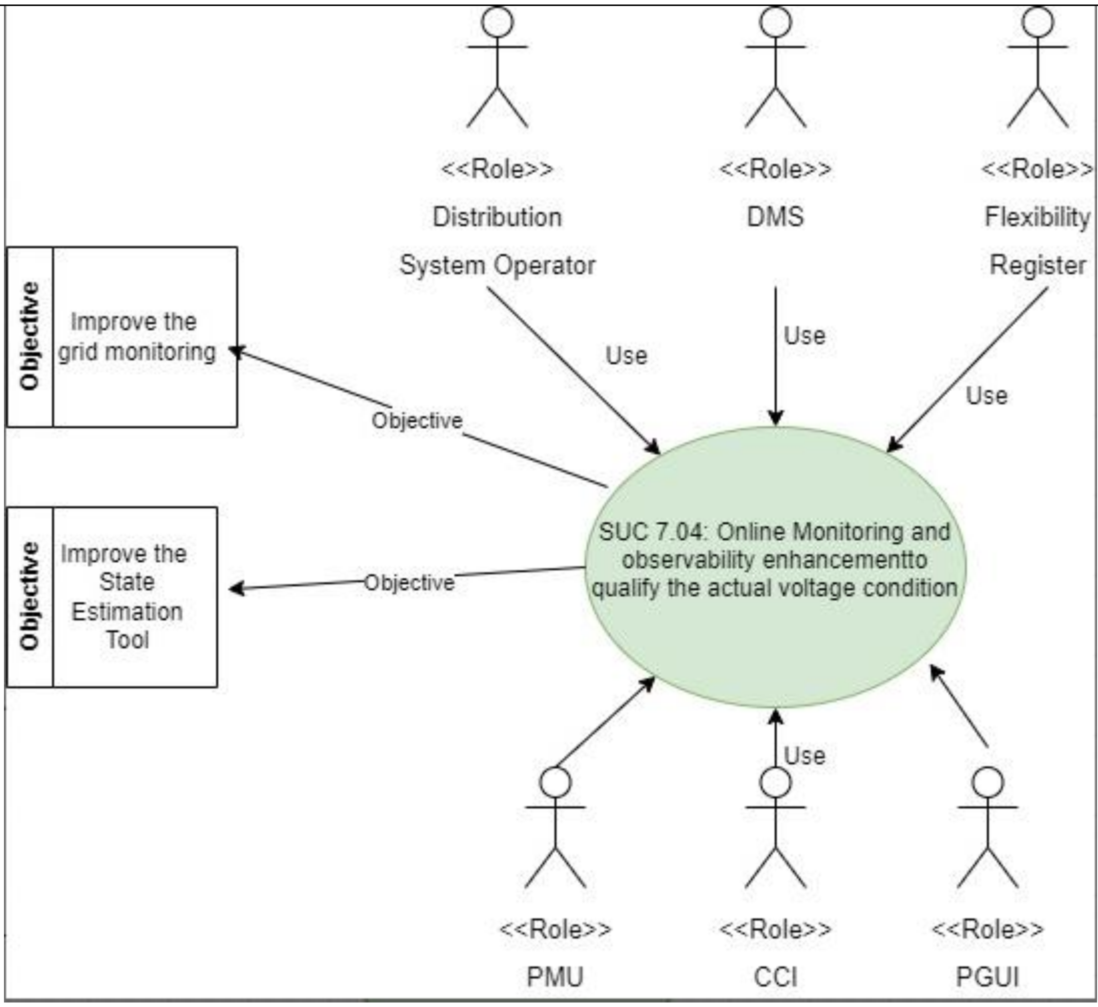

Please paste below the B<u>UC-SUC Relations Diagram</u>: shows which system use cases (SUC) are used by the Business Use Case (BUC). <u>This is diagram is only included in BUC.</u>

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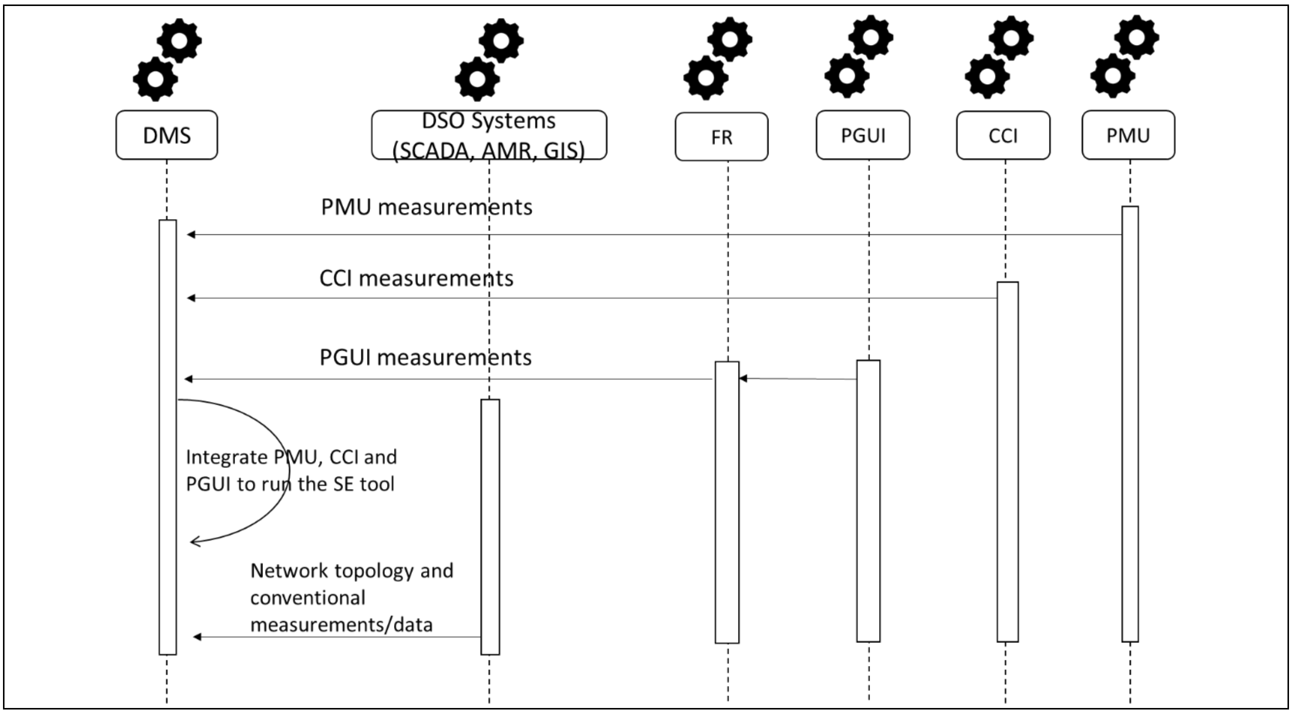
DMS
DSO Systems (SCADA, AMR, GIS)
FR
PGUI
CCI
PMU
PMU measurements
CCI measurements
PGUI measurements
Integrate PMU, CCI and PGUI to run the SE tool
Network topology and conventional measurements/data

3 Technical details

3.1 Actors

Actors		
Actor Name	***Actor Type***	***Actor Description***
DSO	Business Role	DSO is each Distribution System Operator. It is an entity in charge for the management of the energy distribution networks
PGUI	Device	Device installed on the DSO's smart meter in order to read, arrange, certify in Blockchain (at first level) and send to the FR measurements and other data for the flexibility market and observability.
PMU	Device	Phasor Measurement Unit measures the magnitude and phase angle of voltage or current signals, which are synchronised via the global positioning satellite (GPS) system.
CCI	Device	Controllore Centrale di Impianto, device installed on the MV producer power plant to read, arrange and send to the DMS measurements and other data for the grid observability.
Distribution Management System (DMS)	System	A software-based system that manages the distribution network. It performs grid state estimation and productions and consumptions forecasting.
Flexibility Register (FR)	System	Database that gathers all the data and services of flexibility resources and shares them with all the stakeholders
Distribution Energy Resources (DERs)	System	Resources, in customer premises, that provide flexibility to the market. They could be generation plants, electric vehicles, batteries, active demand. They are closely related to the demo's areas
Producer	Business Role	A party that generates electricity.

3.2 References

References						
No.	***References Type***	***Reference***	***Status***	***Impact on use case***	***Originator / organisation***	***Link***
1	Technical Report	Harmonized Electricity	Public	Role Model	BRIDGE	https://energy.ec.europa.eu/system/files/2021-

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		Market Role Model (HEMRM)				06/bridge_wg_regulation_eu_bridge_hemrm_report_2020-2021_0.pdf

4 Step by step analysis of use case

Overview of scenarios

Scenario conditions						
No.	**Scenario name**	**Scenario description**	**Primary actor**	**Triggering event**	**Pre-condition**	**Post-condition**
1	Grid observability		DSO	The devices (PGUI,CCI, PMU) reads and sends the real time measurements	The network model (topology) is known with a good degree of certainty.	The DSO improve the SE tool

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4.2 Steps – Scenarios

Scenario								
Scenario name :		***No. 1 -***	***Reference scenario***					
Step No.	***Event***	***Name of process/ activity***	***Description of process/ activity***	***Service***	***Information producer (actor)***	***Information receiver (actor)***	***Information Exchanged (IDs)***	***Requirement, R-IDs***
1 a	The DER installs the PGUI	PGUI Installation	The user installs the PGUI and starts the communication with the FR	CREATE	DER	FR	I-01	
1 b	The producer installs the CCI	CCI Installation	The producer installs the CCI and starts the communication with the DMS	CREATE	Producer	DMS	I-01	
1 c	The DSO installs the PMU	PMU installation	The DSO installs the PMU and starts the communication with the DMS	CREATE	Producer	DMS	I-01	
2 a	DSO records the PGUI	PGUI registration	The DSO records the PGUI and joins it with the Point of Delivery	CREATE	DSO	PGUI	I-01	
2 b	DSO records the CCI	CCI registration	The DSO records the CCI and joins it with the Point of Delivery	CREATE	DSO	CCI	I-01	
2 c	DSO records the PMU	CCI registration	The DSO records the PMU and joins with the grid node	CREATE	DSO	PMU	I-01	
3 a	PGUI collects the data	Data collection	The PGUI read the data from the meter	GET	meter	PGUI	I-02	
3 a	PGUI sends the data	Sending data	The PGUI sends the data to FR	GET	PGUI	FR	I-02	

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3 b	CCI collects the data	Data collection	The CCI reads the data from the field sensor	GET	sensor	CCI	I-02	
3 b	CCI sends the data	Sending data	The CCI sends the data to DMS	GET	CCI	DMS	I-02	
3 c	PMU collects the data	Data collection	The PMU reads the data from the field sensor	GET	sensor	PMU	I-02	
3 c	PMU sends the data	Sending data	The PMU sends the data to DMS	GET	PMU	DMS	I-02	
4	DMS acquires the data	Data acquisition	The DMS acquire the real time data from the FR	GET	FR	DMS	I-02	

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5 Information exchanged

Information exchanged			
Information exchanged (ID)	*Name of information*	*Description of information exchanged*	*Requirement, R-IDs*
I-01	Registration data	Data for the registration of the device (serial number, certificate, firmware, IP address, Point of delivery etc..)	
I-02	Near real time measures	This information contains for every device the real time data (active power measured, reactive power, voltage, current, state of the power plant,…)	

6 Requirements

Requirements		
Categories ID	**Category name for requirements**	**Category description**
GDPR	Regulatory obligation related to privacy	2016/679 (General Data Protection Regulation)
Requirement R-ID	**Requirement name**	**Requirement description**
GDPR-X	All GDPR constraints apply to this SUC.	e.g., proportional measures of protection, communication of data breach, among others

Security Requirements		
Categories ID	**Category name for requirements**	**Category description**
SEC	Security	Authentication of user, confidentiality, integrity, prevention of denial of service, non-repudiation or accountability, error management
Requirement R-ID	**Requirement name**	**Requirement description**
SEC-1	Service authentication	All parties should be trusted.
SEC-2	Eavesdropping	Ensuring confidentiality, avoiding illegitimate use of data, and preventing unauthorized reading of data, is crucial. • Web services should run over Transport Socket Layer (TSL) File sharing between two machines should occur over FTPS or using pre-agreed encrypted format
SEC-3	Acknowledge timeout	One minute for any M2M communication.

Data Management Requirements		
Categories ID	**Category name for requirements**	**Category description**
D	Data Management	Type of source of data, correctness or validity of data, timeliness or time stamping of data, volume of data, synchronization, or consistency of data across systems, timely access to data, validation of data across organizational boundaries, transaction management, data naming,

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		identification, formats across disparate systems, maintenance of data and databases
Requirement R-ID	**Requirement name**	**Requirement description**
D-1	Data validation from multiple sources	Mapping of data items is required for data from different sources
D-2	Management of data across organizational boundaries	Data exchanges go across organizational boundaries.
D-3	Management of data formats in data exchanges	Conversion of data format handled by a "converter" at Information receiver site.

7 Common Terms and Definitions

Common Terms and Definitions	
Term	**Definition**

8.11. SUC10.1 – Ex-ante validation

1 Description of the use case

1.1 Name of the use case

ID	*Area / Domain(s)*	*Name of Use Case*
SUC10.1	TSO-DSO flexibility coordination	Ex ante validation

1.2 Version management

Version Management			
Version No.	***Date***	***Name of Author(s)***	***Changes***
01	16/07/2023	Tommaso De Marco	First Draft
02	26/10/2023	Tommaso De Marco	Second Draft

1.3 Scope and objectives of use case

Scope and Objectives of Use Case	
Scope	To define a coherent procedure of ex ante validation of the resources participating in the local and global markets
Objective(s)	- To validate resources in such a way to be compliant with both TSO and DSO prescriptions for their respective markets - To communicate the ex ante distribution grid constraint in
Related business case(s)	BUC 06 - Short-term voltage constraints forecasting and management for local flexibility service activation BUC 10 - Dynamic constraints management for global flexibility activation in transmission system operation

1.4 Narrative of use case

Narrative of Use Case
Short description

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The System Use Case refers to the ways in which the TSO and DSO jointly set up a scheme performing an ex ante validation of the flexibility resources presented by the BSPs. In order to do so, a series of information exchanges from the DSO and the TSO must take place – involving a Static Traffic Light and the set-up of a Topological Matrix. Additionally, a set of data about the GCPs of each BSP must be provided.

The process consists of the following steps:

1. Flexibility resource definition
2. Asset evaluation & Enrichment, Static Traffic Light & Validation
3. Asset prequalification and Topology Matrix creation
4. Pool creation & registration

In detail, BSP registers the flexibility resource of its portfolio and its information (technical) considering the interface of Grid Connection Point (GCP) as reference point. The DSO is informed of every single GCP that the BSP registers onto the platform and starts the validation process. The aim of the validation process is to confirm the possibility for the BSP to use that resource in a pool and if so for which amount of flexible power. Furthermore, the DSO is requested to complement the information available for the resource by adding the field that indicated the reference grid element and the Static Traffic Light as the color code among a predefined list of green, yellow, red associated with a Go, Go-If, No-Go. When the DSO has concluded the analysis of the GCP it is then enabled to change the status of the asset so that the asset itself can continue along the prequalification journey. The information is shared with TSO. The information registered by the BSP on every GCP is complemented by the information available in the TSO systems so that a consistent data package for every GCP is considered. At the end of the GCP validation process, the full spatial information is available and therefore the Topology Matrix can be setup. The Topology Matrix includes the reference DSO Perimeter, the reference TSO perimeter and the GCP linked to both the elements and as registered by the BSP. The Matrix is made available to all parties: BSP, DSO, TSO for the relevant actions and acknowledgment feedback. After the GCPs are registered by the BSP and validated by the DSO, the BSP itself can proceed to combine them together in pools of resources (where number of resources is >=1) and register them. The resource group information is shared with the TSO and the pool qualification process starts so that the asset can be qualified into the market.

Complete description

The System Use Case refers to the ways in which the TSO and DSO jointly set up a scheme performing an ex ante validation of the flexibility resources presented by the BSPs. In order to do so, a series of information exchanges from the DSO and the TSO must take place – involving a Static Traffic Light and a Topological Matrix. Additionally, a set of data about the GCPs of each BSP must be provided.

The process consists of the following steps, which will be explored below:

1. Flexibility resource definition
2. Asset evaluation & Enrichment, Static Traffic Light & Validation
3. Asset prequalification and Topology Matrix Creation
4. Pool creation & registration

- Flexibility resource definition

The BSP registers on the CBP the flexibility resource (in this case a distributed flexibility resource) and its information (technical) considering the interface of Grid Connection Point (POD) as reference point. The asset is registered following a defined path based on the differentiation between consumption GCP, generation GCP, mixed GCP. The registration of a flexibility resource is to be considered a one-time event with the option for the BSP to always update the data regarding every GCP and in general accordingly to the status of the flexibility resource and based on the validation rules applied within the SOs backend systems. The BSP will be able to aggregate flexibility resources into pools at a later stage along the process to bring the pool to prequalification.

- Asset Evaluation & Enrichment, Static Traffic Light & Validation

The DSO is informed of every single GPC, connected to his distribution grid, that the BSP registers onto the platform and starts the static validation process (Static Traffic Light – STL). The aim of the validation process is to confirm the possibility for the BSP to use that resource in a pool and if so for which amount of flexible power. Furthermore, the DSO is requested to complement the information available for the resource by adding the field that indicates the reference grid element (Grid Element ID Code). Specifically, this is considered to be a Secondary Substation or a Low Voltage feeder (at least). The DSO is also requested to assign the Static Traffic Light to resources as the color code among a predefined list of green, yellow, red associated with a Go, Go-If, No-Go.

The DSO receives the information for every GCP in its perimeter (only the GCP that have the relevant DSO Name so that every DSO can only access info in its responsibility) and provides back relevant information. When the

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DSO has concluded the analysis of the GCP it is then enabled to change the status of the asset to "Validated" meaning that the asset itself can continue along the prequalification journey. The information is shared with TSO. **- Asset Prequalification & Topology Matrix creation** The information registered by the BSP on every GCP is complemented by the information available in the TSO backend depending on the type of GCP so that a consistent data package for every GCP is considered. At the end of the GCP prequalification process (that reaches the Status "Validated") the complete resource information is available. When a GCP has completed the process of prequalification the full spatial information, called Topology matrix, is available. The Topology Matrix includes: (i) The BSP EIC code; (ii) The reference DSO Perimeter (for example the Secondary Substation to which the GCP is electrically connected); (iii) The reference TSO perimeter; (iv) The GCP linked to the above elements and as registered by the BSP. The matrix is an element of the process with ex-ante nature; its elements can be updated with the same frequency and rules applied generally to GCP: the TSO has the possibility to update the resource, the BSP as well as the DSO has the possibility to update the resource. The Topology Matrix is considered an additional way of sharing information about a Resource in a specific format and is therefore redundant from a merely data exchange perspective. Information shared and updated by BSP, DSO and TSO during registration and prequalification steps are indeed distributed among the parties involved in the Resource registration and Resource constraint flows. **- Pool creation & registration** After the GCPs are registered by the BSP the BSP itself can proceed to combine them together in pools of resources (where number of resources is >=1). When the resource group is registered the pool qualification process starts so that the asset can be qualified into the respective market.

1.5 Use case conditions

Use case conditions
Assumptions
• There are a few distributed resources available for global services market • The DSO cannot impose activation limits to the distributed resources
Prerequisites
• The BSP is compliant with market access rules • The BSP's distributed resources fulfil technical requirements • The DSO participates into the Traffic Light project in compliance with the project regulation • TSO, DSOs and BSPs have access to the data exchange platform

1.6 Further Information to the use case for classification / mapping

Classification Information
Relation to other use cases
BUC 09 - Short-term voltage constraints forecasting and management for local flexibility service activation BUC 10 - Dynamic constraints management for global flexibility activation in transmission system operation
Level of depth
System use case (SUC) use case which describes in detail the functionality/technological solutions of (a part of) a business process.
Prioritisation
High Priority
Generic, regional or national relation
National
Nature of the use case
System use case
Further keywords for classification

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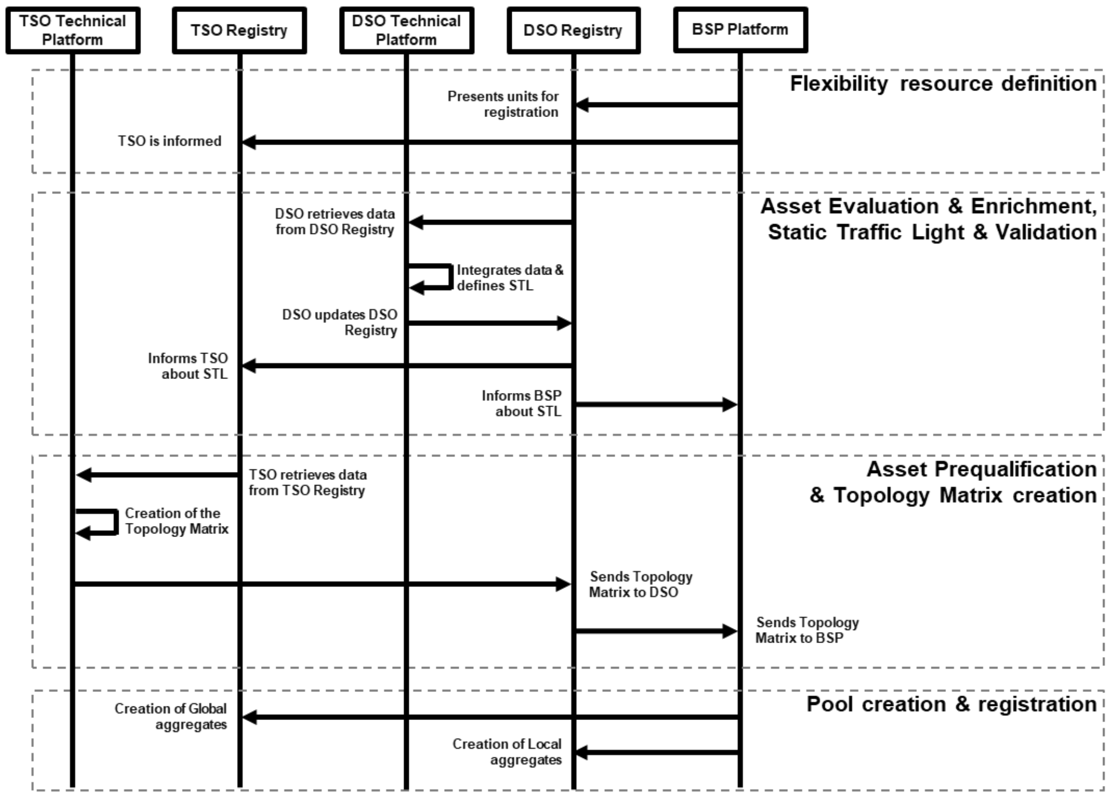
Validation; Ex ante; Static Traffic Light; Topology Matrix

1.7 General Remarks

General Remarks

2 Diagrams of use case

Diagram(s) of use case



3 Technical details

3.1 Actors

Actors		
Actor Name	***Actor Type***	***Actor Description***
Balancing Service Provider (BSP)	Business Role (BRIDGE HEMRM)	A party with reserve-providing units or reserve-providing groups able to provide balancing services to one or more LFC Operators
DSO	Business Role (BRIDGE HEMRM)	A DSO is a System Operator. DSO is responsible for security of supply and reliability of the distribution grid. For this reason, it monitors the grid to identify possible arising issues and, if there is a need, it makes use of resources to solve such problems, by network reconfiguration and/or by requests to market

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		operators or directly to properly contracted customers.
TSO	Business Role (BRIDGE HEMRM)	TSO is a System Operator. TSO is responsible for security of supply and reliability of the transmission grid. For this reason, it monitors the grid to identify possible arising issues and, if there is a need, it makes use of resources to solve such problems, by network reconfiguration and/or by requests to market operators or directly to properly contracted customers.
TSO Technical Platform	System	IT platform of the TSO encompassing all the systems involved in performing technical activities such as validation or prequalification
TSO Registry	System	Internal registry for distributed resources stored in the TSO backend. It contains a list of all the validated PODs and global aggregates participating in the system
DSO Technical Platform	System	IT platform of the DSO encompassing all the systems involved in performing technical activities such as validation or prequalification
DSO Registry	System	Internal registry for distributed resources stored in the DSO backend. It contains a list of all the validated PODs and local aggregates participating in the system
BSP Platform	System	IT platform enabling commercial/technical communication exchanges from/to the BSPs participating in the system

3.2 References

References						
No.	***References Type***	***Reference***	***Status***	***Impact on use case***	***Originator / organisation***	***Link***
N/A	N/A	N/A	N/A	N/A	N/A	N/A

4 Step by step analysis of use case

4.1 Overview of scenarios

Scenario conditions						
No.	**Scenario name**	**Scenario description**	**Primary actor**	**Triggering event**	**Pre-condition**	**Post-condition**
1	Standard ex ante validation scenario		TSO, DSO, BSP	BSP registers the flexibility resource of its portfolio	Waiting for information	Resources validated and ready to participate in the global market.

4.2 Steps – Scenarios

Scenario								
Scenario name :		No. 1 - Reference scenario						
Step No.	Event	Name of process/ activity	Description of process/ activity	Service	Information producer (actor)	Information receiver (actor)	Information Exchanged (IDs)	Requirement, R-IDs
1	BSP registers the flexibility resource of its portfolio	Registration of flexibility resource	BSP registers the flexibility resource of its portfolio and its information (technical) considering the interface of Grid Connection Point (GCP) as reference point.	REPORT	BSP	DSO	[1]	
2	The DSO is informed and starts the validation process.	Validation process	The DSO is informed of every single GCP that the BSP registers onto the platform and starts the validation process. The aim of the validation process is to confirm the possibility for the BSP to use that resource in a pool and if so for which amount of flexible power.	CREATE	DSO			
3	The DSO complements the information available for the resource	Definition of the Static Traffic Light	The DSO is requested to complement the information available for the resource by adding the field that indicated the reference grid element and the Static Traffic Light as the color code among a predefined list of green, yellow, red associated with a Go, Go-If, No-Go.	CREATE	DSO			
4	The DSO changes the status of the asset	Status change	When the DSO has concluded the analysis of the GCP it is then enabled to change the status of the asset that the asset itself can continue along the prequalification journey.	CHANGE	DSO			

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5	The DSO communicates the Static Traffic Light to the TSO	Information sharing	The information about the Static Traffic Light is shared with TSO.	REPORT	DSO	TSO	[2]	
6	The TSO matches the information received by the DSO with the information it already possesses	TSO information matching	The information registered by the BSP on every GCP is complemented by the information available in the TSO systems so that a consistent data package for every GCP is considered.	CHANGE	TSO			
7	The Topology Matrix is set up.	Topology Matrix creation	At the end of the GCP validation process, the full spatial information is available and therefore the Topology Matrix can be setup. The Topology Matrix includes the reference DSO Perimeter, the reference TSO perimeter and the GCP linked to both the elements and as registered by the BSP.	CREATE	TSO			
8	The Topology Matrix is shared among all the participants.	Topology Matrix sharing.	The Matrix is made available to all parties: BSP, DSO, TSO for the relevant actions and acknowledgment feedback.	REPORT	TSO	BSP, DSO	[3]	
9	The BSPs create their pools of resources.	Aggregation of resources	After the GCPs are registered by the BSP and validated by the DSO, the BSP itself can proceed to combine them together in pools of resources (where number of resources is >=1) and register them.	CREATE	BSP			
10	Information about the new	Communication of the newly	The resource group information is shared with the TSO and the	REPORT	BSP	TSO, DSO	[4]	

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	pool of resource is disseminated among participants.	created pool of resources.	pool qualification process starts so that the asset can be qualified into the global market.					

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5 Information exchanged

Information exchanged			
Information exchanged (ID)	***Name of information***	***Description of information exchanged***	***Requirement, R-IDs***
[1]	Technical data about the flexibility resources	GCP; Geographical localization; Modulating power; Nominal capability	
[2]	Static Traffic Light information	The validation rules to be applied to the Static Traffic Light flow are: If the DSO can accept all the amount of modulating power for the GCP, DSO Validated Flexible Power is equal to BSP Flexible Power and Static Traffic Light is green. *DSO Flex P =BSP Flex P⇒Green STL* If the DSO can accept partially the amount of modulating upward power for the GCP, DSO Validated Flexible Upward Power is smaller than BSP Flexible Upward Power and Static Traffic Light is yellow. *DSO Flex Pup <BSP Flex Pup ⇒Yellow STL* If the DSO can accept partially the amount of modulating downward power for the GCP, DSO Validated Flexible Downward Power is smaller (in absolute value) than BSP Flexible Downward Power (the value is negative) and Static Traffic Light is yellow. *DSO Flex Pdown <BSP Flex Pdown ⇒Yellow STL* If the DSO cannot accept any modulating power for the GCP, DSO Validated Flexible Power is equal to zero and Static Traffic Light is red. *DSO Flex P =0 ⇒Red STL*	
[3]	Topology Matrix	The Topology Matrix includes: (i) The BSP EIC code; (ii) The reference DSO Perimeter (for example the Secondary Substation to which the GCP is electrically connected); (iii) The reference TSO perimeter (the aggregation perimeter of UVAM, as included in the GCP data package during prequalification); (iv) The GCP linked to the above elements and as registered by the BSP.	
[4]	Aggregate resources	Pool of resources to be qualified	

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6 Requirements

Requirements		
Categories ID	**Category name for requirements**	**Category description**
1	Configuration Issues	Reflect the typical, probable, or envisioned communication configurations that are relevant to the use case step. These configuration issues include numbers of devices and/or systems, expected growth of the system over time, locations, distances, communications types, network bandwidth, existing protocols, etc., but only from the user's point of view. In some cases, only one of the possible choices is reasonable, while for other situations, more than one choice is reasonable.
2	Data Management	Covers both the management of the data exchanges in each Use Case step and the management of data at either end if that management is impacted by data exchanges. An example of the first type of data management is the initial setting up and on-going maintenance of what data needs to be exchanged, say between a Geographic Information System and the many different applications that use its data. An example of the second type of data management is the need to backup data or ensure consistency of data whenever it is exchanged, such as if new protection settings are issued to multiple field devices, these settings need to be reflected in Contingency Analysis functions. It should not address database design but should concentrate on the user requirements for the interfaces to databases and other data handling applications.
Requirement R-ID	**Requirement name**	**Requirement description**
6	Communication paradigm	Ad hoc
7	Data exchange method	Ad hoc
17	Operation mode of Information Producer	Manual
43	Validation of data exchanges	Crucial
44	Management of accessing different types of data to be exchanged	Each data exchange could entail different types of data (e.g. query a database)
45	Management of data across organizational boundaries	Data exchanges go across organizational boundaries

7 Common Terms and Definitions

Common Terms and Definitions	
Term	**Definition**
N/A	N/A

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8.12. SUC10.2 – Constraints definition

1 Description of the use case

1.1 Name of the use case

ID	Area / Domain(s)	Name of Use Case
SUC 10.2	Select from: (1) **Local energy sharing and flexibility market;** (2) Grid-centric flexibility; (3) **TSO-DSO flexibility coordination;** (4) Cross-sector	Constraints definition

1.2 Version management

Version Management			
Version No.	Date	Name of Author(s)	Changes
0.1	11.07.2023	Giorgia Lattanzio, Marco Rossi	First draft
0.2	01.09.2023	Giorgia Lattanzio	Second draft
0.3	23.10.2023	Giorgia Lattanzio	Draft finalized after Italian DSO review

1.3 Scope and objectives of use case

Scope and Objectives of Use Case	
Scope	The UC describes the process to define the Dynamic Traffic Light which expresses the limits given by the DSO to the flexibility activation of the TSO.
Objective(s)	The SUC wants to: • Define common conventions to communicate flexibility limits
Related business case(s)	BUC 10 – Dynamic constraints management for global flexibility activation in transmission system operation

1.4 Narrative of use case

Narrative of Use Case
Short description
This SUC define the structure and contents of the exchanged data to coordinate the use of distributed flexibility for transmission purposes closer to real time with respect to the registration and prequalification process. Leaving the evaluation of distribution grid limitations to the DSO, the SUC starts defining the methodology deployed to express distribution grid limitations and so limits to flexibility activation. The meaning of the DTL colours (green, yellow and red) is described. Then the structure of the data exchange is defined: DSO informs the TSO about Dynamic traffic light values referring to the grid interface defined in the Topology Matrix.
Complete description
<u>Services from the DoA:</u> • GA Service 22: Dynamic Grid Constraints • GA Service 26: Dynamic Grid Constraints assessment to coordinate with TSO This SUC describes a methodology for TSO-DSO coordination when distributed flexibility resources (connected to MV/LV network) are qualified to provide global services. Assuming that the DSO is able to define the optimal

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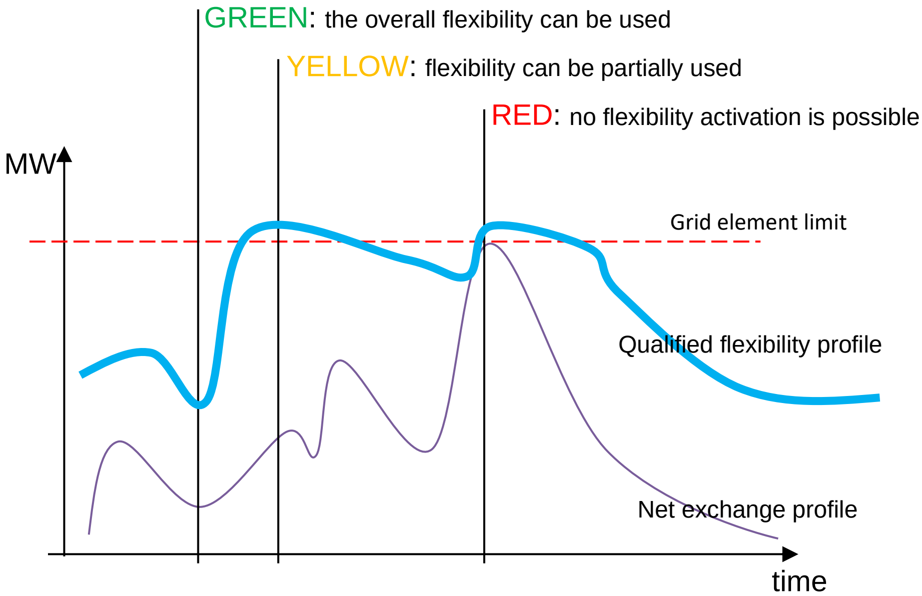
methodology to define grid constraints in order to maximize available and activatable flexibility, the results of DSO evaluations are then translated and transmitted to the TSO in terms of “Traffic Light (TL) values”. The idea of TL is to express distribution grid limitations using one of the colours *green, yellow* or *red:*

- *Green* → there are no restriction on the use of flexibility resources/aggregates connected to the relative DSO-TSO interface. This means that there are no critical network situations, all market products can be supplied and demanded without restriction.
- *Yellow* → a potential network shortage is identified by the DSO in the relative grid element if the overall qualified flexibility is activated. The DSO evaluates and reports the portion of flexible power which can be actually used by the TSO.
- *Red* → an actual network critical situation is identified by the DSO on the relative grid element, thus DSO communicate the TSO the impossibility of activating flexibility for a certain period.



Assuming that DSO continuously assess its own grid capacity to express limits to the flexibility activation, the use case process can be described in **one single step divided in three phases**:

1. **Constraint evaluation**
   The DSO evaluates the network constraints so as to minimize the flexibility limitations taking into account all necessary technical data such as: net exchanges, overall grid status, forecasts, historical data, nominal rating, etc. The computation is made within the DSO Technical Platform which communicate with the Flexibility Register in order to read the necessary information concerning flexibility assets. The constraint values can also be defined statically, indeed a default value is established during the *Registration and Prequalification phase* for each Grid Connection Point (GCP) and, if there is no further report of a real time analysis, the limitation will match the static value registered. The step is focused in understanding how the activation of flexibility resources for global purposes could affect the security of supply of the distribution grid. The DSO promptly analyses its grid on the basis of the resources or aggregates entitled to procure global services:
   - DSO extract from the flexibility register which are the distributed resources that can provide global flexibility services.
   - DSO forecasts possible congestions caused by the activation of resources by TSO.

Tools called by the step
Flexibility Register
DSO Technical Platform

2. **Dynamic Traffic Light Determination**
   The values, obtained during DSO analyses, are expressed in relation to the Topology Matrix, thus it is indicated for each TSO-DSO grid interface. A TL colour is associated according to the described convention and, when the selected colour is yellow, the information is combined with the *capability*. The *capability* represents the actual value of the constraint for each DSO Grid Element. Thus, constraints identified in step 1) are translated according to a pre-defined structure of the information:

- DSO identifies representative perimeters to set limitations to TSO on the use of flexibility resources connected to the distribution grid. DSOs perimeters can be updated continuously within a reasonable time before the gate closure of the global market (exact definition of timing is left to TSO and DSO).
- DSO translates the constraints evaluated in step 1), which are generally relative to resources, aggregating them and to be representative of the DSO perimeter constraints.

Tools called by the step
DSO DERMS

3. **Information Exchange**
   The information is transmitted by the DSO to the TSO by means of a dedicated and shared platform, the Crowd Balancing Platform. Information are packed and transmitted with API. The DSO is responsible for notifying TL values for D on the D-1 and can update them during D consistently with global market operation.

Tools called by the step
Crowd Balancing Platform – Data Exchange Platform Flexibility Register – Data Exchange Platform

1.5 Use case conditions

Use case conditions
Assumptions
• There are at least few distributed resources available for global services market • The DSO cannot impose activation limits to the distributed resources • DSO developed an efficient methodology to estimate grid constraints • DSO continuously assess its own grid capacity to express limits to the flexibility activation
Prerequisites
• TSO, DSOs and BSPs have access to the data exchange platform • Flexibility resources enabled to participate to global services passed the prequalification and qualification procedure • DSO and TSO use the same model for the evaluation of the baseline

1.6 Further Information to the use case for classification / mapping

Classification Information
Relation to other use cases
BUC 10 – Dynamic constraints management for global flexibility activation in transmission system operation
Level of depth
System use case (SUC) use case which describes in detail the functionality/technological solutions of (a part of) a business process.
Prioritisation
High priority for Italian demo
Generic, regional or national relation
National
Nature of the use case
Technological System Use Case focused on data exchange system for the coordination between TSO and DSOs.
Further keywords for classification
Data exchange platform, technological communication system, TSO-DSO coordination.

