Use Case Description

UC WP7_1

Improve grid flexibility

using

Smart Storage Unit

Scope

This document describes the Use Case **WP7_1 – Improve grid flexibility using Smart Storage Unit**

The Use Case description within is divided in to five areas:

1. Description of the Use Case
2. Diagrams of the Use Case
3. Technical data - Actors
4. Step by Step Analysis of Use Case (can be extended by detailed info on “information exchanged”)
5. Information exchanged

1. Description of the Use Case

1.1. Use Case Identification

ID	Domains/Zones[1]	Name of Use Case	Level of Use Case[2]
WP7_0	DER/Market	Create flexibility to prevent grid investments	Cluster
WP7_1	**DER/Operation**	**Improve grid flexibility using Smart Storage Unit**	**High level**
WP7_2	DER/Operation	Improve grid flexibility using Electric Vehicle	High level
WP7_3	DER/Market	Usability of an integrated flex market	High level

1.2. Version Management

Version	Date	Name Author(s) or	Changes
V0.1 – 0.8	5-5-17	Marcel Willems Kees van Zwienen Ivan Theunissen Olga Westerlaken	Document initiation
V0.9	31-05-17	Team	Group review changes

1.3. Scope and objectives

Scope	Enabling ancillary services, congestion management, voltage support for PV integration using centralized, grid-connected storage systems to improve grid observability of prosumers, promoting batteries in multi-service approach. In scope: - Battery infrastructure and deployment - Congestion management - Voltage support for PV integration - Multi-service approach - Local Infrastructure Management System Out of scope: - Other ancillary services (is not in pilot, but aggregator can use the battery for ancillary services if part of its business model) - Power quality improvement (other than voltage support) - Domestic battery systems In this pilot, and therefore this use case document, the battery will be called Smart Storage Unit or the abbreviation SSU will be used.
Objective	*Small headline:* This use case conceptualizes, implements the systems and interactions necessary to achieve a stable grid through flexibility using Smart Storage Unit and PV systems. By implementing use case 1, Enexis and the involved aggregators test and validate the application of a smart storage unit for the following purposes: - Congestion management - Energy trading / portfolio management through spot market, imbalance market and/or ancillary service provision - Power quality improvement & voltage control upon request from DSO *Specific*: Design local infrastructure management systems and extend aggregators platform to translate DSO requirements (based on real-time measurements or predictions) into actual load balancing and voltage control requests. *Measurable*: Battery-based storage efficiency (KPI_NL1). Percentage of time during which the storage is available (KPI_NL2). The percentage of shifted energy, contribution to load shedding and ancillary services (KPI_NL3). Share of energy/power displaced for each type of flexibility (KPI_NL4). Percentage of decrease on ratio Peak/average at MV feeder level (third level area) (KPI_NL5). *Assignable*: Technical/local aggregator (with its LIMS) and commercial aggregators (with its FAP) have a primary role to implement this capability in their systems. Initiation of this functionality can be done by DSO (flex requirements/request) and aggregators (change in availability of resources).

	The DSO is responsible for availability: Smart Storage unit (SSU), PV systems, LIMS, GMS (incl. grid measurements from distribution automation boxes and smart meters), solar car The commercial aggregator is responsible for availability: FAP TNO is responsible for interoperability and interchangeability of the systems. *Realistic*: Flexibility availability by using locally available Smart Storage Unit and PV systems. *Time-related*: When the Smart Storage Unit and PV systems are in place and the aggregator systems have been developed and/or adapted, see project planning.
Related Business Case	Not applicable

1.4. Narrative of Use Case

Short description
The development and implementation of the LIMS which is used for connecting, measuring and controlling the local resources by the local aggregator. The commercial aggregator can use services of the local aggregator for flexibility in the local grid. The DSO forecasts flexibility demands.
Complete description

The goal of this demonstration is to validate technically, economically and contractually the usability of a smart storage unit embedded as a commercial storage. Centralised storage must be valued with the support of all the players involved: the TSO, the DSO, the storage operator, the prosumers. It demonstrates the applicability of large scale centralized storage units at the substation/street level to demand side management. The deployed capacity of the centralized storage unit is in the range of 250 kW / 500 kWh.

To enable interaction between actors, markets and local resources a Local Infrastructure Management System (LIMS) is defined. The goal is to realise a local interface from and to the potential flexibility sources.

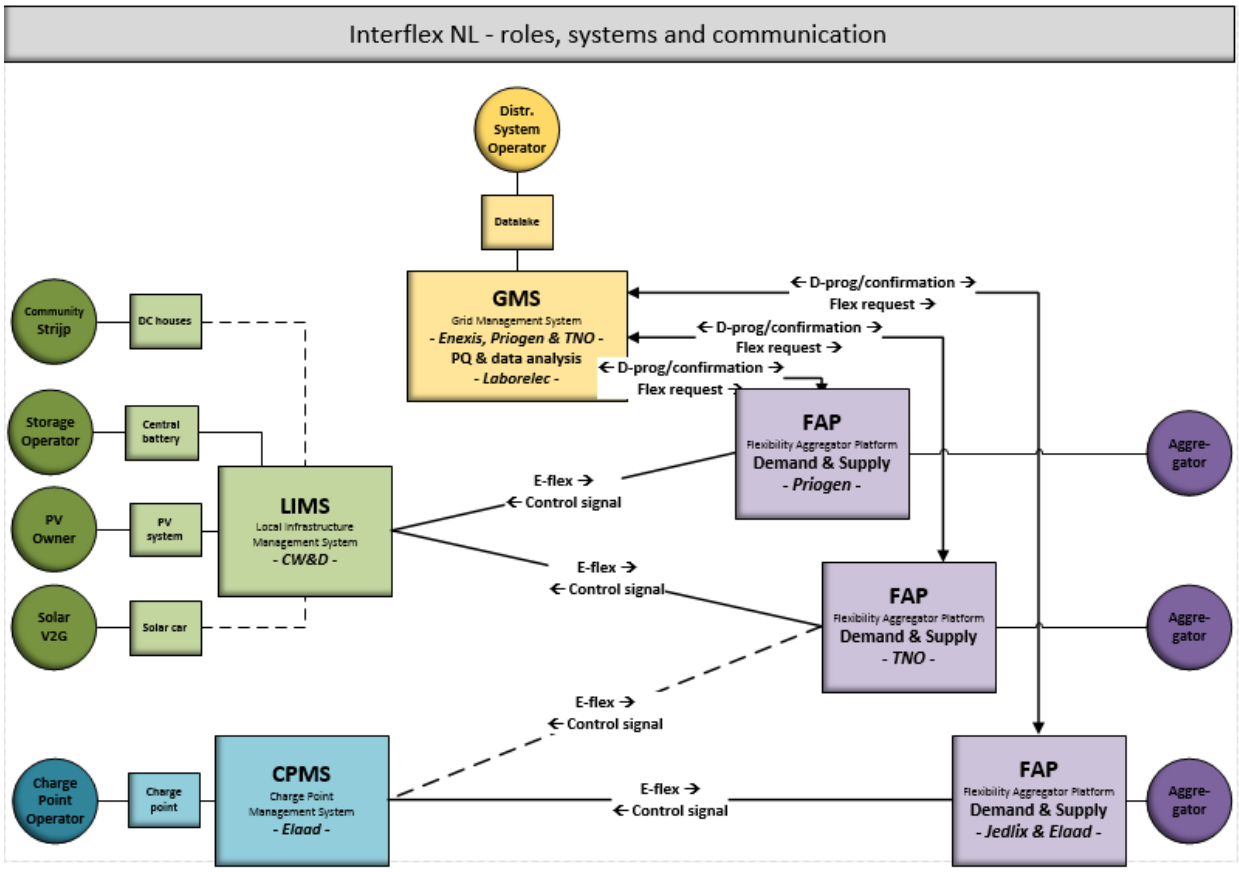
The LIMS should consist of the following technical functions:

- Realise an interface from and to the smart storage unit and PV installation
    - Collect and forward measurement data from smart storage unit and PV installation for the purpose of congestion management
    - Collect and forward measurement data from smart storage unit and PV installation for the purpose of voltage management
    - Monitor and maintenance of the smart storage unit
    - Operation of the smart storage unit
    - Power quality improvement
- Realise interfaces with various potential flexibility sources (e.g. DC households, solar car, household storage solutions, PV installations, heat pumps and white goods).
    - Collect and forward measurement data from smart storage unit and PV installation for the purpose of congestion management
    - Collect and forward measurement data from smart storage unit and PV installation for the purpose of voltage management
    - Operation of the smart storage unit
    - Power quality improvement
- Implementation conform standardised protocols for the interaction with commercial aggregators. Protocols are selected in consultation with the aggregator.

The LIMS should have the following organisational functions:

- Provide local flexibility sources to the commercial aggregators
- Technically and organisationally responsible for (the interface with) these flexibility sources

Negotiate contractual agreements with aggregators for the provision of flexibility



Brief system descriptions:

GMS: Grid management system, this system is operated by the DSO and is responsible for keeping track of the actual and forecasted state of the grid. If a congestion occurs the GMS is will try to buy flexibility from one or more commercial aggregators.
LIMS: Local Infrastructure Management system, this system is operated by the party who is responsible for the hardware in the field. The LIMS connects the physical hardware via a secure internet connection to the commercial aggregators.
FAP: The Flexibility Aggregation Platform is operated by the commercial aggregator and is responsible for controlling the flexibility assets of the aggregator. Also the FAP provides a interface to the DSO (e.g. via USEF)
CPMS: Charge Pole Management System, this system is the backend of the charging stations and is operated by the owner of the charging stations. The CPMS is provides an interface to an aggregator so flexibility of the electrical vehicles can be monetized

1.5. KPIs

ID	Name	Description	Reference to mentioned Use Case objectives
KPI_NL1	**Efficiency**	**Battery-based storage efficiency**	**WP7_1**, WP7_2
KPI_NL2	**Availability**	**% of time during which the storage is available**	**WP7_1**
KPI_NL3	**Impact on the grid**	**% of shifted energy** **Contribution to load shedding** **Contribution to ancillary services**	**WP7_1**, WP7_2
KPI_NL4	**Potential to shift demand**	**Share of energy/power displaced for each type of flexibility**	**WP7_1**, WP7_2, WP7_3
KPI_NL5	**Local peak load reduction**	**% of decrease on ratio Peak / average at MV feeder level (third level area)**	**WP7_1**, WP7_2, WP7_3
KPI_NL6	Activation of flexibilities	% of energy savings (kWh)	*WP7_3*
KPI_NL7	Lower energy bills	% of increase power selling in kWh	*WP7_3*