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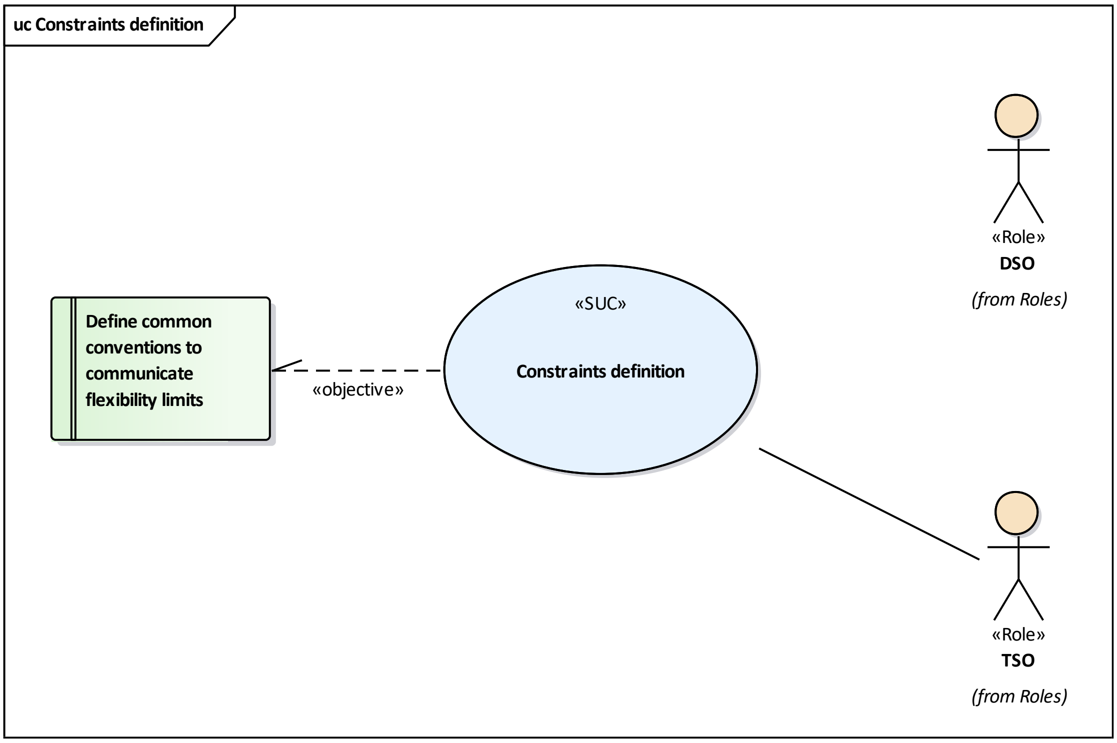
1.7 General Remarks

General Remarks
N/A

2 Diagrams of use case

Diagram(s) of use case


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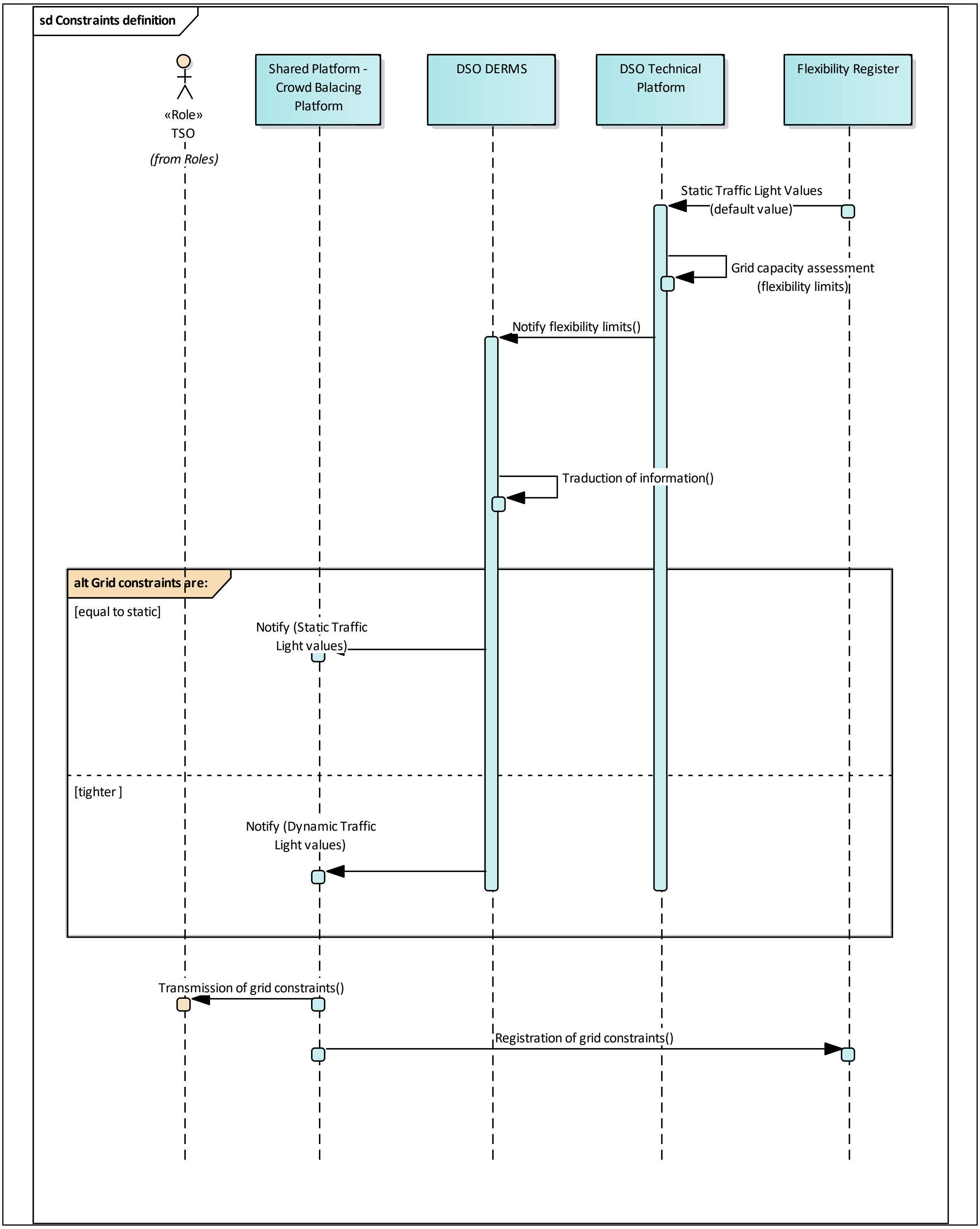

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3 Technical details

3.1 Actors

Actors		
Actor Name	***Actor Type***	***Actor Description***
DSO	Business Role (BRIDGE HEMRM)	A DSO is a System Operator. DSO is responsible for security of supply and reliability of the distribution grid. For this reason, it monitors the grid in order to identify possible arising issues and, if there is a need, it makes use of resources to solve such problems, by network reconfiguration and/or by requests to market operators or directly to properly contracted customers. In addition to the above and more in detail: - is responsible for the access of the customers to the grid; - operates, maintains, develops and is fully responsible of the part of the electricity system, named “Distribution Network”, typically starting from the HV/MV transformers (or vHV/HV transformers depending upon Member State Regulation) down to the customer’s POD; - acts on Local Flexibility Market requiring Local Flexibility Services to solve distribution grids issues; - ensures a transparent and non-discriminatory access to the distribution network for each users; - assess network status of the distribution grid and broadcasts selected information of the network status to eligible actors (e.g. aggregators, other system operators); in critical situations, implements dedicated actions and deliver alerts during stress events If necessary, implement emergency measures including load shedding and DER curtailment; - cooperates with the Transmission System Operator in carrying out their responsibilities (e.g. load shedding)
TSO	Business Role (BRIDGE HEMRM)	TSO is a System Operator. TSO is responsible for security of supply and reliability of the transmission grid. For this reason, it monitors the grid in order to identify possible arising issues and, if there is a need, it makes use of resources to solve such problems, by network reconfiguration and/or by requests to market operators or directly to properly contracted customers. In addition to the above and more in detail: - is responsible for real time the physical generation-consumption balance on a geographical perimeter, including ensuring the frequency control service; - operates, maintains, develops and is fully responsible of the part of the electricity system, named “Transmission Network”, typically starting from the producers connected to the HV grid and arriving to the DSOs’ HV/MV transformers (or vHV/HV transformers depending upon the Member State Regulation); - acts on Markets requiring services to solve transmission grids issues; - ensures a transparent and non-discriminatory access to the transmission network for each users;

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		- assess network status of the transmission grid and broadcast selected information of the network status to eligible actors (e.g. aggregators, other system operators); - provides data to the interconnection capacity market operator for the management of cross border transactions; - in critical situations, implements dedicated actions and deliver alerts during stress events. If necessary, implement emergency measures (e.g. system defence plan) including load shedding; cooperates with the Distribution System Operators in carrying out their responsibilities (e.g. load shedding).
DSO DERMS	System Actor	DERMS is a software package specifically tailored for utilities to support them in overcoming DER-imposed challenges and for using DERs to plan and operate the grid in most efficient and economical way. DERMS provides long-term forecast in network planning module, as well as a comprehensive set of advanced applications for constraint management, grid optimization, and planning of distribution systems with high DER penetration.
DSO Technical Platform	System Actor	The platform enables the utilization of the flexibility provided by Distributed Energy Resources (DERs) connected to their grids. For that purpose, the platform determines the most cost-effective activation planning of flexibility services that can attend to specific grid needs, considering market constraints. Once the activation planning is confirmed, the platform reports it through involved agents such as service providers or market operators.
Flexibility Register	System Actor	The Flexibility Register is a repository system where all data related to flexible POD are stored and made available to demo platforms and stakeholders. Data are organized according to predefined schemes and can be read by authorized platforms and stakeholders followed by authentication procedures. Data updating is allowed, after authentication, only for some types of data: for example, POD Baseline for day after can be updated by the Aggregator, while Market Outcomes cannot.
CBP - Crowd Balancing Platform	System Actor	The CBP is a blockchain-based system to share relevant information between the participating parties in a transaction – such as TSOs, DSOs, Aggregators and data providers – in a trusted and secured way. The CBP facilitates the standardised registration, bidding and activation of flexibility transactions from aggregators of distributed energy resources (DERs). The CBP enables the proof of delivery of flexibility transactions, while allowing the market to operate within grid limits.

3.2 References

References						
No.	***References Type***	***Reference***	***Status***	***Impact on use case***	***Originator / organisation***	***Link***

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	Technical Report	Harmonized Electricity Market Role Model (HEMRM)	Public	Role Model	BRIDGE	https://energy.ec.europa.eu/system/files/2021-06/bridge_wg_regulation_eu_bridge_hemrm_report_2020-2021_0.pdf
	Deliverable	Deliverable 4.1 BeFlex	Private	-	-	-
	Website	The Platform - EQUIGY	Public	-	EQUIGY	https://equigy.com/the-platform/#cbp-product

4 Step by step analysis of use case

4.1 Overview of scenarios

Scenario conditions						
No.	**Scenario name**	**Scenario description**	**Primary actor**	**Triggering event**	**Pre-condition**	**Post-condition**
1.0	Constraints definition	DSO defines limitations concerning flexibility activations of distributed resources for global services	DSO, TSO	Prequalification, Registration of flexibility resources connected to MV/LV grid into global services	TSO is allowed to use flexibility resources connected to MV/LV grid to procure global flexibility services	N/A

4.2 Steps – Scenarios

Scenario								
Scenario name :		***No. 1 - Reference scenario***						
Step No.	***Event***	***Name of process/ activity***	***Description of process/ activity***	***Service***	***Information producer (actor)***	***Information receiver (actor)***	***Information Exchanged (IDs)***	***Requirement, R-IDs***
1.0	Initialization of grid capacity evaluation	Static Traffic Light Values	Static Traffic light values registered during the prequalification and qualification phase are loaded by the DSO from the Flexibility Register.	REPORT	Flexibility Register	DSO Technical Platform	Prequalification and registration values	
2.0	Necessity to determine updated grid constraints	Grid Capacity Assessment	DSO performs grid analyses to evaluate the updated grid loading and eventually find tighter constraints for flexibility activations (GA Service 22 – Dynamic Grid Constraints, GA Service 26: Dynamic Grid Constraints assessment to coordinate with TSO)	CREATE	DSO Technical Platform	DSO Technical Platform	N/A	
3.0	Information is transmitted to the DSO DERMS	Notify (Flexibility Limits)	DSO Technical Platform sends the flexibility limits to the DSO DERMS for translation	REPORT	DSO Technical Platform	DSO DERMS	Flexibility limits	
4.0	A common convention is defined to express grid constraints between TSO and DSO	Translation of information	DSO translates information according to predefined structure, defining them with a colour and capability value, when necessary.	CREATE	DSO DERMS	DSO DERMS	N/A	
4.1	Traffic light data have to be updated in the shared platform	Notify (Static Traffic values)	If grid constraints result to be equal to the static traffic light values, TL data are exchanged by default and static values are collected in	REPORT	DSO DERMS	Shared Platform – Crowd Balancing Platform	N/A	1.1

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			the shared platform					
4.2	Traffic light data have to be updated in the shared platform	Notify (Dynamic Traffic values)	If grid constraints result to be tighter than static traffic light values, updated TL data are exchanged. (Dynamic TL)	CHANGE	DSO DERMS	Shared Platform– Crowd Balancing Platform	N/A	1.1
4.3	Registration of grid constraints	Notify (Dynamic Traffic values)	If grid constraints result to be tighter than static traffic light values, updated TL data are exchanged. (Dynamic TL)	CHANGE	DSO DERMS	Flexibility Register		
5.0	Dynamic traffic light values are required to run global market clearing process	Transmission of grid constraints	TSO load traffic light values for a defined period from the shared platform.	GET	Shared Platform	TSO	N/A	1.1

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5 Information exchanged

Information exchanged			
Information exchanged (ID)	*Name of information*	*Description of information exchanged*	*Requirement, R-IDs*
1	Static Traffic Light Data	Static traffic light values coming from the prequalification and registration procedure. Determined in SUC 8.1.	N/A
2	Dynamic Traffic Light Data	Dynamic values determined hourly and preliminarily with respect to global market clearing processes.	N/A
3	Flexibility Data	Flexibility data related to the providers and contained in Flexibility Register, possibly together the outcome of the static grid prequalification	N/A
4	Grid constraints	Results of the DSO technical platform representing the grid distribution status in near-to-real-time analysis	N/A

6 Requirements

Requirements		
Categories ID	**Category name for requirements**	**Category description**
1	Configuration Issues	Reflect the typical, probable, or envisioned communication configurations that are relevant to the use case step. These configuration issues include numbers of devices and/or systems, expected growth of the system over time, locations, distances, communications types, network bandwidth, existing protocols, etc., but only from the user's point of view. In some cases, only one of the possible choices is reasonable, while for other situations, more than one choice is reasonable.
2	Data Management	Covers both the management of the data exchanges in each Use Case step and the management of data at either end if that management is impacted by data exchanges. An example of the first type of data management is the initial setting up and on-going maintenance of what data needs to be exchanged, say between a Geographic Information System and the many different applications that use its data. An example of the second type of data management is the need to backup data or ensure consistency of data whenever it is exchanged, such as if new protection settings are issued to multiple field devices, these settings need to be reflected in Contingency Analysis functions. It should not address database design but should concentrate on the user requirements for the interfaces to databases and other data handling applications.
3	Availability of information flows	No specific availability is required

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Requirement R-ID	Requirement name	Requirement description
7	Data exchange method	Ad hoc
12	Location of Information Producer	Control room operation (DSO)
13	Location of Information Receiver	Control room operation (TSO)
37	Type of source data	Source data was previously automatically stored in a database
44	Management of accessing different types of data to be exchanged	Each data exchange could entail different types of data (e.g. query a database)
46	Management of data across organizational boundaries	Data exchanges go across organizational boundaries

7 Common Terms and Definitions

Common Terms and Definitions	
Term	Definition

8.13. SUC10.3 – Bids placements and verification

1 Description of the use case

1.1 Name of the use case

ID	*Area / Domain(s)*	*Name of Use Case*
SUC10.3	TSO-DSO flexibility coordination	Bids placements and verification

1.2 Version management

Version Management			
Version No.	*Date*	*Name of Author(s)*	*Changes*
01	16/07/2023	Tommaso De Marco	First Draft
02	25/10/2023	Tommaso De Marco	Second Draft

1.3 Scope and objectives of use case

Scope and Objectives of Use Case	
Scope	Bid placement and verification process within the TSO and DSO coordination of the procurement of system services from distributed resources through local and global markets.
Objective(s)	The market-based coordination among the involved actors aims to manage the procurement of services via efficient data exchange, avoiding network constraint violation when the resources are activated, allowing value stacking for the distributed resources, and striving for overall economic efficiency of market-based procurement.
Related business case(s)	BUC 06 - Short-term voltage constraints forecasting and management for local flexibility service activation BUC 10 - Dynamic constraints management for global flexibility activation in transmission system operation

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1.4 Narrative of use case

Narrative of Use Case
Short description
The Systems Use Case describes the process of bidding by the BSP on the Global Flexibility Market and how these bids are collected and processed by the TSO, together with Dynamic Traffic Light, to avoid distribution grid bottlenecks in case of activation.
Complete description
The Systems Use Case describes the process of bidding by the BSP on the Global Flexibility Market and how these bids are collected and processed by the TSO, together with Dynamic Traffic Light, to avoid distribution grid bottlenecks in case of activation. The process consists of the following steps, which will be explored below: 5. Flexibility bids creation & Definition of components at DSO perimeter 6. Bid Components Reception & Bid Components Allocation to Respective Constraint 7. Overall Bids Selection 8. Confirmed Bids Registration & Confirmed Bids Communication **- Flexibility bids creation & Definition of components at DSO perimeter** Based on their own business operations the BSP creates ASM bids based on available flexibility and forwards them to the market operator. The bid that is forwarded to the market operator is defined by an aggregate price and an aggregate quantity together with a validity time and timestamp. At the same time the BSP is requested to give the TSO visibility of the components of the bid at DSO perimeter level. This is possible thanks to the information contained in the Topology Matrix which acts as the key for both the TSO and the BSP to manage the entire bidding process. Components of the bid at DSO perimeter level is a level of information needed: - to TSO to compare constraints shared by the DSO with the BSP bids and if necessary, modify them before activation; - to BSP to be able to properly break down the flexibility offers associated with its portfolio and to have, after the offer selection process, visibility of the constraints to be respected when activating its resources. The DSO is expected to communicate constraint value to the TSO one hour ahead of each ASM's Gate Time Closure, then the TSO will validate the constraint and communicate the association of constraint-POD-BSP to the BSP that then can reallocate the bid quantity to the resources located in other DSO areas or decrease the total bid volume if it is able to do so with the resources in its portfolio. As for constraint communication by the DSO, the TSO will receive all bids shared by the BSP and will consider the last bid consistent with ASM's Gate Time Closures as valid. **- Bid Components Reception & Bid Components Allocation to Respective Constraint** The TSO receives data, processed by the BSP, that specify the amount of flexibility offered at the grid interface. The TSO will validate within its own systems the constraints shared by the DSO considering the last available constraint to be valid in accordance with the Gate Closures of the MSD sessions. After the reception of DSO information regarding constraints per DSO perimeter and BSP cumulative flexibility bids available at DSO Perimeter, TSO compares on each DSO Perimeter the flexible availability offered by BSP and the Dynamic Traffic Light constraints imposed by the DSOs. The TSO, at this point, evaluates the resources activation taking into consideration the DSO constraints to avoid distribution grid bottlenecks. Therefore, the TSO proceeds to assign the TSO Dynamic Traffic Light to each bidding component communicated by the BSP in order to respect the respective distribution grid area capability. **- Overall Bids Selection** The TSO's ASM market clearing algorithm receives all bids placed for assets participating in the ASM and the previously adjusted bids (those that were subject to the TSO Dynamic Traffic Light). All those bids are processed as per the usual market clearing processes. As per normal operation the results of the clearing process are then communicated to the market operators.

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- Confirmed Bids Registration & Confirmed Bids Communication TSO register the market clearing outputs at the end of every single ASM session; it collects validated upward/downward quantities and accepted/reserved quantities for every period of the market session. If there are modified flexibility bid components (related to bids that have undergone limitations due to DSO constraints), the TSO informs the BSP about limitations, by and no later than one hour before the hourly delivery period of the offer for which the variation is made. The BSP must receive that information package because it is responsible to the proper flexibility activation in order to supply ancillary services to the TSO.

1.5 Use case conditions

Use case conditions
Assumptions
• There are a few distributed resources available for global services market • The DSO cannot impose activation limits to the distributed resources
Prerequisites
• The BSP is compliant with market access rules • The BSP's distributed resources fulfil technical requirements • The DSO participates into the Traffic Light project in compliance with the project regulation • TSO, DSOs and BSPs have access to the data exchange platform

1.6 Further Information to the use case for classification / mapping

Classification Information
Relation to other use cases
BUC 06 - Short-term voltage constraints forecasting and management for local flexibility service activation BUC 10 - Dynamic constraints management for global flexibility activation in transmission system operation
Level of depth
System use case (SUC) use case which describes in detail the functionality/technological solutions of (a part of) a business process.
Prioritisation
High Priority
Generic, regional or national relation
National
Nature of the use case
System use case
Further keywords for classification
Bidding; Dynamic Traffic Light; Bids selection; Bids modulation

1.7 General Remarks

General Remarks

2 Diagrams of use case

Diagram(s) of use case

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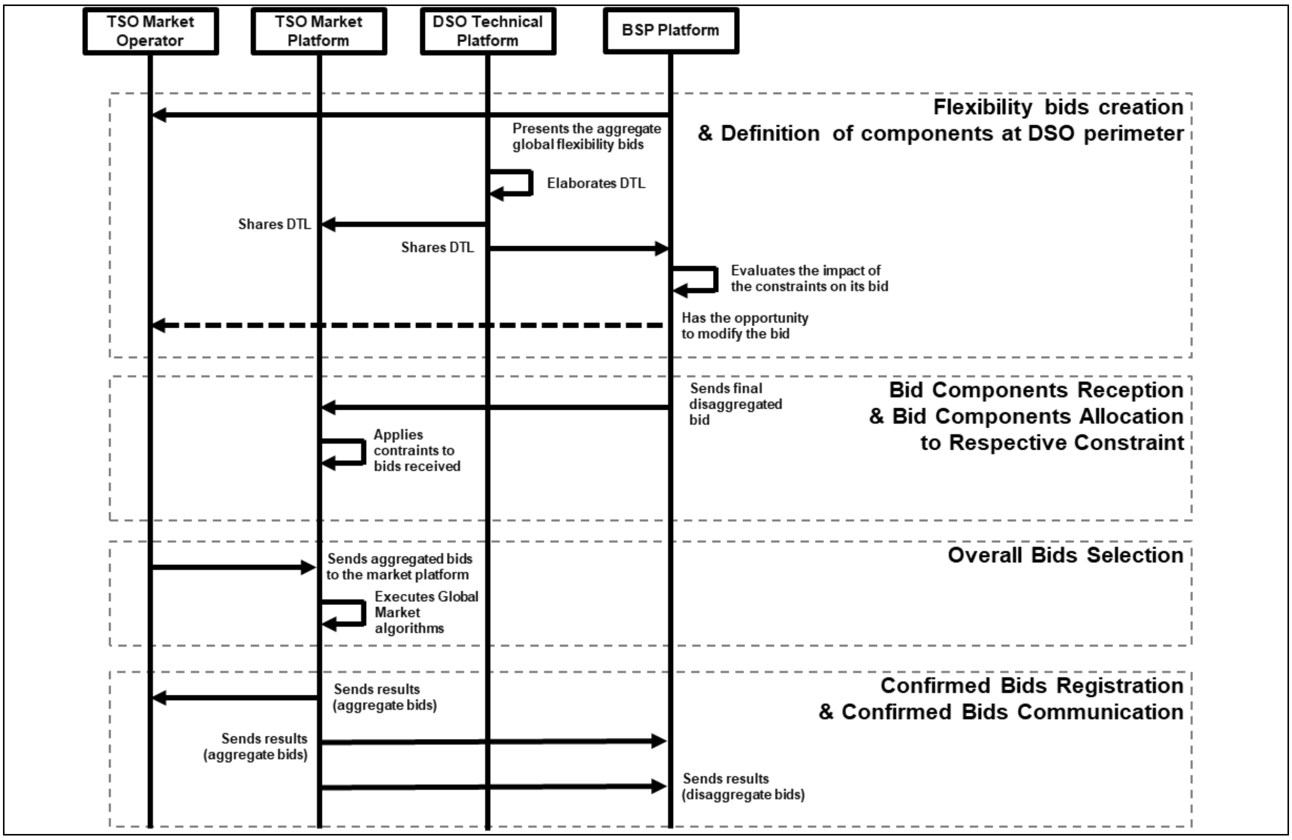

3 Technical details

3.1 Actors

Actors		
Actor Name	***Actor Type***	***Actor Description***
Balancing Service Provider (BSP)	Business Role (BRIDGE HEMRM)	A party with reserve-providing units or reserve-providing groups able to provide balancing services to one or more LFC Operators
DSO	Business Role (BRIDGE HEMRM)	A DSO is a System Operator. DSO is responsible for security of supply and reliability of the distribution grid. For this reason, it monitors the grid to identify possible arising issues and, if there is a need, it makes use of resources to solve such problems, by network reconfiguration and/or by requests to market operators or directly to properly contracted customers.
TSO	Business Role (BRIDGE HEMRM)	TSO is a System Operator. TSO is responsible for security of supply and reliability of the transmission grid. For this reason, it monitors the grid to identify possible arising issues and, if there is a need, it makes use of resources to solve such problems, by network reconfiguration and/or by requests to market operators or directly to properly contracted customers.
TSO Market Operator	Business Role	Third party entity that oversee and exercises the TSO global flexibility market
TSO Market Platform	System	Platform encompassing all the systems performing activities made necessary to exercise and manage the global flexibility market (both in terms of communication flows and market algorithms). It interfaces with the

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		Market Operator which oversees the offers gathering and economic dimension of the market processes
DSO Technical Platform	System	IT platform of the DSO encompassing all the systems involved in performing technical activities such as validation or prequalification
BSP Platform	System	IT platform enabling commercial/technical communication exchanges from/to the BSPs participating in the system

3.2 References

References						
No.	***References Type***	***Reference***	***Status***	***Impact on use case***	***Originator / organisation***	***Link***
N/A	N/A	N/A	N/A	N/A	N/A	N/A

4 Requirements

Requirements		
Categories ID	**Category name for requirements**	**Category description**
1	Configuration Issues	Reflect the typical, probable, or envisioned communication configurations that are relevant to the use case step. These configuration issues include numbers of devices and/or systems, expected growth of the system over time, locations, distances, communications types, network bandwidth, existing protocols, etc., but only from the user's point of view. In some cases, only one of the possible choices is reasonable, while for other situations, more than one choice is reasonable.
2	Quality of Service (QoS)	Address availability of the system, such as acceptable downtime, recovery, backup, rollback, etc. QoS issues also address accuracy and precision of data, the frequency of data exchanges, and the necessary flexibility for future changes.
3	Data Management	Covers both the management of the data exchanges in each Use Case step and the management of data at either end if that management is impacted by data exchanges. An example of the first type of data management is the initial setting up and on-going maintenance of what data needs to be exchanged, say between a Geographic Information System and the many different applications that use its data. An example of the second type of data management is the need to backup data or ensure consistency of data whenever it is exchanged, such as if new protection settings are issued to multiple field devices, these settings need to be reflected in Contingency Analysis functions. It should not address database design but should concentrate on the user requirements for the interfaces to databases and other data handling applications.

Requirement R-ID	Requirement name	Requirement description
6	Communication paradigm	Ad hoc
7	Data exchange method	Ad hoc
22	Contractual timelines for exchanging data	The timing for data exchange between TSO and BSP must be defined to have the possibility of applying the modified bids
37	Type of source data	Source data was previously automatically stored in a database
43	Validation of data exchange	Crucial
44	Management of accessing different types of data to be exchanged	Each data exchange could entail different types of data (e.g. query a database)
45	Management of data across organizational boundaries	Data exchanges go across organizational boundaries

5 Common Terms and Definitions

Common Terms and Definitions	
Term	**Definition**
N/A	N/A

8.14. SUC10.4 – Delivery validation

1 Description of the use case

1.1 Name of the use case

ID	*Area / Domain(s)*	*Name of Use Case*
SUC 10.4	Select from: (1) **Local energy sharing and flexibility market;** (2) Grid-centric flexibility; (3) **TSO-DSO flexibility coordination**; (4) Cross-sector	Delivery Validation

1.2 Version management

Version Management			
Version No.	*Date*	*Name of Author(s)*	*Changes*
1	13.07.2023	Giorgia Lattanzio, Marco Rossi	First draft
2	23.10.2023	Giorgia Lattanzio	Final Version

1.3 Scope and objectives of use case

Scope and Objectives of Use Case	
Scope	The SUC describes the process to validate compliance with offer set points and with distribution grid limitations.
Objective(s)	• Verify that BSPs successfully comply with the constraints set on flexibility (flexibility limits)

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Related business case(s)	BUC10 – Dynamic constraints management for global flexibility activation in transmission system operation

1.4 Narrative of use case

Narrative of Use Case
Short description
The DSO will be able to verify whether the BSP has correctly activated the resources in its portfolio compliant to the selection made by the TSO (which in turn is compliant with the DSO constraint) by using the measurements of the certified meter installed at the resource premises as for any flexibility service in place.
Complete description
This SUC represents the last step of the TSO-DSO coordination mechanism to allow TSO to use resources connected to the distribution grid without creating critical situations on its operation. Given the coordination mechanism described in BUC 10, it is responsibility of the BSP not overcome distribution grid limits communicated by the DSO to the TSO and then transmitted to the BSP. The DSO can request the TSO to conduct specific analysis to understand whether the BSP has successfully activated the resources without overcoming them. The overall verification process can be divided in the following steps:

1) **DSO notifies the TSO on the necessity to conduct a verification**
The DSO requests to the TSO how the distribution grid constraints have been considered during the market clearing process, together with the considered baseline of the activated BSP.

Tools called by the step
CBP – Crowd Balancing Platform
Flexibility Register

2) **Activation Limits and Baseline reporting**
TSO sends to the DSO the requested information (upper limits of each DSO perimeter) during an ex-post phase (after the delivery) highlighting the effects of DSO constraints on the BSP offers.
TSO will communicate to the DSO the baseline related to each DSO perimeter, which is given by the combination of the baselines communicated by the BSPs to the TSO. Anyway, this step could be avoided considering that, according to the prerequisites for a correct coordination, the baseline should be determined within the same methodology for both TSO and DSO.

Tools called by the step
CBP – Crowd Balancing Platform

3) **Measurements**
DSO is authorized to read hourly measurements of the Grid Connection Points (GCP) of each DSO perimeter, mostly provided by devices installed at DERs' premises able to gather metering data from low voltage and medium voltage meters. Measurements of consumption/production of the different resources are read. The measurements are sent to the Flexibility Register (through the Blockchain Access Layer). Thanks to the Flexibility register it is then possible to associate the resource to the DSO perimeter and each BSP.

Tools called by the step
Flexibility Register
PGUI
CE2G

4) **Evaluation of compliance**
DSO verifies that BSP fulfilled activation limits for each DSO perimeter. The sum of the baseline communicated by the BSP to the TSO and the accepted flexibility quantity is compared with the upper limits evaluated by the TSO. It is then the DSO to determine if grid limitations have been correctly taken into consideration when the flexibility resources are activated.

Tools called by the step
Flexibility Register

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5) **Notification of results** DSO communicate the positive or negative outcome of the analyses referring them to a single DSO perimeter. The information exchange is managed by means of a shared platform, which in the Italian pilot will be represented by the Crowd Balancing Platform.

1.5 Use case conditions

Use case conditions
Assumptions
• TSO-DSO coordination • There are at least few distributed resources available for global services market • Distributed resources are activated for global services purposes
Prerequisites
• Distributed resources are activated for global services • DSOs participate to the Traffic Light project according to the regulation • DSO have access to technical data (baseline and metering) and to the data exchange platform

1.6 Further Information to the use case for classification / mapping

Classification Information
Relation to other use cases
BUC 10 – Dynamic constraints management for global flexibility activation in transmission system operation
Level of depth
System use case (SUC) use case which describes in detail the functionality/technological solutions of (a part of) a business process.
Prioritisation
High priority for Italian demo
Generic, regional or national relation
National
Nature of the use case
Technological System Use Case focused on verification of flexibility activation compliance with distribution grid constraints.
Further keywords for classification
TSO-DSO coordination, grid constraints.

1.7 General Remarks

General Remarks
Is used for further comments which are not considered elsewhere.

2 Diagrams of use case

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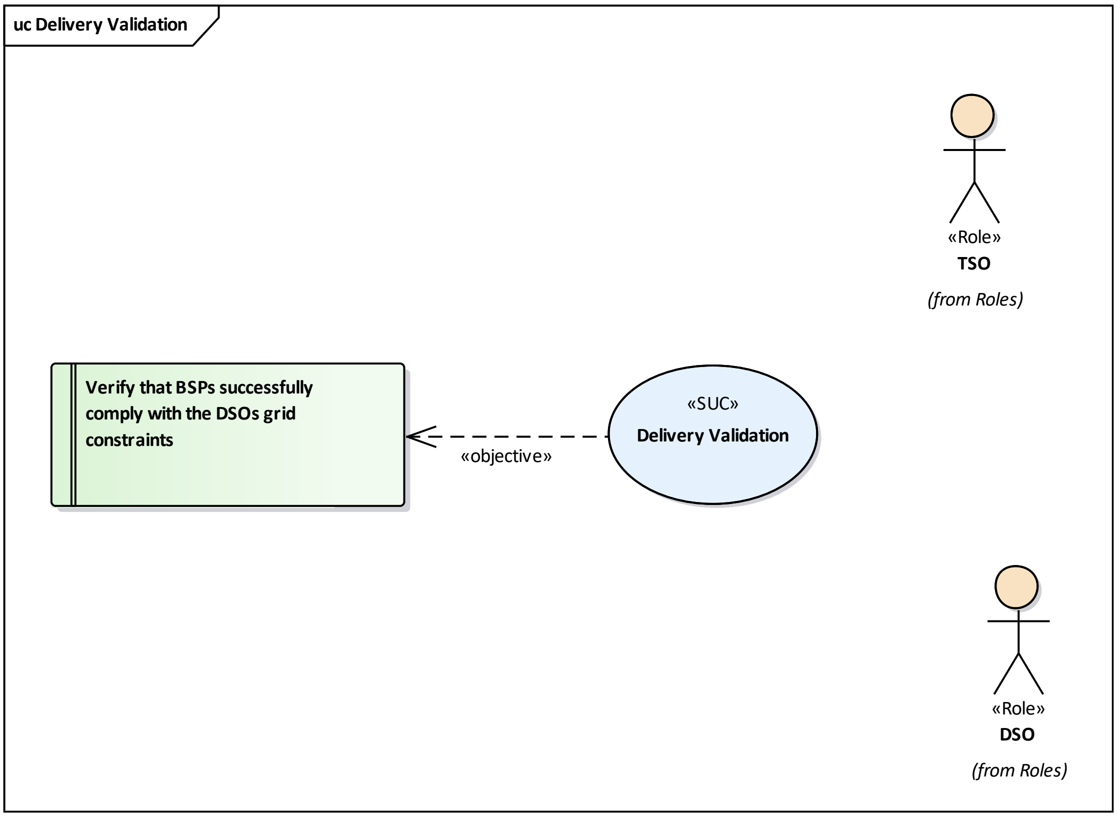
Diagram(s) of use case


3 Technical details

3.1 Actors

Actors		
Actor Name	**Actor Type**	**Actor Description**

DSO	Business Role (BRIDGE HEMRM)	A DSO is a System Operator.
		DSO is responsible for security of supply and reliability of the distribution grid. For this reason, it monitors the grid in order to identify possible arising issues and, if there is a need, it makes use of resources to solve such problems, by network reconfiguration and/or by requests to market operators or directly to properly contracted customers.
		In addition to the above and more in detail:
		- is responsible for the access of the customers to the grid;
		  - operates, maintains, develops and is fully responsible of the part of the electricity system, named “Distribution Network”, typically starting from the HV/MV transformers (or vHV/HV transformers depending upon Member State Regulation) down to the customer’s POD;
		  - acts on Local Flexibility Market requiring Local Flexibility Services to solve distribution grids issues;

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		- ensures a transparent and non-discriminatory access to the distribution network for each users; - assess network status of the distribution grid and broadcasts selected information of the network status to eligible actors (e.g. aggregators, other system operators); in critical situations, implements dedicated actions and deliver alerts during stress events If necessary, implement emergency measures including load shedding and DER curtailment; - cooperates with the Transmission System Operator in carrying out their responsibilities (e.g. load shedding)
TSO	Business Role (BRIDGE HEMRM)	TSO is a System Operator. TSO is responsible for security of supply and reliability of the transmission grid. For this reason, it monitors the grid in order to identify possible arising issues and, if there is a need, it makes use of resources to solve such problems, by network reconfiguration and/or by requests to market operators or directly to properly contracted customers. In addition to the above and more in detail: - is responsible for real time the physical generation-consumption balance on a geographical perimeter, including ensuring the frequency control service; - operates, maintains, develops and is fully responsible of the part of the electricity system, named “Transmission Network”, typically starting from the producers connected to the HV grid and arriving to the DSOs’ HV/MV transformers (or vHV/HV transformers depending upon the Member State Regulation); - acts on Markets requiring services to solve transmission grids issues; - ensures a transparent and non-discriminatory access to the transmission network for each users; - assess network status of the transmission grid and broadcast selected information of the network status to eligible actors (e.g. aggregators, other system operators); - provides data to the interconnection capacity market operator for the management of cross border transactions; - in critical situations, implements dedicated actions and deliver alerts during stress events. If necessary, implement emergency measures (e.g. system defence plan) including load shedding; cooperates with the Distribution System Operators in carrying out their responsibilities (e.g. load shedding).
PGUI and Block Chain Access Platform	Deliverable 4.1	The Blockchain Access Platform and the PGUI form the Access Layer, a data exchange infrastructure among flexible DERs, platforms and stakeholders within demo architecture. The PGUI is a device, installed at DERs’ premises, able to gather POD metering data from Low Voltage (LV) and Medium Voltage (MV) meters, receives Setpoint from DSO Technical Platform and could make it available to Customers Activation Systems such as Energy Management System (EMS), smart appliance etc. to activate flexibility.

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		The Blockchain Access Layer then connects the PGUI to the FR ensuring, through timestamping features, the immutability of data along the whole path.
Flexibility Register	Deliverable 4.1	The Flexibility Register is a repository system where all data related to flexible POD are stored and made available to demo platforms and stakeholders. The Database stores data such as POD general data (connection voltage level, contractual power etc.), POD Baseline, POD available flexibility, POD measurements, POD setpoint, Market outcomes, etc, as for example those collected in Table 6. Some of these data come from the Light Node (e.g. metering data), some other from the Aggregator Platform (e.g. POD Baseline), other by the Market Platform (e.g. market outcomes), other from the DSO Technical Platform, etc.
Crowd Balancing Platform	Deliverable 4.1	CBP is developed by Equigy, a joint venture participated by Terna, Tennet and Swissgrid, APG, Transnet BW, with the aim of developing a platform to facilitate the participation of small distributed resources to the energy markets. The CBP constitutes the central technological layer of the system, creating a frontend which coordinates the proprietary back-end systems of the different actors (TSO, DSOs and BSPs).

3.2 References

References						
No.	***References Type***	***Reference***	***Status***	***Impact on use case***	***Originator / organisation***	***Link***
	Technical Report	Harmonized Electricity Market Role Model (HEMRM)	Public	Role Model	BRIDGE	https://energy.ec.europa.eu/system/files/2021-06/bridge_wg_regulation_eu_bridge_hemrm_report_2020-2021_0.pdf

4 Requirements

Requirements		
Categories ID	**Category name for requirements**	**Category description**
1	Configuration	Reflect the typical, probable, or envisioned communication configurations that are relevant to the use case step. These configuration issues include numbers of devices and/or systems, expected growth of the system over time, locations, distances, communications types, network bandwidth, existing protocols, etc., but only from the user’s point of view. In some cases, only one of the possible choices is reasonable, while for other situations, more than one choice is reasonable.
2	Quality of Service	Address availability of the system, such as acceptable downtime, recovery, backup, rollback, etc. QoS issues also address accuracy and precision of data, the frequency of data exchanges, and the necessary flexibility for future changes.

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4	Data Management	Covers both the management of the data exchanges in each Use Case step and the management of data at either end if that management is impacted by data exchanges. An example of the first type of data management is the initial setting up and on-going maintenance of what data needs to be exchanged, say between a Geographic Information System and the many different applications that use its data. An example of the second type of data management is the need to backup data or ensure consistency of data whenever it is exchanged, such as if new protection settings are issued to multiple field devices, these settings need to be reflected in Contingency Analysis functions. It should not address database design, but should concentrate on the user requirements for the interfaces to databases and other data handling applications.
Requirement R-ID	**Requirement name**	**Requirement description**
N/A	Communication access services requirements	N/A
5	Communication ownership	Utility-owned
6	Communication paradigm	One-to-many
12	Location of Information Producer	Control room operation Customer site
14	Location of Information Receiver	Control room operation
16	Operation mode of Information Producer	Automatic
17	Operation mode of Information Receiver	Manual
21	Elapsed time response requirements for exchanging data	No specific response requirements
26	Information integrity violation: Ensuring that data is not changed or destroyed	Crucial
38	Correctness of source data	Crucial
43	Validation of data exchanges	Crucial

5 Common Terms and Definitions

Common Terms and Definitions	
Term	**Definition**

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9. Annex IV – TSO-DSO flexibility coordination

9.1. SUC08.1 – Flexibility Register

1 Description of the use case

1.1 Name of the use case

ID	Area / Domain(s)	Name of Use Case
SUC08.1	TSO-DSO flexibility coordination	Flexibility Register

1.2 Version management

Version Management			
Version No.	Date	Name of Author(s)	Changes
01	16.07.2023	Tommaso De Marco	First Draft
02	26/10/2023	Tommaso De Marco	Second Draft

1.3 Scope and objectives of use case

Scope and Objectives of Use Case	
Scope	Coordinate local flexibility markets and global ancillary services market in the processes for procuring flexibility services from distributed resources
Objective(s)	• Provide to global and/or local BSPs a common channel allowing data registry, market operation functionalities • Enable a common data exchange approach between TSO, DSOs and BSPs
Related business case(s)	BUC 08; BUC 10

1.4 Narrative of use case

Narrative of Use Case
Short description
This Systems Use Case is about how the Flexibility Register is used to facilitate markets participation by establishing a common data model across grid operators and across different flexibility products/services.
Complete description
The Crowd Balancing Platform (CBP) constitutes the central technological layer of the system, creating a frontend which coordinates the proprietary back-end systems of the different actors (TSO, DSOs and BSPs). The CBP can include the functionalities of data registry, market operation and stakeholders' interaction, which can be operated as modules within the platform. The CBP represents the coordination and orchestration layer between all the stakeholders involved in the process and acts as single-entry point to centrally collects all relevant data from every user. As a single-entry point, the CBP orchestrates all the information to be shared between the back-end systems of the actors and has all the functionalities that are necessary to manage the distributed data exchange that enables the coordination process across markets and the flexibility value chain stakeholders.

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Virtually all the information exchanges related to the coordination of the system take place through the CBP. The CBP plays a central role in the registration, validation and pre-qualification of resources, managing in an integrated way the exchanges of information between the proprietary systems of the DSO and those of the TSO in order to harmonize the process of enabling the participation of small distributed resources to the energy markets and the creation of a coherent registry among the various backends. The Flexibility Register is thus defined as a built-in module of the CBP performing the role of managing the shared repository for all the relevant data provided by the BSPs about their DERs. The data are physically stored on the backend systems of the participating parties. During registration, validation and pre-qualification, all the information flows referring to the creation, modification and update of these data are mediated by the CBP. In detail: - The BSPs use CBP's registration functionalities to register the GCPs they intend to qualify for the local/global flexibility markets; - The DSOs use CBP's registration functionalities to receive the resource's own data in order to perform the ex-ante validation of the resources (Static Traffic Light). After this, it uses the CBP to share relevant information about GCPs: (i) Grid Element ID Code (a specific grid area defined by the following attributes DSO EIC Code; ISTAT Code of the municipality (Commune) in which the grid area is found (6 elements string); DSO Perimeter Number (4 elements string); DSO Perimeter Type: either _CS (in case of Secondary Substation) or _AG (in case of aggregates of distribution grid elements) (ii) Static Traffic Light: the colour code among a predefined list of green, yellow, red associated with a Go, Go-If, No-Go; must be defined (mandatory) both for upward flexible power and for downward flexible power; (iii) DSO Validated Flexible upward power: the amount of modulating power the DSO can accept the GCP for; (iv) DSO Validated Flexible downward power: the amount of modulating power the DSO can accept the GCP for; (v) Measurement Treatment. - As a user of the CBP the TSO receives the information on the GCP and then transfers the same information into the backend systems. The information registered by the BSP on every GCP is complemented by the information available in the TSO backend depending on the type of GCP so that a consistent data package for every GCP is considered. - The Topology Matrix is considered an additional way of sharing information about a Resource in a specific format and is therefore redundant from a merely data exchange perspective. Information shared and updated by BSP, DSO and TSO during registration and prequalification steps are indeed distributed among the parties involved in the Resource registration and Resource constraint flows. A specific service of the CBP enables it to forward the Topology Matrix to all the participant of the system in order to keep updated the repository stored in their own backend systems. - The TSO, DSO and BSP shall use the CBP for updating the resources' data. - The CBP allows the BSPs to define the aggregates through CBP's aggregation functionalities and associate them with the services for which it intends to enable the aggregates. - The CBP is used to forward the information to the responsible for the pre-qualification (TSO and/or DSO), then the TSO and/or DSO uses CBP prequalification functionalities to qualify the aggregates for the provision of global and/or local services.