1.6. Use Case conditions

Actor	Triggering Event	Pre-conditions	Assumption
DSO: Grid Management System (GMS)	forecasts a flexibility need	❖ Grid forecasting e.g. based on historical measurements ❖ Current grid status ❖ Flex interface between GMS and FAP(s)	❖ Availability of sufficient relevant data to make predictions ❖ Definition of process triggers e.g. thresholds ❖ Interoperability of interfaces
DSO: Grid Management System (GMS)	triggers a load emergency event	❖ Emergency detection ❖ Current grid status ❖ Flex interface between GMS and FAP(s)	❖ Definition of relevant emergency situations ❖ Interoperability of interfaces
DSO: Grid Management System (GMS)	receives a daily energy Energy prognosis from a FAP (commercial aggregator) that, added to the prediction, exceeds thresholds	❖ Grid forecasting e.g. based on historical measurements ❖ Flex interface between GMS and FAP(s)	❖ Availability of sufficient relevant data: to make predictions by DSO and calculate Energy prognosis by commercial aggregators ❖ Definition of process triggers e.g. thresholds ❖ Interoperability of interfaces
Local Aggregator: Local Infrastructure Management System (LIMS)	Availability changes (status)	❖ Interface between LIMS and smart storage unit/PV systems ❖ Flex interface between	❖ Availability of sufficient relevant data ❖ Definition of process triggers e.g. thresholds ❖ Interoperability of interfaces

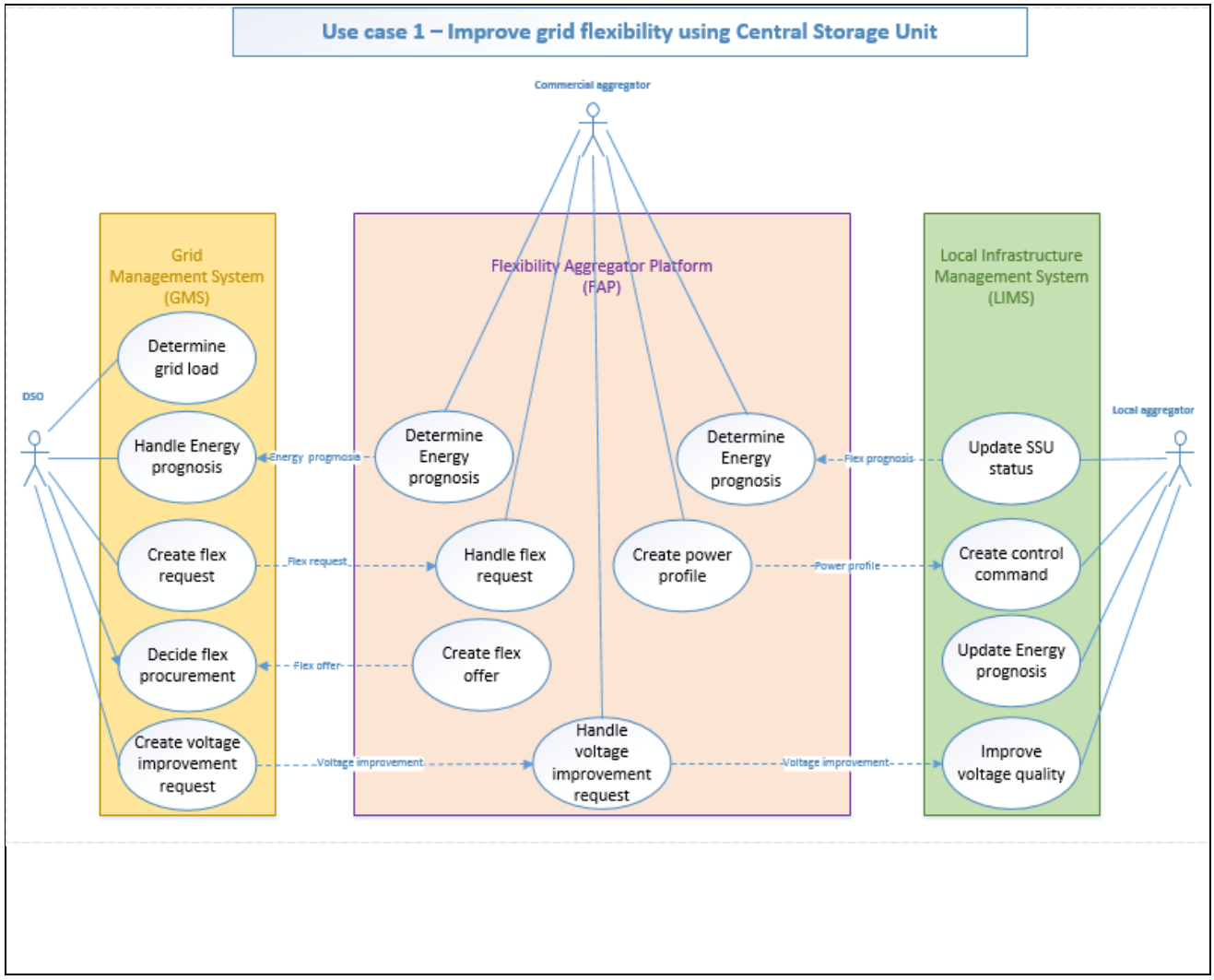
Actor	Triggering Event	Pre-conditions	Assumption
		LIMS and FAP(s)	

1.7. Classification information

Relation to Other Use Cases in the same project or area
Use case WP7_2 is very similar but there we focus on charge points as a flexibility source instead of batteries (this use case). Use case WP7_3 combines the two use cases WP7_1 and WP7_2 into an integrated flex market including contracts and financial flow.
Level of Depth - the degree of specialization of the Use Case
High Level Use Case
Prioritization
Mandatory, since it is prerequisite for use case WP7_3.
Generic, Regional or National Regional relation
Regional scaling to (inter)national
Nature of the viewpoint- describes the viewpoint and field of attention
Technical (WP7_1 and WP7_2) - business/market and political in case of regulation change (WP7_3)
Further Keywords for Classification
- *Smart grid* - *Flexibility* - *Congestion management* - *Smart storage unit* - *PV* - *Flexibility forecast* - *Commercial aggregator* - *Local aggregator*
Maturity of Use Case
- *in business operation* - *realized in demonstration project*

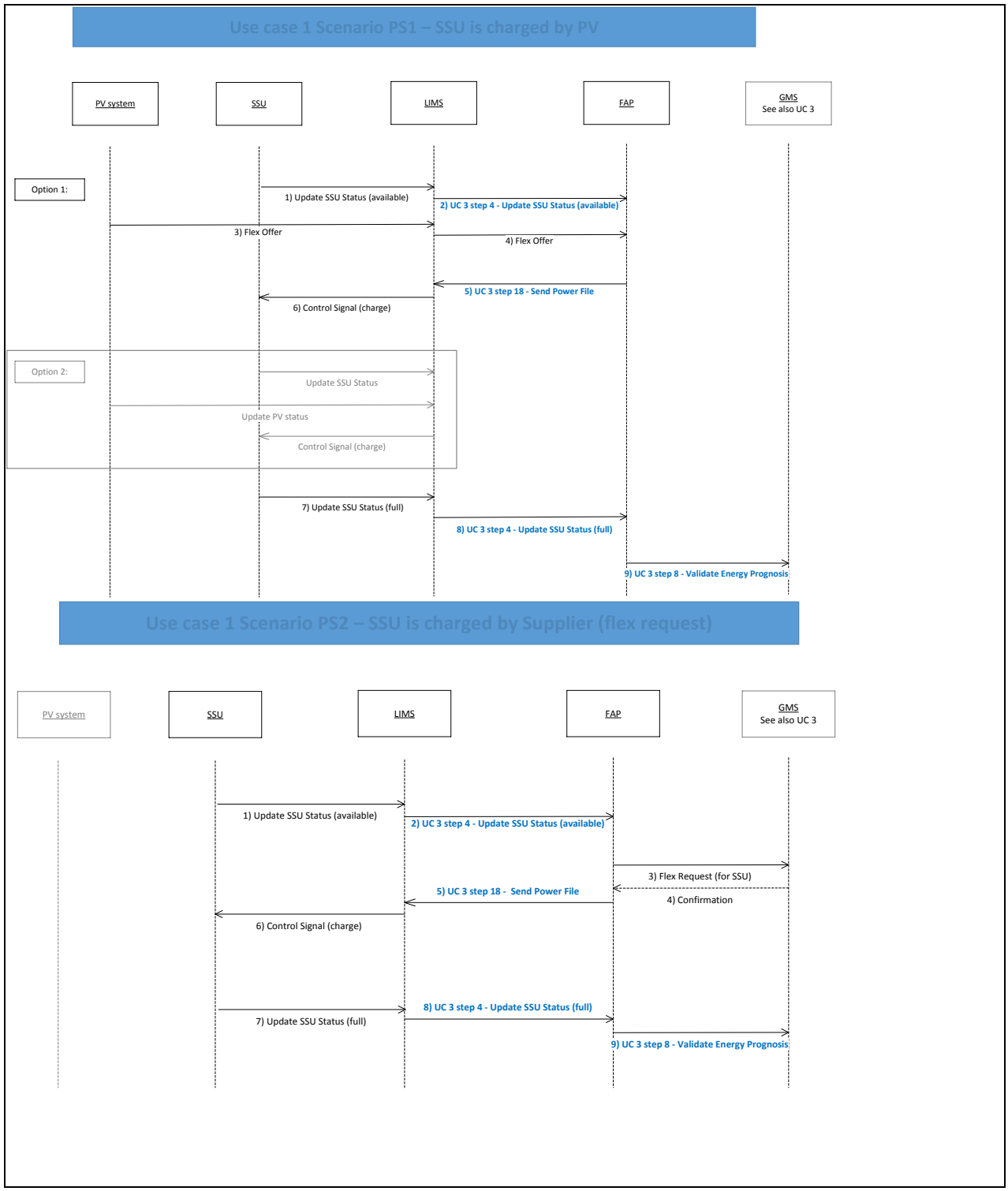
2. Diagrams of the Use Case

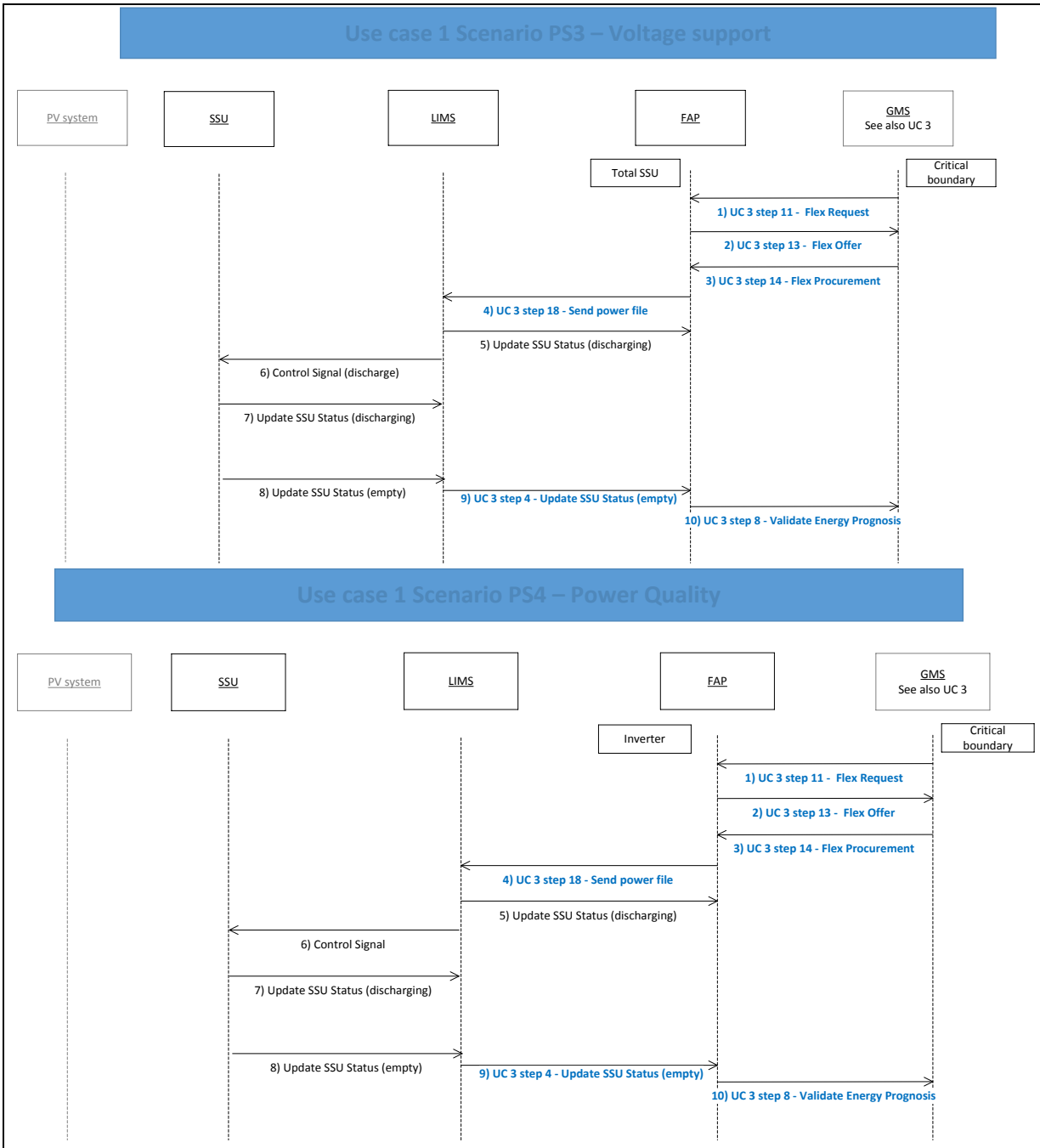
2.1. Diagram of the Use Case



2.2. Sequence diagram(s) of Use Case

Assumption in the sequence diagrams below is that the flex agreement cycle between FAP and GMS is active.





Abbreviations:

CPMS = Charge Point Management System
FAP1 = Flexibility Aggregator Platform (with EV contract)
FAP2 = Flexibility Aggregator Platform (with Battery contract)
BRP = Balance Responsible