1.5 Use case conditions

Use case conditions
Assumptions
• TSO and DSOs collect differently flexibility data and do not share it between them • TSO and DSOs use their own communication system with BSPs • TSO-DSO coordination data exchange system do not exist for flexibility procurement
Prerequisites
• The BSP is compliant with market access rules • TSO, DSOs and BSPs have access to the data exchange platform

1.6 Further Information to the use case for classification / mapping

Classification Information
Relation to other use cases
BUC08 – BUC10
Level of depth

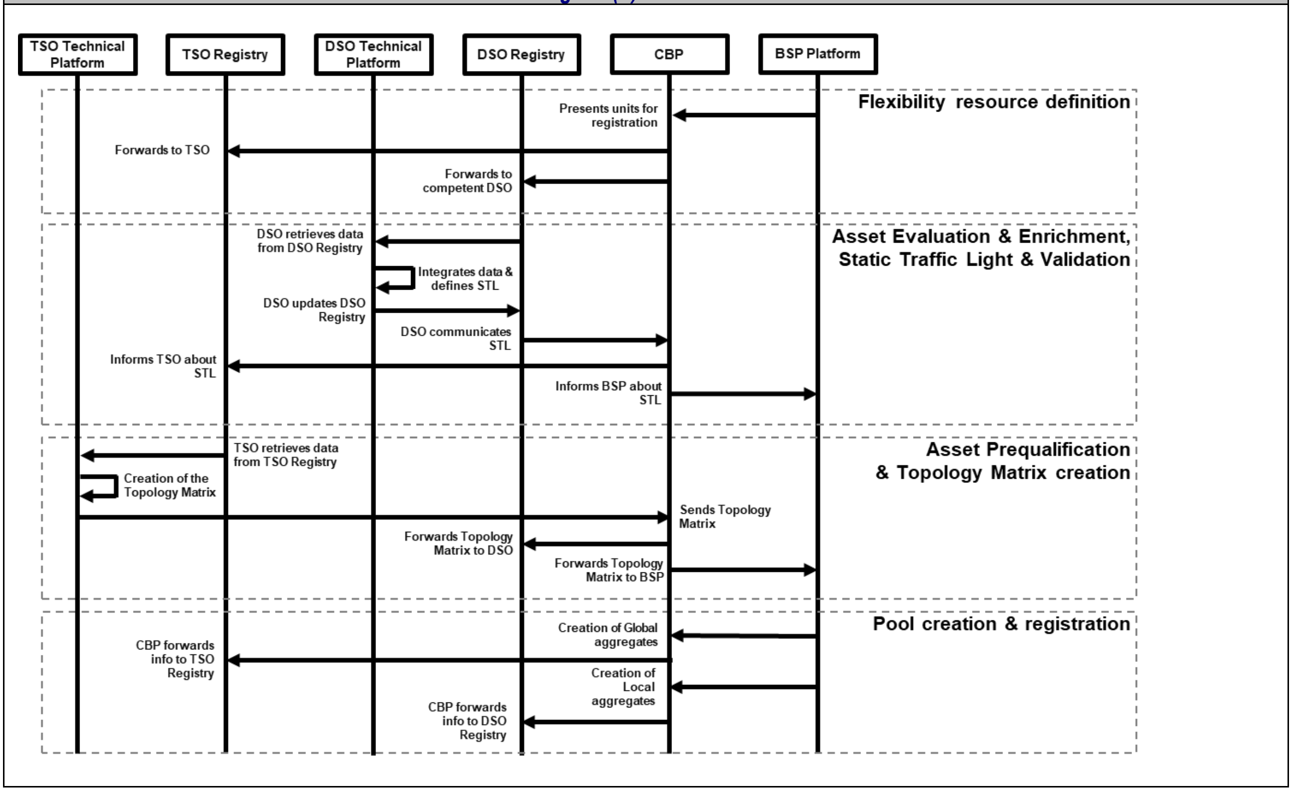
System use case (SUC) use case which describes in detail the functionality/technological solutions of (a part of) a business process.
Prioritisation
High Priority for Italian demo
Generic, regional or national relation
National
Nature of the use case
Technical/system use case
Further keywords for classification
Flexibility Register; Prequalification; Bids

1.7 General Remarks

General Remarks

2 Diagrams of use case

Diagram(s) of use case



3 Technical details

3.1 Actors

Actors		
Actor Name	*Actor Type*	*Actor Description*

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Balancing Service Provider (BSP)	Business Role (BRIDGE HEMRM)	A party with reserve-providing units or reserve-providing groups able to provide balancing services to one or more LFC Operators
DSO	Business Role (BRIDGE HEMRM)	A DSO is a System Operator. DSO is responsible for security of supply and reliability of the distribution grid. For this reason, it monitors the grid to identify possible arising issues and, if there is a need, it makes use of resources to solve such problems, by network reconfiguration and/or by requests to market operators or directly to properly contracted customers.
TSO	Business Role (BRIDGE HEMRM)	TSO is a System Operator. TSO is responsible for security of supply and reliability of the transmission grid. For this reason, it monitors the grid to identify possible arising issues and, if there is a need, it makes use of resources to solve such problems, by network reconfiguration and/or by requests to market operators or directly to properly contracted customers.
TSO Technical Platform	System	IT platform of the TSO encompassing all the systems involved in performing technical activities such as validation or prequalification
TSO Registry	System	Internal registry for distributed resources stored in the TSO backend. It contains a list of all the validated PODs and global aggregates participating in the system
DSO Technical Platform	System	IT platform of the DSO encompassing all the systems involved in performing technical activities such as validation or prequalification
DSO Registry	System	Internal registry for distributed resources stored in the DSO backend. It contains a list of all the validated PODs and local aggregates participating in the system
BSP Platform	System	IT platform enabling commercial/technical communication exchanges from/to the BSPs participating in the system
CBP	System	Acronym for Crowd Balancing Platform, a blockchain-powered system enabling direct communication between all the involved parties. It can perform multiple functions through dedicated services

3.2 References

References						
No.	***References Type***	***Reference***	***Status***	***Impact on use case***	***Originator / organisation***	***Link***
	CBP implementation	The Crowd Balancing Platform cannot be implemented by project/demos where Terna is not involved with an implementation role		IPR	Terna/Equigy	

4 Step by step analysis of use case

4.1 Overview of scenarios

Scenario conditions						
No.	**Scenario name**	**Scenario description**	**Primary actor**	**Triggering event**	**Pre-condition**	**Post-condition**

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1	Registration, validation, prequalification	The Flexibility Register is used as a single interface to optimize information exchange between stakeholders	TSO, DSO, BSP	N/A	TSO and DSO use different systems to collect BSP distributed resource and aggregate data.	Beside BSPs, the TSO and DSOs can access to the distributed resource and aggregate data via the CBP and collected into the Flexibility Register.

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4.2 Steps – Scenarios

Scenario								
Scenario name :		No. 1 - Reference scenario						
Step No.	Event	Name of process/ activity	Description of process/ activity	Service	Information producer (actor)	Information receiver (actor)	Information Exchanged (IDs)	Requirement, R-IDs
1	BSP registers the flexibility resource of its portfolio in the Flexibility Register	Registration of flexibility resource	BSP registers on the CBP the flexibility resource of its portfolio and its information (technical) considering the interface of Grid Connection Point (GCP) as reference point.	REPORT	BSP	DSO	[1]	
2	The DSO is informed and starts the validation process.	Validation process	The DSO is informed via CBP of every single GCP that the BSP registers onto and starts the validation process. The aim of the validation process is to confirm the possibility for the BSP to use that resource in a pool and if so for which amount of flexible power.	CREATE	DSO			
3	The DSO complements the information available for the resource	Definition of the Static Traffic Light	The DSO is requested to complement the information available for the resource by adding the field that indicated the reference grid element and the Static Traffic Light as the color code among a predefined list of green, yellow, red associated with a Go, Go-If, No-Go.	CREATE	DSO			
4	The DSO changes the status of the asset	Status change	When the DSO has concluded the analysis of the GCP it is then enabled to change the status of the asset that the asset itself can continue along the prequalification journey.	CHANGE	DSO			
5	The DSO	Information	The information about the	REPORT	DSO	TSO	[2]	

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	communicates the Static Traffic Light to the TSO	sharing	Static Traffic Light is shared with TSO.					
6	The TSO matches the information received by the DSO with the information it already possesses	TSO information matching	The information registered by the BSP on every GCP is complemented by the information available in the TSO systems so that a consistent data package for every GCP is considered.	CHANGE	TSO			

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5 Information exchanged

Information exchanged			
Information exchanged (ID)	*Name of information*	*Description of information exchanged*	*Requirement, R-IDs*
[1]	Technical data about the flexibility resources	GCP; Geographical localization; Modulating power; Nominal capability	
[2]	Static Traffic Light information	The validation rules to be applied to the Static Traffic Light flow are: If the DSO can accept all the amount of modulating power for the GCP, DSO Validated Flexible Power is equal to BSP Flexible Power and Static Traffic Light is green. *DSO Flex P =BSP Flex P⇒Green STL* If the DSO can accept partially the amount of modulating upward power for the GCP, DSO Validated Flexible Upward Power is smaller than BSP Flexible Upward Power and Static Traffic Light is yellow. *DSO Flex Pup <BSP Flex Pup ⇒Yellow STL* If the DSO can accept partially the amount of modulating downward power for the GCP, DSO Validated Flexible Downward Power is smaller (in absolute value) than BSP Flexible Downward Power (the value is negative) and Static Traffic Light is yellow. *DSO Flex Pdown <BSP Flex Pdown ⇒Yellow STL* If the DSO cannot accept any modulating power for the GCP, DSO Validated Flexible Power is equal to zero and Static Traffic Light is red. *DSO Flex P =0 ⇒Red STL*	

6 Requirements

Requirements		
Categories ID	**Category name for requirements**	**Category description**
1	Configuration Issues	Reflect the typical, probable, or envisioned communication configurations that are relevant to the use case step. These configuration issues include numbers of devices and/or systems, expected growth of the system over time, locations, distances, communications types, network bandwidth, existing protocols, etc., but only from the user's point of view. In some cases, only

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		one of the possible choices is reasonable, while for other situations, more than one choice is reasonable.
2	Data Management	Covers both the management of the data exchanges in each Use Case step and the management of data at either end if that management is impacted by data exchanges. An example of the first type of data management is the initial setting up and on-going maintenance of what data needs to be exchanged, say between a Geographic Information System and the many different applications that use its data. An example of the second type of data management is the need to backup data or ensure consistency of data whenever it is exchanged, such as if new protection settings are issued to multiple field devices, these settings need to be reflected in Contingency Analysis functions. It should not address database design but should concentrate on the user requirements for the interfaces to databases and other data handling applications.
Requirement R-ID	**Requirement name**	**Requirement description**
6	Communication paradigm	Ad hoc
7	Data exchange method	Ad hoc
17	Operation mode of Information Producer	Manual
44	Management of accessing different types of data to be exchanged	Each data exchange could entail different types of data (e.g. query a database)
45	Management of data across organizational boundaries	Data exchanges go across organizational boundaries

7 Common Terms and Definitions

Common Terms and Definitions	
Term	**Definition**
CBP	The Crowd Balancing Platform (CBP) is a blockchain-based system available for sharing information between TSO, DSOs and BSPs in a trusted and secured way.

9.2. SUC08.2 – Market data exchange functionalities

1 Description of the use case

1.1 Name of the use case

ID	***Area / Domain(s)***	***Name of Use Case***
SUC08.2	TSO-DSO flexibility coordination	Market data exchange functionalities

1.2 Version management

Version Management

Version No.	***Date***	***Name of Author(s)***	***Changes***
01	16.07.2023	Tommaso De Marco	First Draft
02	25/10/2023	Tommaso De Marco	Second Draft

1.3 Scope and objectives of use case

Scope and Objectives of Use Case	
Scope	Coordinate local flexibility markets and global ancillary services market in the processes for procuring flexibility services from distributed resources
Objective(s)	• Provide to global and/or local BSPs a common channel allowing data registry, market operation functionalities • Enable a common data exchange approach between TSO, DSOs and BSPs
Related business case(s)	BUC 08, BUC 10

1.4 Narrative of use case

Narrative of Use Case

Short description

This Systems Use Case is about how TSO and DSOs exchange market data through the Crowd Balancing Platform in the ex-ante market phases, enabling TSO-DSO coordination and to guarantee visibility over aggregates activation.

Complete description

In the ex-ante market phase, TSO and DSOs exchange market data through the CBP, enabling TSO-DSO coordination and to guarantee visibility over aggregates activation. The process starts with the DSO performing the power flows necessary to: plan the local flexibility needs selecting the necessary aggregates qualified to procure local flexibility services and set/update the dynamic grid constraints. TSO is then informed through CBP of: (i) DERs Aggregates planned for the provision of local flexibility services; (ii) The Dynamic traffic Light concerning each DSO perimeter. This flow is described in detail in the System Use Case dedicated to the Dynamic Traffic Light data exchange functionalities.

The market data information exchange taking place through the CBP being the focus of this System Use Case accrue to the following phases, which will be explored below:

1. Bids creation;
2. Bids validation.

- Bids creation

This step concerns the Global Flexibility Market. Based on their own business operations the BSP creates ASM bids based on available flexibility and forwards them to the market operator. This flow does not take place through the CBP, whereas the one being described below does. In fact, the BSP is requested to give the TSO visibility of the components of the bid at DSO perimeter level: the BSP thus will forward to the TSO via the CBP the following information:

- Validity Time (Unix Time Format)
- Timestamp (Unix Time Format)
- UVA ID Code
- Aggregate quantity (Q)
- UVA Baseline profile
- Component of the aggregate quantity (Q_i) and respective Grid Element ID Code
- Market zone (Nord, Centro Nord, Centro Sud, Sud, Calabria, Sicilia, Sardegna)

The aggregate quantity Q corresponds to the sum of the Qi components referring to the individual DSO Perimeter for which a Dynamic Traffic Light is defined. The BSP is required to provide the above mentioned elements (and

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unavailability), for every DSO Perimeter designed with a Yellow or Red DTL, via a constant-length vector of 24 elements, before 17:00 of D-1. **- Bids validation** After the reception of DSO information regarding constraints per DSO perimeter and BSP cumulative flexibility bids available at DSO perimeter, the TSO evaluates the resources activation taking into consideration the DSO constraints to avoid distribution grid bottlenecks. Since the constraints received from the DSO already internalize Local Flexibility Market outcomes, it is assured TSO activations are not incompatible with those from the DSO. After this step, at the end of every single session of the Global Flexibility Forward Market, the TSO registers via the CBP data about the validated upward/downward quantities for every period of the market session and the accepted/reserved quantities for every period of the market session. If there are modified flexibility bid components (related to bids that have undergone limitations due to DSO constraints), the TSO informs the BSP about limitations via the CBP platform, by and no later than one hour before the hourly delivery period of the offer for which the variation is made. The post-selection notification message contains: - Modified quantities per DSO Perimeter (Q_i^*), equivalent to communicating the limit to consider at DSO Perimeter level in case of requested activation - Aggregate selected quantities (Q)

1.5 Use case conditions

Use case conditions
Assumptions
• TSO and DSOs collect differently flexibility data and do not share it between them • TSO and DSOs use their own communication system with BSPs • TSO-DSO coordination data exchange system do not exist for flexibility procurement
Prerequisites
• The BSP is compliant with market access rules • TSO, DSOs and BSPs have access to the data exchange platform

1.6 Further Information to the use case for classification / mapping

Classification Information
Relation to other use cases
BUC08, BUC 10
Level of depth
System use case (SUC) use case which describes in detail the functionality/technological solutions of (a part of) a business process.
Prioritisation
High Priority
Generic, regional or national relation
National
Nature of the use case
Technical/system use case
Further keywords for classification
Data exchange platform, TSO-DSO coordination

1.7 General Remarks

General Remarks

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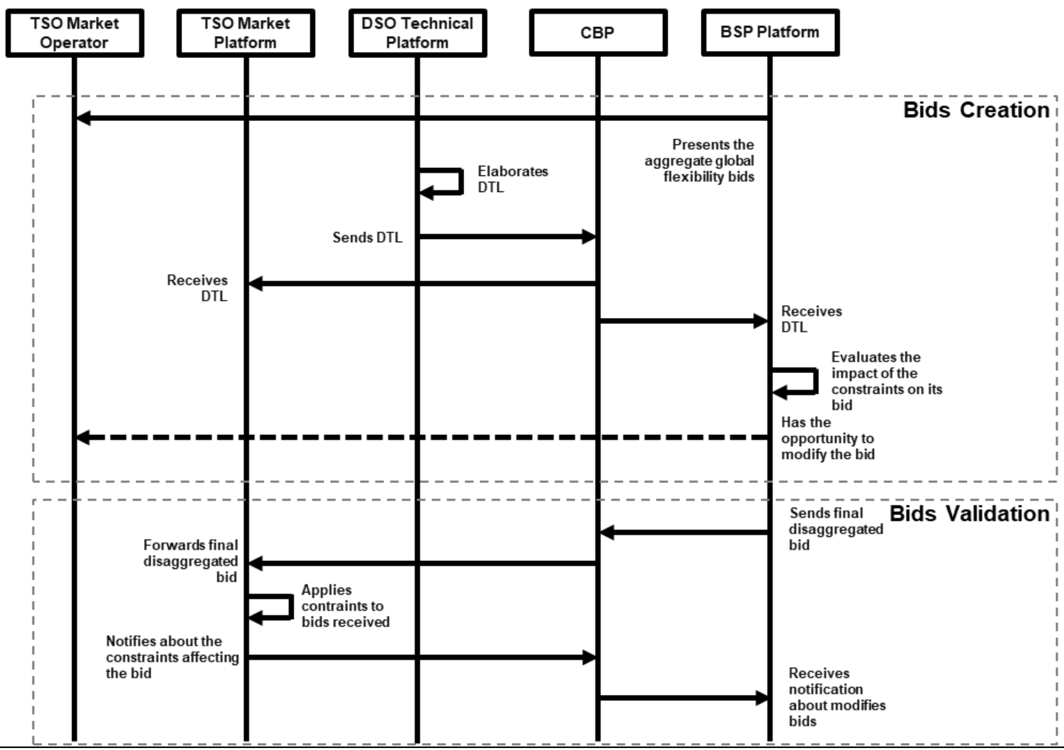
2 Diagrams of use case

Diagram(s) of use case


3 Technical details

3.1 Actors

Actors		
Actor Name	*Actor Type*	*Actor Description*
Balancing Service Provider (BSP)	Business Role (BRIDGE HEMRM)	A party with reserve-providing units or reserve-providing groups able to provide balancing services to one or more LFC Operators
DSO	Business Role (BRIDGE HEMRM)	A DSO is a System Operator. DSO is responsible for security of supply and reliability of the distribution grid. For this reason, it monitors the grid to identify possible arising issues and, if there is a need, it makes use of resources to solve such problems, by network reconfiguration and/or by requests to market operators or directly to properly contracted customers.
TSO	Business Role (BRIDGE HEMRM)	TSO is a System Operator. TSO is responsible for security of supply and reliability of the transmission grid. For this reason, it monitors the grid to identify possible arising issues and, if there is a need, it makes use of resources to solve such problems, by network reconfiguration and/or by requests to market operators or directly to properly contracted customers.
TSO Market Operator	System	Third party entity that oversee and exercises the TSO global flexibility market

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TSO Market Platform	System	Platform encompassing all the systems performing activities made necessary to exercise and manage the global flexibility market (both in terms of communication flows and market algorithms). It interfaces with the Market Operator which oversees the offers gathering and economic dimension of the market processes
DSO Technical Platform	System	IT platform of the DSO encompassing all the systems involved in performing technical activities such as validation or prequalification
BSP Platform	System	IT platform enabling commercial/technical communication exchanges from/to the BSPs participating in the system
CBP	System	Acronym for Crowd Balancing Platform, a blockchain-powered system enabling direct communication between all the involved parties. It can perform multiple functions through dedicated services

3.2 References

References						
No.	***References Type***	***Reference***	***Status***	***Impact on use case***	***Originator / organisation***	***Link***
	CBP implementation	The Crowd Balancing Platform cannot be implemented by project/demos where Terna is not involved with an implementation role		IPR	Terna/Equigy	

4 Requirements

Requirements		
Categories ID	**Category name for requirements**	**Category description**
1	Configuration Issues	Reflect the typical, probable, or envisioned communication configurations that are relevant to the use case step. These configuration issues include numbers of devices and/or systems, expected growth of the system over time, locations, distances, communications types, network bandwidth, existing protocols, etc., but only from the user’s point of view. In some cases, only one of the possible choices is reasonable, while for other situations, more than one choice is reasonable.
2	Quality of Service (QoS)	Address availability of the system, such as acceptable downtime, recovery, backup, rollback, etc. QoS issues also address accuracy and precision of data, the frequency of data exchanges, and the necessary flexibility for future changes.
3	Data Management	Covers both the management of the data exchanges in each Use Case step and the management of data at either end if that management is impacted by data exchanges. An example of the first type of data management is the initial setting up and on-going maintenance of what data needs to be exchanged, say between a

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		Geographic Information System and the many different applications that use its data. An example of the second type of data management is the need to backup data or ensure consistency of data whenever it is exchanged, such as if new protection settings are issued to multiple field devices, these settings need to be reflected in Contingency Analysis functions. It should not address database design but should concentrate on the user requirements for the interfaces to databases and other data handling applications.
Requirement R-ID	**Requirement name**	**Requirement description**
6	Communication paradigm	Ad hoc
7	Data exchange method	Ad hoc
22	Contractual timelines for exchanging data	The timing for data exchange between TSO and BSP must be defined to have the possibility of applying the modified bids
37	Type of source data	Source data was previously automatically stored in a database
44	Management of accessing different types of data to be exchanged	Each data exchange could entail different types of data (e.g. query a database)
45	Management of data across organizational boundaries	Data exchanges go across organizational boundaries

5 Common Terms and Definitions

Common Terms and Definitions	
Term	**Definition**
CBP	The Crowd Balancing Platform (CBP) is a blockchain-based system available for sharing information between TSO, DSOs and BSPs in a trusted and secured way.

9.3. SUC08.3 – Traffic light data exchange functionalities

1 Description of the use case

1.1 Name of the use case

ID	*Area / Domain(s)*	*Name of Use Case*
SUC 8.3	TSO-DSO flexibility coordination: local and global market coordination	Traffic Light data exchange functionalities

1.2 Version management

Version Management			
Version No.	*Date*	*Name of Author(s)*	*Changes*
01	05.07.2023	Giorgia Lattanzio, Marco Rossi	First draft
0.2	23.10.2023	Giorgia Lattanzio	Final Version

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1.3 Scope and objectives of use case

Scope and Objectives of Use Case	
Scope	The use case describes the process of data exchange between TSO and DSOs where transparency over respective aggregates activation is guaranteed.
Objective(s)	• To enable local and global market coordination and, respectively, stakeholders coordination. • To guarantee coherent flexibility activations between local and global markets. • To provide TSO information about how much flexibility can be exploited from the distribution network and to allow an efficient exploitation of them.
Related business case(s)	BUC 08 – Crowd balancing interoperable data exchange between stakeholders

1.4 Narrative of use case

Narrative of Use Case

Short description

TSOs and DSOs are responsible for ensuring security of supply respectively on transmission and distribution networks. The development of two separate parallel markets (global and local markets) introduces the necessity of a coordination which must guarantee and facilitate the procurement of flexibility in both markets.

The Traffic Light (TL) mechanism represents the coordination process thanks to which TSO is allowed to access distributed flexibility without compromising the operation of the distribution grid.

The CBP is a market-intermediary platform which, among other scopes, enables the communication of TL data sets created by DSO by means of distribution grid analyses. The Crowd Balancing Platform (CBP) collects local market data and grid constraints data, as well as global market data, and enables the parallel run of separate markets. It allows to guarantee that the global market is operated within distribution grid bottlenecks. TL data sets are divided into *static data* and *dynamic* data sets; they represent respectively the overall possibility to exploit flexibility from a resource independently from the temporary grid load and the impracticability due to the temporary grid status. The data sets are then made available to the TSOs that perform grid analyses considering the distribution grid constraints to activate flexibility.

Complete description

Connected services from the DoA:

- *GA Service 22: Dynamic Grid Constraints*
- *GA Service 26: Dynamic Grid Constraints assessment to coordinate with TSO*

TL data exchange procedure requires the participation of DSO, TSO and BSP which must have access to the CBP, which represents the intermediary platform where common data can be loaded, updated and read.

The TL data exchange functionalities can be divided in two main categories:

1. **Qualification purposes**
   When a BSP requests to provide global flexibility services by means of aggregated resources connected to the distribution network, DSO becomes responsible of the validation procedure of each Grid Connection Point (GCP) included in the aggregate. Within the validation procedure, the TL data represent the outcome of DSO analyses where the power modulation, specified by the BSP on the CBP, is compared with the distribution grid operational constraints. Therefore, DSO can partially or completely limit the deployment of flexibility of those resources that could jeopardise the security of the distribution grid. This mechanism is defined as *Static Traffic Light* and the results of the process are forwarded to the BSP and TSO through the CBP. Static TL data are necessary to determine the maximum estimated flexibility that could be activated from a pool of resources for forecasting and planning purposes.

Tools called by the step
DSO Technical Platform CBP – Static Traffic Light

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2. **Market clearing purposes**
Closer to real-time, before the global market clearing process, the DSO can notify additional limitations coming from analyses of the expected or foreseen power exchange profile for each delivery time. Therefore, having a more precise overview of the distribution grid, DSO continuously perform analyses to determine the security of grid operation using more reliable weather forecast data, load forecast data, local flexibility activations, extraordinary grid maintenance, etc.. According to the performed grid simulations, the limitations and allowance coming from the Static TL mechanism can be modified for the specific delivery date. This process is called *Dynamic Traffic Light.* Limitations of the distribution grid are defined for each DSO perimeter (a portion of the network) by associating:
- Green: there are no limitations on the distribution grid and the entire amount of flexibility in the perimeter can be activated.
- Yellow: a potential network shortage exists in the network segment and further limitations are communicated with respect to the constrained perimeter.
- Red: a direct danger with the network security of supply exists within the respective network area, there is no possibility of activating any flexible resource underlying the analysed network segment.

The format of the exchanged data is defined in advance, so that the TSO is able to assess the planning procedure and correctly determine flexibility activations without exceeding distribution network constraints.

Tools called by the step
DSO Technical Platform CBP - Dynamic Traffic Light

1.5 Use case conditions

Use case conditions
Assumptions
• Local flexibility services and global flexibility services coexist • TSO is allowed by regulation to procure flexibility from aggregates of resources of which the GCP belongs to the distribution network. • CBP is a share intermediate platform among TSO, DSO and BSP
Prerequisites
DSO and TSO developed grid models which consider of flexibility resources in the planning process. DSO is able to communicate grid limitations with sufficient advance.

1.6 Further Information to the use case for classification / mapping

Classification Information
Relation to other use cases
BUC08 – Crowd Balancing: Interoperable data exchange between stakeholders
Level of depth
System use case (SUC) use case which describes in detail the functionality/technological solutions of (a part of) a business process.
Prioritisation
The solution will be implemented in the Italian demo. It is considered of high priority in order to efficiently exploit the use of flexibility resources.
Generic, regional or national relation
National relation. A generic extension can be reached limiting details to functionalities instead of technological and technical aspects.
Nature of the use case
Technical/system use case
Further keywords for classification

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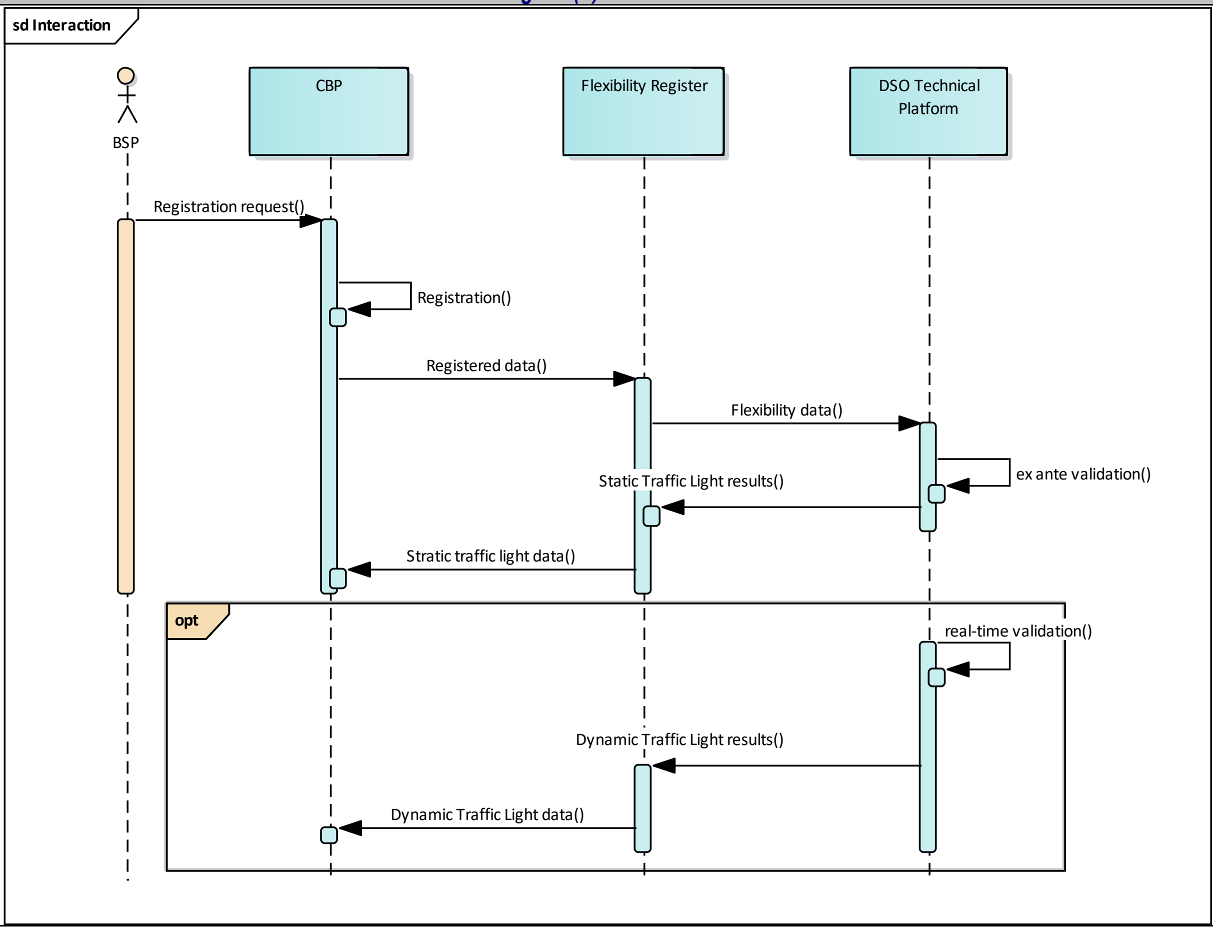
Flexibility services, grid constraints, data exchange platform, TSO-DSO coordination.

2 Diagrams of use case

Diagram(s) of use case


3 Technical details

3.1 Actors

Actors		
Actor Name	***Actor Type***	***Actor Description***
CBP – Crowd Balancing Platform	System Actor	The CBP is a blockchain-based system to share relevant information between the participating parties in a transaction – such as TSOs, DSOs, Aggregators and data providers – in a trusted and secured way. The CBP facilitates the standardised registration, bidding and activation of flexibility transactions from aggregators of distributed energy resources (DERs). The CBP enables the proof of delivery of flexibility transactions, while allowing the market to operate within grid limits.
DSO Technical Platform	System Actor	The platform enables the utilization of the flexibility provided by Distributed Energy Resources (DERs) connected to their grids. For that purpose, the platform determines the most cost-effective activation planning of flexibility services that can attend to specific grid needs, considering market constraints. Once the activation

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		planning is confirmed, the platform reports it through involved agents such as service providers or market operators.
Flexibility Register	System Actor	The Flexibility Register is a repository system where all data related to flexible POD are stored and made available to demo platforms and stakeholders. Data are organized according to predefined schemes and can be read by authorized platforms and stakeholders followed by authentication procedures. Data updating is allowed, after authentication, only for some types of data: for example, POD Baseline for day after can be updated by the Aggregator, while Market Outcomes cannot.
BSP	Business Role (BRIDGE HEMRM)	A party with reserve-providing units or reserve-providing groups able to provide balancing services to one or more LFC Operators (corresponding to the TSO and the DSO in this BUC)

3.2 References

References						
No.	***References Type***	***Reference***	***Status***	***Impact on use case***	***Originator / organisation***	***Link***
	Technical Report	Harmonized Electricity Market Role Model (HEMRM)	Public	Role Model	BRIDGE	https://energy.ec.europa.eu/system/files/2021-06/bridge_wg_regulation_eu_bridge_hemrm_report_2020-2021_0.pdf
	Deliverable	Deliverable 4.1 BeFlex	Private	-	-	-
	Website	The Platform - EQUIGY	Public	-	EQUIGY	https://equigy.com/the-platform/#cbp-product

4 Step by step analysis of use case

4.1 Overview of scenarios

Scenario conditions						
No.	**Scenario name**	**Scenario description**	**Primary actor**	**Triggering event**	**Pre-condition**	**Post-condition**
1.0	Constraints definition	DSO defines limitations concerning flexibility activations of distributed resources for global services	DSO, TSO	Prequalification, Registration of flexibility resources connected to MV/LV grid into global services	TSO is allowed to use flexibility resources connected to MV/LV grid to procure global flexibility services	N/A

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4.2 Steps – Scenarios

Scenario								
Scenario name :		No. 1 - Reference scenario						
Step No.	Event	Name of process/ activity	Description of process/ activity	Service	Information producer (actor)	Information receiver (actor)	Information Exchanged (IDs)	Requirement, R-IDs
1.0	Request from BSP to provide global flexibility services	Submission of market participation request	The BSP controlling a aggregation of resources connected to distribution network, submit the request to participate to global services markets.	CREATE	BSP	Crowd Balancing Platform, Flexibility Register	Flexibility Data	
2.0	CBP notifies the DSO on the necessity of calculating Traffic Light	Request of Static Traffic Light	CBP notifies the DSO on the necessity of calculating ex-ante grid constraints for flexibility controlled by the considered BSP.	REPORT	CBP	DSO Technical Platform	Flexibility Data	
3.0	Evaluation of distribution grid operational constraints	Static Traffic Light	The DSO TP calculates the potential grid impact of power modulation of each grid connection point included within the aggregate, determining the volume of maximum flexibility that can be activated for global services (Static Traffic Light).	REPORT	DSO Technical Platform	Flexibility Register	Static Traffic Light Data	
4.0	Communication of the aggregate activation constraints	Static traffic light publication	The resulting traffic light is published on the Flexibility register and CBP, where it can be consulted by TSO and BSP related the market participation request.	REPORT	Flexibility Register	Crowd Balancing Platform	Static Traffic Light Data	
5.0	Variation of the distribution network capacity for flexibility	Distribution network monitoring	The DSO continuously monitors the state of the network and, for each grid perimeter, it evaluates the potential constraints for local	REPEAT	DSO Technical Platform	DSO Technical Platform		

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	services		aggregate to provide global services. (GA Service 22 – Dynamic Grid Constraints, GA Service 26: Dynamic Grid Constraints assessment to coordinate with TSO)					
5.1	Real-time estimation of the maximum flexibility that can be delivered from the aggregate to the global market	Dynamic Traffic Light	On the basis of the results of the previous step, the volume of maximum flexibility that can be activated in the next global market sessions is calculated.	REPORT	DSO Technical Platform	Flexibility Register	Dynamic Traffic Light Data	
5.2	Communication of the aggregate activation constraints	Dynamic traffic light publication	The resulting traffic light is published on the Flexibility register and CBP, where it can be consulted by TSO and BSP related the market participation request.	REPORT	Flexibility Register	Crowd Balancing Platform	Dynamic Traffic Light Data	

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5 Information exchanged

Information exchanged			
Information exchanged (ID)	***Name of information***	***Description of information exchanged***	***Requirement, R-IDs***
1	Static Traffic Light Data	Static traffic light values coming from the prequalification and registration procedure. Determined in SUC 8.1	N/A
2	Dynamic Traffic Light Data	Dynamic values determined hourly and preliminarily with respect to a market clearing process	N/A
3	Flexibility Data	Flexibility data related to the aggregated resources and contained in Flexibility Register, which can include the outcome of the static grid prequalification	N/A

6 Requirements

Requirements		
Categories ID	**Category name for requirements**	**Category description**
1	Configuration	Reflect the typical, probable, or envisioned communication configurations that are relevant to the use case step. These configuration issues include numbers of devices and/or systems, expected growth of the system over time, locations, distances, communication types, network bandwidth, existing protocols, etc., but only from the user's point of view. In some cases, only one of the possible choices is reasonable, while for other situations, more than one choice is reasonable.
2	Quality of Service (QoS)	Address availability of the system, such as acceptable downtime, recovery, backup, rollback, etc. QoS issues also address accuracy and precision of data, the frequency of data exchanges, and the necessary flexibility for future changes.
3	Data Management	Covers both the management of the data exchanges in each Use Case step and the management of data at either end if that management is impacted by data exchanges. An example of the first type of data management is the initial setting up and on-going maintenance of what data needs to be exchanged, say between a Geographic Information System and the many different applications that use its data. An example of the second type of data management is the need to backup data or ensure consistency of data whenever it is exchanged, such as if new protection settings are issued to multiple field devices, these settings need to be reflected in Contingency Analysis functions. It should not address database design but should concentrate on the user requirements for the interfaces to databases and other data handling applications.

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Requirement R-ID	Requirement name	Requirement description
6	Communication paradigm	Ad hoc
12	Location of Information Producer	Control room operation (DSO)
13	Location of Information Receiver	Control room operation (TSO)
17	Operation mode of Information Producer	Manual (static traffic light) & Automatic (dynamic traffic light)
22	Contractual timelines for exchanging data	The timing for data exchange between TSO and DSO must be defined to have the possibility of running each required simulation and market.
45	Management of data across organizational boundaries	Data exchanges go across organizational boundaries

7 Common Terms and Definitions

Common Terms and Definitions	
Term	Definition

9.4. SUC08.4 – Verification functionalities

1 Description of the use case

1.1 Name of the use case

ID	*Area / Domain(s)*	*Name of Use Case*
SUC08.4	TSO-DSO flexibility coordination	Verification Functionalities

1.2 Version management

Version Management			
Version No.	*Date*	*Name of Author(s)*	*Changes*
01	12.10.2023	Saloni Dhingra	First Draft

1.3 Scope and objectives of use case

Scope and Objectives of Use Case	
Scope	Coordinate local flexibility markets and global ancillary services market in the processes for procuring flexibility services from distributed resources
Objective(s)	• Provide to global and/or local BSPs a common channel allowing data registry, market operation functionalities • Enable a common data exchange approach between TSO, DSOs and BSPs
Related business case(s)	BUC 08: Crowd Balancing: Interoperable data exchange between stakeholders

1.4 Narrative of use case

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Narrative of Use Case
Short description
This Systems Use Case is about the phase after flexibility services are delivered, BSPs report their outputs to TSOs and DSOs. These reports undergo verification against actual grid data. Discrepancies are resolved, ensuring the economic neutrality of BSPs due to service imbalances. The process concludes with a transparent settlement, maintaining grid stability and fostering stakeholder trust.
Complete description
TSOs and DSOs collaborate to ensure stability in the power grid. BSPs are obligated to maintain neutrality in the economic exposures due to imbalances during flexibility services supply. There is a need for transparent verification and settlement processes to ensure proper accounting of energy transactions. Balancing Service Providers (BSPs) deliver flexibility services to redress energy imbalances and then report these outputs to Transmission System Operators (TSOs) and Distribution System Operators (DSOs). This reported data undergoes rigorous verification against the actual grid data maintained by TSOs and DSOs. In cases of discrepancies, clarifications are sought and reconciled, ensuring economic neutrality. Any discrepancies that emerge during this stage necessitate immediate intervention. TSOs and DSOs engage in a dialog with the concerned BSPs to iron out inconsistencies, seek further data, or gain clarifications. Following the resolution of discrepancies, BSPs submit a final, comprehensive report which is then utilized by the TSOs and DSOs to calculate the economic impact. The calculated figures form the basis of a transparent settlement process. All commercial and physical transactions linked to the rendered flexibility services are recorded precisely, ensuring that all stakeholders have clear visibility into the transactions.

1.5 Use case conditions

Use case conditions
Assumptions
• TSO and DSOs collect differently flexibility data and do not share it between them • TSO and DSOs use their own communication system with BSPs • TSO-DSO coordination data exchange system do not exist for flexibility procurement
Prerequisites
• The BSP is compliant with market access rules • TSO, DSOs and BSPs have access to the data exchange platform

1.6 Further Information to the use case for classification / mapping

Classification Information
Relation to other use cases
SUC08.1 Flexibility Register, SUC08.2 Market data Exchange functionalities, SUC10.4 Delivery Validation
Level of depth
System use case (SUC) is use case which describes in detail the functionality/technological solutions of (a part of) a business process.
Prioritisation
High Priority for Italian demo
Generic, regional or national relation
National
Nature of the use case
Technical/system use case
Further keywords for classification
Verification Functionalities; Transactions; Settlement

2 Diagrams of use case

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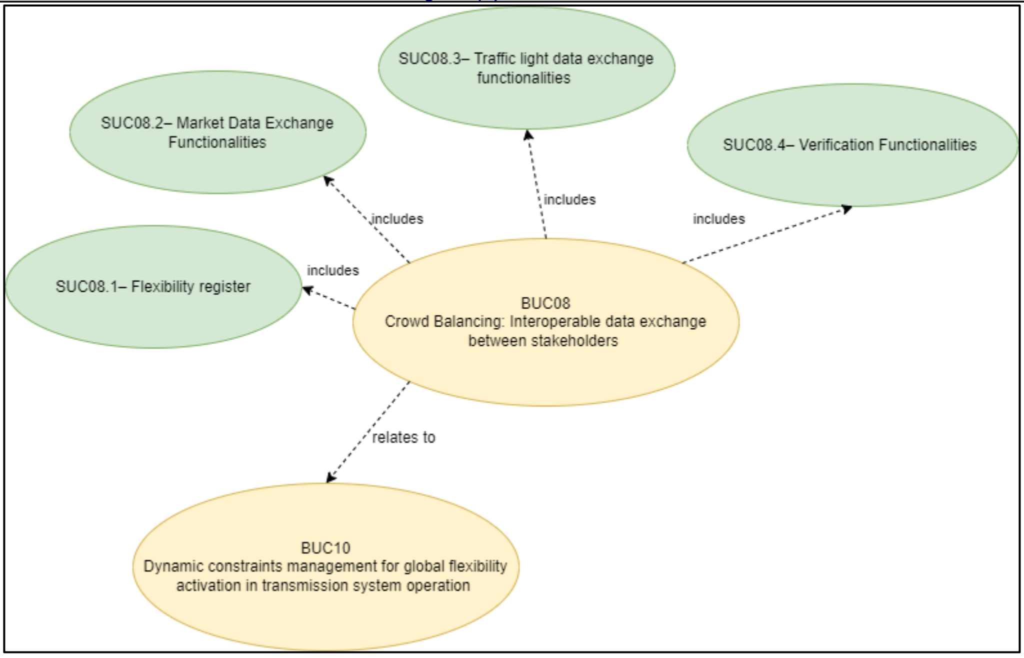
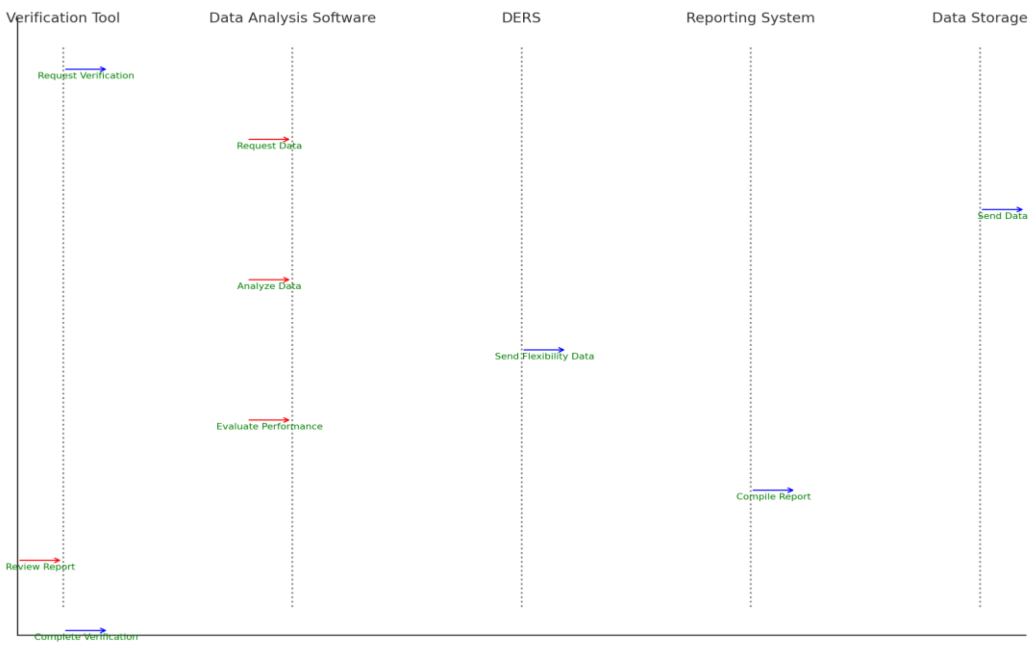
Diagram(s) of use case





3 Technical details

3.1 Actors

Actors		
Actor Name	***Actor Type***	***Actor Description***
Verification Tool	Software/System	A tool or system used to initiate and manage the verification process of flexibility services, ensuring compliance with specified criteria and standards.