LIMS = Local Infrastructure Management System
GMS = Grid Management System
SSU = Smart Storage Unit

3. Technical details of the Use Case - Actors

Actor Name	Actor Type	Actor Subcategories (see Annex A)	Actor description	Further information specific to this UC	Equipment Manufacturer	Grid Connection Requirements	IEC Standards
Enexis	Role	DSO	Responsible for the planning, operation and maintenance of the distribution networks	The DSO performs load management of its grid and acts in case of an (forecasted) emergency. The DSO pays for requested flexibility in the net and has a flex contract with the	-	YES, conform Dutch electricity act (elektriciteitswet), grid code (netcode), measurement code (meetcode), and system code (systeemcode)[1]	NO
GMS	System	IS IT	Load Management System	The DSO uses this system to perform load management of its grid and send messages to the aggregator	-	NO	NO
DA(LI) / smart meters	System	Network device	Data collection from local infrastructure and households	-	Phoenix (DALI) / SAE (DA) / Kamstrup, Landes & Gyr, IBM-kaifa (slimme meters	NO	NO
	System	Communication infrastructure	Facilitates communication between various platforms	Based on mobile network (3G/4G)	KPN	NO	NO
TNO	Role	Research partner	Applied research institute	TNO provides a Flexibility Aggregation Platform, also acts as a simulated aggregator.	-	NO	NO
Priogen	Role	Commercial Aggregator	Commercial aggregator of the flexibility of a grid battery	Trades flexibility to wholesale markets and to the DSO	-	NO	NO