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Data Analysis Software	Software/System	Software used for analysing and processing data received from various sources (including DERS and data storage) to evaluate the performance and outcomes of the verification process.
DERS	Distributed Energy Resource System	Systems that manage and control distributed energy resources, providing flexibility data and other relevant information required for the verification of energy services.
Reporting System	Software/System	A system that compiles, organizes, and presents the results of the verification process in a structured report format for review and finalization.
Data Storage	Hardware/Software System	A system for securely storing and managing data that is used in the verification process, ensuring data integrity and accessibility for analysis and reporting purposes.

3.2 References

References						
No.	***References Type***	***Reference***	***Status***	***Impact on use case***	***Originator / organisation***	***Link***

4 Step by step analysis of use case

4.1 Overview of scenarios

Scenario conditions						
No.	**Scenario name**	**Scenario description**	**Primary actor**	**Triggering event**	**Pre-condition**	**Post-condition**
1	Verification and Settlement	The Flexibility Register is used as a single interface to optimize information exchange between stakeholders	TSO, DSO, BSP	The delivery period for a specific flexibility service end	TSO and DSO use different systems to collect BSP-distributed resources and aggregate data.	All flexibility services have been verified and settled and economic exposures of the BSP due to imbalances have been neutralized.

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4.2 Steps – Scenarios

Scenario								
Scenario name :		***No. 1 - Reference scenario***						
Step No.	***Event***	***Name of process/ activity***	***Description of process/ activity***	***Service***	***Information producer (actor)***	***Information receiver (actor)***	***Information Exchanged (IDs)***	***Requirement, R-IDs***
1	BSP collects data	Data collection	Post-delivery, the BSP collects data regarding the amount and type of flexibility service provided.	CREATE	BSP			N/A
2	BSP sends a preliminary report	Initial Reporting	BSP sends a preliminary report to the TSO and DSO detailing the flexibility services rendered during the delivery period.	REPORT	BSP	DSO,TSO	[1]	7 (Data Exchange Method), 22 (Contractual timelines for exchanging data), 37 (Type of source data)
3	TSO and DSO verifies flexibility service deliveries	Verification	TSOs and DSOs cross-reference the BSP's data against their monitoring systems to verify the accuracy of service deliveries.	EXECUTE	TSO, DSO			N/A
4	TSO and DSO communicates with BSP for clarifications	Discrepancy Handling	In the event of data mismatches, TSOs and DSOs communicate with BSPs to seek clarifications or additional data.	GET	TSO,DSO	BSP	[2]	44 (Management of accessing different types of data to be exchanged)
5	Final reporting is done by BSP after clarification	Clarification	In case of discrepancies, BSPs provide additional data or clarification to the TSO and DSO. After any issues are clarified, the BSP sends a final report on flexibility service deliveries.	REPORT	BSP	TSO,DSO	[3]	N/A
6	Economic Exposure calculation and settlement	Settlement Notification	TSO and DSOs calculate the economic exposure due to imbalances in the supply of flexibility services. TSO and DSOs inform the BSP of the	REPORT	TSO	BSP	[4]	45 (Management of data across organizational boundaries)

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	notification by BSP		final settlement amount.					
7	Transaction record and payment by the parties involved	Final Settlement	All commercial and physical transactions related to the flexibility services are recorded for transparency. Based on the settlement notification, the respective party (either BSP or TSO/DSO, depending on whether there was a surplus or deficit) initiates the payment process.					N/A

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5 Information exchanged

Information exchanged			
Information exchanged (ID)	***Name of information***	***Description of information exchanged***	***Requirement, R-IDs***
[1]	Preliminary Report about flexibility services	BSP sends a preliminary report to the TSO and DSO detailing the flexibility services rendered during the delivery period.	7 (Data Exchange Method), 22 (Contractual timelines for exchanging data), 37 (Type of source data)
[2]	Clarification about discrepancies	In case of discrepancies in the preliminary report, BSPs provide additional data or clarification to the TSO and DSO.	44 (Management of accessing different types of data to be exchanged)
[3]	Final flexibility service report	If discrepancies arise, BSPs clarify with TSO and DSO. After resolving issues, BSP sends a final flexibility service report.	N/A
[4]	Settlement notification	TSO and DSOs determine economic risks from flexibility service imbalances and notify BSP of the final settlement.	45 (Management of data across organizational boundaries)

6 Requirements

Requirements		
Categories ID	**Category name for requirements**	**Category description**
1	Configuration Issues	Reflect the typical, probable, or envisioned communication configurations that are relevant to the use case step. These configuration issues include numbers of devices and/or systems, expected growth of the system over time, locations, distances, communication types, network bandwidth, existing protocols, etc., but only from the user's point of view. In some cases, only one of the possible choices is reasonable, while for other situations, more than one choice is reasonable.
2	Quality of Service (QoS)	Address availability of the system, such as acceptable downtime, recovery, backup, rollback, etc. QoS issues also address accuracy and precision of data, the frequency of data exchanges, and the necessary flexibility for future changes.
3	Data Management	Covers both the management of the data exchanges in each Use Case step and the management of data at either end if that management is impacted by data exchanges. An example of the first type of data management is the initial setting up and on-going maintenance of what data needs to be exchanged, say between a Geographic Information System and the many different applications that use its data. An example of the second type of data management is the need to backup data or ensure consistency of data whenever it is

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		exchanged, such as if new protection settings are issued to multiple field devices, these settings need to be reflected in Contingency Analysis functions. It should not address database design but should concentrate on the user requirements for the interfaces to databases and other data handling applications.
Requirement R-ID	**Requirement name**	**Requirement description**
7	Data exchange method	Ad hoc
22	Contractual timelines for exchanging data	The timing for data exchange between TSO and BSP must be defined to have the possibility of applying the modified bids
37	Type of source data	Source data was previously automatically stored in a database
44	Management of accessing different types of data to be exchanged	Each data exchange could entail different types of data (e.g. query a database)
45	Management of data across organizational boundaries	Data exchanges go across organizational boundaries

7 Common Terms and Definitions

Common Terms and Definitions	
Term	**Definition**
Load Frequency Control (LFC)	Load Frequency Control is a system used to regulate the power output of electric utilities in response to changes in system frequency, usually caused by changes in load.

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10. Annex V – Cross-sector flexibility boosters

10.1. SUC11.1 – Evaluate the flexibility capability of water distribution networks

1.1 Name of the use case

ID	*Area / Domain(s)*	*Name of Use Case*
SUC11.1	Cross-sector flexibility boosters	Evaluate the flexibility capability of water distribution networks

1.2 Version management

Version Management			
Version No.	*Date*	*Name of Author(s)*	*Changes*
0.1	26.04.2023	Olivia Cicala	First draft version
0.2	29.05.2023	Ferdinando Bosco	Added UC diagrams and Scenario 1
0.3	24.11.2023	Ferdinando Bosco	Refinement of the SUC
0.4	29.11.2023	Olivia Cicala	Complete System Use Case; Information exchanged

1.3 Scope and objectives of use case

Scope and Objectives of Use Case	
Scope	Investigate new methods to boost cross-sector flexibility
Objective(s)	The main goal is the calculation of the potential flexibility on the water distribution network, in order to be made available for the electrical grid
Related business case(s)	BUC11: Capitalizing on flexibility available by leveraging on water distribution network assets

1.4 Narrative of use case

Narrative of Use Case
Short description
The energy consumption of water facilities along with their flexible components such as water pumps and tanks make them suitable candidates for energy efficiency and optimization applications. A joint effort between electrical system and the water facilities create a great opportunity for enhancing the flexibility of power systems. In this use case a model is developed to optimize the demand response and regulation capacity that a water distribution network can offer in power systems operation. From the power system point of view, the resource flexibility improve the system operations, reduce operation costs, and reduce emission from the electricity sector. The pilot is focused on the load shifting solution from water facilities and considers its impacts on power systems. However, the water distribution grid operator may be also concern the negative impacts of modifying the operation of his systems on the reliable delivery of water to the consumers. This would require a comprehensive model to optimize the dynamic energy flexibility of the asset considering the underlying hydraulic constraints. The main points of the Use Case are: • Define a portion of the water distribution grid and his interaction with the power system;

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- Characterize the topology of the water distribution grid;
- Gather the historical and the real time measurement (where available);
- Check and control the data;
- Identify and characterize the flexibility components;
- Implement a tool to study the behaviour of water distribution assets;
- Quantifying the flexibility potential to make it available to the electrical grids
- Parametrize the output for a scalability and replicability analyses.

This will possible enable the integration of the energy flexibility of water distribution systems in power systems operation.

The benefits are

- From W-DSO side, optimizing the operation of Water Distribution System flexible components for minimizing its energy costs and creating a new revenue, while respecting the hydraulic operation constraints of the Water Distribution System
- From E-DSO side, reduce energy congestions in specific grid area.

Complete description

This SUC aims to evaluate the potential flexibility on the water distribution network, in order to be made available for the electrical grids.

The analysis is organized in several steps. The first step will be to identify an appropriate area of the water network, in which there will be at least one pumping plant equipped with energy meters and flow meters and a distribution tank equipped with a level meter.

Flow and level measurements will be acquired by the remote control system.

The electrical and hydraulic characteristics of the system components under analysis will be mapped.

They will then be collected with frequency by establishing electricity measurements, raised water volumes and tank levels.

With the above data will be calculated an energy performance indicator whose performance will be representative of the behaviour of the pumping unit.

At the same time, monitoring of the collected flow data and tank levels will be carried out in order to assess the volume of water collected during the monitoring period and the potential volume that could be collected by moving the operation of the pumping system (water volume of flexibility)

Once the volume has been identified through the energy performance indicator, the potential for flexibility to be offered at the service of the electricity grid will be evaluated.

In summary the main phases of the analysis are:

- The main steps of the analysis are:
- Mapping the topology of the water network in the system
- Register water pump and other flexibility equipment specification on the system
- Enable periodic collection from water pump and other flexibility assets
- Forecast water demand
- Match water demand with energy consumption of the portion of water distribution network studied

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• Quantify flexibility potential

1.5 Use case conditions

Use case conditions
Assumptions
The potential flexibility is calculated in a water network topology intended as example of possible network to be investigated and adapted for the Italian Pilot.
Prerequisites

1.6 Further Information to the use case for classification / mapping

Classification Information
Relation to other use cases
BUC06 – Short-term congestion constraints forecasting and management for local flexibility service activation
BUC05: Aggregation for TSO and DSO grid services BUC11: Capitalizing on flexibility available by leveraging on water distribution network assets
Level of depth
System use case (SUC) use case which describes in detail the functionality/technological solutions of (a part of) a business process.
Prioritisation
Low Priority
Generic, regional or national relation
Generic
Nature of the use case
Business case
Further keywords for classification
Renewable energy, local flexibility, planning, water distribution network

1.7 General Remarks

General Remarks

2 Diagrams of use case

Diagram(s) of use case

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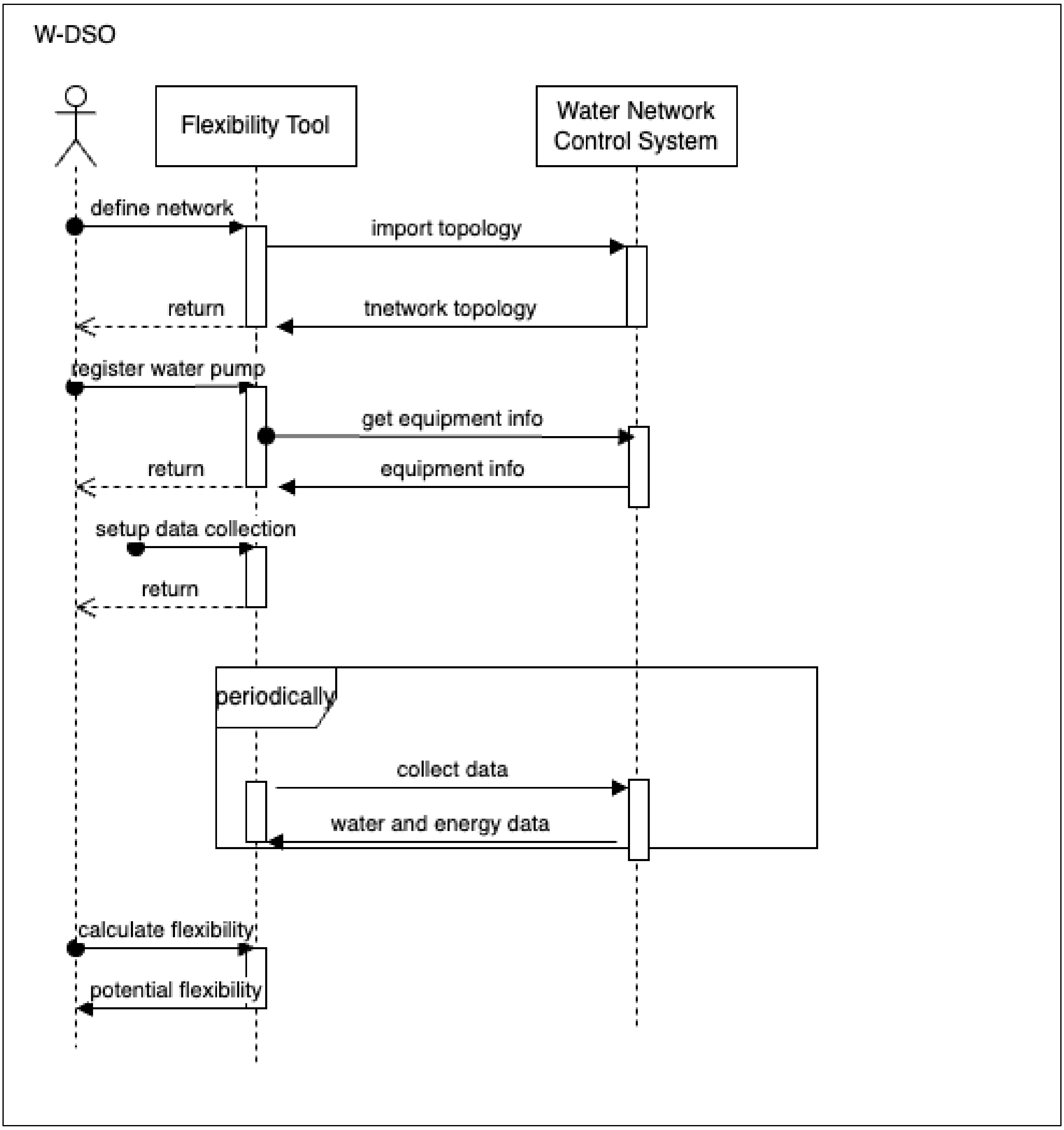
W-DSO
Flexibility Tool
Water Network Control System
define network
import topology
return
tnetwork topology
register water pump
get equipment info
return
equipment info
setup data collection
return
periodically
collect data
water and energy data
calculate flexibility
potential flexibility

3 Technical details

3.1 Actors

Actors		
Actor Name	***Actor Type***	***Actor Description***
Water Distribution System Operator (WDSO)	Business Role (BRIDGE HEMRM)	A WDSO is a party responsible for security of supply and reliability of the water distribution grid.
Flexibility Tool	System	Is the system in charge of collect the needed info and calculate the potential flexibility
Water Network Control System (WNCS)	System	Is the system that allow the WDSO the control the water network and collect info from that

3.2 References

References						
No.	***References Type***	***Reference***	***Status***	***Impact on use case***	***Originator / organisation***	***Link***
1	Scientific paper	Optimal Coordination of Water Distribution Energy Flexibility With Power Systems Operation	Published.		IEEE	

4 Step by step analysis of use case

4.1 Overview of scenarios

Scenario conditions						
No.	**Scenario name**	**Scenario description**	**Primary actor**	**Triggering event**	**Pre-condition**	**Post-condition**
1	Evaluate the flexibility capability of the water distribution network	The WDS-O monitors and analysis a portion of the water distribution network, identifying the water needs and quantifying the flexibility potentials for the electrical network.	WDS-O	Occurs periodically (daily)	Flexibility resource (water pump) available and registered.	

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4.2 Steps – Scenarios

Scenario								
Scenario name :		***No. 1 - Evaluate the flexibility capability of the water distribution network***						
Step No.	***Event***	***Name of process/ activity***	***Description of process/ activity***	***Service***	***Information producer (actor)***	***Information receiver (actor)***	***Information Exchanged (IDs)***	***Requirement, R-IDs***
1	Setup	Definition of the water network	Define the water network for the evaluation	CREATE	W-DSO	Flexibility Tool	IE-0	
2	Setup	Get network topology	Retrieve information about water network topology	GET	Flexibility Tool	WNCS	IE-1	
3	Setup	Register the resources	Select from water network the resources to be monitored.	CREATE	W-DSO	Flexibility Tool	IE-2	
4	Setup	Get equipment information	Retrieve equipment information from flexibility resources	GET	Flexibility Tool	WNCS	IE-3 IE-4	
5	Monitoring (daily)	Monitoring flexibility resources	Periodically collect needed information from flexibility resourced for calculating water demand and potential flexibility	GET	Flexibility Tool	WNCS	IE-5 IE-6 IE-7 IE-8	
6	Calculate Flexibility	Calculate Potential Flexibility	Calculate the potential electrical flexibility offered by the water distribution network in aggregated way	GET	W-DSO	Flexibility Tool	IE-9	

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5 Information exchanged

Information exchanged			
Information exchanged (ID)	***Name of information***	***Description of information exchanged***	***Requirement, R-IDs***
IE-1	Water Network Topology	hydraulic diagram of the selected area	
IE-2	Flexibility Resource (Water Pump)	Basic information for register a flexibility resource on the system	
IE-3	Nominal Power	Nominal Power of the specific water pump	
IE-4	Performance	Actual Performance of the specific water pump [kWh/m3]	
IE-5	Flow Rate	volume of fluid per time the fluid has flowed[m^3/s]	
IE-6	Hydraulic head	measurement of the height of a static water column above an arbitrary point [m]	
IE-7	Energy Consumption	amount of energy needed by the pump station [kWh]	
IE-8	KPI	This indicator allows to measure and compare the energy performance of the pumping station [kWh/$m^{3]}$	
IE-9	Potential Flexibility	Calculation of the potential electrical flexibility, based on the aggregated resources of the water network.[kWh]	

6 Requirements

Requirements		
Categories ID	**Category name for requirements**	**Category description**
Unique identifier for the category.	Name for the category of requirements.	Description of the requirement category.
Requirement R-ID	**Requirement name**	**Requirement description**
Unique identifier which identifies the requirement within its category and which can link the requirement to an	A name of the requirement.	Description of the requirement (this might be populated automatically from the repository, if the requirement has already been described in the external document before).

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external requirement document.		

7 Common Terms and Definitions

Common Terms and Definitions	
Term	**Definition**
W-DSO	Water Distribution System Operator
WNCS	Water Network Control System
e-DSO	Electrical Distribution System Operator

10.2. SUC12.1 – Connect flexibility providers across the value chain

1 Description of the use case

1.1 Name of the use case

ID	*Area / Domain(s)*	*Name of Use Case*
SUC 12.1	Cross-sector flexibility booster	Connect flexibility providers across the value chain

1.2 Version management

Version Management			
Version No.	*Date*	*Name of Author(s)*	*Changes*
0.1	29.05.2023	Fábio Coelho (INESCTEC)	First complete draft.
0.2	10.07.2023	Fábio Coelho (INESCTEC)	Scope/Objectives section, Complete description section, diagrams section
0.3	13.07.2023	Fábio Coelho (INESCTEC)	Draft for scenarios and revision of complete description
0.4	15.07.2023	Stephane Dotto (SAP)	Sequence Diagrams
0.5	27.07.2023	Fábio Coelho (INESCTEC)	Draft of scenario descriptions, requirements and Information Exchanged
0.6	31.07.2023	Fábio Coelho (INESCTEC)	Requirements and Information Exchanged.
1.0	12.09.2023	Fábio Coelho (INESCTEC)	Final version

1.3 Scope and objectives of use case

Scope and Objectives of Use Case	
Scope	BUC 12 – Operating a value chain enabler for flexibility-centric energy and non-energy services. Service part of the value-chain enabler that ensures all stakeholders are onboarded, namely consumers/prosumers, service providers (e.g., Flexibility Service Providers), Aggregators or DSOs. Specific requirements for each stakeholder type provide ground data for the services detailed in this SUC.

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Objective(s)	Connect consumers with suppliers/installers/O&M service providers of flexible DER to participate in the value chain and exploit flexibility business models.
Related business case(s)	BUC 12 – Operating a value chain enabler for flexibility-centric energy and non-energy services

1.4 Narrative of use case

Narrative of Use Case
Short description
The current SUC details the first and second stages of the Flexibility-centric Energy Value-chain embodied by the Grid Data Business Network platform (GDBN). The GDBN is a cloud-based digital platform that links and engages key stakeholders to promote new business services for energy flexibility. The GDBN holds services to onboard consumers / prosumers, service providers, most notably Flexibility Service Providers (FSPs), Aggregators, Community Managers, Market Operators and DSOs. Consumers/Prosumers register their flexibility potential by registering the flexible assets they have available or show availability to receive recommendations on services with business opportunities that capacitate them (i.e., install) with flexible assets; afterwards deciding for the subscription of services. In brief, this SUC details how to: **Engage consumers with flexible assets to participate in the value chain. [Flexibility Capacitation]** Consumers / prosumers (asset owners) register their flexible assets to participate in the value chain to take their flexibility potential to market. Service providers capture/provide that flexibility potential in return for the available flexibility. **Integrate flexible assets and services in the value chain. [Integration/Enablement]** Service providers integrate their operational platforms with the value chain enabler to collect the flexibility potential from prosumers. Prosumers integrate their smart flexible assets with the value-chain enabler.
Complete description
The current SUC details the first stage of the Flexibility-centric Energy Value-chain embodied by the Grid Data Business Network platform (GDBN). The GDBN is a cloud-based digital platform that links and engages key stakeholders to promote new business services for energy flexibility. The GDBN holds services to onboard consumers / prosumers, service providers, most notably Flexibility Service Providers (FSPs), Aggregators, Community Managers, Market Operators and DSOs. Consumers/Prosumers (resource owners) register their flexibility potential by registering the flexible assets they have available or show availability to receive recommendations on services with business opportunities that capacitate them (i.e., install) them with flexible assets; afterwards deciding for the subscription of such services. In brief, this SUC details how to: ▪ **Engage consumers with flexible assets to participate in the value chain. [Flexibility Capacitation]** Consumers / prosumers (asset owners) register their flexible assets to participate in the value chain to take their flexibility potential to market. Service providers capture/provide the flexibility potential in return for the available flexibility. ○ (what)(why) Consumers (asset owners) make their flexibility potential available to service providers in exchange for benefits, incentives, and services. Service Providers collect the flexibility potential from the consumers or agree to install assets. ○ (when) Consumers (asset owners) do this when they join the value chain through the available services. Service providers periodically seek for new opportunities to increase their consumer's base. ○ (expectation) Asset owners want to collect a return on investment of the installed assets. Service providers expect to use the energy generation or flexibility potential of the available loads. ○ Conditions: a. Consumers already have flexible assets within their premises, which are already capable to export information about their state and to receive instructions to change their consumption pattern; or there is a service or system capable to relay that information. b. Consumers already have flexible assets within their premises, but they are not connected or do not have smart features. In this case a retrofit is needed (provided via step 2 by a service provider). c. Service providers offer services with business models exploring flexibility. ▪ **Integrate flexible assets and services in the value chain. [Integration/Enablement]**

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Consumers / prosumers (asset owners) allow technical platforms available to communicate information to be used to compute their flexibility potential and to receive commands to activate or change their appliance's scheduling. o (what)(why) Consumers/prosumers allow their technical platform system (EMS) or allow technical platforms of service providers to use data from their installed devices and to allow flexible asset to receive commands that modulate or change their scheduling. o (when) During onboarding of the service on a specific technical integration step or whenever authorisations have been revoked and are under way to be reinstated. o (expectation) Participation in the flexibility market is conducted through a service provider (Aggregator) that will command flexible assets to change their consumption profiles. o Conditions: a. Consumers are onboarded on a service from a registered service provider. b. Consumers hold an EMS service or have granted consent for a service provider platform to use their data. c. Flexible assets (owned or installed by service provider) are within the premises of the consumer. The SUC decomposes in 4 main actions. Steps 1.a to 1.d occur in parallel for each role: 1. All stakeholders onboard the platform, during which they provide personal/business relevant data that will allow them to be matched and their details shared among them while respecting terms and conditions and data usage limitations imposed by GDPR. a. Consumers/ Prosumers onboard the service and provide personal and location details, together with the catalogue of flexible assets they have installed, or the absence of flexible assets. b. Service providers onboard the service and provide details about their service offering, including details on target locations, target consumers/prosumers or target assets. Moreover, they provide relevant billing information to be used for integrated cash-flow management of the service. The type of participant is automatically set to community manager. c. Community Managers or Aggregators (if present) onboard the service and provide community characteristics such as main location, geographical boundaries or services provided. d. DSOs register and detail basic identification information and geographical influence area. DSOs provide identical information as Aggregators. 2. All stakeholders agree with the terms and conditions of the platform, firming a usage contract between them and the platform operator. Further contractual relationship may exist in scope of the other services. 3. Stakeholders (when applicable) supply billing information to be part of the integrated cash-flow management mechanism. It departs from financial settlement process derived from market operation to charge/distribute revenues because of market operation. 4. Consumers/prosumers undergo technical integration of their EMS systems by allowing it to connect and provide data to external parties.

1.6 Use case conditions

Use case conditions
Assumptions
The energy and non-energy services are not detailed in this SUC (just their relationship in the value-chain). The business models and services from energy stakeholders are not described in this SUC.
Prerequisites
Service providers have their own technical platforms which they integrate with the interfaces for the GDBN. Consumers have internet connection and interface with the GDBN via their browsers or mobile application. Consumers have flexible assets with connectivity capabilities. Consumers own an EMS (or equivalent service).

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1.7 Further Information to the use case for classification / mapping

Classification Information
Relation to other use cases
BUC 12 – Operating a value chain enabler for flexibility-centric energy and non-energy services. SUC 12.2 - Support investment in flexibility by value chain actors
Level of depth
System use case (SUC) use case which describes in detail the functionality/technological solutions of (a part of) a business process.
Prioritisation
High Level of Priority – To be demonstrated in France (Pilot 3.5 and 3.6)
Generic, regional or national relation
Generic
Nature of the use case
Cross-sector: flexibility boosters.
Further keywords for classification
Flexibility, value-chain, cross-sector, GDBN

1.8 General Remarks

General Remarks
This SUC is part of Grid Data and Business Network concept. The implementation considers the support of a cloud service provider and framework of services support by SAP. XaaS approach is to be prioritized and should tentatively be adopted for all services.

2 Diagrams of use case

Diagram(s) of use case

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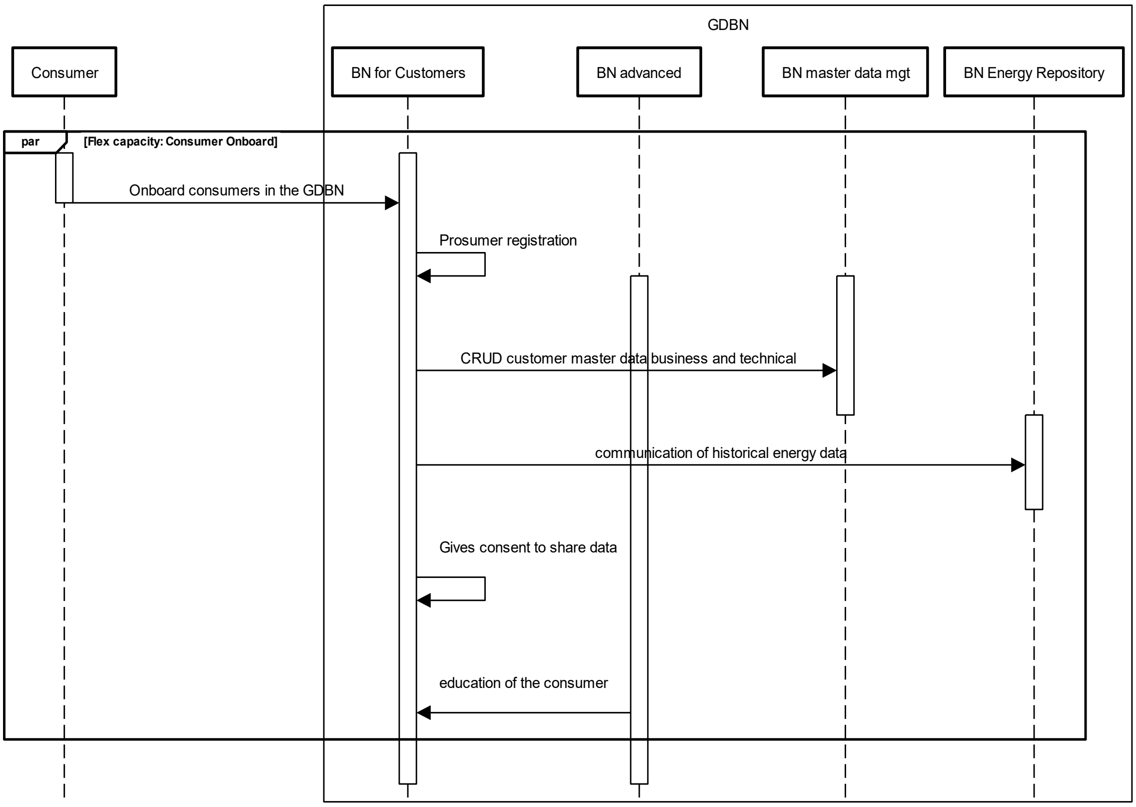

Figure 1 - Flexibility Capacitation - Consumer View

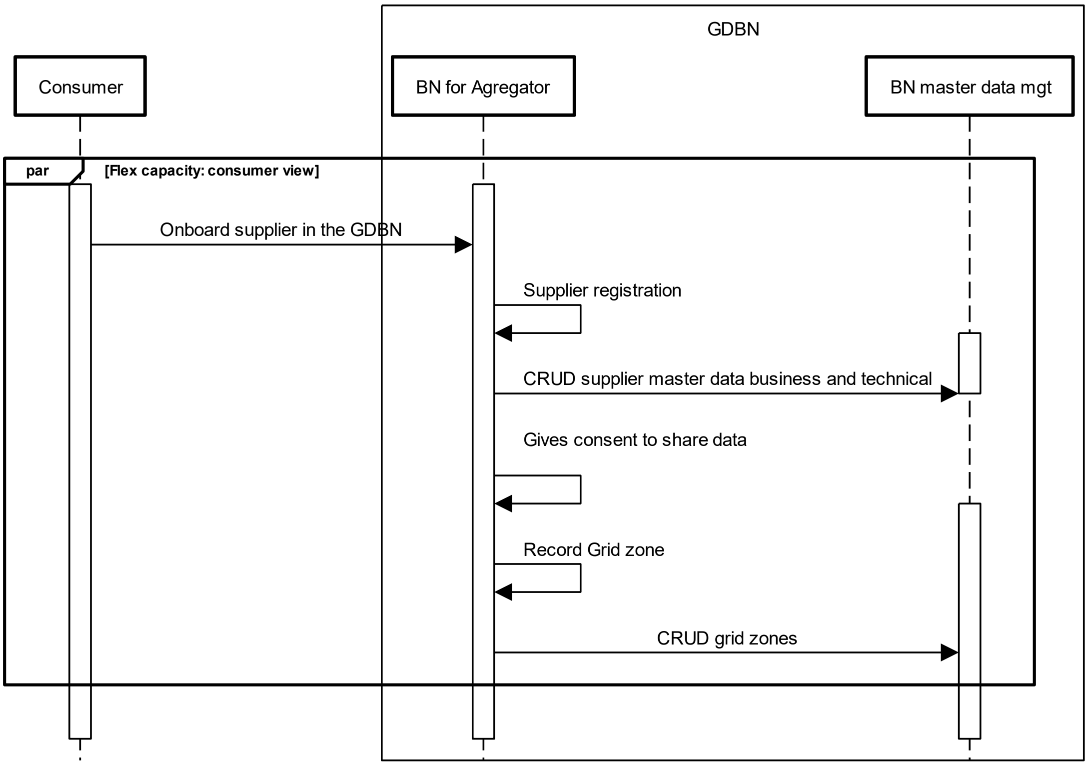

Figure 2 - Flexibility Capacitation - Aggregator View

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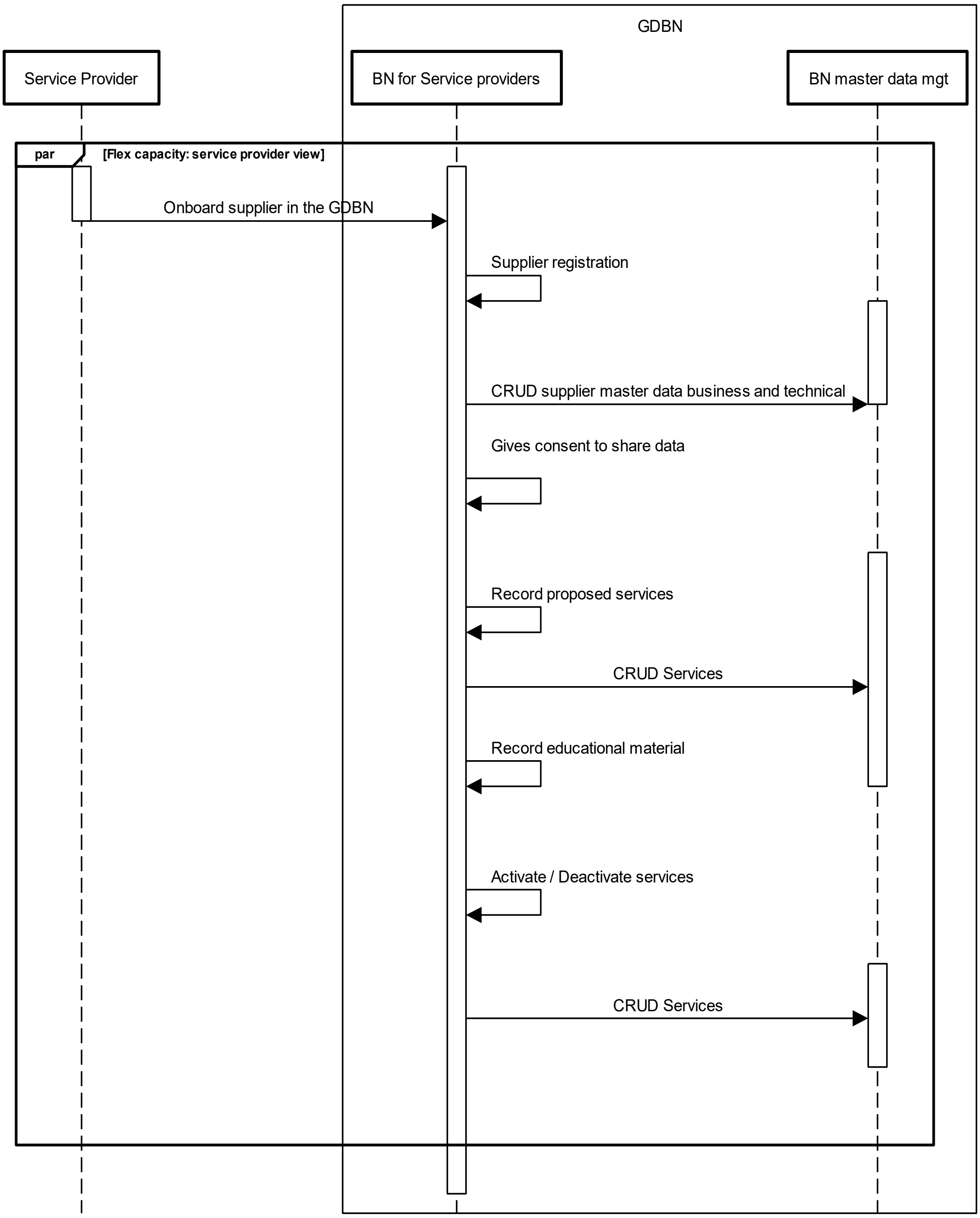

Figure 3 Flexibility Capacitation - Service Provider View

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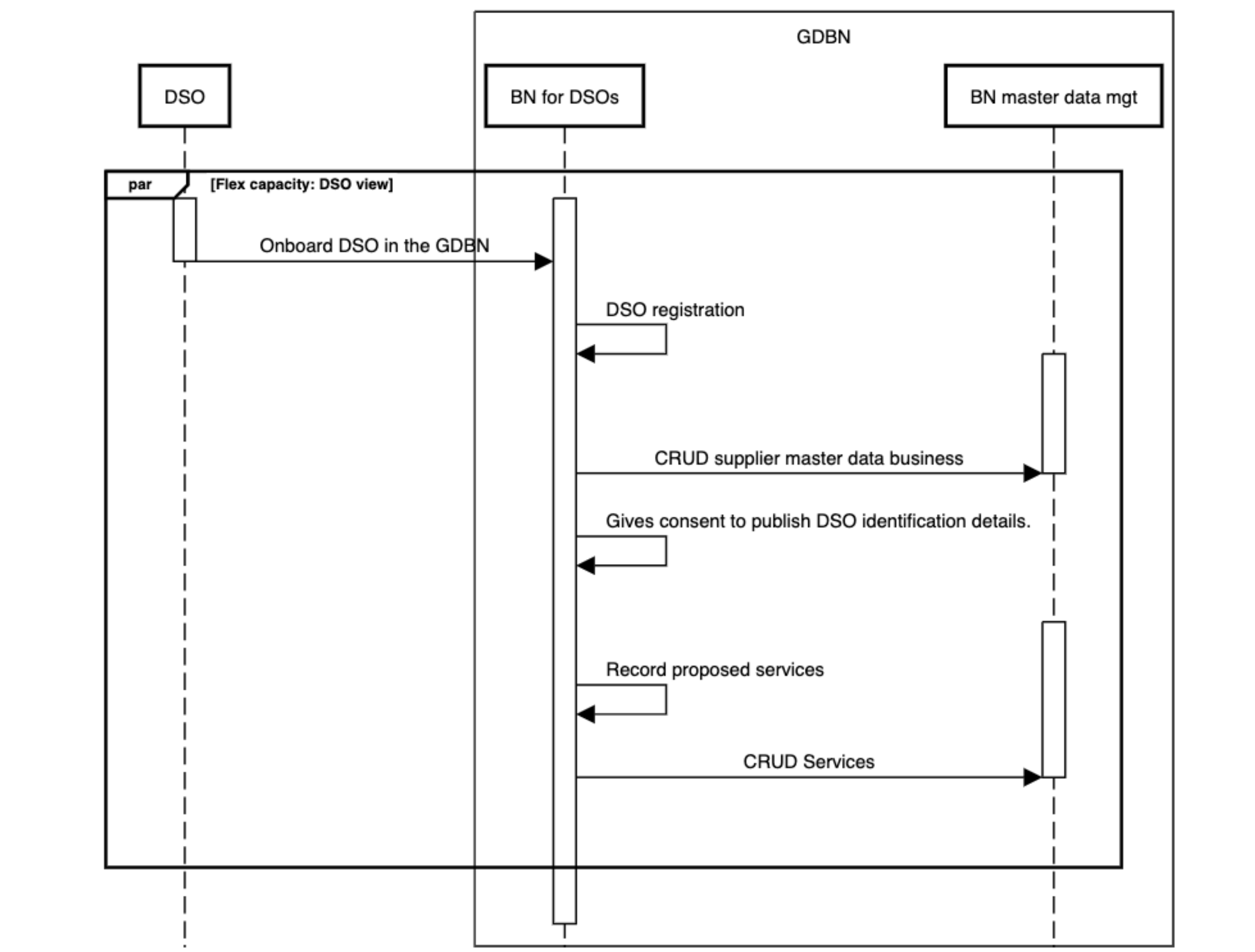

Figure 4 - Flexibility Capacitation – DSO view.

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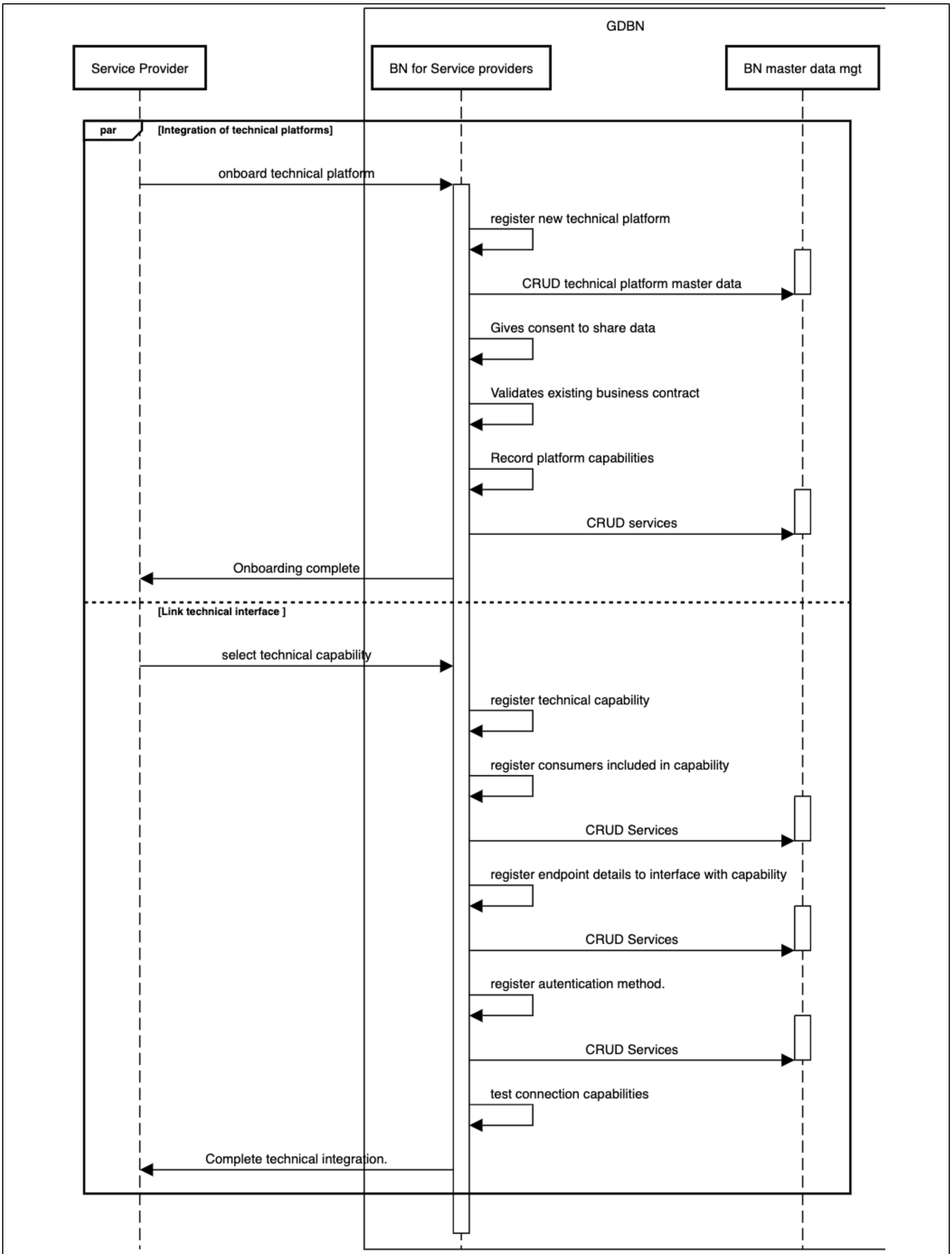

Figure 5 - Integration of technical platforms from consumer and service provider.

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3 Technical details

3.1 Actors

Actors		
Actor Name	**Actor Type**	**Actor Description**
Aggregator	System Actor	Platform (often technical) that makes services available on behalf of service providers.
Consumer	System Actor	Interface where the consumer requests actions trough functions on a web browser or mobile application.
DSO	System Actor	Distribution system operator (considering it's technical platforms)
GBBN (BN for Energy Repository)	Role	Repository (catalogue) service that hosts energy services.
GDBN	System Actor	The GDBN is a facilitator of all the activities withing the flexibility provision value chain
GDBN (BN Aggregator	Role	Aggregator functions within the GDBN.
GDBN (BN Customers)	Role	Costumer functions within the GDBN.
GDBN (BN service provider)	Role	Service provider functions within the GDBN
GDBN (BN advanced)	Role	Advanced service functions within the GDBN.
GDBN (BN DSO)	Role	DSO functions within the GDBN
GDBN (BN master data mgt)	Role	Data management service functions within the GDBN.
Service Provider	System Actor	Platform (often technical) that makes services available on behalf of service providers.

3.2 References

References						
No.	**References Type**	**Reference**	**Status**	**Impact on use case**	**Originator / organisation**	**Link**
1	Technical Report	Harmonized Electricity Market Role Model (HEMRM)	Public	Role Model	BRIDGE	https://energy.ec.europa.eu/system/files/2021-06/bridge_wg_regulation_eu_bridge_hemrm_report_2020-2021_0.pdf
2	Regulation	GDPR	Public	Requirements	EU	https://eur-lex.europa.eu/eli/reg/2016/679/oj

4 Step by step analysis of use case

4.1 Overview of scenarios

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Scenario conditions						
No	**Scenario name**	**Scenario description**	**Primary actor**	**Triggering event**	**Pre-condition**	**Post-condition**
1	Onboard all stakeholders in the GDBN. (Success)	All stakeholders: consumer/prosumer, community manager, service provider, DSO complete the onboarding process in the GDBN. The EMS system (Prosumer) or the technical platforms (other stakeholders) complete the technical integration.	GDBN	Each stakeholder profile starts the onboarding process in the GDBN and/or the integration procedure.	A record for the specific stakeholder profile and identity does not exist. The GDBN service is operational.	A stakeholder record for the profile being registered is added to the GDBN database.
1.1	Onboard all stakeholders on the GDBN. (Success) – Consumer View					
1.2	Onboard all stakeholders on the GDBN. (Success) – Aggregator View					
1.3	Onboard all stakeholders on the GDBN. (Success) – Service Provider View					
1.4	Onboard all stakeholders on the GDBN. (Success) – DSO View					
2	Integrate stakeholder's technical platforms in the GDBN.	Stakeholders: service providers, DSOs, consumers provide the details in integrate their technical platforms, namely their capabilities and connection details.	GDBN	Stakeholders completes the onboarding stage and are prompted to complete the technical integration. Optionally, service providers manually trigger the manual configuration	Each stakeholder completed the onboarding process in the GDBN.	Stakeholders become able to exchange data and become able to take part in the GDBN workflows.

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4.2 Steps – Scenarios

Scenario								
Scenario name :		**No. 1.1 – Onboard all stakeholders on the GDBN (Success) – Consumer View**						
Step No.	**Event**	**Name of process/ activity**	**Description of process/ activity**	**Service**	**Information producer (actor)**	**Information receiver (actor)**	**Information Exchanged (IDs)**	**Requirement, R-IDs**
	Onboard consumers in the GDBN	Onboard consumers in the GDBN	The consumer connects to the BN via a mobile application or via the web portal	GET	Consumer	GDBN (BN Customers)	IE-1	O-X, SEC-1, SEC-4, F-1,F-2, F-3,D-1,D-2,D-3,D-4
	Onboard consumers in the GDBN	Prosumer registration	The customer starts the registration process to the BN by indication its information that will be used later	GET	GDBN (BN Customers)	GDBN (BN Customers)	IE-1	O-X, SEC-1, SEC-4, F-1,F-2,F-3,D-1
	Onboard consumers in the GDBN	CRUD customer master data business and technical	The consumer describes the specificities of its house and the equipment's he owns or rent and what are its objectives	CREATE	GDBN (BN Customers)	GDBN (BN master data mgt)	IE-1	O-X, SEC-1, SEC-4, F-1,F-2,F-3, D-1, D-2,D-3,D-4
	On request	Communication of historical energy data	The consumer can share its consumption data to get the most accurate recommendation / offering	GET	GDBN (BN Customers)	GBBN (BN for Energy Repository)	IE-4	O-X, SEC-1, SEC-4, F-,F-3, F-4,D-2,D-4
	One time during the duration of the contract	Gives consent to share data	The consumer gives its consent to share its data with the nominated supplier	CREATE	GDBN (BN Customers)	GBBN (BN for Energy Repository)	IE-1,IE-2, IE-9	O-X, D-1, F-1,F-2,F-3, F-7,SEC-1,SEC-2,SEC-4,
	On request	Education of the consumer	The consumer wants to know more about the service, the	GET	GDBN (BN advanced)	GDBN (BN Customers)	IE-12	O-X, D-1, F-1,F-2,F-3, SEC-1,SEC-2,SEC-4, ,D-1,D-2,D-3,D-4

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			outcomes, the timing and possible contracts					

Scenario								
Scenario name :	***No. 1.2 – Onboard all stakeholders on the GDBN and integrate EMS or operational platforms (Success) – Aggregator View***							
Step No.	***Event***	***Name of process/ activity***	***Description of process/ activity***	***Service***	***Information producer (actor)***	***Information receiver (actor)***	***Information Exchanged (IDs)***	***Requirement, R-IDs***
	Onboard aggregator in the GDBN	Onboard supplier in the GDBN	The aggregator connects to the BN via a mobile application or via the web portal	GET	Aggregator	GDBN (BN Aggregator	IE-1, IE-2	O-X, SEC-1, SEC-4, F-2, F-3,D-1,D-2,D-3,D-4
	Onboard aggregator in the GDBN	Supplier registration	The aggregator starts the registration process to the BN by indication its information that will be used later	GET	GDBN (BN Aggregator	GDBN (BN Aggregator	IE-1, IE-2	O-X, SEC-1, SEC-4, F-2, F-3,D-1
	Onboard aggregator in the GDBN	CRUD supplier master data business and technical	The aggregator registers its information's in the BN	CREATE	GDBN (BN aggregator	GDBN (BN master data mgt)	IE-20	O-X, SEC-1, SEC-4, F-2, F-3, D-1, D-2,D-3,D-4
	Onboard aggregator in the GDBN	Gives consent to share data	The aggregator gives consent to publish its information's	GET	GDBN (BN aggregator	GDBN (BN aggregator	IE-2, IE-3, IE-9	O-X, D-1,F-1, F-2,F-3, F-7,SEC-1,SEC-2, SEC-4,D-1,D-2,D-4
	On request	Record Grid zone	The aggregator defines the geographical scope, area, and grid where he can propose services	GET	GDBN (BN aggregator	GDBN (BN aggregator	IE-1	O-X, D-1,F-1, F-2,F-3, F-16,D-1,D-2,D-3,D-4

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	Recuring until the aggregator defines grid area	CRUD grid zones	Aggregator updates the grid master data	REPEAT	GDBN (BN Aggregator	GDBN (BN master data mgt)	IE-1	O-X, D-1,F-1, F-2,F-3, F-16,D-1,D-2,D-3,D-4

Scenario								
Scenario name :	***No. 1.3 – Onboard all stakeholders on the GDBN and integrate EMS or operational platforms (Success) – Service Provider View***							
Step No.	***Event***	***Name of process/ activity***	***Description of process/ activity***	***Service***	***Information producer (actor)***	***Information receiver (actor)***	***Information Exchanged (IDs)***	***Requirement, R-IDs***
	Onboard service provider in the GDBN	Onboard supplier in the GDBN	The service provider connects to the BN via a mobile application or via the web portal	GET	Service Provider	GDBN (BN service provider)	IE-1, IE-2	O-X, SEC-1, SEC-4, F-2, F-3,D-1,D-2,D-3,D-4
	Onboard service provider in the GDBN	Supplier registration	The service provider starts the registration process to the BN by indication its information that will be used later	GET	GDBN (BN service provider)	GDBN (BN service provider)	IE-1, IE-2	O-X, SEC-1, SEC-4, F-2, F-3,D-1
	Onboard service provider in the GDBN	CRUD supplier master data business and technical	The service provider registers its information's in the BN	CREATE	GDBN (BN service provider)	GDBN (BN master data mgt)	IE-2	O-X, SEC-1, SEC-4, F-2, F-3, D-1, D-2,D-3,D-4,D-5
	Onboard service provider in the GDBN	Gives consent to share data	The service provider gives consent to publish its information's	GET	GDBN (BN service provider)	GDBN (BN aggregator	IE-2, IE-3, IE-9	O-X, D-1,F-1, F-2,F-3, F-7,SEC-1,SEC-2, SEC-4, D-1,D-2,D-3,D-4
	Onboard service	Record proposed services	The service provider provides details about the	EXECUTE	GDBN (BN service provider)	GDBN (BN service provider)	IE-3,IE-6, IE-13	O-X, D-1,D-2, F-1,F-2, F-3,F-6, F-10, F-12, ,D-1,D-2,D-3,D-5

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	provider in the GDBN		services offered and the details					
	Recuring until the service provider defines services	CRUD services	Service provider updates the service master data	REPEAT	GDBN (BN service provider)	GDBN (BN master data mgt)	IE-3, IE-10, IE-16,	O-X, D-1,D-2, F-1,F-2, F-3,F-6, F-10, F-12,D-1,D-2,D-3,D-4,D-5
	On request	Record educational material	The service provider includes educational material as advice and tips to consumers.	REPEAT	GDBN (BN service provider)	GDBN (BN service provider)	IE-12	O-X, D-1,D-2, F-1,F-2, F-3,F-6, F-10, F-12, F-18
	Recuring until the service provider defines services	Activate / Deactivate services	The service provider defines from the list of service the one that are active or not and for which period	REPEAT	GDBN (BN service provider)	GDBN (BN service provider)	IE-3	F-1,F-2,F-3,F-12, F-20, F-21,D-1,D-2
	Recuring until the service provider defines services	CRUD services	Service provider updates the service master data	REPEAT	GDBN (BN service provider)	GDBN (BN master data mgt)	IE-3	F-1,F-2,F-3,F-12, F-20, F-21,D-1,D-2,D-3,D-4,D-5

Scenario								
Scenario name :		***No. 1.4 – Onboard all stakeholders on the GDBN (Success) – DSO View***						
Step No.	***Event***	***Name of process/ activity***	***Description of process/ activity***	***Service***	***Information producer (actor)***	***Information receiver (actor)***	***Information Exchanged (IDs)***	***Requirement, R-IDs***

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1.4.1	Onboard DSO in the GDBN	Onboard DSO in the GDBN	The DSO connects to the BN.	GET	DSO	GDBN (BN DSO)	IE-25	O-X, SEC-1, SEC-4, F-2, F-3,D-1,D-2,D-3,D-4,D-5
1.4.2	Onboard DSO in the GDBN	DSO registration	The DSO starts the registration process to the BN by indication its information that will be used later	EXECUTE	GDBN (BN DSO)	GDBN (BN DSO)	IE-25	O-X, SEC-1, SEC-4, F-2, F-3,D-1,D-2,D-3,D-4,D-5
1.4.3	Onboard DSO in the GDBN	CRUD supplier master data business and technical	The DSO registers its information's in the BN	CREATE	GDBN (BN DSO)	GDBN (BN master data mgt)	IE-25	O-X, SEC-1, SEC-4, F-2, F-3, ,D-1,D-2,D-3,D-4,D-5
1.4.4	Onboard service provider in the GDBN	Gives consent to publish DSO identification data	The DSO gives consent to publish information that is visible by the GDBN.	GET	GDBN (BN DSO)	GDBN (BN DSO	IE-26, IE-9	O-X, D-1,F-1, F-2,F-3, F-7,SEC-1,SEC-2, SEC-4, ,D-1,D-2,D-4,D-5
1.4.5	Onboard service provider in the GDBN	Record proposed services	The DSO provides details about the services offered and the details	EXECUTE	GDBN (BN DSO)	GDBN (BN DSO)	IE-26	O-X, D-1,D-2, F-1,F-2, F-3,F-22, F-12,D-1,D-2,D-3,D-4,D-5
1.4.6	Recuring until the service provider defines services	CRUD services	DSO updates the service master data	REPEAT	GDBN (BN DSO)	GDBN (BN master data mgt)	IE-26, IE-16	O-X, D-1,D-2, F-1,F-2, F-3,F-22, F-12,D-1,D-2,D-3,D-4,D-5

Scenario	
Scenario name :	***No. 2 – Integrate stakeholder's operational platforms in the GDBN (Success)***

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Step No.	Event	Name of process/ activity	Description of process/ activity	Service	Information producer (actor)	Information receiver (actor)	Information Exchanged (IDs)	Requirement, R-IDs
121 2.1	Onboard technical platform	Onboard technical platform	The service provider starts the process to onboard the technical platform	CREATE	Service Provider	GDBN (BN service provider)	IE-23	O-X, SEC-1, SEC-4, F-2, F-3
2.2	Register new technical platform	Register new technical platform	The service provider starts the process of technical integration by supplying technical data.	EXECTUE	GDBN (BN service provider)	GDBN (BN service provider)	IE-23	O-X, SEC-1, SEC-4, F-2, F-3,D-2
2.3	CRUD technical platform master data	CRUD technical platform master data	The platform's details are recorded in the master database.	CREATE	GDBN (BN service provider)	GDBN (BN master data mgt)	IE-23	O-X, SEC-1, SEC-4, F-2, F-3,D-1,D-2,D-3,D-4,D-5
2.4	Give consent to share data	Give consent to share data	The service provider gives consent to publish platform's details.	EXECUTE	GDBN (BN service provider)	GDBN (BN service provider)	IE-9	O-X, SEC-1, SEC-4, F-2, F-3,D-2
2.5	Validate existing business contract	Validate existing business contract	A verification is done to ensure a valid contract is available.	EXECUTE	GDBN (BN service provider)	GDBN (BN service provider)	IE-19	O-X, SEC-1, SEC-4, F-2, F-3,D-1,D-2,D-3
2.6	Record platform capabilities	Record platform capabilities	Platform's capabilities and processed.	EXECUTE	GDBN (BN service provider)	GDBN (BN service provider)	IE-23, IE-24	O-X, SEC-1, SEC-4, F-2, F-3,D-2,D-5
2.7	CRUD services	CRUD services	The platform's capabilities are recorded in the master database.	CREATE	GDBN (BN service provider)	GDBN (BN master data mgt)	IE-23, IE-24	O-X, SEC-1, SEC-4, F-2, F-3,D-1,D-2,D-3,D-4,D-5
2.8	Onboarding complete	Onboarding complete	The onboarding is confirmed	GET	GDBN (BN service provider)	Service Provider	IE-18	O-X, SEC-1, SEC-4, F-2, F-3,D-2

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2.9	Select technical capability	Select technical capability	Technical capabilities are added to the record of a technical platform. Capabilities are selected from a pre-established list	EXECUTE	Service Provider	GDBN (BN service provider)	IE-24	O-X, SEC-1, SEC-4, F-2, F-3,D-2,D-5
2.10	Register consumers included in capability	Register consumers included in capability	The consumer IDs to be consider in the influence area of this platform is collected and pre-processed.	REPEAT	GDBN (BN service provider)	GDBN (BN service provider)	IE-1,	O-X, SEC-1, SEC-4, F-2, F-3, D-2,D-3,D-4,D-5
2.11	CRUD services	CRUD services	The platform's capabilities are recorded in the master database.	CREATE	GDBN (BN service provider)	GDBN (BN master data mgt)	IE-23, IE-24,IE-1	O-X, SEC-1, SEC-4, F-2, F-3,D-1,D-2,D-3,D-4,D-5
2.12	Register endpoint details to interface with capability	Register endpoint details to interface with capability	The technical details for the capability being registered are collected, namely the URL and any call parameters. RESTFull endpoints are considered as default.	EXECUTE	GDBN (BN service provider)	GDBN (BN service provider)	IE-24	O-X, SEC-1, SEC-4, F-2, F-3,D-2,D-5
2.13	CRUD services	CRUD services	Technical details for the capability are recorded in the master database.	CREATE	GDBN (BN service provider)	GDBN (BN master data mgt)	IE-24	O-X, SEC-1, SEC-4, F-2, F-3,D-1,D-2,D-3,D-4,D-5
2.14	Register authentication method	Register authentication method	Preferred authentication method and details are recorded pre-processed.	EXECUTE	GDBN (BN service provider)	GDBN (BN service provider)	IE-24	O-X, SEC-1, SEC-4, F-2, F-3,D-2,D-5
2.15	CRUD services	CRUD services	Technical details for authentication are recorded in the master database.	CREATE	GDBN (BN service provider)	GDBN (BN master data mgt)	IE-24	O-X, SEC-1, SEC-4, F-2, F-3,D-1,D-2,D-3,D-4,D-5
2.16	Test connection capabilities	Test connection capabilities	Connection is tested	EXECUTE	GDBN (BN service provider)	GDBN (BN service provider)	IE-24	O-X, SEC-1, SEC-4, F-2, F-3

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2.17	Complete technical integration	Complete technical integration	Operation completion acknowledgement is sent.	GET	GDBN (BN service provider)	Service Provider	IE-18	O-X, SEC-1, SEC-4, F-2, F-3

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5 Information exchanged

Information exchanged			
Information exchanged (ID)	**Name of information**	**Description of information exchanged**	**Requirement, R-IDs**
IE-1	Consumer profile	Basic information to register a consumer, including personal identification : name, surname, location, email account	O-X
IE-2	Service provider profile	Basic information to register a service provider, including identification : name, location, email (as username), contact, type of services	O-X
IE-3	Service available by service provider	Information that details a service, namely: name, API URL (if applicable), description, targets (client types, geographic locations), contact person, support centre contacts, conditions.	F-10
IE-4	Metering Data	Metering data account for active power consumption in periods of 15 minutes for spanning several hours (ideally 24)	F-4
IE-5	Semantic representation of consumer	Consumer representation in RDF format accounting to its characteristics namely location	F-12
IE-6	Service List	A list composed by IE-3 messages	F-10
IE-7	Flexible asset	Description of a flexible asset	F-5
IE-8	List of Flexible asset	A list composed by IE-7 messages	F-7,F9
IE-9	Consent	One stakeholder provides consent to other stakeholder in scope of a service.	O-1, O-4
IE-10	Flexibility capacity	The measurable capacity to be flexible (i.e., change consumption profile) of an asset.IE	O-X, F-8, F-9
IE-11	Aggregated flexibility capacity	Grouping of flexibility capacity by aggregating several loads represented by IE-10 messages. Can represent one household or a group of households.	O-X, F-8, F-9
IE-12	Tips and advice for service	Tips and direct advice towards flexibility and sustainable energy consumption.	O-X, F-9
IE-13	Service subscription	Service onboarding details that pair a consumer with a service provider.	O-X, F-6,F-10
IE-14	Payment invoice	Cash flow output generating an invoice	O-X, F-14

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IE-15	Historical data	Consumer's historical metering data in 15 minutes periods.	O-X,F-15
IE-16	Service terms and conditions	Services specific terms and conditions	O-X
IE-17	Form acknowledgement	Stakeholder accepts/reject action. This is multi scope. Can be used for several purposes. Context is enclosed in request.	O-X
IE-18	Acknowledgment notification	Acknowledges operation success. This is multi scope. Can be used for several purposes. Context is enclosed in request.	O-X
IE-19	Service Contract	Service provider's contract to onboard another stakeholder	O-X
IE-20	Aggregator Profile	Basic information to register an aggregator, including identification : name, location, email (as username), contact, type of services, geographical interest area.	O-X
IE-21	Flexibility Model	Flexibility model details included in a service.	
IE-22	Flexibility offering	Flexibility offering resulting from the pre-qualification process.	F-19
IE-23	Technical platform details	The identification of a technical platform, including capabilities and description and capabilities	
IE-24	Technical platform capability	Technical details on how to activate one given capability, namely type and endpoint details of the destination system or authentication details.	
IE-25	DSO profile		
IE-26	Service available by DSO		

4 Requirements

Security Requirements		
Categories ID	**Category name for requirements**	**Category description**
Sec	Security	Authentication of user, confidentiality, integrity, prevention of denial of service, non-repudiation or accountability, error management
Requirement R-ID	**Requirement name**	**Requirement description**
SEC-1	Service authentication	All parties should be trusted.

SEC-2	Eavesdropping	Eavesdropping: Ensuring confidentiality, avoiding illegitimate use of data, and preventing unauthorized reading of data, is crucial.
SEC-3	Acknowledge timeout	One minute for any M2M communication.
SEC-4	Authentication	Authentication: Masquerade and/or spoofing: Ensuring that data comes from the stated source or goes to authenticated receiver is crucial

	Data Management Requirements	
Categories ID	**Category name for requirements**	**Category description**
D	Data Management	Type of source of data, correctness or validity of data, timeliness or time stamping of data, volume of data, synchronization, or consistency of data across systems, timely access to data, validation of data across organizational boundaries, transaction management, data naming, identification, formats across disparate systems, maintenance of data and databases
Requirement R-ID	**Requirement name**	**Requirement description**
D-1	Data persistence	Data is persistently store in the platform database.
D-2	Data validation	All data must be validated on each data exchange
D-3	Data validation from multiple sources	Mapping of data items is required for data from different sources
D-4	Management of data across organizational boundaries	Data exchanges go across organizational boundaries.
D-5	Management of data formats in data exchanges	Conversion of data format I handled by a “converter” at Information receiver site.

	Functional Requirements	
Categories ID	**Category name for requirements**	**Category description**
F	Functional	Essential functionalities that build the core concept of the service/SUC.
Requirement R-ID	**Requirement name**	**Requirement description**
F-1	Login in the GDBN	Any FO, aggregator, retailer, producer or industrial consumer has the ability to login into the GDBN web page. A login link must be available for these entities.
F-2	Registration in the GDBN	Any FO, aggregator, retailer, producer or industrial consumer has the right of registration on the GDBN platform.

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F-3	Access to the service	After the login, a webpage link for each available service provided by the GDBN should be available.
F-4	Consumer/prosumer metering data	Request the user's consumption data (energy measured with 15 min interval data). If available, also request user's PV production data (energy measured with 15 min interval). Request user's point of consumption geographical coordinates, to estimate PV production.
F-5	Consumer assets available	Consumer has assets with flexibility potential installed with connectivity capabilities .
F-6	Service provider digital service available	Service provider has a service with a digital interface towards consumers that targets classes of specific assets, or classes of consumers.
F-7	Service providers control flexible assets	Flexible assets get controlled by receiving commands to change their consumption profile or scheduled operation.
F-8	Consumers/prosumers share their flexibility capacity with third-party services	The flexibility potential is computed and shared with third-party services, namely those of service providers.
F-9	Consumers/prosumers hold a profile that characterises them	A profile represents the identity and characteristics of a consumer/prosumer for several purposes.
F-10	Service providers make service available in the platform.	Service providers have one or more services available.
F-11	Unique ID for grid users and aggregator	A unique ID should be defined for eligible grid users and aggregators on the GDBN. This ID is shared between the GDBN and the DSO. DSO can use this ID to identify the flexibility provider to assess the offers.
F-12	Metadata is collected and fed to semantic system	Metadata is encoded in a semantic system to derive and discover new data links.
F-13	Consumer/ prosumer subscribes services	Service onboarding details that pair a consumer with a service provider.
F-14	Invoice is generated	An invoice is generated to count the
F-15	Consumer accesses / shares historical data	Consumer has access to his/her historical data.
F-16	Aggregator needs consumer's geographical location	Consumer's geographical location is needed to map consumer's geographical positioning in an area.
F-17	Aggregator takes consumer's flexibility capacity to market	Consumer's flexibility capacity is grouped by an aggregator and is included as part of a bid that is taken to market.

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F-18	Consumers are paired with service providers	Consumers are paired with service providers according to flexibility objectives, available assets, and geographic location.
F-19	Aggregator sends a flexibility offering	A flexibility aggregation offer is sent.
F-20	Service contract	A service contract exists and bounds the relationship between two stakeholders for a time period.
F-21	Service can be activated and deactivated	A service provider may activate or deactivate a service.
F-22	DSO digital service available	DSO has a service with a digital interface towards consumers that targets classes of specific assets, or classes of consumers, or aggregators.

Other Requirements		
Categories ID	**Category name for requirements**	**Category description**
O	Regulatory obligation related to privacy	2016/679 (General Data Protection Regulation)
Requirement R-ID	**Requirement name**	**Requirement description**
O-1	Data processing consent	Personal data may not be processed unless there is at least one legal basis to do so.
O-2	Data retention policy	Data retention policy outlines the specific sensitive time period data can be retained, plus how it will be disposed of when the time to do so comes.
O-3	Right to access, rectify, erasure, restriction	The data subject shall have the right to obtain from the controller without undue delay the access/rectification/erasure/restriction of inaccurate personal data concerning him or her.
O-4	Data transfer consent	Personal data may not be transferred to a third-party if the data subject did not agree and the third party provide appropriate safeguard.
O-X	All constraints also apply.	All requirements in this category.

Quality of Service Requirements		
Categories ID	**Category name for requirements**	**Category description**
QoS	Quality of Service – Non-Functional requirements	Generic properties that service/SUC should provide – quality attributes.
Requirement R-ID	**Requirement name**	**Requirement description**
QoS-1	Logging access	Any access to the data is logged in the database.

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QoS-2	Metadata is derived from key data types	Metadata is derived from main types.
QoS-3	Elapsed time	Elapsed time response requirements for exchanging data from 1-2 seconds

5 Common Terms and Definition

Common Terms and Definitions	
Term	**Definition**
CRUD	Create-Remove-Update-Delete
GDBN	Grid Data Business Network
GDPR	General Data Protection Regulation
M2M	Machine-to-machine
MGMT	Management
QoS	Quality-of-Service
REC	Renewable Energy Community

10.3. SUC12.2 – Support investment in flexibility by value chain actors

1 Description of the use case

1.1 Name of the use case

ID	*Area / Domain(s)*	*Name of Use Case*
SUC 12.2	Cross-sector flexibility booster	Support investment in flexibility by value chain actors

1.2 Version management

Version Management			
Version No.	*Date*	*Name of Author(s)*	*Changes*
0.1	29.05.2023	Fábio Coelho (INESCTEC)	First draft.
0.2	10.07.2023	Fábio Coelho (INESCTEC)	Scope/Objectives section, Complete description section, diagrams section
0.3	13.07.2023	Fábio Coelho (INESCTEC)	Draft for scenarios and revision of complete description
0.9	12.09.2023	Fábio Coelho (INESCTEC)	Review final version
1.0	27.10.2023	Fábio Coelho (INESCTEC)	Final version

1.3 Scope and objectives of use case

Scope and Objectives of Use Case	
Scope	BUC 12 – Operating a value chain enabler for flexibility-centric energy and non-energy services. Service part of the value-chain enabler that ensures all stakeholders are onboarded, namely consumers/prosumers, service providers (e.g., Flexibility Service Providers), Aggregators

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	or DSOs. Specific requirements for each stakeholder type provide ground data for the services detailed in this SUC. Promote sustainable business models to unlock the potential distributed flexibility of final consumers for an improved system operation, with special emphasis on DSO flexibility system services.
Objective(s)	offer and search for targeted energy and non-energy services to consumers. Identify and characterise available flexible assets.
Related business case(s)	BUC 12 – Operating a value chain enabler for flexibility-centric energy and non-energy services

1.4 Narrative of use case

Narrative of Use Case
Short description
The current SUC details the first and second stages of the Flexibility-centric Energy Value-chain embodied by the Grid Data Business Network platform (GDBN). The GDBN is a cloud-based digital platform that links and engages key stakeholders to promote new business services for energy flexibility. The GDBN holds services to onboard consumers / prosumers, service providers, most notably Flexibility Service Providers (FSPs), Aggregators, Community Managers, Market Operators and DSOs. Consumers/Prosumers register their flexibility potential by registering the flexible assets they have available or show availability to receive recommendations on services with business opportunities that capacitate them (i.e., install) them with flexible assets; afterwards deciding for the subscription of such services. In brief, this SUC details how to: ▪ **Install flexible assets in candidate consumers through service subscriptions. [Business Network]** Service providers exploit business models to install flexible assets in candidate consumers in exchange for their participation while providing them incentives. ▪ **Pair consumers with flexible assets and service providers exploiting flexibility business models. [Business Network]** Service providers are matched with consumers with assets available in the value chain, engaging consumers and increasing flexibility potential. ▪ **Aggregate flexibility potential. [Aggregation]** A renewable energy community manager embodying the role of aggregator, or an aggregator creates and pre-qualifies a flexibility bid that will be submitted to market negotiation. Service providers with subscribed prosumers or capacitated prosumers are expected to activate the flexible loads.
Complete description
The current SUC details part of the first, second and fully describes the third stage of the Flexibility-centric Energy Value-chain embodied by the Grid Data Business Network platform (GDBN). The GDBN is a cloud-based digital platform that links and engages key stakeholders to promote new business services for energy flexibility. The GDBN holds services to onboard consumers / prosumers, service providers, most notably Flexibility Service Providers (FSPs), Aggregators, Community Managers, Market Operators and DSOs. Consumers/Prosumers register their flexibility potential by registering the flexible assets they have available or show interest to receive recommendations on services with business opportunities that capacitate them (i.e., install) with flexible assets; afterwards deciding for the subscription of such services. In brief, this SUC details how to: ▪ **Install flexible assets in candidate consumers through service subscriptions. [Business Network]**

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Service providers offer services with business models where consumers are provided with flexible assets in exchange for their participation while providing them incentives.

- (what) Consumers that do not have flexible assets onboard services that offer business models focused on providing them flexible assets.
- (what) Consumers that have flexible assets that do not allow a remote interaction, onboard services that offer business models focused on the retrofit of those assets.
- (why) Service providers apply business models where assets are installed in consumers premisses (e.g., with a no up-front investment for the consumer) to maximize their portfolio.
- (when) Service providers specify when new candidates are included in their business plan, allowing for three main trends:
  a. during specific candidate enrolment campaigns.
  b. always.
- (expectation) Increase the service subscription revenues together with the user base from which flexibility could be harvested.
- Conditions:
  a. Consumers do not have flexible assets or do have them but want to increase their number.
  b. Service providers have a business plan where incentives are clearly defined.

- **Pair consumers with flexible assets and service providers exploiting flexibility business models. [Business Network]**
  Service providers are matched with consumers with assets available in the value chain, engaging consumers and increasing flexibility potential.
  - (what) The Digital Platform Provider matches enrolled consumers with and without flexible assets with service providers offerings (e.g., in specific geographies; with specific flexibility goals).
  - (why) Matching demand and offer will boost the service subscriptions from service providers and maximize the use of the available flexibility potential.
  - (when) Service providers specify the frequency when matching cycles occur for their services. A default daily matching is considered.
  - (expectation) Ensure service providers are not short on service subscription when using the value chain and consumers quickly start monetizing their existing assets or are contacted to subscribe services.
  - Conditions:
    a. Registered consumers are available in the regional areas where service providers operate.

The SUC decomposes in 6 main actions:

1. Service providers find new consumers by triggering the corresponding service in the GDBN or receive a generated list of candidate consumers.
2. Service providers perform a selection based on technical and business objectives and prompt selected candidates to onboard their service.
3.
   a. Consumers receive onboarding request and opt to onboard a specific service from a service provider by activating that service.
   b. Consumers search for service providers.
4. After a technical and data analysis, a service proposition is sent to the consumer.
5. Consumers validate the terms and conditions and sign the contract.
6. Service provider activates the service for the subscribed service.

1.6 Use case conditions

Use case conditions
Assumptions
The energy and non-energy services are not detailed in this SUC (just their relationship in the value-chain). The business models and services from energy stakeholders are not described in this SUC.
Prerequisites
Service providers have their own technical platforms which they integrate with the interfaces for the GDBN. Consumers have internet connection and interface with the GDBN via their browsers or mobile application. Consumers do not have flexible assets with connectivity capabilities.

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1.7 Further Information to the use case for classification / mapping

Classification Information
Relation to other use cases
BUC 12 – Operating a value chain enabler for flexibility-centric energy and non-energy services- SUC 12.1 – Connect flexibility providers across the value chain.
Level of depth
System use case (SUC) use case which describes in detail the functionality/technological solutions of (a part of) a business process.
Prioritisation
High Level of Priority – To be demonstrated in France (Pilot 3.5 and 3.6)
Generic, regional or national relation
Generic
Nature of the use case
Cross-sector: flexibility boosters.
Further keywords for classification
Flexibility, value-chain, cross-sector, GDBN

1.8 General Remarks

General Remark
This SUC is part of Grid Data and Business Network concept. The implementation considers the support of a cloud service provider and framework of services support by SAP. XaaS approach is to be prioritized and should tentatively be adopted for all services.

2 Diagrams of use case

Diagram(s) of use case

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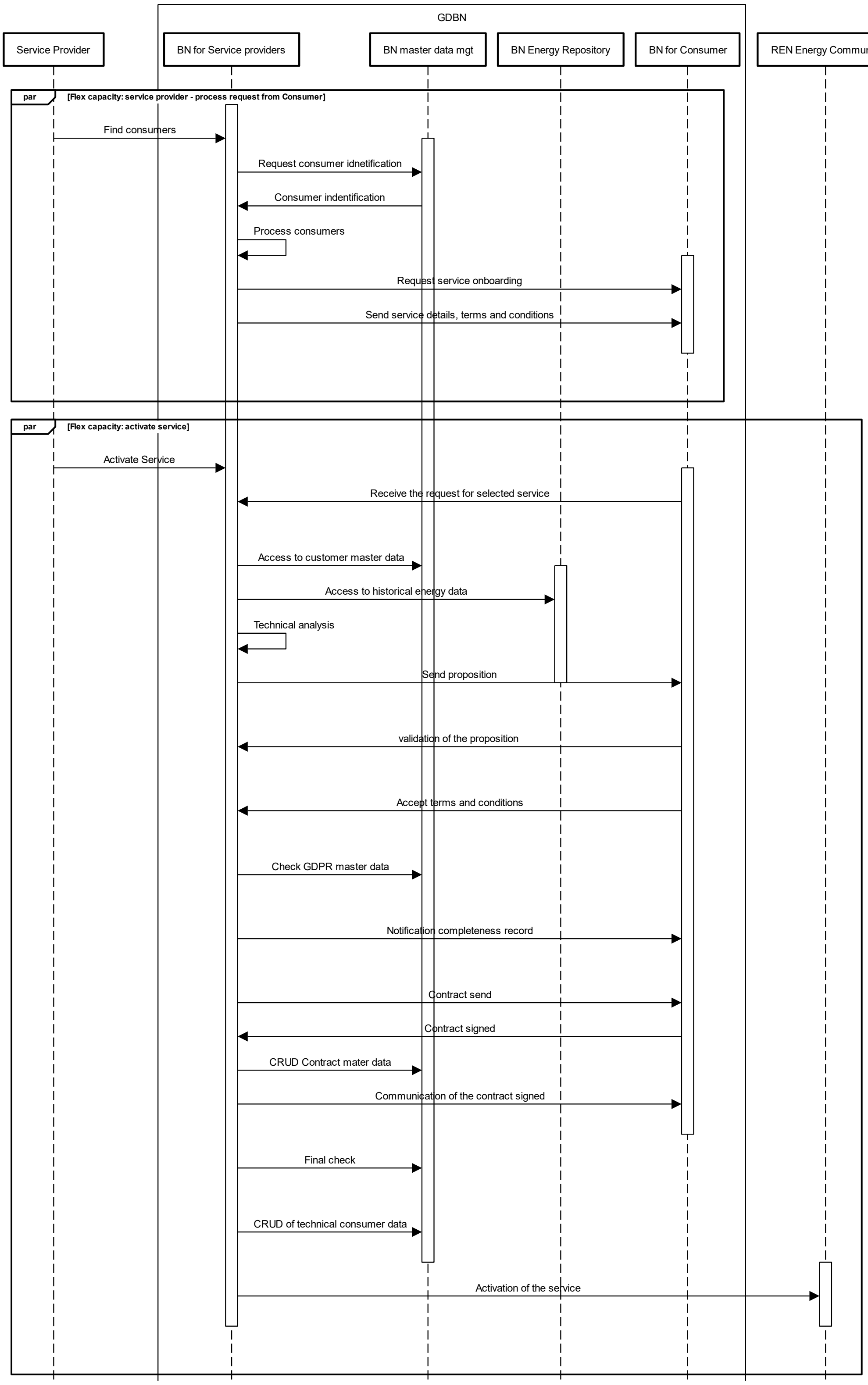

Figure 1 - Flexibility Capacitation - Service Provider View- Find consumers and activate services.

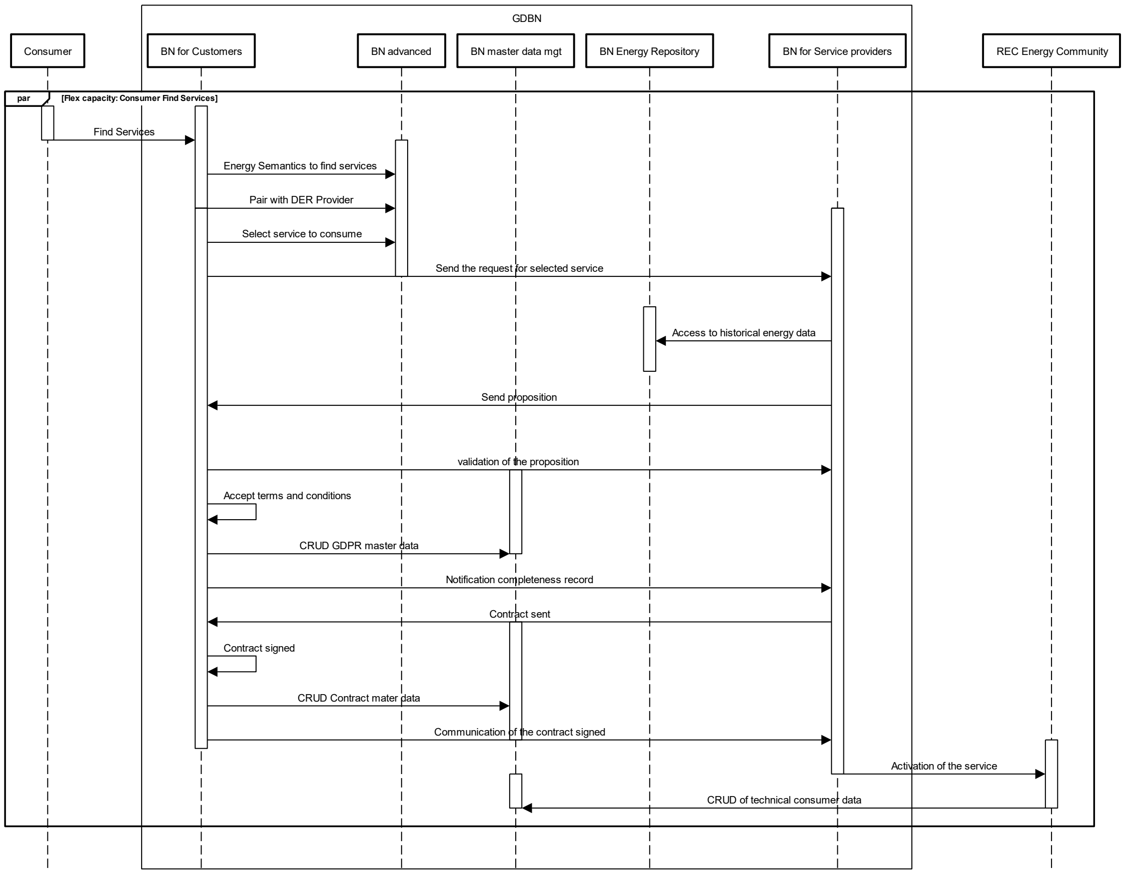

Figure 2 - Flexibility Capacitation - Service Provider View - Find consumers.

3 Technical details

3.1 Actors

Actors		
Actor Name	**Actor Type**	**Actor Description**
GDBN (Consent Administrator role)	Role	Consent manager service functions within the GDBN.
Aggregator	System Actor	Platform (often technical) that makes services available on behalf of service providers.
Consumer	System Actor	Interface where the consumer requests actions trough functions on a web browser or mobile application.
GBBN (BN for Energy Repository)	Role	Repository (catalogue) service that hosts energy services.
GDBN	System Actor	The GDBN is a facilitator of all the activities withing the flexibility provision value chain
GDBN (BN Aggregator	Role	Aggregator functions within the GDBN.
GDBN (BN Customers)	Role	Costumer functions within the GDBN.
GDBN (BN service provider)	Role	Service provider functions within the GDBN

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GDBN (BN service provider)	Role	Service provider functions within the GDBN
GDBN (BN advanced)	Role	Advanced service functions within the GDBN.
GDBN (BN master data mgmt)	Role	Data management service functions within the GDBN.
REC Manager (Renewable Energy Community)	System Actor	Platform that manages a REC and all its participants.
Service Provider	System Actor	Platform (often technical) that makes services available of behalf of service providers.