[1] https://www.acm.nl/nl/onderwerpen/energie/wet--en-regelgeving/wet--en-regelgeving-energie/

Actor Name	Actor Type	Actor Subcategories (see Annex A)	Actor description	Further information specific to this UC	Equipment Manufacturer	Grid Connection Requirements	IEC Standards
TNO	Role	Commercial Aggregator	Applied research institute	TNO provides a Flexibility Aggregation Platform, also acts as a simulated aggregator.	-	NO	NO
FAP TNO	System	IS IT	Flexibility Aggregator Platform for commercial aggregator	The flexibility aggregation platform used by the aggregator to control its flexible assets	-	NO	NO
FAP Priogen	System	IS IT	Flexibility Aggregator Platform for commercial aggregator	The flexibility aggregation platform used by the aggregator to control its flexible battery and other assets	-	NO	NO
Smart Storage Unit (Battery)	System		Facilitate storage of energy	-	tbd	NO	61000 61427-2 62281 62485-1 62619 62620
Croonwolter&dros	Role	Local Aggregator	Provider and operator of LIMS	The local aggregator receives payment for used flexibility in the net and has a flex contract with the commercial aggregator.	-	NO	NO
LIMS	System	IS IT	Local Infrastructure Management System	Operation, measurements & maintenance of local flexibility sources	tbd	NO	NO

4. Step by Step Analysis of the Use Case

4.1. List of scenarios (local)

Scenario No.	Scenario Name	Scenario Description	Primary Actor	Triggering Event	Pre-Condition	Post-Condition
PS1	SSU is charged by PV	LIMS lets SSU be charged by available PV energy. Because local aggregator wants to have maximum flexibility available	Local aggregator/LIMS	SSU is not fully charged and availability of PV energy	SSU partly charged PV energy available LIMS is online	**Success if:** SSU is (completely) charged **Failure if:** SSU is offline
PS2	SSU is charged via energy supplier	LIMS lets SSU be charged by energy supplier. Because local aggregator wants to have maximum flexibility available	Local aggregator/LIMS	SSU is not target charged	SSU partly charged LIMS is online	**Success if:** SSU is (completely) charged **Failure if:** SSU is offline
PS3	Voltage support	When the voltage reaches a critical boundary, voltage control is initiated	DSO	GMS receives real time a warning	GMS is online Real time measurements available LIMS is online SSU online and sufficiently charged	**Success if:** When the voltage stays within its critical boundaries **Failure if:** When the voltage does not stay within its critical boundaries or the preconditions are not available
PS4	Power quality	When the power quality reaches a critical boundary, power quality control is initiated	DSO	GMS receives real time a warning	GMS is online Real time measurements available LIMS is online SSU online and sufficiently charged	**Success if:** When the power quality stays within its critical boundaries **Failure if:** When the voltage does not stay within its critical boundaries or the preconditions are not available

4.2. Steps – Primary Scenario

4.2.1. PS1: SSU is charged by PV

Scenario Name :									
Step No.	**Event**	**Description of Process/Activity**	**Information Producer**	**Information Receiver**	**Information Exchanged**	**Service**	**Requirements**	**Communication Media**	**Communication Means**
1	Update SSU Status (available)	The SSU sends its latest status information towards the LIMS.	SSU	LIMS	SSU Status Update	Get	Security, Privacy,	GPRS	SSU specific
2	Update SSU Status (available)	*Use case 3 step 4:* The LIMS sends its latest status information towards the FAP. With this information the FAP creates an expected power consumption profile (A-prognosis).	LIMS	FAP	SSU Status Update	Get	Security, Privacy,	Fibre	Protocol (e.g. OpenADR or EFI)
3	Flex Offer	The PV system has flexibility available and sends an offer to the LIMS.	PV system	LIMS	Flex Offer	Get	Security, Privacy,	Fibre	PV specific
4	Flex Offer	The LIMS sends its latest status information towards the FAP. With this information the FAP creates an expected power consumption profile (A-prognosis).	LIMS	FAP	Flex Offer	Get	Security, Privacy,	Fibre	Protocol (OpenADR or EFI)
5	Send Power File	*Use case 3 step 18:* The FAP sends the power consumption for the next period to the LIMS	FAP	LIMS	Power Profile Allocation	Create	Security, Privacy,	Fibre	Protocol (e.g. OpenADR or EFI)
6	Control Signal (charge)	The LIMS sends a control signal to the SSU to start charging	LIMS	SSU	Control signal	Create	Security, Privacy,	GPRS	SSU specific
7	Update SSU Status (full)	The SSU sends its latest status information towards the LIMS.	SSU	LIMS	SSU Status Update	Get	Security, Privacy,	GPRS	SSU specific
8	Update SSU Status (full)	*Use case 3 step 4:* The LIMS sends its latest status information towards the FAP. With this information the FAP creates an expected power consumption profile (A-prognosis).	LIMS	FAP	SSU Status Update	Get	Security, Privacy,	Fibre	Protocol (e.g. OpenADR or EFI)