3.2 References

References						
No.	***References Type***	***Reference***	***Status***	***Impact on use case***	***Originator / organisation***	***Link***
1	Technical Report	Harmonized Electricity Market Role Model (HEMRM)	Public	Role Model	BRIDGE	https://energy.ec.europa.eu/system/files/2021-06/bridge_wg_regulation_eu_bridge_hemrm_report_2020-2021_0.pdf
2	Regulation	GDPR	Public	Requirements	EU	https://eur-lex.europa.eu/eli/reg/2016/679/oj

4 Step by step analysis of use case

4.1 Overview of scenarios

Scenario conditions						
No.	**Scenario name**	**Scenario description**	**Primary actor**	**Triggering event**	**Pre-condition**	**Post-condition**
1	Install flexible assets in consumers to explore flexibility capacity.	Service providers identify consumers and install flexible assets.	GDBN (BN for Service Provider)	Service provider profile triggers the service.	Consumers and service provider are onboarded in the GDBN. Consumers do not have flexible assets or have them and qualify for extra ones.	Flexible assets are installed in consumer's premisses and become technically integrated with the GDBN (BN for service provider). Flexibility

						capacity is explored by the Service Provider.
1.1	Install flexible assets in consumers to explore flexibility capacity – Service Provider View					
1.2	Install flexible assets in consumers to explore flexibility capacity – Consumer View					
2	Flexibility Aggregation	Service provider as Flexibility Service Provider aggregates flexibility capacity in its portfolio and takes it market in an upstream stage. A downstream stage transmits activation commands as part of the downstream stage.	GDBN (BN for Service Provider)	Service provider platform daily triggers the process.		

Scenario conditions						
No.	**Scenario name**	**Scenario description**	**Primary actor**	**Triggering event**	**Pre-condition**	**Post-condition**
1	Install flexible assets in consumers to explore flexibility capacity.	Service providers identify consumers and install flexible assets.	GDBN (BN for Service Provider)	Service provider profile triggers the service.	Consumers and service provider are onboarded in the GDBN. Consumers do not have flexible assets or have them and qualify for extra ones.	Flexible assets are installed in consumer's premisses and become technically integrated with the GDBN (BN for service provider). Flexibility capacity is explored by the Service Provider.
1.1	Install flexible assets in consumers to explore flexibility capacity – Service Provider View					
1.2	Install flexible assets in consumers to explore flexibility capacity – Consumer View					
2	Flexibility Aggregation	Service provider as Flexibility Service Provider aggregates flexibility capacity in its portfolio and takes it market in	GDBN (BN for Service Provider)	Service provider platform daily triggers the process.		

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		an upstream stage. A downstream stage transmits activation commands as part of the downstream stage.				

4.2 Steps – Scenarios

Scenario								
Scenario name :	No. 1.1 - install flexible assets in consumers to explore flexibility capacity – Service Provider view							
Step No.	Event	Name of process/ activity	Description of process/ activity	Service	Information producer (actor)	Information receiver (actor)	Information Exchanged (IDs)	Requirement, R-IDs
1.1.1	On request	Find consumers	The service provider requests to find candidate consumers	GET	Service Provider	GDBN (BN service provider)	IE-1,IE-2,IE-5	O-X, F-1,F-2,F-3, F-6, F-9, F-10-F-11, SEC-1,SEC-2,D-1,D-2,D-3,D-4,D-5
1.1.2	On request	Request consumer identification	Request list of candidate consumer IDs	GET	GDBN (BN service provider)	GDBN (BN master data mgmt)	IE-1,IE-5	O-X, F-1,F-2,F-3, F-6, F-9, F-10-F-11, SEC-1,SEC-2,D-1,D-2,D-3,D-5
1.1.3	On request	Consumer Identification	Send list of candidate consumer IDs	GET	GDBN (BN master data mgmt)	GDBN (BN service provider)	IE-1,IE-5	O-X, F-1,F-2,F-3, F-6, F-9, F-10-F-11, SEC-1,SEC-2,D-1,D-2,D-3
1.1.4	On request	Process consumers	Validate and identify final list of consumer IDs that match service needs	EXECUTE	GDBN (BN service provider)	GDBN (BN service provider)	IE-1,IE-5	O-X, F-1,F-2,F-3, F-6, F-9, F-10-F-11, SEC-1,SEC-2,D-1,D-2,D-3,D-5
1.1.5	On request	Request service onboarding	Request specific consumer IDs to onboard service	GET	GDBN (BN service provider)	GDBN (BN consumer	IE-1,IE-3, IE-5	O-X, F-1,F-2,F-3, F-6, F-9, F-10-F-11, SEC-1,SEC-2,D-1,D-2,D-3
1.1.6	On request	Send service details, terms and conditions	Send specific consumer IDs service details, terms and conditions for review.	GET	GDBN (BN service provider)	GDBN (BN consumer	IE-1,IE-3,IE-16	O-X, F-1,F-2,F-3, F-6, F-9, F-10-F-11, SEC-1,SEC-2,D-1,D-2,D-3
1.1.7	On request	Activate Service	The service provider request the activation of a service for a consumer	GET	Service Provider	GDBN (BN service provider)	IE-1,IE-3, IE-13,IE-16	O-X, F-1,F-2,F-3, F-6, F-9, F-10-F-11, SEC-1,SEC-2,D-1,D-2,D-3,D-4,D-5
1.1.8	On request	Receive the request for selected service	The service provider receives a request from a consumer to access to one service	GET	GDBN (BN Consumers	GDBN (BN service provider)	IE-1, IE-3, IE-5, IE-13,IE-16,IE-17	O-X, F-1,F-2,F-3, F-6, F-9, F-10-F-11, SEC-1,SEC-2,D-1,D-2
1.1.9	On request	Access to consumer master data	The service provider selects the consumer characteristic and access to consumers information's	GET	GDBN (BN service provider)	GDBN (BN consumer	IE-1,IE-7, IE-8	O-X, F-1,F-2,F-3, F-6, F-9, F-10-F-11, F-16, SEC-1,SEC-2,D-1,D-2
1.1.10	On request	Access to consumer historical data	The Aggregator wants to know more about the consumer, the assets, the	GET	GDBN (BN service provider)	GDBN (BN Energy Repository)	IE-1,IR-5, IE-7, IE-8, IE-15	O-X, F-1,F-2,F-3, F-6, F-9, F-10-F-11, SEC-1,SEC-2,D-1,D-2

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			timing, possible contracts and metering data.					
1.1.11	On request	Technical analysis	The service provider evaluates business potential	EXECUTE	GDBN (BN service provider)	GDBN (BN service provider)		O-X, F-1,F-2,F-3, F-9,F-11,F-12, F-13
1.1.12	Recuring until contract acceptation	Send proposition	The service provider sends the offering	EXECUTE	GDBN (BN service provider)	GDBN (BN service provider)	IE-19	O-X, F-1,F-2,F-3, F-9,F-11,F-12, F-13
1.1.13	On request	Validation of the proposition	The supplier accepts terms and conditions of the service	EXECUTE	GDBN (BN Consumer	GDBN (BN service provider)	IE-18, IE-19	O-X, F-1,F-2,F-3, F-9,F-11,F-12, F-13
1.1.14	On request	Accept terms and conditions	The consent master data are updated for the period of the contract	EXECUTE	GDBN (BN Consumer	GDBN (BN service provider)	IE-18, IE-19	O-X, F-1,F-2,F-3, F-9,F-11,F-12, F-13
1.1.15	On request	Check GDPR master data	The consent master data are updated for the period of the contract	CREATE	GDBN (BN service provider)s	GDBN (BN master data mgmt)	IE-1, IE-2, IE-13, IE-17,IE-18	O-X, F-1,F-2,F-3, F-9,F-11,F-12,F-16, D-1,D-2
1.1.16	On request	Notification completeness record	The aggregator notifies the suppler about the completeness of the contract	EXECUTE	GDBN (BN service provider)	GDBN (BN consumer	IE-18	O-X, F-1,F-2,F-3, F-9,F-11,F-12,F-16, D-1,D-2
1.1.17	On request	Contract send	The service provider sends the contract	EXECUTE	GDBN (BN service provider)	GDBN (BN consumer	IE-19	F-1,F-2,F-3,F-12, F-20, D-1,D-2
1.1.18	On request	Contract signed	The contract is signed	GET	GDBN (BN Consumer	GDBN (BN service provider)	IE-19	F-1,F-2,F-3,F-12, F-20, D-1,D-2
1.1.19	On request	CRUD Contract meter data	The business master data are recorder into the BN to follow the contract execution	CREATE	GDBN (BN service provider)	GDBN (BN master data mgmt)	IE-19	F-1,F-2,F-3,F-12, F-20, D-1,D-2
1.1.20	On request	Communication of the contract signed	The consumer signs the contract	EXECUTE	GDBN (BN service provider)	GDBN (BN consumer	IE-1,IE-2,IE-3, IE-18	F-1,F-2,F-3,F-12, F-20
1.1.21	On request	Final check	The aggregator ensures the final completeness of the contractual and technical set up	CREATE	GDBN (BN service provider)	GDBN (BN master data mgmt)	IE-18	F-1,F-2,F-3,F-12, F-20
1.1.22	On request	CRUD of technical data	Service provider updates the consumer's technical master data	CREATE	GDBN (BN service provider)	GDBN (BN master data mgmt)	IE-18	F-1,F-2,F-3,F-12, F-20,D-1,D-2

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1.1.23	On request	Activation of the service	The aggregator starts the service execution	EXECUTE	GDBN (BN service provider)	REC Manager	IE-18	F-1,F-2,F-3,F-12, F-20, F-21, D-1,D-2,D-3
Scenario								
Scenario name :		**No. 1.2 - install flexible assets in consumers to explore flexibility capacity – consumer view**						
Step No.	**Event**	**Name of process/ activity**	**Description of process/ activity**	**Service**	**Information producer (actor)**	**Information receiver (actor)**	**Information Exchanged (IDs)**	**Requirement, R-IDs**
1.2.1	Recuring until the consumer finds the service	Energy Semantics to find services	Consumer looks for the best supplier with the help of a smart engine search considering its characteristics	REPEAT	GDBN (BN Customers)	GDBN (BN advanced)	IE-5	O-X, SEC-1,F-,F-3, F-4,F-12, D-2, QoS-2
1.2.2	One time during the duration of the contract	Pair with DER Provider	The consumer has found an interesting supplier and start the engage with him	CREATE	GDBN (BN Customers)	GDBN (BN advanced)	IE-1,IE-6	O-X, SEC-1,F-1,F-2,F-3, QoS-2
1.2.3	Can evolve over time	Select service to consume	The consumer selects the service and indicates extra information about its installation, certificates etc.	EXECUTE	GDBN (BN Customers)	GDBN (BN advanced)	IE-1, IE-2	O-X, D-1, F-1,F-2,F-3, F-7,SEC-1,SEC-2
1.2.4	One time during the duration of the contract	Send the request for selected service	The consumer decides to go for a service	GET	GDBN (BN Customers)	GDBN (BN service provider)	IE-13	O-X, D-1, F-1,F-2,F-3, F-13,SEC-1,SEC-2
1.2.5	On request	Access to historical energy data	The supplier access to the consumption data and technical data describing the installation	GET	GDBN (BN service provider)	GBBN (BN for Energy Repository)	IE-15	O-X, SEC-1,F-1,F-2,F-3, F-15, D-1, D-2
1.2.6	One time during the duration of the contract	Send proposition	The supplier run an internal analysis and organise a visit at customer location (state change). When the analysis done the supplier send an offering	EXECUTE	GDBN (BN service provider)	GDBN (BN Customers)	IE-13	O-X, SEC-1,F-1,F-2,F-3, F-4, F-6, F-9, QoS-1, QoS-2
1.2.7	One time during the duration of the contract	Validation of the proposition	The consumer accepts the offering	EXECUTE	GDBN (BN Customers)	GDBN (BN service provider)	IE-17	O-X, SEC-1,F-1,F-2,F-3,F-13

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1.2.8	One time during the duration of the contract	Accept terms and conditions	The consumer accepts terms and conditions of the service	EXECUTE	GDBN (BN Customers)	GDBN (BN Customers)	IE-17	O-X, F-1, F-2, D-1, D-2
1.2.9	One time during the duration of the contract	CRUD GDPR master data	The consent master data are updated for the period of the contract	CREATE	GDBN (BN Customers)	GDBN (BN master data mgmt)	IE-17	O-X, D-1, D-2
1.2.10	One time during the duration of the contract	Notification completeness record	The supplier is informed about the completion	GET	GDBN (BN Customers)	GDBN (BN service provider)	IE-18	F-1,F-2,F-3, D-1, D-2
1.2.11	One time during the duration of the contract	Contract sent	The supplier sends the contract	EXECUTE	GDBN (BN service provider)	GDBN (BN Customers)	IE-19	O-X, F-1, F-2, F-6, F-7,F-8,F-9, F-10, F-11, F-13, D-1,D-2
1.2.12	One time during the duration of the contract	Contract signed	The consumer signs the contract	EXECUTE	GDBN (BN Customers)	GDBN (BN Customers)	IE-17,IE-18	O-X, F-1, F-2, F-6, F-7,F-8,F-9, F-10, F-11, F-13, D-1,D-2
1.2.13	One time during the duration of the contract	CRUD Contract mater data	The contract is signed	CREATE	GDBN (BN Customers)	GDBN (BN master data mgmt)	IE-17,IE-18	O-X, F-1, F-2, F-6, F-7,F-8,F-9, F-10, F-11, F-13, D-1,D-2
1.2.14	One time during the duration of the contract	Communication of the contract signed	The business master data are recorder into the BN to follow the contract execution	EXECUTE	GDBN (BN Customers)	GDBN (BN Customers)	IE-17,IE-18	O-X, F-1, F-2, F-6, F-7,F-8,F-9, F-10, F-11, F-13, D-1,D-2
1.2.15	On request	Activation of the service	The service can start	EXECUTE	REC Manager	REC Manager	IE-18	O-X, F-1, F-2, F-6, F-7,F-8,F-9, F-10, F-11, F-13, D-1,D-2
1.2.16	On request	CRUD of technical consumer data	The supplier ensures the follow up of the installation and update the consumer equipment's with the corresponding technical enhancements	CREATE	REC Manager	GDBN (BN master data mgmt)	IE-18	O-X, F-1, F-2, F-6, F-7,F-8,F-9, F-10, F-11, F-13, D-1,D-2

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Scenario								
Scenario name :		***No. 2 – Flexibility Aggregation***						
Step No.	***Event***	***Name of process/ activity***	***Description of process/ activity***	***Service***	***Information producer (actor)***	***Information receiver (actor)***	***Information Exchanged (IDs)***	***Requirement, R-IDs***
1.2.1	Recuring until the aggregator defines services	Activate / Deactivate services	The Aggregator define from the list of service the one that are active or not and for which period	REPEAT	GDBN (BN Aggregator	GDBN (BN Aggregator	IE-3,IE-5,IE-6	O-X, D-1,F-1, F-2,F-3, F-6, F-9, F-10, F-11, F-16
1.2.2	On request	Receive the request for selected service	The Aggregator receive a request from a supplier to access to one service	GET	GDBN (BN service provider)s	GDBN (BN Aggregator	IE-3,IE-6, IE-7	O-X, F-1,F-2,F-3, F-6, F-9, F-10-F-11, SEC-1,SEC-2,D-1,D-2
1.2.3	On request	Access to service supplier master data	The Aggregator selects the service characteristic and access to supplier information's	GET	GDBN (BN Aggregator	GDBN (BN service provider)s	IE-3,IE-5, IE-6	O-X, F-1,F-2,F-3, F-6, F-9, F-10-F-11, SEC-1,SEC-2,D-1,D-2
1.2.4	On request	Access to service supplier master data	The Aggregator wants to know more about the service, the outcomes, the timing and possible contracts	GET	GDBN (BN advanced)	GDBN (BN Aggregator	IE-3	O-X, F-1,F-2,F-3, F-6, F-9, F-10-F-11, SEC-1,SEC-2,D-1,D-2
1.2.5	On request	Access to flexibility	The Aggregator needs to access to the flexibility model of the supplier	GET	GDBN (BN Aggregator	REC Manager	IE-10, IE-20, IE-21	O-X, F-1,F-2,F-3, F-6, F-9, F-10-F-11, SEC-1,SEC-2,D-1,D-2
1.2.6	On request	Access to flexibility	The Aggregator needs to access to the flexibility quantities of the supplier	GET	GDBN (BN service provider)s	GBBN (BN for Energy Repository)	IE-10 IE-20, IE-21	O-X, F-1,F-2,F-3, F-6, F-9, F-10-F-11, SEC-1,SEC-2,D-1,D-2
1.2.7	On request	Technical analysis	The Aggregator run an internal process to evaluate business potential	EXECUTE	GDBN (BN Aggregator	GDBN (BN Aggregator	IE-11	O-X, F-1,F-2,F-3, F-9,F-11,F-12,F-16
1.2.8	Recuring until contract acceptation	Send proposition	The Aggregator sends the offering	EXECUTE	GDBN (BN Aggregator	GDBN (BN service provider)s	IE-22	F-1,F-2,F-3, F-9,F-11,F-12,F-16, F-19
1.B.15	On request	Validation of the proposition	The supplier accepts terms and conditions of the	EXECUTE	GDBN (BN service	GDBN (BN Aggregator	IE-9, IE-17, IE-18	F-1,F-2,F-3, F-9,F-11,F-12,F-16,F-19

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			service		provider)s			
1.B.16	On request	Accept terms and conditions	The consent master data are updated for the period of the contract	EXECUTE	GDBN (BN service provider)s	GDBN (BN Aggregator	IE-9, IE-17, IE-18	F-1,F-2,F-3, F-9,F-11,F-12,F-16,F-19
1.B.17	On request	Check GDPR master data	The consent master data are updated for the period of the contract	CREATE	GDBN (BN service provider)s	GDBN (BN Aggregator	IE-9, IE-18	F-1,F-2,F-3, F-9,F-11,F-12,F-16,F-19, D-1,D-2
1.B.18	On request	Notification completeness record	The aggregator notifies the suppler about the completeness of the contract	EXECUTE	GDBN (BN Aggregator	GDBN (BN service provider)s	IE-18	F-1,F-2,F-3, F-9,F-11,F-12,F-16,F-19, D-1,D-2
1.B.19	On request	Contract send	The Aggregator sends the contract	EXECUTE	GDBN (BN Aggregator	GDBN (BN service provider)s	IE-19	F-1,F-2,F-3,F-12, F-20
1.B.20	On request	Contract signed	The contract is signed	GET	GDBN (BN service provider)s	GDBN (BN Aggregator	IE-19	F-1,F-2,F-3,F-12, F-20, D-1,D-2
1.B.21	On request	CRUD Contract meter data	The business master data are recorder into the BN to follow the contract execution	CREATE	GDBN (BN Aggregator	GDBN (BN master data mgmt)	IE-19	F-1,F-2,F-3,F-12, F-20, D-1,D-2
1.B.22	On request	Communication of the contract signed	The aggregator signs the contract	EXECUTE	GDBN (BN Aggregator	GDBN (BN service provider)s	IE-18	F-1,F-2,F-3,F-12, F-20
1.B.23	On request	Final check	The aggregator ensures the final completeness of the contractual and technical set up	CREATE	REC Manager	GDBN (BN master data mgmt)	IE-18	F-1,F-2,F-3,F-12, F-20
1.B.24	On request	Activation of the service	The aggregator start the service execution	EXECUTE	GDBN (BN Aggregator	REC Manager	IE-18	F-1,F-2,F-3,F-12, F-20, F-21

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5 Information exchanged

Information exchanged			
Information exchanged (ID)	***Name of information***	***Description of information exchanged***	***Requirement, R-IDs***
IE-1	Consumer profile	Basic information to register a consumer, including personal identification : name, surname, location, email account	O-X
IE-2	Service provider profile	Basic information to register a service provider, including identification : name, location, email (as username), contact, type of services	O-X
IE-3	Service description	Information that details a service, namely: name, API URL (if applicable), description, targets (client types, geographic locations), contact person, support centre contacts, conditions.	F-10
IE-4	Metering Data	Metering data account for active power consumption in periods of 15 minutes for spanning several hours (ideally 24)	F-4
IE-5	Semantic representation of consumer	Consumer representation in RDF format accounting to its characteristics namely location	F-12
IE-6	Service List	A list composed by IE-3 messages	F-10
IE-7	Flexible asset	Description of a flexible asset	F-5
IE-8	List of Flexible asset	A list composed by IE-7 messages	F-7,F9
IE-9	Consent	One stakeholder provides consent to other stakeholder in scope of a service.	O-1, O-4
IE-10	Flexibility capacity	The measurable capacity to be flexible (i.e., change consumption profile) of an asset.IE	O-X, F-8, F-9
IE-11	Aggregated flexibility capacity	Grouping of flexibility capacity by aggregating several loads represented by IE-10 messages. Can represent one household or a group of households.	O-X, F-8, F-9
IE-12	Tips and advice for service	Tips and direct advice towards flexibility and sustainable energy consumption.	O-X, F-9
IE-13	Service subscription	Service onboarding details that pair a consumer with a service provider.	O-X, F-6,F-10
IE-14	Payment invoice	Cash flow output generating an invoice	O-X, F-14
IE-15	Historical data	Consumer's historical metering data in 15 minutes periods.	O-X,F-15
IE-16	Service terms and conditions	Services specific terms and conditions	O-X
IE-17	Form acknowledgement	Stakeholder accepts/reject action. This is multi scope. Can be used for several purposes. Context is enclosed in request.	O-X
IE-18	Acknowledgment notification	Acknowledges operation success. This is multi scope. Can be used for several purposes. Context is enclosed in request.	O-X

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IE-19	Service Contract	Service provider's contract to onboard another stakeholder	O-X
IE-20	Aggregator Profile	Basic information to register an aggregator, including identification : name, location, email (as username), contact, type of services, geographical interest area.	O-X
IE-21	Flexibility Model	Flexibility model details included in a service.	
IE-22	Flexibility offering	Flexibility offering resulting from the pre-qualification process.	F-19

6 Requirements

Security Requirements		
Categories ID	**Category name for requirements**	**Category description**
Sec	Security	Authentication of user, confidentiality, integrity, prevention of denial of service, non-repudiation or accountability, error management
Requirement R-ID	**Requirement name**	**Requirement description**
SEC-1	Service authentication	All parties should be trusted.
SEC-2	Eavesdropping	Ensuring confidentiality, avoiding illegitimate use of data, and preventing unauthorized reading of data, is crucial. • Web services should run over Transport Socket Layer (TSL) File sharing between two machines should occur over FTPS or using pre-agreed encrypted format
SEC-3	Acknowledge timeout	One minute for any M2M communication.

Data Management Requirements		
Categories ID	**Category name for requirements**	**Category description**
D	Data Management	Type of source of data, correctness or validity of data, timeliness or time stamping of data, volume of data, synchronization, or consistency of data across systems, timely access to data, validation of data across organizational boundaries, transaction management, data naming, identification, formats across disparate systems, maintenance of data and databases
Requirement R-ID	**Requirement name**	**Requirement description**
D-1	Data persistence	Data is persistently store in the platform database.
D-2	Data validation	All data must be validated on each data exchange
D-3	Data validation from multiple sources	Mapping of data items is required for data from different sources
D-4	Management of data across organizational boundaries	Data exchanges go across organizational boundaries.
D-5	Management of data formats in data exchanges	Conversion of data format I handled by a "converter" at Information receiver site.
Functional Requirements		
Categories ID	**Category name for requirements**	**Category description**

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F	Functional	Essential functionalities that build the core concept of the service/SUC.
Requirement R-ID	**Requirement name**	**Requirement description**
F-1	Login in the GDBN	Any FO, aggregator, retailer, producer or industrial consumer has the ability to login into the GDBN web page. A login link must be available for these entities.
F-2	Registration in the GDBN	Any FO, aggregator, retailer, producer or industrial consumer has the right of registration on the GDBN platform.
F-3	Access to the service	After the login, a webpage link for each available service provided by the GDBN should be available.
F-4	Consumer/prosumer metering data	Request the user's consumption data (energy measured with 15 min interval data). If available, also request user's PV production data (energy measured with 15 min interval). Request user's point of consumption geographical coordinates, to estimate PV production.
F-5	Consumer assets available	Consumer has assets with flexibility potential installed with connectivity capabilities .
F-6	Service provider digital service available	Service provider has a service with a digital interface towards consumers that targets classes of specific assets, or classes of consumers.
F-7	Service providers control flexible assets	Flexible assets get controlled by receiving commands to change their consumption profile or scheduled operation.
F-8	Consumers/prosumers share their flexibility capacity with third-party services	The flexibility potential is computed and shared with third-party services, namely those of service providers.
F-9	Consumers/prosumers hold a profile that characterises them	A profile represents the identity and characteristics of a consumer/prosumer for several purposes.
F-10	Service providers make service available in the platform.	Service providers have one or more services available.
F-11	Unique ID for grid users and aggregator	A unique ID should be defined for eligible grid users and aggregators on the GDBN. This ID is shared between the GDBN and the DSO. DSO can use this ID to identify the flexibility provider to assess the offers.
F-12	Metadata is collected and fed to semantic system	Metadata is encoded in a semantic system to derive and discover new data links.
F-13	Consumer/ prosumer subscribes services	Service onboarding details that pair a consumer with a service provider.
F-14	Invoice is generated	An invoice is generated to count the
F-15	Consumer accesses / shares historical data	Consumer has access to his/her historical data.
F-16	Aggregator needs consumer's geographical location	Consumer's geographical location is needed to map consumer's geographical positioning in an area.
F-17	Aggregator takes consumer's flexibility capacity to market	Consumer's flexibility capacity is grouped by an aggregator and is included as part of a bid that is taken to market.
F-18	Consumers are paired with service providers	Consumers are paired with service providers according to flexibility objectives, available assets, and geographic location.
F-19	Aggregator sends a flexibility offering	A flexibility aggregation offer is sent.

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F-20	Service contract	A service contract exists and bounds the relationship between two stakeholders for a time period.
F-21	Service can be activated and deactivated	A service provider may activate or deactivate a service.

Other Requirements		
Categories ID	**Category name for requirements**	**Category description**
O	Regulatory obligation related to privacy	2016/679 (General Data Protection Regulation)
Requirement R-ID	**Requirement name**	**Requirement description**
O-1	Data processing consent	Personal data may not be processed unless there is at least one legal basis to do so.
O-2	Data retention policy	Data retention policy outlines the specific sensitive time period data can be retained, plus how it will be disposed of when the time to do so comes.
O-3	Right to access, rectify, erasure, restriction	The data subject shall have the right to obtain from the controller without undue delay the access/rectification/erasure/restriction of inaccurate personal data concerning him or her.
O-4	Data transfer consent	Personal data may not be transferred to a third-party if the data subject did not agree and the third party provide appropriate safeguard.
O-X	All GDPR constraints also apply.	All requirements in this category.

Quality of Service Requirements		
Categories ID	**Category name for requirements**	**Category description**
QoS	Quality of Service – Non-Functional requirements	Generic properties that service/SUC should provide – quality attributes.
Requirement R-ID	**Requirement name**	**Requirement description**
QoS-1	Logging access	Any access to the data is logged in the database.
QoS-2	Metadata is derived from key data types	Metadata is derived from main types.

5 Common Terms and Definitions

Common Terms and Definitions	
Term	**Definition**
CRUD	Create-Remove-Update-Delete
GDBN	Grid Data Business Network
GDPR	General Data Protection Regulation
M2M	Machine-to-machine
MGMT	Management
QoS	Quality-of-Service
REC	Renewable Energy Community

10.4. SUC13.1 – Optimize residential demand-side flexibility

1 Description of the use case

1.1 Name of the use case

ID	*Area / Domain(s)*	*Name of Use Case*
SUC 13-1	Select from: (1) **Local energy sharing and flexibility market**; (2) Grid-centric flexibility; (3) TSO-DSO flexibility coordination; (4) **Cross-sector**	Optimize residential demand-side flexibility

1.2 Version management

Version Management			
Version No.	*Date*	*Name of Author(s)*	*Changes*
0.1	26.06.2023	Francisco Martín	First Draft
0.2	07.07.2023	Francisco Martín	Second Draft
0.3	04.09.2023	JC Pazzaglia	Renumbering (13.1) and adding EV / EVSE paragraphs

1.3 Scope and objectives of use case

Scope and Objectives of Use Case	
Scope	This UC describes the services to optimize residential demand-side flexibility.
Objective(s)	The SUC will address the following questions: • How residential demand gets involved? • How is the normal operation performed? • How is the flexibility of residential demand optimized?
Related business case(s)	BUC 13 - Combine energy services (production, storage) with mobility

1.4 Narrative of use case

Narrative of Use Case
Short description
This SUC gathers the different use cases needed to optimize the residential demand side flexibility. This starts with the client onboarding stage where the device able to monitor and control energy assets are installed. Once installed the device can be managed following energy efficiency optimization orders (normal operation) or following flexible activations (flexible operation). In all cases, different KPIs are being monitored to obtain insights from clients usage of interfaces, devices, energy behaviours and monetary indicators.
Complete description
In this document different uses cases are going to be described to conform the system use case of enabling the optimization of residential demand flexibility. Each of the steps needed for this are going to be described below. **1. Client Onboarding** **a. Clients' selection**

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A potential user gets interested in being part of the pilot. Once the potential users show interest, a deep analysis of their facilities is performed. If their appliances and electrical devices satisfy the minimum to participate and become a new member they are approved and join the pilot.

b. Best initial installation resolution

Once a potential user has been accepted the user becomes a prosumer that needs to make the sign-up procedure shown in the next step. In parallel, the aggregator and the pilot leader decide what devices could be the best ones to be controlled by the user to create plans for the end users and be aware of what devices needs to be ordered for them.

c. Sign up procedure for users and installers.

The newcomer, that is the prosumer, fills its private data and sign the terms and conditions of the project. Then, the aggregator offers different plans that the user could join based on step 2. In the same way, a new installer should sign their T&C and fill their information. In particular, the installer fills in the employee and company information as well as the employee's availability. With all the data gathered, the installer knows which devices are intended to be installed at every prosumer location, The whole process is supervised by the pilot leader where the installation is taking place.

d. Installation process

The prosumer applies to a plan offered at the aggregator level and fills a survey. This survey is about all the appliances and their characteristics. Once the aggregator has analysed the data and information provided by the prosumer it gives (or not, depending on the analysis) the final approval to arrange the installation. The installer gets the specific characteristics of the client who will receive the installation of the devices ordered by the aggregator and the pilot leader. It assesses the installation after it has made the budget and it has been approved by the pilot leader. The installation starts right after these steps have concluded. Whenever the configuration will include EV/EVSE, the prosumer will need to onboard his vehicle(s) by providing the technical details and optionally provides the credentials to access to the data stored in the car manufacturer cloud or a dedicate aggregator service.

2. Normal Operation

a. Storage of data into the cloud

Data saved in the cloud could have different origins. Data could be originated on the devices, measuring different parameters (temperature, consumption…) with some sample periods. In addition, other data could come directly from the user (references, operation modes…). Finally, data could arrive from requests to external sources. External sources include meteorological agencies (providing weather data) and market operator as well as transmission and distribution system operators (providing electrical grid data, constraints for next periods, participation information, prices…).

All this data is received as inputs from different services to make analysis or control the devices with intelligent algorithms. This data will be used to run electric algorithms, forecasting… to be as efficient and flexible as possible.

b. Relationship with interfaces

User interfaces are the main tool for prosumers to interact with their devices. User interface plots the information to give visibility to the prosumer about the main variables or most useful ones. It is through the user interface where the prosumer has a relationship, decision making on the status of the devices and manageability of the devices. Prosumer can change the devices operation mode, update its desired schedule for manual mode, modify the temperature references, indicate the desired EV SOC and time, provide data for mobility and check information. All the updates in any configuration made by the prosumer because of its relationship with interfaces should be noted and saved in the cloud database, to allow the service developer platform to use the last inputs from the prosumers.

c. Data flow to devices

Data of different types are sent to the devices to run according to the prosumer's habits and needs. Data could be from operational modes to bounds (like temperature limits, electric vehicle charge limits) to actions (on/off), etc. Data could be stored in the cloud database as result of services or as input of the user. The service developer platform will send data should sent to the device when it is needed.

d. Forecasts

Forecasting is essential within the project to have a better understanding of behaviours, weather and electric market movements among all fields. Fed by the cloud database, which provides historical real data, the aggregator performs among others forecast of weather (e.g., solar irradiation or wind), user behaviour (e.g., occupation, comfort references, process demands, EV connection) and electric markets (e.g., Prices, market activations). All the forecasting will be stored in the cloud.

e. Energy efficiency optimisation

Forecasts stored in the cloud are used by the aggregator to analyse the best economic consumption which means to consider thermal inertias and electric energy prices to allocate the consumption in low price periods satisfying

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comfort or other user constraints. Since the real conditions (solar production, prices, consumptions…) change in real time, this optimization runs each quarter of an hour updating the values for that current period considering forecast for at least the end of the next day to prepare consumptions accordingly. In the specific case of the piloting of the EV charging exhibits some peculiarities since EV are1) by nature mobile: the EV is not always connected and therefore the flexibility capacity less predictable; 2)provides a potential flexibility in term of time shifting and duration of several hours; 3) in term of energy consumption/storage above standard household devices. The prosumers should enable to have an insight on EV usage (arrival, departure time and respective State of Charge - SoC) that will provide the possibility to best leverage the flexibility potential.

The aggregator commands the devices accordingly to results obtained for the current quarter period and provides useful efficiency insights to the service developer. Other service developers could use the outputs to show consumption forecasts or develop gamification algorithms.

f. Real-time temperature control

The temperature in a household is one of the necessities a prosumer demands implying energy. The exact temperature comfort boundaries depend on the prosumer but maintaining the temperature within bounds depends on the aggregator and its real-time temperature control. Thus, the aggregator launches forecasts to analyse the temperature in the next hours and the energy needed to maintain it under limits, at the same time, it applies the use case of energy efficiency optimisation to send power reference to devices.

The temperature monitoring and control is performed in real-time with the data stored in the cloud, which is checked consequently. The internal control always checks the operational mode, the power references and the temperature bounds of the device. Four different modes are typically present:

- *Automatic:* where the devices follow power references if the temperature within limits,
- *Manual*, where the temperature is doing a hysteresis control around the temperature reference. The manual mode does not allow the device to participate in demand response nor flexibility.
- *On*, the device is always connected following their own intelligence in the case of heat pumps.
- *Off*, the device is switched off.

3. Flexible Operation

a. Submission of offers to the electric markets.

Once the market clearer, who depending on the market the aggregator is operating can be the market operator, the transmission system operator, or the distribution system operator, opens the reception offers period. the aggregator will send their offers.

b. Optimisation to get consumption flexibility.

Before sending the offers, the aggregator should decide them (typically the day-ahead for balancing services). The first thing the aggregator does is to get (tomorrow's) quarterly/hourly forecast variables like activations, consumptions, expected renewables generation, etc. With the forecast done, it gets the best quarterly economic consumption to both the prosumers. Considering the individual result of each prosumer, the aggregator analyses the available flexibility in the periods where the ratio activation/price could be more profitable. The offers submission is performed as explained in the previous case.

c. Commitments' reception

After the market clearance, the market clearer set prices and/or accept some services. It sends then the quarter or hourly prices and requirements to the participants including the aggregator.

d. Real-time power control

This use case represents the power control implemented by the aggregator to guarantee the correct behaviour inside each quarterly period. It is useful to avoid power consumption over the power contracted and to manage flexibility. To do this, the aggregator checks the current activation stored in the cloud database that also provides current device consumptions. If needed because of flexibility, optimization or prosumer necessities, the aggregator adjusts power by turning on/off the devices.

e. Flexibility activation

The transmission and distribution system operators individually or jointly trigger contingencies when flexibility is needed. This information is stored in the cloud database and received by the aggregator, who in real-time updates activations forecast for next optimizations and activates real-time power control if needed.

f. Market simulation and virtualisation

In some cases where markets are still not open or requirement are not satisfied, the aggregator needs to have a market simulation and virtualisation that starts with the actor virtual market which is one of the services. It runs a

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market routine with forecasted data sent by the cloud database, obtaining simulated outputs that are stored in the cloud to be used afterwards by the aggregator. **4. Performance monitoring** This use case explains how service monitoring is performed. A series of KPIs is defined to measure specific variables extracting valuable data on how the project is performing. Each service developer measures specific variables, which include savings analysis, system behaviours, results comparisons to expected ones, commitments compliance and forecasting performance, among others.

A subset of these services will be implemented depending on pilot participants:

N	Service	Category	Main Provider
1	Optimization of thermal consumption considering self-consumption, peak shaving and ToU tariffs	CC-E-BE, CC-E-AE, CC-CS-HC	TV
5	Smart Charging Point Management System	CC-E-BE, CC-E-AE, CC-CS-MO	SAP
6	Customized interoperable digital home energy management systems	CC-E-FX	INESC
9	Aggregation (VPP) of thermal flexibility for DSO congestion management & voltage control	CC-E-FX	TV
12	Thermal appliances retrofit (or new devices) and efficient control	CC-CS-HC	TV
14	Charging Point Supervision	CC-CS-MO	SAP
16	Ecosystem for flexibility valorization and customer engagement	CC-CE-DM, CC-CE-GM, CC-CE-TR	STEMY

1.5 Use case conditions

Use case conditions
Assumptions
1. The detailed services from stakeholders are not described in this SUC.
Prerequisites
-

1.6 Further Information to the use case for classification / mapping

Classification Information
Relation to other use cases
BUC 13 - Combine energy services (production, storage) with mobility
Level of depth
System use case (SUC) use case which describes in detail the functionality/technological solutions of (a part of) a business process.
Prioritisation
Normal Level of Priority – To be demonstrated in France (Pilot 3.5 & 3.6)
Generic, regional or national relation
Generic

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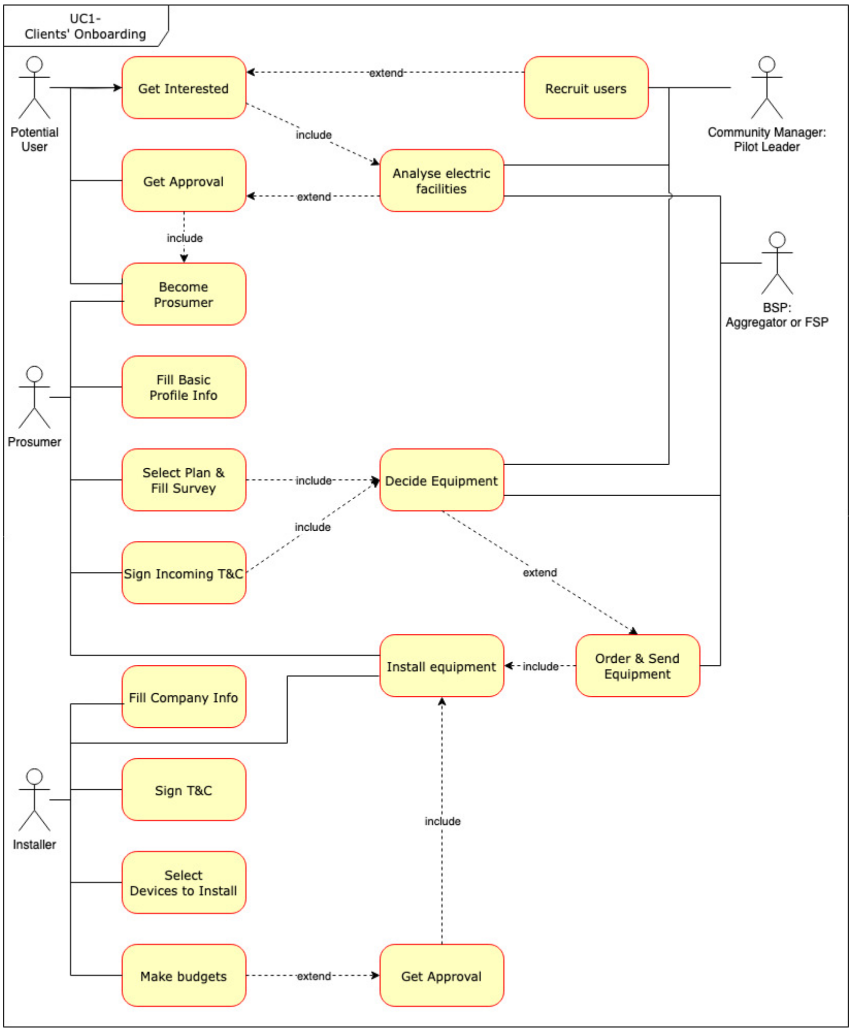
Nature of the use case
Customer enablement Services (CC-CE)
Further keywords for classification
Residential Flexibility, Ecosystem, Customer Journey.

1.7 General Remarks

General Remarks
Is used for further comments which are not considered elsewhere.

2 Diagrams of use case

Diagram(s) of use case


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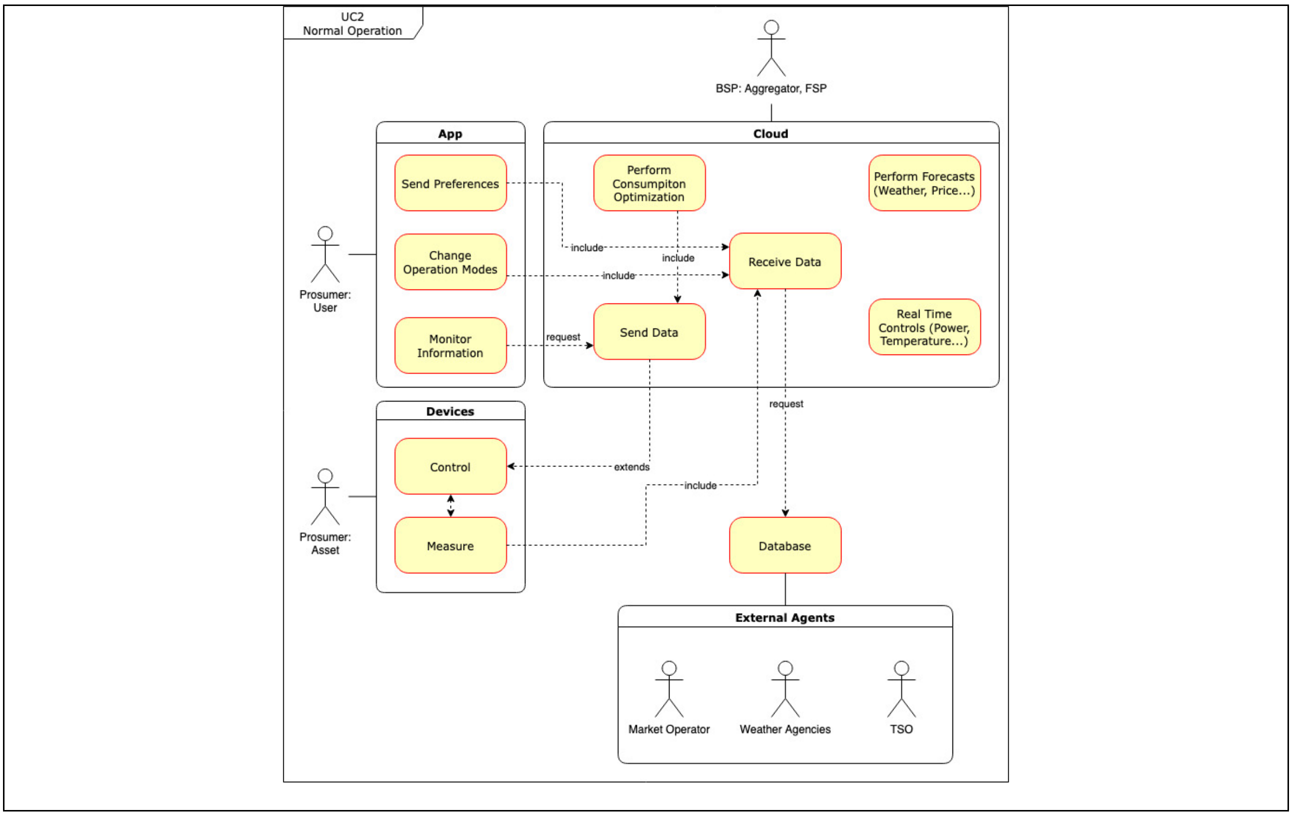

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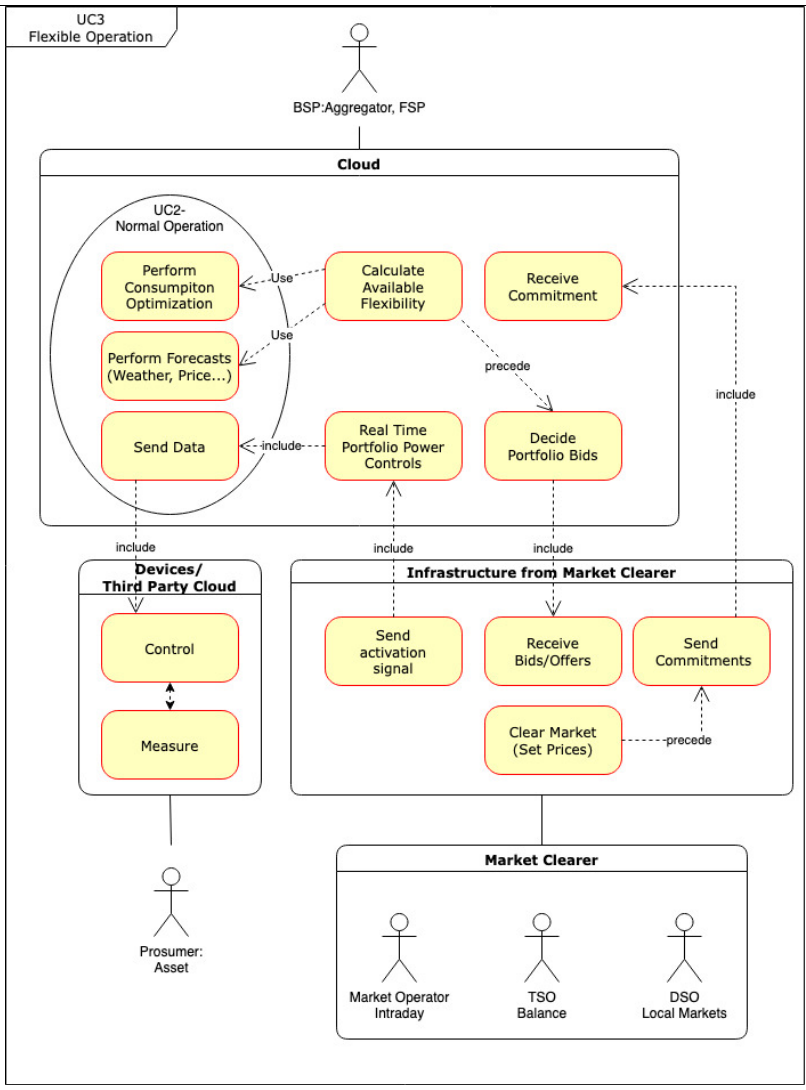

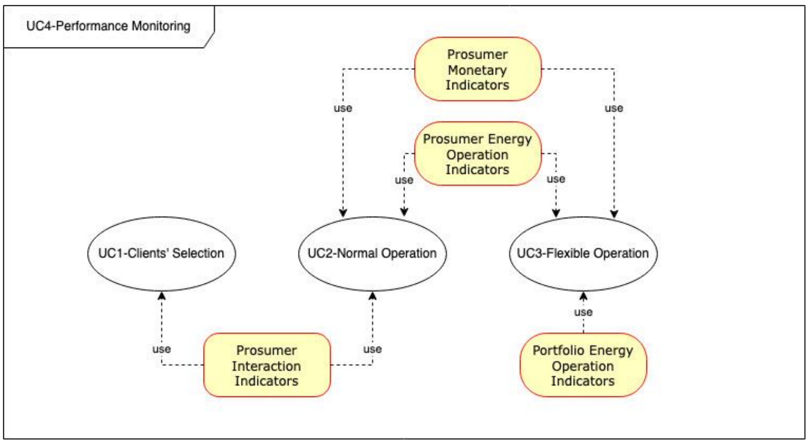

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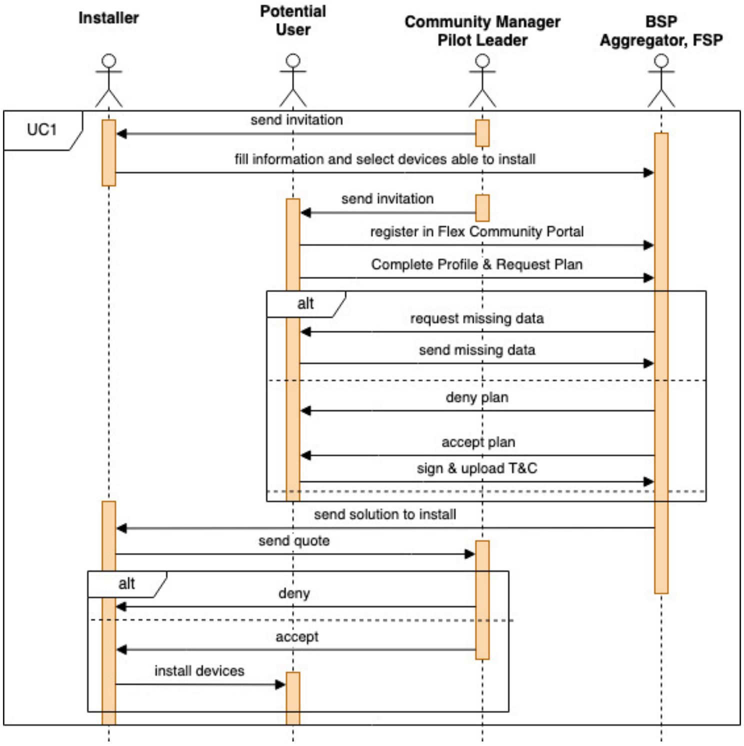
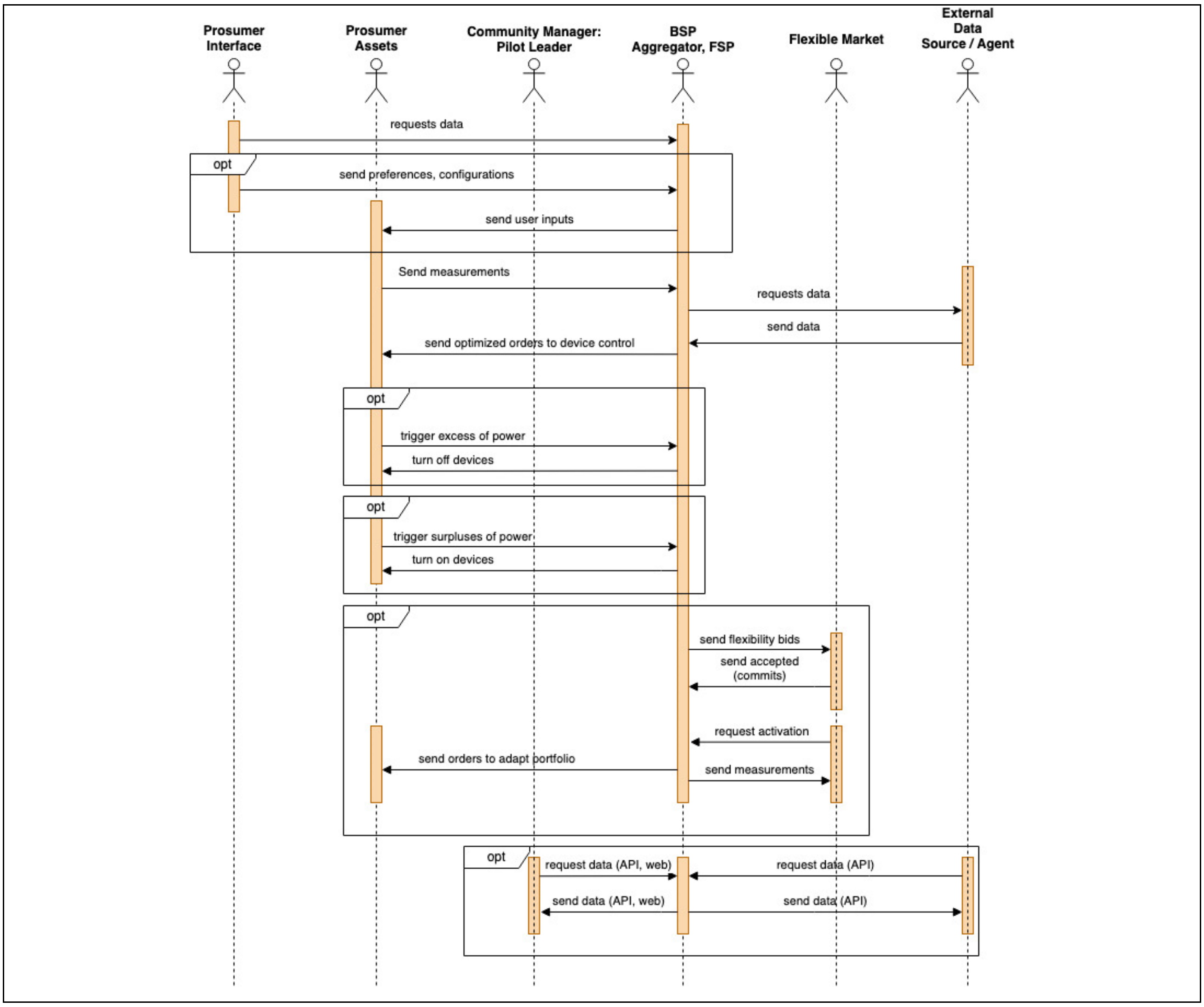
Sequence Diagram:





3 Technical details

3.1 Actors

Actors		
Actor Name	***Actor Type***	***Actor Description***
DSO	Business Role (BeFlexible role model, BRIDGE HEMRM)	Responsible for the security of supply and reliability of the distribution network. It continuously monitors the grid to detect potential issues and, whenever necessary, it uses multiple resources to solve such problems, including network reconfiguration and/or requesting assistance from market operators or directly from contracted customers.
Local Flexibility Market Operator	Business Role (BeFlexible role model, BRIDGE HEMRM)	DSO can be this agent. Responsible for the local flexibility market services.
BSP	Business Role (BeFlexible role model, BRIDGE HEMRM)	A party with reserve-providing units or reserve-providing groups able to provide balancing services to one or more LFC Operators. Additional information: Based on Electricity Balancing - Art.2 Definitions.

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		BSP can also be an extension of BRP. Example: Aggregator, Flexibility Services Provider (FSP)
Aggregator	Business Role (BeFlexible role model, BRIDGE HEMRM)	Aggregates (i.e., collects and combines) multiple resources for usage by a service provider for energy market services.
Flexible Service Provider	Business Role (BeFlexible role model, BRIDGE HEMRM)	A party providing flexibility services to energy stakeholders via bilateral agreements or flexibility markets. An FSP can also be a BSP if enabled to the LFC services. In the Bridge HEMRM, FSP is an extension of BSP. FSP offer services potentially to all the system operators, directly or through market operators. Example: BSP or Aggregator.
Consumer	Business Role (BeFlexible role model, BRIDGE HEMRM)	Party connected to the grid which purchases and consumes electricity.
Prosumer		Consumer that could have PV panels
Market Operator	Business Role (BRIDGE HEMRM)	Provides a service whereby the offers to sell electricity are matched with the bids to buy it.
TSO	Business Role (BeFlexible role model, BRIDGE HEMRM)	Responsible for security of supply and reliability of a transmission network and also real time operation and monitoring, building, expanding, and maintaining the transmission system.
Community Manager/Pilot Leader	Business Role (BeFlexible role model)	Entity responsible of managing the end-users in a demo location.
Third-party/ External Data Source		Any external agent. Example: Partners of consortium, Companies, Data sources.
Installer		Person in charge of connect the needed physical equipment to control an asset.

3.2 References

References						
No.	***References Type***	***Reference***	***Status***	***Impact on use case***	***Originator / organisation***	***Link***
	Technical Report	Harmonized Electricity Market Role Model (HEMRM)	Public	Role Model	BRIDGE	https://energy.ec.europa.eu/system/files/2021-06/bridge_wg_regulation_eu_bridge_hemrm_report_2020-2021_0.pdf

4 Step by step analysis of use case

4.1 Overview of scenarios

Scenario conditions						
No.	**Scenario name**	**Scenario description**	**Primary actor**	**Triggering event**	**Pre-condition**	**Post-condition**
1	Engage consumers in the aggregator service and install devices for	Concerns the inclusion and supply of flexible DER to consumers as a service subscription.	Aggregator	Occurs after Local Pilot invitation	DER assets.	Consumers contribute with flexibility towards the value-chain and collect incentives.

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	normal operation					
2	Normal operation of devices: Peak shaving	Concerns the capability to reduce excess consumption	Aggregator	Occurs sporadically	Consumer part of the Aggregator system	Go to normal power levels
3	Normal operation of devices: Avoid surpluses	Concerns the capability to reduce injection in the grids.	Aggregator	Occurs sporadically	Consumer part of the Aggregator system	More usage of local generation.
4	Flexible operation: Acceptance of bids and activation	Concerns the capability calculate bids and follow activations	Aggregator	Occurs frequently	Consumer part of the Aggregator system and requested to participate in flexible activities.	More usage of local generation.

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4.2 Steps – Scenarios

Scenario								
Scenario name :	***No. 1 - Engage consumers in the aggregator service and install devices***							
Step No.	***Event***	***Name of process/ activity***	***Description of process/ activity***	***Service***	***Information producer (actor)***	***Information receiver (actor)***	***Information Exchanged (IDs)***	***Requirement, R-IDs***
1	Onboard consumers	Onboard Consumers	Registered consumers are onboarded on Aggregator platform (Flex community in Stemy case)	CREATE	Consumer	Aggregator	4	GDPR-[1-4] SI [1-2] CI [1-2]
2	Plans and Devices are recommended to consumers	Consumer service recommendations	Service recommendations are delivered to consumers suggesting the requests of plans (Technology, Flex, Solar community) from the available plan catalogue.	EXECUTE	Aggregator Pilot leader	Consumer	5	GDPR-[1-4] SI [1-2] CI [1-2]
3	Installation of devices for flexible assets	Installs assets	Installers selected by the pilot leader deploy the equipment	REPEAT	Installers	Consumer	-	GDPR-[1-4] SI [1-2] CI [1-2]
4	Consumers starts using the service	Normal Operation	Users starts to monitor and control flexible asset's data.	REPORT	Consumer	Aggregator	1	GDPR-[1-4] SI [1-2] CI [1-2]
5	Devices can receive orders to work in energy efficiency mode	Energy efficiency operation	Devices follows the orders from the cloud consumption optimization.	EXECUTE	Aggregator	Consumer	3	GDPR-[1-4] SI [1-2] CI [1-2]

Scenario								
Scenario name :	***No. 2 - Normal operation of devices: Peak shaving***							
Step No.	***Event***	***Name of process/ activity***	***Description of process/ activity***	***Service***	***Information producer (actor)***	***Information receiver (actor)***	***Information Exchanged (IDs)***	***Requirement, R-IDs***
1	Consumers are using the devices	Normal Operation	Users starts to monitor and control flexible asset's data.	REPORT	Consumer	Aggregator	1	GDPR-[1-4] SI [1-2] CI [1-2]

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2	Occurs periodically (daily/hourly)	Power consumption excess.	Power consumption is close to the maximum allowed (contracted power)	REPORT /GET	Devices	Aggregator	2	GDPR-[1-4] SI [1-2] CI [1-2]
3	Occurs periodically (daily/hourly)	Reduce power	Power controls send to more manageable device the order to reduce their power	EXECUTE	Aggregator	Devices	3	GDPR-[1-4] SI [1-2] CI [1-2]

Scenario								
Scenario name :	***No. 3 - Normal operation of devices: Avoid surpluses***							
Step No.	***Event***	***Name of process/ activity***	***Description of process/ activity***	***Service***	***Information producer (actor)***	***Information receiver (actor)***	***Information Exchanged (IDs)***	***Requirement, R-IDs***
1	Consumers are using the devices	Normal Operation	Users starts to monitor and control flexible asset's data.	REPORT	Consumer	Aggregator	1	GDPR-[1-4] SI [1-2] CI [1-2]
2	Occurs periodically (daily/hourly)	Power consumption surpluses.	Power is injected in the grid	REPORT /GET	Devices	Aggregator	2	GDPR-[1-4] SI [1-2] CI [1-2]
3	Occurs periodically (daily/hourly)	Reduce power	Power controls send to more manageable device the order to increase their power	EXECUTE	Aggregator	Devices	3	GDPR-[1-4] SI [1-2] CI [1-2]

Scenario								
Scenario name :		***No. 4 - Flexible operation: Acceptance of bids and activation***						
Step No.	***Event***	***Name of process/ activity***	***Description of process/ activity***	***Service***	***Information producer (actor)***	***Information receiver (actor)***	***Information Exchanged (IDs)***	***Requirement, R-IDs***
1	Consumers are using the devices	Normal Operation	Users starts to monitor and control flexible asset's data.	REPORT	Consumer	Aggregator	1	GDPR-[1-4] SI [1-2] CI [1-2]
2	Occurs periodically (daily/hourly)	Share flexibility potential availability	Send the calculated availability for the portfolio to the Market Responsible Operator	EXECUTE	Aggregator	Market Operator, TSO, DSO	6	GDPR-[1-4]
3	Occurs periodically (daily/hourly)	Receive accepted	Reception of accepted bids in order to be prepared for	GET	Market Operator,	Aggregator	7	GDPR-[1-4]

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		flexibility needs	being activated		TSO, DSO			
4	Occurs periodically (daily/hourly/minutely)	Receive activation signal	A need of a flexibility need has appeared and the Market Responsible Operator is sending a power request.	GET	Market Operator, TSO, DSO	Aggregator	8	GDPR-[1-4]
5	Occurs periodically (daily/hourly/minutely)	Adjust the portfolio power consumption	Reduce or increase manageable device to comply with the request.	EXECUTE	Aggregator	Devices	3	GDPR-[1-4]

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5 Information exchanged

Information exchanged			
Information exchanged (ID)	***Name of information***	***Description of information exchanged***	***Requirement, R-IDs***
1	User Preferences	User can change the devices operation mode, update its desired schedule for manual mode, modify the temperature references, indicate the desired EV SOC and time, provide data for mobility and check information.	GDPR-[1-4] SI [1-2] CI [1-2]
2	Device Measurements	Devices measure different parameters (temperature, consumption…) with some sample periods.	GDPR-[1-4] SI [1-2] CI [1-2]
3	Device orders	Devices support orders and parameters to be incorporated in their control algorithm to determine if consumption should be done.	GDPR-[1-4] SI [1-2] CI [1-2]
4	Login and prosumer ID	The first time the users creates their account the authentication system links their email with an ID for the rest of the system.	GDPR-[1-4] SI [1-2] CI [1-2]
5	Plans and control devices	Depending on the pilot leader, the plans can be offered to the user to manage the installation of assets and devices to control their assets. In particular, Solar plan (sharing local generation), Technology plan (install a new asset and the device to control it) or Flex plan (install device to existing assets)	GDPR-[1-4] SI [1-2] CI [1-2]
6	Available Power	The aggregator should decide the bids by the day-ahead for balancing services or some hours in advance for other services. The aggregator's first task is to get (tomorrow's) quarterly/hourly forecast variables like activations, consumptions, expected renewables generation, etc. With the forecast done, the best economic consumption to both the prosumers and the aggregator is done. Considering the individual result of each prosumer, the aggregator analyses the available flexibility in the periods where the ratio activation/price could be more profitable. With this information the available power is send to the Market Responsible Operator	GDPR-[1-4] SI [1-2] CI [1-2]
7	Commits	The accepted bids from the selected flexible market	GDPR-[1-4] SI [1-2] CI [1-2]

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8	Activation signal	Some times the commit means an activation signal directly but other only a commit to be available to receive the requirement in the form of power to increase or reduce consumption.	GDPR-[1-4] SI [1-2] CI [1-2]

6 Requirements

Requirements		
Categories ID	**Category name for requirements**	**Category description**
GDPR	Regulatory obligation related to privacy	2016/679 (General Data Protection Regulation)
SI	Security Issues	BeFlex Requirements
CI	Configuration Issues	BeFlex Requirements
Requirement R-ID	**Requirement name**	**Requirement description**
GDPR-1	Data processing consent	Personal data may not be processed unless there is at least one legal basis to do so.
GDPR-2	Data retention policy	Data retention policy outlines the time period specific sensitive data can be retained, plus how it will be disposed of when the time to do so comes.
GDPR-3	Right to access, rectify, erasure, restriction	The data subject shall have the right to obtain from the controller without undue delay the access/rectification/erasure/restriction of inaccurate personal data concerning him or her.
GDPR-4	Data transfer consent	Personal data may not be transferred to a third-party if the data subject did not agree and the third party provide appropriate safeguard.
GDPR-X	All GDPR constraints also apply to this BUC.	e.g., proportional measures of protection, communication of data breach, among others
SI - 1	Login in the platform of the aggregator to any exchange with the aggregator cloud	Authentication and Access Control mechanisms commonly used with this data exchange
SI -2	Exchange information from assets and the cloud	Network security measures commonly used with this data exchange
CI – 1	Assets should has good communication quality	Communication configuration
CI - 2	Only devices in Automatic mode will response for flexible and energy efficiency orders	Operation mode

7 Common Terms and Definitions

Common Terms and Definitions	
Term	**Definition**

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10.5. SUC13.2 – Incentives for charging from RES and EV chargers sharing

1 Description of the use case

1.1 Name of the use case

ID	*Area / Domain(s)*	*Name of Use Case*
SUC 13-2	**Cross-sector**	Incentives for charging from RES and EV chargers sharing

1.2 Version management

Version Management			
Version No.	*Date*	*Name of Author(s)*	*Changes*
0.1	17.08.2023	JC Pazzaglia	First Draft
0.2	31.10.2023	Jean-Christophe Pazzaglia, Jorge Boavida	Draft for scenarios and chapters 3 and 4

1.3 Scope and objectives of use case

Scope and Objectives of Use Case	
Scope	This UC describes the services to incentives EV drivers to charge their cars to best leverage RES
Objective(s)	The SUC will address the following questions: • How to maximize RES mix in EV charging? • How to avoid EV usage disruption? • How to best motivate EV drivers to use RES for charging?
Related business case(s)	BUC 13 - Combine energy services (production, storage) with mobility

1.4 Narrative of use case

Narrative of Use Case
Short description
This SUC focus on how to incentivize EV drivers to privilege flexible or carbon friendly energy to charge from private EVSE (e.g., home or office) leveraging grid renewable energy sources (RES). The SUC requires to gather forecast about the RES ratio available at the main EVSE sites (typically home and office), the forecast of EVSE usage and the EV forecast on location and energy needs. Leveraging this information it will investigate on how to modify EV behaviors.
Complete description
In this document different uses cases are going to be described to conform the system use case of enabling the optimization of EV charging. Each of the steps needed for this are going to be described below. Please note that we assume that the EV driver can leverage flexible residential or company charging capabilities (e.g. SUC 13.1 and SUC 13.2) **5. EV Driver/Prosumer Onboarding** a. **Sign up procedure for users** The EV driver fills its private data and sign the terms and conditions of the project. **b. Application installation**

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The EV driver will be asked his vehicle characteristics, and to identify the main charging locations he is using daily. He should provide default charging preferences (e.g. Arrival SoC per location, Min SoC, max SoC, preferred SoC per location and per calendar day). He will optionally provide access to real time information provided by his car (e.g. SoC). **6. Charging the Car** **a. Arrival near a charging station** On the arrival nearby a flexible charging station, the application will provide an advice to the EV driver to connect / to start a charge / to avoid a charge. **b. Starting a charge** The application will exhibit the default preferences to the driver to enable him to change his charging parameters. On approval, it will display a choice of charging strategies (e.g. Fastest, flexible, opportunistic) to charge his car indicating the potential impact on SoC at departure (if any) and gain. **c. Optimal flexible charge reached** The application will provide an advice of the EV Driver about what to do (e.g. Stay connected or disconnected and move the car) when the optimal flexible SoC is reached, please note that this level is not fixed since it will depend on the E driver preference and the current flexibility strategy. **d. Stopping a charge** When the charge will be stopped the application will inform the EV driver about the impact of the strategy and provide a reward for flexible strategy.

N	Service	Category	Main Provider
5	Smart Charging Point Management System	CC-E-BE, CC-E-AE, CC-CS-MO	SAP
14	Charging Point Supervision	CC-CS-MO	SAP
17	Consumption best practice assistant	CC-CE-GM	SAP

1.5 Use case conditions

Use case conditions
Assumptions
2. The detailed services from stakeholders are not described in this SUC.
Prerequisites
-

1.6 Further Information to the use case for classification / mapping

Classification Information
Relation to other use cases
BUC 13 - Combine energy services (production, storage) with mobility
Level of depth
System use case (SUC) use case which describes in detail the functionality/technological solutions of (a part of) a business process.
Prioritisation
Normal Level of Priority – To be demonstrated in France (Pilot 3.5 & 3.6)
Generic, regional or national relation
Generic
Nature of the use case
Customer enablement Services (CC-CE)

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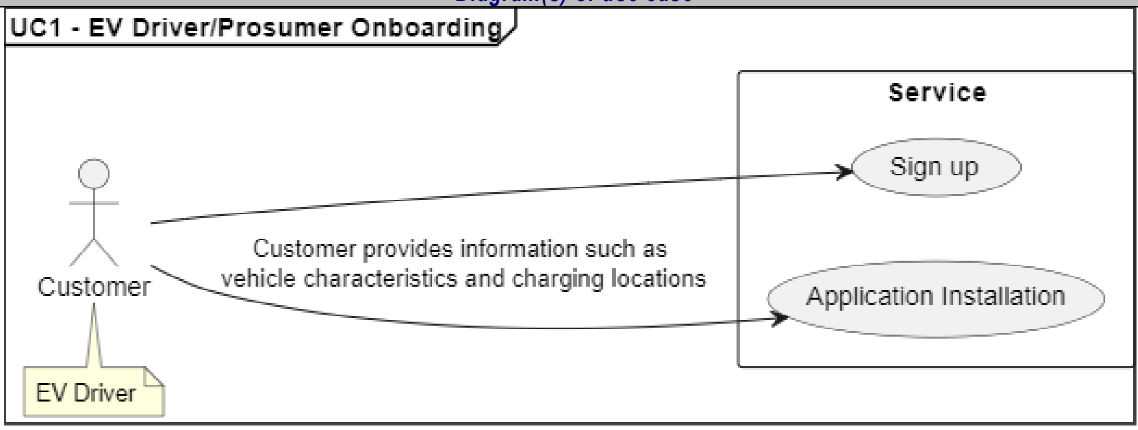
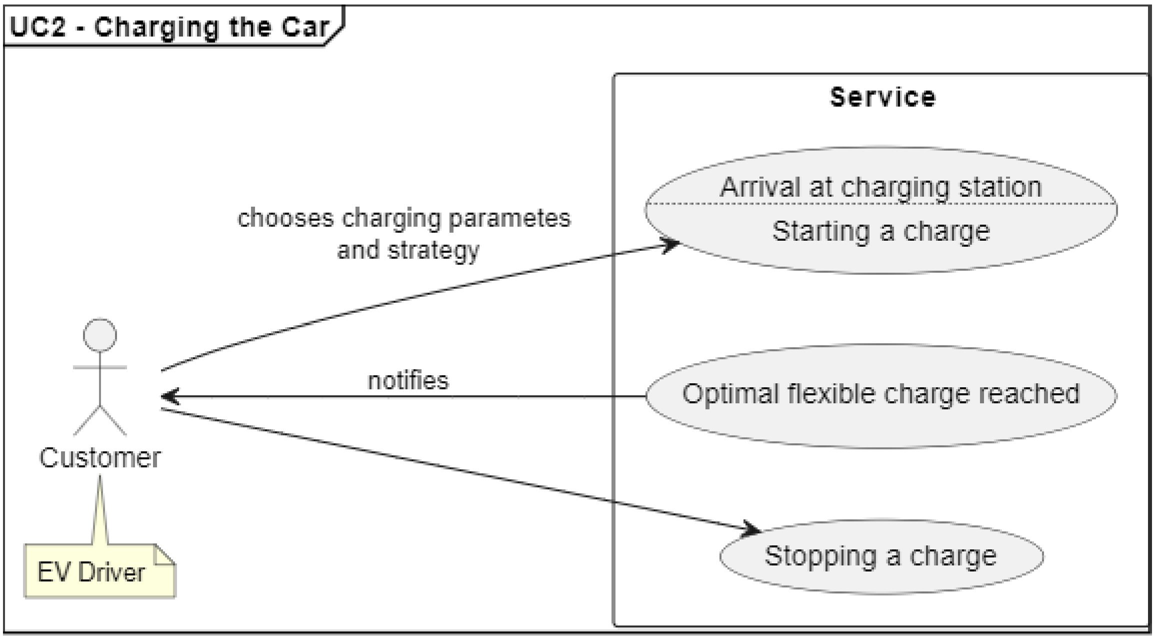
Further keywords for classification
Residential Flexibility, Ecosystem, Customer Journey, Incentives

1.7 General Remarks

General Remarks
Is used for further comments which are not considered elsewhere.

2 Diagrams of use case

Diagram(s) of use case
    *Sequence Diagram*:

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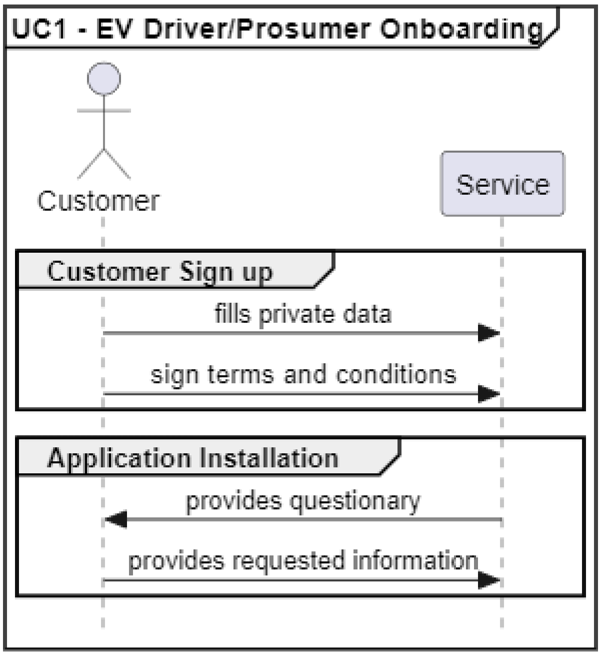

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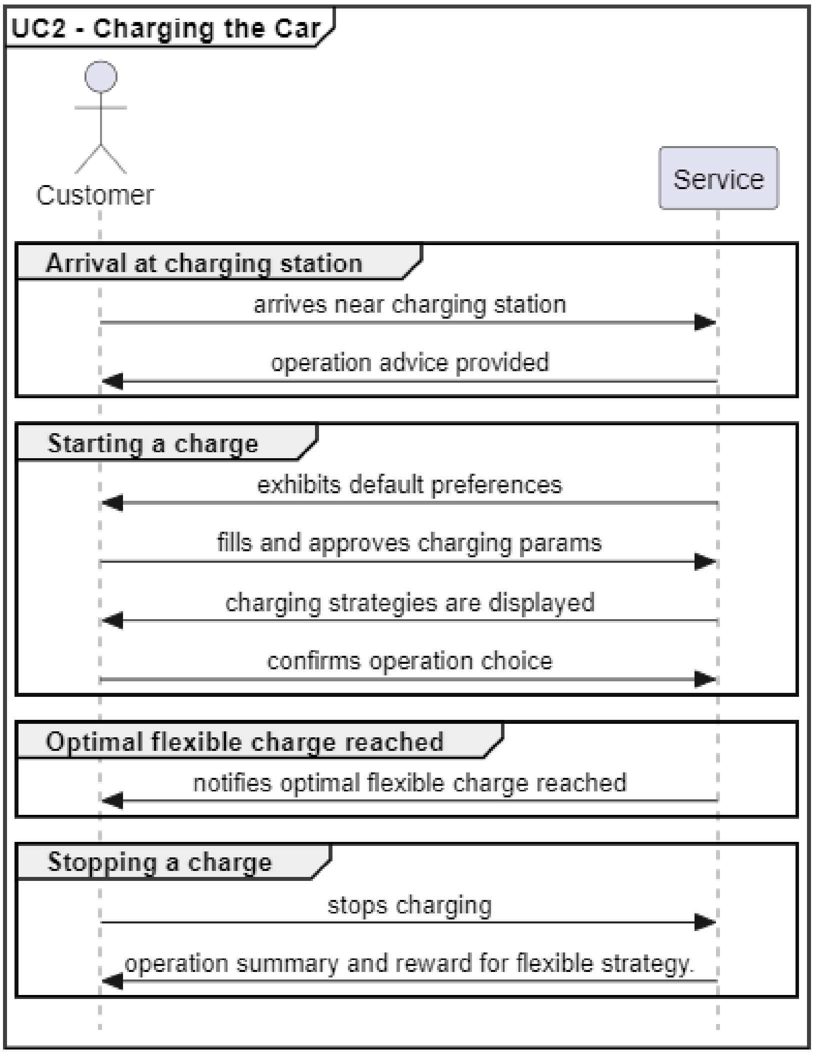

3 Technical details

3.1 Actors

Actors		
Actor Name	***Actor Type***	***Actor Description***
Customer	Business Role (BeFlexible role model)	Consumer of the service – EV Driver

3.2 References

References						
No.	***References Type***	***Reference***	***Status***	***Impact on use case***	***Originator / organisation***	***Link***
	Technical Report	Harmonized Electricity Market Role Model (HEMRM)	Public	Role Model	BRIDGE	https://energy.ec.europa.eu/system/files/2021-06/bridge_wg_regulation_eu_bridge_hemrm_report_2020-2021_0.pdf

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4 Step by step analysis of use case

4.1 Overview of scenarios

Scenario conditions						
No.	Scenario name	Scenario description	Primary actor	Triggering event	Pre-condition	Post-condition
1	EV Driver/Prosumer Onboarding	Concerns the customer sign in and application installation	Customer	Occurs sporadically		
2	Charging the Car	Concerns the process of charging the car and its available optimal flexible strategies	Customer	Occurs sporadically	Customer to be signed in	Consumers contribute with flexibility towards the value-chain and collect incentives.

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4.2 Steps – Scenarios

Scenario								
Scenario name :		No. 1 - EV Driver/Prosumer Onboarding						
Step No.	Event	Name of process/ activity	Description of process/ activity	Service	Information producer (actor)	Information receiver (actor)	Information Exchanged (IDs)	Requirement, R-IDs
1	Customer Sign up	EV Driver/Prosumer Onboarding	Customer (EV driver) fills its private data and sign the terms and conditions of the service	CREATE	Customer	Service	1	GDPR-[1-4] SI [1-2] CI [1-2]
2	Application Installation	EV Driver/Prosumer Onboarding	Service recommendations are delivered to consumer and his/her choice is gathered along with other information that was requested. The EV driver will be asked his vehicle characteristics, and to identify the main charging locations he is using daily. He should provide default charging preferences (e.g. Arrival SoC per location, Min SoC, max SoC, preferred SoC per location and per calendar day). He will optionally provide access to real time information provided by his car (e.g. SoC).	REPORT/GET	Customer	Service	1	GDPR-[1-4] SI [1-2] CI [1-2]

Scenario								
Scenario name :		No. 2 - Charging the Car						
Step No.	Event	Name of process/ activity	Description of process/ activity	Service	Information producer (actor)	Information receiver (actor)	Information Exchanged (IDs)	Requirement, R-IDs

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1	Customer arrives at Charging station	Arrival at charging station	Customer arrives at Charging station	GET	Customer	Service		GDPR-[1-4] SI [1-2] CI [1-2]
2	Operation advice is provided	Arrival at charging station	Service provides an advice to the EV driver to connect / to start a charge / to avoid a charge.	REPORT /GET	Service	Customer	2	GDPR-[1-4] SI [1-2] CI [1-2]
3	Service exhibits default preferences	Starting a charge	The application will exhibit the default preferences to the driver to enable him to change his charging parameters.	REPORT /GET	Service	Customer	1	GDPR-[1-4] SI [1-2] CI [1-2]
	Customer fills and approves charging params	Starting a charge	Customer fills and approves charging parameters.	CREATE	Customer	Service	1	GDPR-[1-4] SI [1-2] CI [1-2]
	Charging strategies are displayed	Starting a charge	Service displays a choice of charging strategies (e.g. Fastest, flexible, opportunistic) to charge customer's car indicating the potential impact on SoC at departure (if any) and gain.	REPORT /GET	Service	Customer	4	GDPR-[1-4] SI [1-2] CI [1-2]
	Customer confirms operation choice	Starting a charge	Customer confirms desired charging strategy	CREATE	Customer	Service	1	GDPR-[1-4] SI [1-2] CI [1-2]
	Notifies optimal flexible charge is reached	Optimal flexible charge reached	The application provides an advice of the EV Driver about what to do (e.g. Stay connected or disconnected and move the car) when the optimal flexible SoC is reached - will depend on the driver preference and the current flexibility strategy.	REPORT /GET	Service	Customer	2	GDPR-[1-4] SI [1-2] CI [1-2]
	Customer s	Stopping a	Customer stops charging EV	GET	Customer	Service		GDPR-[1-4]

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	tops charging	charge	car.					SI [1-2] CI [1-2]
	Operation summary and reward for flexible strategy.	Stopping a charge	Service informs the EV driver about the impact of the strategy and provide a reward for flexible strategy.	REPORT /GET	Service	Customer	4	GDPR-[1-4] SI [1-2] CI [1-2]

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5 Information exchanged

Information exchanged			
Information exchanged (ID)	**Name of information**	**Description of information exchanged**	**Requirement, R-IDs**
1	User/charging Preferences	User's private data and Charging preferences (e.g. Arrival SoC per location, Min SoC, max SoC, preferred SoC per location and per calendar day)..	GDPR-[1-4] SI [1-2] CI [1-2]
2	Service advice	Advice to the EV driver to connect / to start a charge / to avoid a charge or to Stay connected or disconnected and move the car	GDPR-[1-4] SI [1-2] CI [1-2]
3	Login and prosumer ID	The first time the users creates their account the authentication system links their email with an ID for the rest of the system.	GDPR-[1-4] SI [1-2] CI [1-2]
4	Charging Strategies	Charging strategies (e.g. Fastest, flexible, opportunistic) to charge customer's car indicating the potential impact on SoC at departure (if any) and gain.	GDPR-[1-4] SI [1-2] CI [1-2]

6 Requirements

Requirements		
Categories ID	**Category name for requirements**	**Category description**
GDPR	Regulatory obligation related to privacy	2016/679 (General Data Protection Regulation)
SI	Security Issues	BeFlex Requirements
CI	Configuration Issues	BeFlex Requirements
Requirement R-ID	**Requirement name**	**Requirement description**
GDPR-1	Data processing consent	Personal data may not be processed unless there is at least one legal basis to do so.
GDPR-2	Data retention policy	Data retention policy outlines the time period specific sensitive data can be retained, plus how it will be disposed of when the time to do so comes.
GDPR-3	Right to access, rectify, erasure, restriction	The data subject shall have the right to obtain from the controller without undue delay the access/rectification/erasure/restriction of inaccurate personal data concerning him or her.
GDPR-4	Data transfer consent	Personal data may not be transferred to a third-party if the data subject did not agree and the third party provide appropriate safeguard.
GDPR-X	All GDPR constraints also apply to this BUC.	e.g., proportional measures of protection, communication of data breach, among others
SI - 1	Login in the platform of the aggregator to any exchange with the aggregator cloud	Authentication and Access Control mechanisms commonly used with this data exchange
SI -2	Exchange information from assets and the cloud	Network security measures commonly used with this data exchange

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CI – 1	Assets should has good communication quality	Communication configuration
CI - 2	Only devices in Automatic mode will response for flexible and energy efficiency orders	Operation mode

7 Common Terms and Definitions

Common Terms and Definitions	
Term	**Definition**

10.6. SUC13.3 – Optimize and manage corporate EV charging

1 Description of the use case

1.1 Name of the use case

ID	*Area / Domain(s)*	*Name of Use Case*
SUC 13-3	Select from: (1) **Local energy sharing and flexibility market**; (2) Grid-centric flexibility; (3) TSO-DSO flexibility coordination; (4) **Cross-sector**	Optimize and manage corporate EV charging

1.2 Version management

Version Management			
Version No.	*Date*	*Name of Author(s)*	*Changes*
0.1	04.09.2023	Jean-Christophe Pazzaglia	First Draft
0.9	31.10.2023	Jean-Christophe Pazzaglia	Consolidated draft for review

1.3 Scope and objectives of use case

Scope and Objectives of Use Case	
Scope	This UC describes the services to optimize and manage corporate EV charging in the flexibility context
Objective(s)	The SUC will address the following questions: • How corporation demand gets involved? • How is the normal operation performed? • How is the flexibility of corporate site demand optimized?
Related business case(s)	BUC 13 - Combine energy services (production, storage) with mobility

1.4 Narrative of use case

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Narrative of Use Case
Short description
This SUC gathers the different use cases needed to optimize and manage corporate EV charging in the flexibility context. This starts with the onboarding stage where the different charging areas able to monitor and control corporate fleet charging are installed. Once installed the EVSE can be managed following energy efficiency optimization orders (normal operation) or following flexible activations (flexible operation), the level of flexibility will be driven by the type of fleet (e.g. employee, delivery, commercials) that will modify the need of energy and the business constraints. In all cases, different KPIs are being monitored to obtain insights from fleet usage of EV, EVSE usage, energy behaviours and monetary indicators and to ascertain that business constraints are not jeopardized .The current CPMS does not support flexibility.
Complete description

In this document different uses cases are going to be needed to optimize and manage corporate EV charging in the flexibility context. Each of the steps needed for this are going to be described below.

7. Client Onboarding

A potential company gets interested in leveraging flexibility in the operation of its EV charging process.

a. Infrastructure onboarding

All EVSE should be compatible with the CPMS (OCCP 1.6 certified). It is particularly important that the EVSE support the sending of ChargingProfile in a reliable manner. All EVSE should be connected to the system and the electric setup of each charging area described. Infrastructures are described in a hierarchy and a company can operate different sites with multiple charging areas with assets and charging stations. The system can scale to 1000’s of charging stations

b. Fleet onboarding

The corporate fleet will be as well onboarded in the system in order to know the characteristics of every EV (e.g. Battery and charging capacity). Complementary, the EV may be connected to the CPMS to provide real time information about the state of charge of the battery, while this is optional this can benefit to the optimisation especially for opportunistic charges and future V2G scenarios.

c. Driver onboarding

The driver will have to upload and signup with the mobile application of the CPO to start/stop charge and to eventually provide preferences(e.g. SoC and departure time).

d. Area flexibility setup

The company will define which charging station areas should be operated using smart charging capability including a flexibility strategy. On top, each area may be able to setup static power control (for example: 50% between 5pm and 8 pm).