Scenario Name :									
Step No.	**Event**	**Description of Process/Activity**	**Information Producer**	**Information Receiver**	**Information Exchanged**	**Service**	**Requirements**	**Communication Media**	**Communication Means**
9	Validate Energy Prognosis	*Use case 3 step 8:* The FAP sends the expected power consumption profile for congestion area 1 (Energy prognosis) to the GMS.	FAP	GMS	Energy prognosis	Create	Security, Privacy,	Fibre	Protocol (e.g. USEF)

4.2.2. PS2: SSU is charged by Supplier (flex request)

Scenario Name :									
Step No.	**Event**	**Description of Process/Activity**	**Information Producer**	**Information Receiver**	**Information Exchanged**	**Service**	**Requirements**	**Communication Media**	**Communication Means**
1	Update SSU Status (available)	The SSU sends its latest status information towards the LIMS.	SSU	LIMS	SSU Status Update	Get	Security, Privacy,	GPRS	SSU specific
2	Update SSU Status (available)	*Use case 3 step 4:* The LIMS sends its latest status information towards the FAP. With this information the FAP creates an expected power consumption profile (A-prognosis).	LIMS	FAP	SSU Status Update	Get	Security, Privacy,	Fibre	Protocol (e.g. OpenADR or EFI)
3	Flex request (for SSU)	The FAP sends a flex request to the GMS for charging the smart storage unit (t solve a problem)	FAP	GMS	Flex Request	Create	Security, Privacy,	Fibre	Protocol (e.g. USEF)
4	Confirmation	The GMS sends a confirmation of the flex request	GMS	FAP	Confirmation	Get	Security, Privacy,	Fibre	Protocol (e.g. USEF)
5	Send Power File	*Use case 3 step 18:* The FAP sends the power consumption for the next period to the LIMS	FAP	LIMS	Power Profile Allocation	Create	Security, Privacy,	Fibre	Protocol (e.g. OpenADR or EFI)
6	Control Signal (charge)	The LIMS sends a control signal to the SSU to start charging	LIMS	SSU	Control signal	Create	Security, Privacy,	GPRS	SSU specific

Scenario Name :									
Step No.	**Event**	**Description of Process/Activity**	**Information Producer**	**Information Receiver**	**Information Exchanged**	**Service**	**Requirements**	**Communication Media**	**Communication Means**
7	Update SSU Status (full)	The SSU sends its latest status information towards the LIMS.	SSU	LIMS	SSU Status Update	Get	Security, Privacy,	GPRS	SSU specific
8	UC 3 step 4 - Update SSU Status (full)	*Use case 3 step 4:* The LIMS sends its latest status information towards the FAP. With this information the FAP creates an expected power consumption profile (A-prognosis).	LIMS	FAP	SSU Status Update	Get	Security, Privacy,	Fibre	Protocol (e.g. OpenADR or EFI)
9	UC 3 step 8 - Validate Energy Prognosis	*Use case 3 step 8:* The FAP sends the expected power consumption profile for congestion area 1 (Energy prognosis) to the GMS.	FAP	GMS	Energy prognosis	Create	Security, Privacy,	Fibre	Protocol (e.g. USEF)

4.2.3. PS3: Voltage Support

Scenario Name :									
Step No.	**Event**	**Description of Process/Activity**	**Information Producer**	**Information Receiver**	**Information Exchanged**	**Service**	**Requirements**	**Communication Media**	**Communication Means**
1	Flex request	*Use case 3 step 11:* The DSO sends a Flex request to FAP in order to request flexibility during the expected congestion period.	GMS	FAP	Flex Request	Create	Security, Privacy,	Fibre	Protocol (e.g. USEF)
2	Flex Offer	*Use case 3 step 13:* The FAP has flexibility during the expected congestion period and sends an offer to the DSO.	FAP	GMS	Flex Offer	Create	Security, Privacy,	Fibre	Protocol (e.g. USEF)

Scenario Name :									
Step No.	**Event**	**Description of Process/Activity**	**Information Producer**	**Information Receiver**	**Information Exchanged**	**Service**	**Requirements**	**Communication Media**	**Communication Means**
3	Flex Procurement	*Use case 3 step 14:* The DSO evaluates the received flex offers, determines that FAP offered flexibility the cheapest. So the DSO sends a flex procurement message to FAP.	GMS	FAP	Flex Procurement	Create	Security, Privacy,	Fibre	Protocol (e.g. USEF)
4	Send Power File	*Use case 3 step 18:* The FAP sends the power consumption for the next period to the LIMS	FAP	LIMS	Power Profile Allocation	Create	Security, Privacy,	Fibre	Protocol (e.g. OpenADR or EFI)
5	Update SSU Status (discharging)	*Use case 3 step 4:* The LIMS sends its latest status information towards the FAP. With this information the FAP creates an expected power consumption profile (A-prognosis).	LIMS	FAP	SSU Status Update	Get	Security, Privacy,	Fibre	Protocol (e.g. OpenADR or EFI)
6	Control Signal (discharge)	The LIMS sends a control signal to the SSU to start discharging	LIMS	SSU	Control Signal	Create	Security, Privacy,	GPRS	SSU specific
7	Update SSU Status (discharging)	The SSU sends its latest status information towards the LIMS.	SSU	LIMS	SSU Status Update	Get	Security, Privacy,	GPRS	SSU specific
8	Update SSU Status (empty)	The SSU sends its latest status information towards the LIMS.	SSU	LIMS	SSU Status Update	Get	Security, Privacy,	GPRS	SSU specific
9	Update SSU Status (empty)	*Use case 3 step 4:* The LIMS sends its latest status information towards the FAP. With this information the FAP creates an expected power consumption profile (A-prognosis).	LIMS	FAP	SSU Status Update	Get	Security, Privacy,	Fibre	Protocol (e.g. OpenADR or EFI)
10	Validate Energy Prognosis	*Use case 3 step 8:* The FAP sends the expected power consumption profile for congestion area 1 (Energy prognosis) to the GMS.	FAP	GMS	Energy prognosis	Create	Security, Privacy,	Fibre	Protocol (e.g. USEF)