8. Normal Operation

a. Storage of data into the cloud

All data related to the charging process will be stored in the CPMS solution. This include static data (e.g. EV characteristics) and dynamic data (e.g. state of charge and geographic position together with arrival and departure time). Finally, data could arrive from requests to external sources. External sources include meteorological agencies (providing weather data) and market operator as well as transmission and distribution system operators (providing electrical grid data, constraints for next periods, participation information, prices…).

All this data is received as inputs from different services to make analysis or control the EVSE infrastructure with intelligent algorithms. The data that can be linked with personal information will adhere to GDPR constraints (e.g. Consent, data retention).

b. Charging transactions and EVSE Usage

The CPMS enables EV drivers to start/stop transactions using an RFID card or the application. Drivers get informed about the charging process, and the price of the charging session in real time that is used to provide the invoice. On top the system provides the EVSE usage (e.g. Number of transactions, inactivity time, price) based on the transactions.

c. **Management of Energy**

The EMS computes in real time the instantaneous available power per charging areas taking into account the grid power, the assets production and the assets consumptions (e.g. EVSE, Smart building). Whenever production is greater than the consumption, the EMS arbitrates between grid reinjection or local energy storage whenever available.

d. **EV Fleet Smart charging**

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Smart charging supports dynamic and intelligent load balancing during the charging process EVs. Dynamic load management allows to optimize charging capacity by continuously distributing capacities across all electric vehicles charging at a specific time taking into account EV capabilities, charging needs and duration. Every 15 minutes or upon charging events, the smart charging is computed and charging profiles are sent to the EVSE. **9. Flexible Operations** **a. Subscription to a flexibility aggregator service** The CPMS subscribe to a flexibility aggregator for all charging station areas able to provide flexibility in the aggregator geographical area. Multiple aggregators eventually spanning different countries can therefore be attached to the same CPMS. **b. Flexibility capacity evaluation** The CPMS computes the flexibility capacity per areas based on short term (e.g. 15-60 minutes) or day ahead forecast (e.g. Production/consumption). The computation takes into account the quality of service requested by EV drivers or fleet managers that may want to enforce a minimum of SoC at departure time before enabling a specific EV to be part of the flexibility offer. **c. Submission of offers to the electric markets.** The market clearer, who depending on the market the aggregator is operating can be the market operator, the transmission system operator, or the distribution system operator, as well as a mix of them, opens the reception offers period. Once the period is opened, it receives offers from different agents (generation companies or other aggregators), but only from the aggregator. **d. Commitments' reception** After the market clearance, the market clearer set prices and/or accept some services. It sends then the quarter or hourly prices and requirements to the participants including the aggregator. **e. Flexibility activation** The transmission and distribution system operators individually or jointly trigger contingencies when flexibility is needed. This information is stored in the cloud database and received by the aggregator, who in real-time updates activations forecast for next optimizations and activates real-time power control if needed. **f. Smart Charging Real-time power control** The smart charging adjusts the level of energy available to charge the connected EVs during the flexibility period on each charging areas. While the maximum usage is bounded by the physical hardware, the minimum can eventually below 0 thanks to the reinjection of renewable energy or energy stared in stationary batteries and in the future by V2G enabled cars. **10. Performance monitoring** A series of KPIs is defined to measure the impact of the flexibility offer to the quality of service, the operation cost, the flexibility offer (e.g. Volume and reactiveness) and the CO2 footprint impact.

N	Service	Category	Main Provider
5	Smart Charging Point Management System	CC-E-BE, CC-E-AE, CC-CS-MO	SAP
14	Charging Point Supervision	CC-CS-MO	SAP
18	Sustainability dashboarding	CC-CE-TR	SAP

1.5 Use case conditions

Use case conditions
Assumptions
• The detailed services from stakeholders are not described in this SUC.
Prerequisites
-

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1.6 Further Information to the use case for classification / mapping

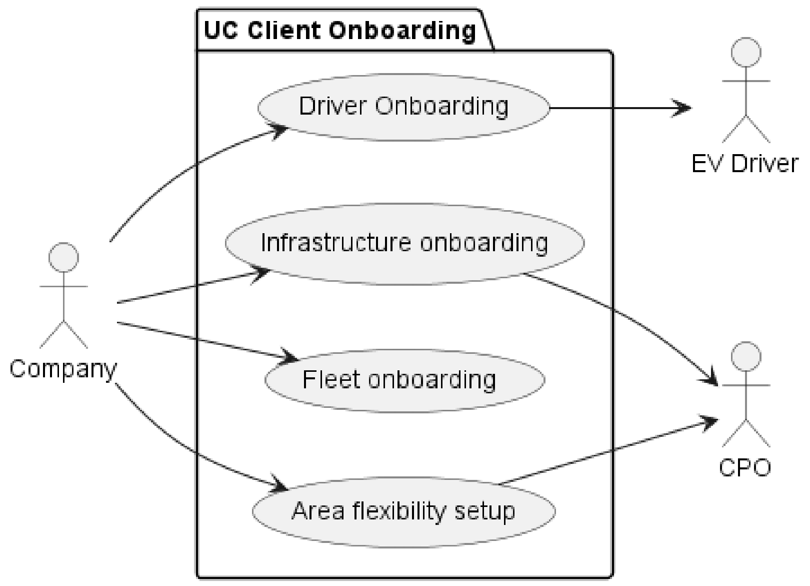
Classification Information
Relation to other use cases
BUC 13 - Combine energy services (production, storage) with mobility
Level of depth
System use case (SUC) use case which describes in detail the functionality/technological solutions of (a part of) a business process.
Prioritisation
Normal Level of Priority – To be demonstrated in France (Pilot 3.5 & 3.6)
Generic, regional or national relation
Generic
Nature of the use case
Customer enablement Services (CC-CE)
Further keywords for classification
Residential Flexibility, Ecosystem, Customer Journey.

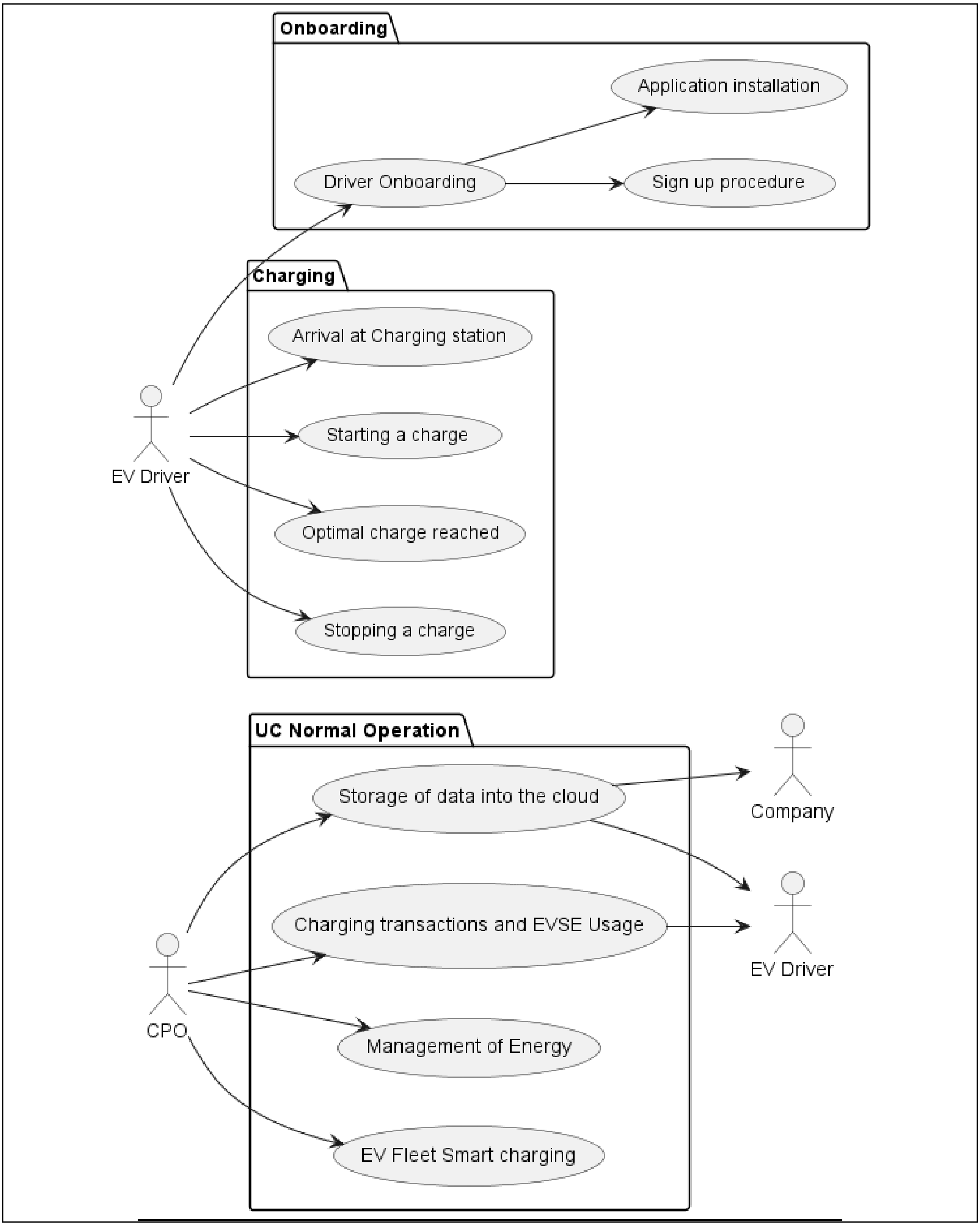
1.7 General Remarks

General Remarks
Is used for further comments which are not considered elsewhere.

2 Diagrams of use case

Diagram(s) of use case





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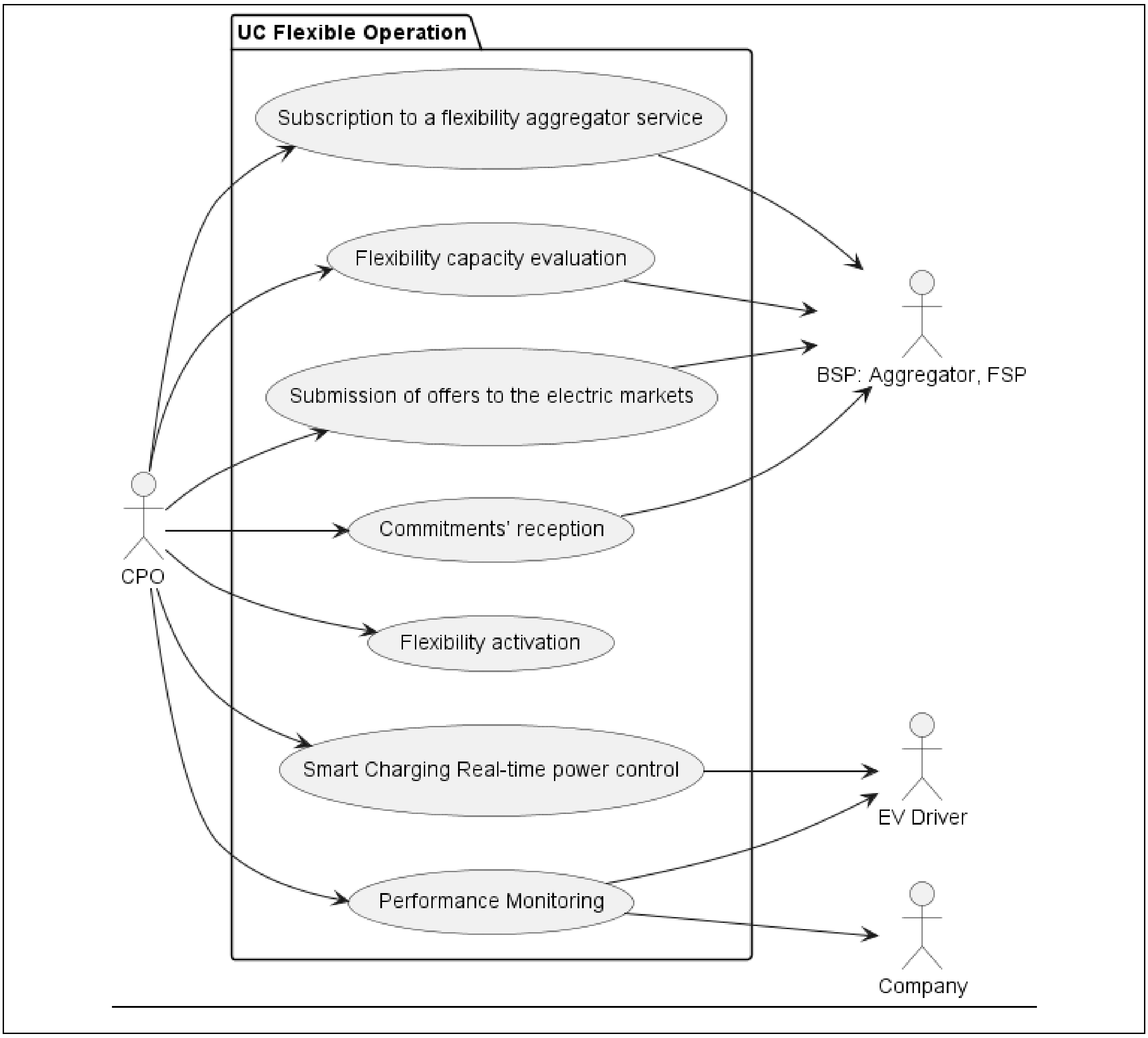

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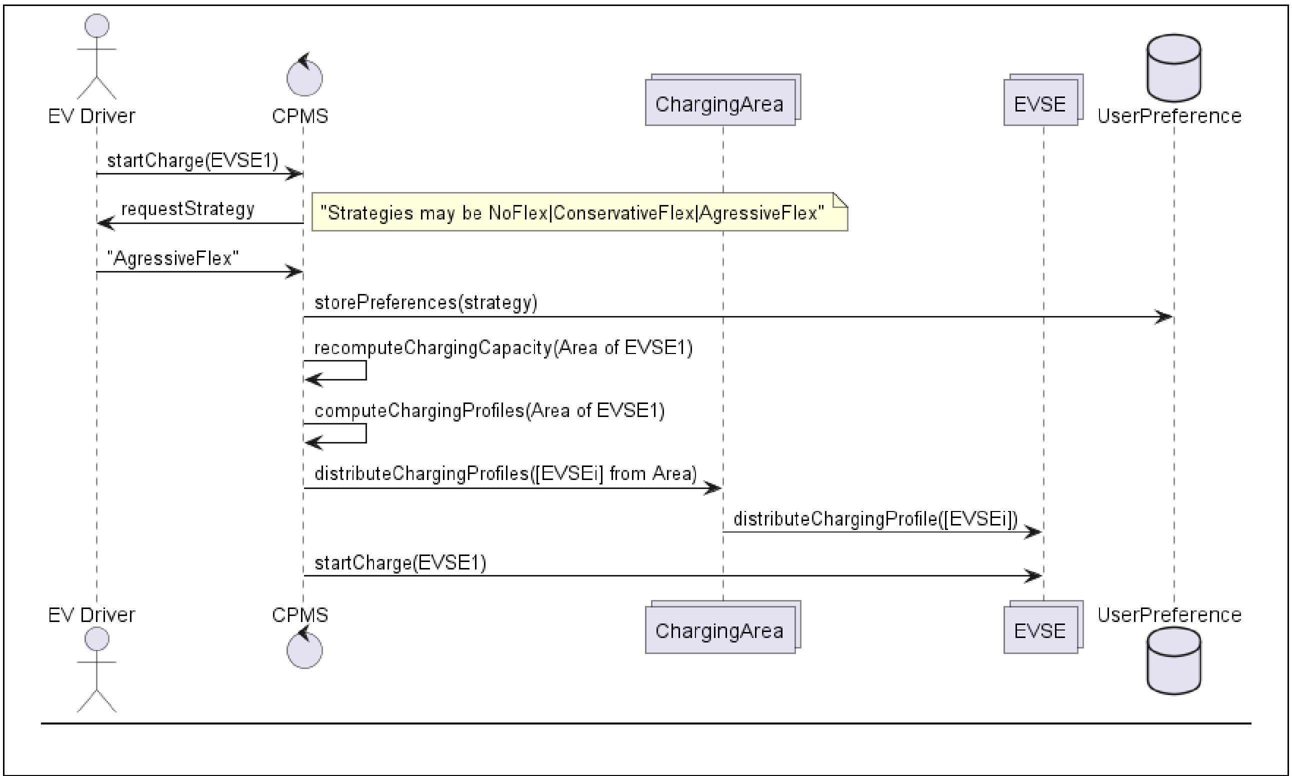

3 Technical details

3.1 Actors

Actors		
Actor Name	***Actor Type***	***Actor Description***
CPO		Charge Point Operator installs and maintains charge stations so customers/drivers can charge their EV (electric vehicles)
Local Flexibility Market Operator	Business Role (BeFlexible role model, BRIDGE HEMRM)	DSO can be this agent. Responsible for the local flexibility market services.
BSP	Business Role (BeFlexible role model, BRIDGE HEMRM)	A party with reserve-providing units or reserve-providing groups able to provide balancing services to one or more LFC Operators. Additional information: Based on Electricity Balancing - Art.2 Definitions. BSP can also be an extension of BRP. Example: Aggregator, Flexibility Services Provider (FSP)
Aggregator	Business Role (BeFlexible role model, BRIDGE HEMRM)	Aggregates (i.e., collects and combines) multiple resources for usage by a service provider for energy market services.
Flexible Service Provider	Business Role (BeFlexible role model, BRIDGE HEMRM)	A party providing flexibility services to energy stakeholders via bilateral agreements or flexibility markets. An FSP can also be a BSP if enabled to the LFC services. In the Bridge HEMRM, FSP is an extension of BSP. FSP offer services potentially to all the system operators, directly or through market operators. Example: BSP or Aggregator.

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Consumer/Company	Business Role (BeFlexible role model, BRIDGE HEMRM)	Party connected to the grid which purchases and consumes electricity.
Market Operator	Business Role (BRIDGE HEMRM)	Provides a service whereby the offers to sell electricity are matched with the bids to buy it.
TSO	Business Role (BeFlexible role model, BRIDGE HEMRM)	Responsible for security of supply and reliability of a transmission network and also real time operation and monitoring, building, expanding, and maintaining the transmission system.
Third-party/ External Data Source		Any external agent. Example: Partners of consortium, Companies, Data sources.
Installer		Person in charge of connect the needed physical equipment related to the EVSE
EV Driver		Main user of the EVSE infrastructure provided by the company. They will be in majority employees or contractors of the company.

3.2 References

References						
No.	***References Type***	***Reference***	***Status***	***Impact on use case***	***Originator / organisation***	***Link***
	Technical Report	Harmonized Electricity Market Role Model (HEMRM)	Public	Role Model	BRIDGE	https://energy.ec.europa.eu/system/files/2021-06/bridge_wg_regulation_eu_bridge_hemrm_report_2020-2021_0.pdf

4 Step by step analysis of use case

4.1 Overview of scenarios

Scenario conditions						
No.	**Scenario name**	**Scenario description**	**Primary actor**	**Triggering event**	**Pre-condition**	**Post-condition**
1	Client Onboarding	A potential company gets interested in leveraging flexibility in the operation of its EV charging process.	Company	Occurs after Pilot invitation	EVSE infrastructure.	Company will be enabled to contribute with flexibility towards the value-chain and collect incentives for charging of EV fleet.
2	Normal operation	EV charging without taking into account flexibility request	Prosumer/EV Driver	Occurs sporadically	EVSE supervised by a CPMS or unsupervised	
3	Flexible operation	EV charging taking into account flexibility request and user charging preferences	Prosumer/EV Driver	Occurs frequently	EVSE supervised by a flexibility enabled CPMS.	Grid friendly usage of energy for EV charges.
4	Performance monitoring	Analyse impact of flexibility enabled CPMS on energy	CPO	Occurs frequently	EVSE supervised by a flexibility	Report insights to prosumers/company.

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		price/consumption, carbon footprint, QoS			enabled CPMS.	

4.2 Steps – Scenarios

Scenario								
Scenario name :		**Client onboarding for flexible company charges**						
Step No.	**Event**	**Name of process/ activity**	**Description of process/ activity**	**Service**	**Information producer (actor)**	**Information receiver (actor)**	**Information Exchanged (IDs)**	**Requirement, R-IDs**
1	Onboard consumers	Driver Onboarding	Company ask EV Driver to upload and signup with application of the CPO to start/stop charge and provide preferences	CREATE	Company	EV Driver	1	GDPR-[1-4] SI [1-2] CI [1-2]
2	Devices are onboarded in the CPMS	Infrastructure onboarding	Onboarded of compatible EVSE in the CPMS	CREATE	Aggregator Pilot leader	CPO	5	SI [1-2] CI [1-2]
3	Description of EV characteristic	Fleet onboarding	Corporate fleet onboarded in the system to know the characteristics of every EV (e.g. Battery and charging capacity).	CREATE	Company	CPO	10	SI [1-2] CI [1-2]
4	Setup the areas	Area flexibility setup	Charging station areas setup for smart charging capability including a flexibility strategy	CHANGE	Company	CPO	5	SI [1-2] CI [1-2]

Scenario								
Scenario name :		**No. 3 - Normal operation of devices: Charging EV**						
Step No.	**Event**	**Name of process/ activity**	**Description of process/ activity**	**Service**	**Information producer (actor)**	**Information receiver (actor)**	**Information Exchanged (IDs)**	**Requirement, R-IDs**
1	Occurs periodically (daily/hourly)	Arrival at Charging station	EV Driver identifies an EVSE or is recommended a dedicated one.	EXECUTE	CPO	EV Driver	1	GDPR-[1-4] SI [1-2] CI [1-2]
2	Occurs periodically (daily/hourly)	Starting a charge	EV Driver initiates a charge with a card or application	EXECUTE	EV Driver	EVSE	4	GDPR-[1-4] SI [1-2] CI [1-2]

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3	Occurs periodically (daily/hourly)	Optimal charge reached	CPO informs EV Drivers that optimal charge (requested Soc) is reached	EXECUTE	CPO	EV Driver	2	GDPR-[1-4] SI [1-2] CI [1-2]
3	Occurs periodically (daily/hourly)	Stopping a charge	EV Driver stops a charge with a card or application	EXECUTE	EV Driver	Devices	4	GDPR-[1-4] SI [1-2] CI [1-2]

Scenario								
Scenario name :		***No. 4 - Normal operation of EV Fleet charging***						
Step No.	***Event***	***Name of process/ activity***	***Description of process/ activity***	***Service***	***Information producer (actor)***	***Information receiver (actor)***	***Information Exchanged (IDs)***	***Requirement, R-IDs***
1	Occurs periodically (daily/hourly	Storage of data into the cloud	CPO collects all data related to the charging process and energy to deliver, optimise and monitor charging process.	CREATE	CPO		1-10	GDPR-[1-4] SI [1-2] CI [1-2]
2	Occurs periodically (daily/hourly)	Charging transactions and EVSE Usage	CPMS enables EV drivers to start/stop transactions using an RFID card or the application. Drivers get informed about the charging process, and the price of the charging session	EXECUTE	CPO	EV Driver, Company	2	GDPR-[1-4] SI [1-2] CI [1-2]
3	Occurs periodically (daily/hourly)	Management of Energy	EMS computes in real time the instantaneous available power	EXECUTE	CPO			
4	Occurs periodically (daily/hourly/minutely)	EV Fleet Smart charging	Dynamic and intelligent load balancing during the charging process EVs across EVSE areas	EXECUTE	CPO	Devices	3	GDPR-[1-4] SI [1-2] CI [1-2]

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Scenario								
Scenario name :		**No. 4 - Normal operation of EV Fleet charging**						
Step No.	**Event**	**Name of process/ activity**	**Description of process/ activity**	**Service**	**Information producer (actor)**	**Information receiver (actor)**	**Information Exchanged (IDs)**	**Requirement, R-IDs**
1	On company onboarding	Subscription to a flexibility aggregator service	CPMS subscribe to a flexibility aggregator for all charging station areas	CREATE	CPO	Aggregator		SI [1-2] CI [1-2]
2	Occurs periodically (daily/hourly)	Flexibility capacity evaluation	CPMS computes the flexibility capacity per areas based on short term (e.g. 15-60 minutes) or day ahead forecast (e.g. Production/consumption)	EXECUTE	CPO	-	-	-
3	Occurs periodically (daily/hourly)	Submission of offers to the electric markets	EMS computes in real time the instantaneous available power	EXECUTE	CPO	Aggregator		
4	Occurs periodically (daily/hourly/minutely)	Commitments' reception	Sends then the quarter or hourly prices and requirements	EXECUTE	Aggregator	CPO	7	SI [1-2] CI [1-2]
5	Activation signal	Flexibility Activation	The transmission and distribution system operators individually or jointly trigger contingencies when flexibility is needed.	REPEAT	Aggregator	CPO	8	SI [1-2] CI [1-2]
6		Smart Charging Real-time power control	The smart charging adjusts the level of energy available to charge the connected EVs during the flexibility period on each charging areas.	REPEAT	CPO	Devices	3	SI [1-2] CI [1-2]

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7	Occurs periodically (daily/hourly/minutely)	Performance Monitoring	A series of KPIs is defined to measure the impact of the flexibility offer to the quality of service	CREATE	CPO		1-10	GDPR-[1-4] SI [1-2] CI [1-2]

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5 Information exchanged

Information exchanged			
Information exchanged (ID)	***Name of information***	***Description of information exchanged***	***Requirement, R-IDs***
1	User Preferences	User can change the devices operation mode, update its desired schedule for manual mode, modify the temperature references, indicate the desired EV SOC and time, provide data for mobility and check information.	GDPR-[1-4] SI [1-2]
2	EVSE Measurements (e.g. CDR)	EVSE measure different parameters (temperature, consumption…) with some sample periods. CDR may contain PII.	GDPR-[1-4] SI [1-2] CI [1-2]
3	EVSE orders (e.g. ChargingProfile)	EVSE support orders and parameters to be incorporated in their control algorithm to determine if consumption should be done.	SI [1-2] CI [1-2]
4	Login and prosumer ID	The first time the users creates their account the authentication system links their email with an ID for the rest of the system.	GDPR-[1-4] SI [1-2] CI [1-2]
5	EVSE electrical setup	The EVSE of a company consists in the description of both devices (e.g. Charging point AC of 22kW) but also their connectivity (e.g. 10 charging points are sharing a supply of 50 kW).	SI [1-2] CI [1-2]
6	Available Power	The aggregator should decide the bids by the day-ahead for balancing services or some hours in advance for other services. The aggregator's first task is to get (tomorrow's) quarterly/hourly forecast variables like activations, consumptions, expected renewables generation, etc. With the forecast done, the best economic consumption to both the prosumers and the aggregator is done. Considering the individual result of each prosumer, the aggregator analyses the available flexibility in the periods where the ratio activation/price could be more profitable. With this information the available power is send to the Market Responsible Operator	SI [1-2] CI [1-2]
7	Commits	The accepted bids from the selected flexible market	SI [1-2] CI [1-2]
8	Activation signal	Some times the commit means an activation signal directly but other only a commit to be available to receive the requirement in the form	SI [1-2] CI [1-2]

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		of power to increase or reduce consumption.	
9	EVSE users (e.g. EV Drivers)	CPO will manage a list of users including company's employee	GDPR-[1-4] SI [1-2] CI [1-2]
10	Fleet	The description of the technical characteristics of the cars managed by the company. They may eventually be instrumented to provide more precise information (e.g. SoC, Geoloc).	GDPR-[1-4] SI [1-2] CI [1-2]

6 Requirements

Requirements		
Categories ID	**Category name for requirements**	**Category description**
GDPR	Regulatory obligation related to privacy	2016/679 (General Data Protection Regulation)
SI	Security Issues	BeFlex Requirements
CI	Configuration Issues	BeFlex Requirements
Requirement R-ID	**Requirement name**	**Requirement description**
GDPR-1	Data processing consent	Personal data may not be processed unless there is at least one legal basis to do so.
GDPR-2	Data retention policy	Data retention policy outlines the time period specific sensitive data can be retained, plus how it will be disposed of when the time to do so comes.
GDPR-3	Right to access, rectify, erasure, restriction	The data subject shall have the right to obtain from the controller without undue delay the access/rectification/erasure/restriction of inaccurate personal data concerning him or her.
GDPR-4	Data transfer consent	Personal data may not be transferred to a third-party if the data subject did not agree and the third party provide appropriate safeguard.
GDPR-X	All GDPR constraints also apply to this BUC.	e.g., proportional measures of protection, communication of data breach, among others
SI - 1	Login in the platform of the aggregator to any exchange with the aggregator cloud	Authentication and Access Control mechanisms commonly used with this data exchange
SI -2	Exchange information from assets and the cloud	Network security measures commonly used with this data exchange
CI – 1	Assets should has good communication quality	Communication configuration
CI - 2	Only devices in Automatic mode will response for flexible and energy efficiency orders	Operation mode

7 Common Terms and Definitions

Common Terms and Definitions	
Term	**Definition**

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10.7. SUC13.4 – Share EV charging data for non-energy services

1 Description of the use case

1.1 Name of the use case

ID	Area / Domain(s)	Name of Use Case
SUC 13-4	**Cross-sector**	Share EV charging data for non-energy services

1.2 Version management

Version Management			
Version No.	Date	Name of Author(s)	Changes
0.1	01.09.2023	Jean-Christophe Pazzaglia	First Draft
0.2	27.10.2023	Jean-Christophe Pazzaglia, Jorge Boavida	Draft for scenarios and chapters 3 and 4

1.3 Scope and objectives of use case

Scope and Objectives of Use Case	
Scope	This UC describes the services to share EV charging data for non-energy services.
Objective(s)	The SUC tries to answer: • How external services can subscribe to a data service and leverage data to propose services?
Related business case(s)	BUC 13 - Combine energy services (production, storage) with mobility

1.4 Narrative of use case

Narrative of Use Case
Short description
This SUC gathers the different use cases needed to access the charging station optimize the residential demand side flexibility. It is intended that the data will be used to provide extra service to the CPO (e.g. Identification of infrastructure improvement, cost analysis or contract recommendation) or for the EV ecosystem (e.g. Find a cheap or empty charging areas). The services may include to pay a fee depending on the usage, it is not intended to share private information).
Complete description
11. Service Registration **a. Customer subscription** The customer, likely a Service Provider, fills its private data that may include payment data and sign the terms and conditions of the service. Usage restriction (e.g. API, geofencing, nb of call per day) may apply depending on the contract subscribed. **b. Credential provision** The CPO grant access to the set of endpoint that the customer subscribe to and provide the credentials. He will also indicate the reference to the API documentation. **12. Service Usage** **a. Customer Authentication**

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The customer provides its credentials over a secure connection to the service endpoint. It retrieves a time bounded access token to perform query against the API **b. Customer querying** The Customer retrieves the data needed to perform its added value service. It can typically retrieve historical data of charging areas / EVSEs (e.g. Transaction time, duration and energy delivered) or aggregated (e.g. number of EVSE transaction per days for a certain area) following the API documentation provided during the subscription. **c. Customer sign-out** Upon querying completion, il is recommend signing out from the service to avoid to consume useless resources and potentially avoid extra cost to the customer.

N	Service	Category	Main Provider
15	EV and EV Infrastructure usage data provider	CC-CS-MO, CC-CE-DM	SAP

1.5 Use case conditions

Use case conditions
Assumptions
The detailed services from stakeholders are not described in this SUC.
Prerequisites
-

1.6 Further Information to the use case for classification / mapping

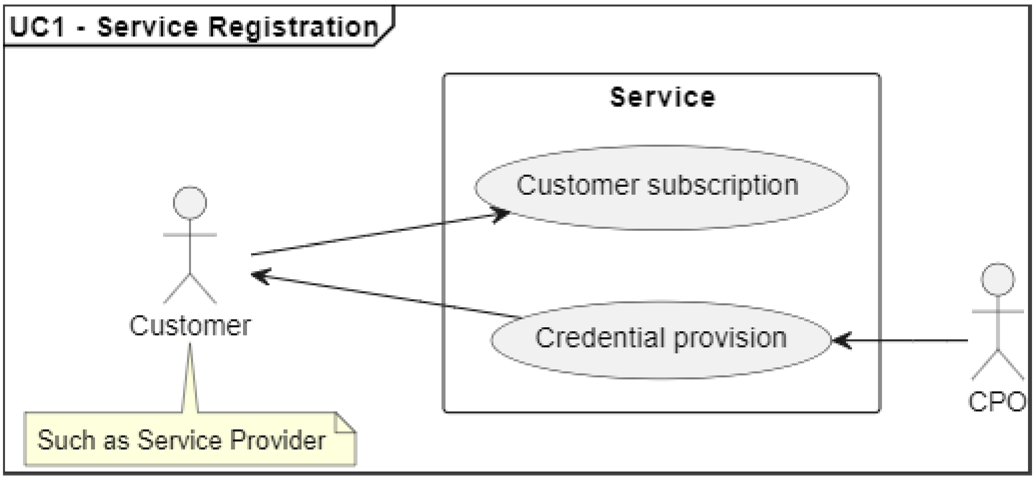
Classification Information
Relation to other use cases
BUC 13 - Combine energy services (production, storage) with mobility
Level of depth
System use case (SUC) use case which describes in detail the functionality/technological solutions of (a part of) a business process.
Prioritisation
Normal Level of Priority – To be demonstrated in France (Pilot 3.5 & 3.6)
Generic, regional or national relation
Generic
Nature of the use case
Customer enablement Services (CC-CE)
Further keywords for classification
Residential Flexibility, Ecosystem, Customer Journey.

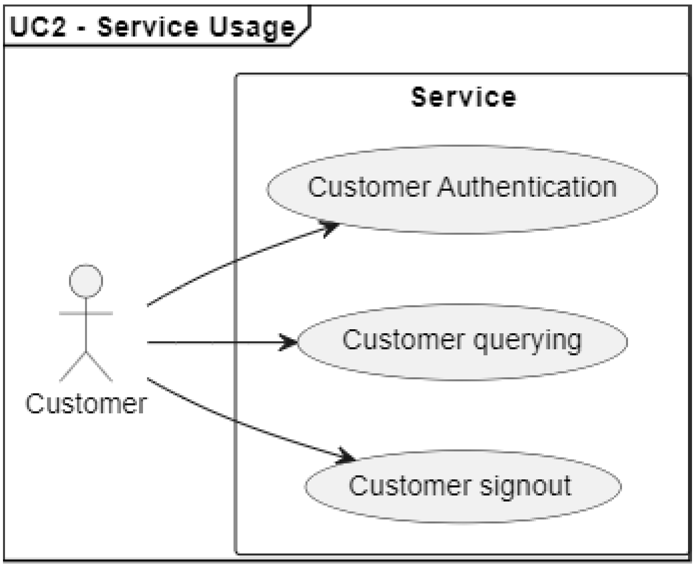
1.7 General Remarks

General Remarks
Is used for further comments which are not considered elsewhere.

2 Diagrams of use case

Diagram(s) of use case





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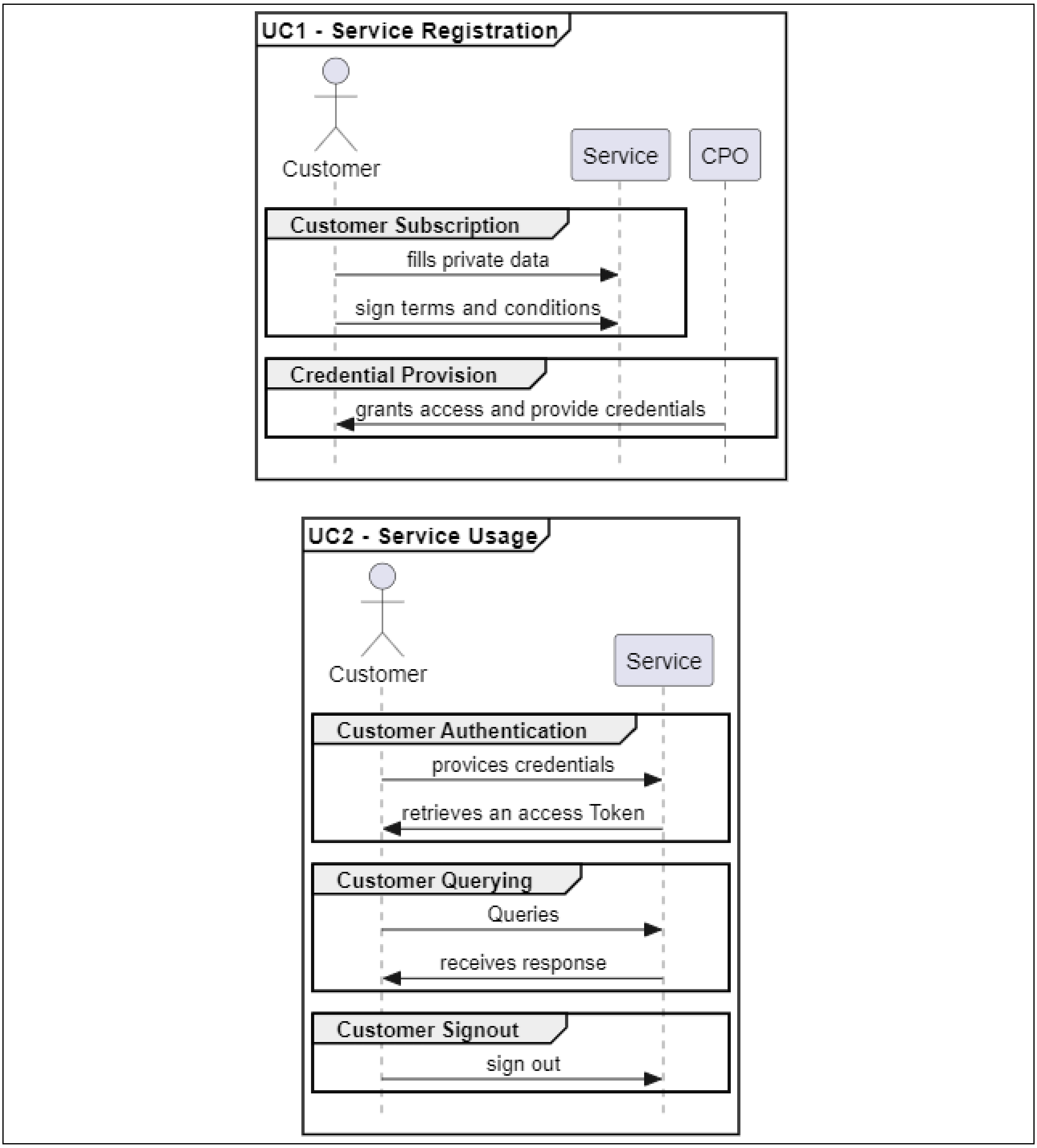

3 Technical details

3.1 Actors

Actors		
Actor Name	***Actor Type***	***Actor Description***
CPO		Charge Point Operator installs and maintains charge stations so customers/drivers can charge their EV (electric vehicles)

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Customer	Business Role (BeFlexible role model)	Consumer of the service, likely a Service Provider in this case.

3.2 References

References						
No.	***References Type***	***Reference***	***Status***	***Impact on use case***	***Originator / organisation***	***Link***
	Technical Report	Harmonized Electricity Market Role Model (HEMRM)	Public	Role Model	BRIDGE	https://energy.ec.europa.eu/system/files/2021-06/bridge_wg_regulation_eu_bridge_hemrm_report_2020-2021_0.pdf

4 Step by step analysis of use case

4.1 Overview of scenarios

Scenario conditions						
No.	**Scenario name**	**Scenario description**	**Primary actor**	**Triggering event**	**Pre-condition**	**Post-condition**
1	Service Registration	Concerns the customer subscription to the service and the following credential provision	Customer	Occurs sporadically		
2	Service Usage	Concerns the usage of the service – authentication, querying, and signout	Customer	Occurs sporadically	Customer to be registered	

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4.2 Steps – Scenarios

Scenario								
Scenario name :		No. 1 - Service Registration						
Step No.	Event	Name of process/ activity	Description of process/ activity	Service	Information producer (actor)	Information receiver (actor)	Information Exchanged (IDs)	Requirement, R-IDs
1	Customer fills private data	Customer Subscription	Customer provides and fills private data	CREATE	Customer	Service	4	GDPR-[1-4] SI [1-2] CI [1-2]
2	Customer signs terms and conditions	Customer Subscription	Customer signs terms and conditions of the service	CREATE	Customer	Service	1	GDPR-[1-4] SI [1-2] CI [1-2]
3	Access is granted – credentials provided	Credential provision	Credentials are provided and the access is granted	REPORT	Service/CPO	Customer	4	GDPR-[1-4] SI [1-2] CI [1-2]

Scenario								
Scenario name :		No. 2 - Service Usage						
Step No.	Event	Name of process/ activity	Description of process/ activity	Service	Information producer (actor)	Information receiver (actor)	Information Exchanged (IDs)	Requirement, R-IDs
1	Provision of credentials	Customer Authentication	Customer provides credentials to service	GET	Customer	Service	4	GDPR-[1-4] SI [1-2] CI [1-2]
2	Access token is retrieved to Customer	Customer Authentication confirmation	Service sends access token to customer	REPORT/GET	Service	Customer	4/1	GDPR-[1-4] SI [1-2] CI [1-2]
3	Customer Queries the service	Customer querying	Customer queries the service	EXECUTE	Customer	Service	-2	GDPR-[1-4] SI [1-2] CI [1-2]
4	Customer receives response	Customer query result	Customer receives query result from service	REPORT	Service	Customer	-3	GDPR-[1-4] SI [1-2] CI [1-2]
5	Customer Signs out	Sign out	Customer signs out	CANCEL/CLOSE	Customer	Service	-	GDPR-[1-4] SI [1-2] CI [1-2]

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2	Query payload	Data measurements requested - payload	GDPR-[1-4] SI [1-2] CI [1-2]
3	Data measures/statistics	typically historical data of charging areas / EVSEs (e.g. Transaction time, duration and energy delivered) or aggregated (e.g. number of EVSE transaction per days for a certain area) following the API documentation provided during the subscription	GDPR-[1-4] SI [1-2] CI [1-2]
4	Login and prosumer ID	The first time the users creates their account the authentication system links their email with an ID for the rest of the system.	GDPR-[1-4] SI [1-2] CI [1-2]

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GDPR-X	All GDPR constraints also apply to this BUC.	e.g., proportional measures of protection, communication of data breach, among others
SI - 1	Login in the platform of the aggregator to any exchange with the aggregator cloud	Authentication and Access Control mechanisms commonly used with this data exchange

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SI -2	Exchange information from assets and the cloud	Network security measures commonly used with this data exchange
CI – 1	Assets should has good communication quality	Communication configuration
CI - 2	Only devices in Automatic mode will response for flexible and energy efficiency orders	Operation mode

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Common Terms and Definitions	
Term	**Definition**

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