4.2.4. PS4: Power Quality

Scenario Name :									
Step No.	**Event**	**Description of Process/Activity**	**Information Producer**	**Information Receiver**	**Information Exchanged**	**Service**	**Requirements**	**Communication Media**	**Communication Means**
1	Flex request	*Use case 3 step 11:* The DSO sends a Flex request to FAP in order to request flexibility during the expected congestion period.	GMS	FAP	Flex Request	Create	Security, Privacy,	Fibre	Protocol (e.g. USEF)
2	Flex Offer	*Use case 3 step 13:* The FAP has flexibility during the expected congestion period and sends an offer to the DSO.	FAP	GMS	Flex Offer	Create	Security, Privacy,	Fibre	Protocol (e.g. USEF)
3	Flex Procurement	*Use case 3 step 14:* The DSO evaluates the received flex offers, determines that FAP offered flexibility the cheapest. So the DSO sends a flex procurement message to FAP.	GMS	FAP	Flex Procurement	Create	Security, Privacy,	Fibre	Protocol (e.g. USEF)
4	Send Power File	*Use case 3 step 18:* The FAP sends the power consumption for the next period to the LIMS	FAP	LIMS	Power Profile Allocation	Create	Security, Privacy,	Fibre	Protocol (e.g. OpenADR or EFI)
5	Update SSU Status (discharging)	*Use case 3 step 4:* The LIMS sends its latest status information towards the FAP. With this information the FAP creates an expected power consumption profile (A-prognosis).	LIMS	FAP	SSU Status Update	Get	Security, Privacy,	Fibre	Protocol (e.g. OpenADR or EFI)
6	Control Signal	The LIMS sends a control signal to the SSU to start charging	LIMS	SSU	Control Signal	Create	Security, Privacy,	GPRS	SSU specific
7	Update SSU Status (discharging)	The SSU sends its latest status information towards the LIMS.	SSU	LIMS	SSU Status Update	Get	Security, Privacy,	GPRS	SSU specific

Scenario Name :									
Step No.	**Event**	**Description of Process/Activity**	**Information Producer**	**Information Receiver**	**Information Exchanged**	**Service**	**Requirements**	**Communication Media**	**Communication Means**
8	Update SSU Status (empty)	The SSU sends its latest status information towards the LIMS.	SSU	LIMS	SSU Status Update	Get	Security, Privacy,	GPRS	SSU specific
9	Update SSU Status (empty)	*Use case 3 step 4:* The LIMS sends its latest status information towards the FAP. With this information the FAP creates an expected power consumption profile (A-prognosis).	LIMS	FAP	SSU Status Update	Get	Security, Privacy,	Fibre	Protocol (e.g. OpenADR or EFI)
10	Validate Energy Prognosis	*Use case 3 step 8:* The FAP sends the expected power consumption profile for congestion area 1 (Energy prognosis) to the GMS.	FAP	GMS	Energy prognosis	Create	Security, Privacy,	Fibre	Protocol (e.g. USEF)

4.3. Steps – Alternative, Error Management, and/or Maintenance/Backup Scenario

Scenario Name :									
Step No.	**Event**	**Description of Process/Activity**	**Information Producer**	**Information Receiver**	**Information Exchanged**	**Service**	**Requirements**	**Communication Media**	**Communication Means**

5. Information exchanged

Inf. ID	Name of information exchanged	Description of information exchanged	Information Subcategories[5] (see Annex B)	Requirements
UC3_S4	SSU status	Information about the status of the grid SSU (State of Charge, Capacity, etc)	Other device state and output	
UC3_S2/5	Energy Prognosis	Prognosis of the power consumption of	Forecast data	
UC3_S8	Energy Prognosis	Prognosis of the available flexibility within the smart storage unit or electric vehicle	Forecast data	
UC3_S10/11	Flex Request	Request from the DSO for a load adjustments of the aggregators portfolio peak reduction or additional electricity	Solution cost and selling price	
UC3_S12/13	Flex Offer	An offer send from the aggregator to the DSO as a reply on the Flex Request, the offer contains an offered amount of flex together	Solution cost and selling price	
UC3_S14	Flex Procurement	A procurement message to acknowledge the agreement for flex procurement between DSO and aggregator	Solution cost and selling price	
UC3_S18/19	Power file	The load profile send to appliances to control their power consumption over time	Forecast data	
UC1_S6	Control signal	Actual fulfilment of the offered flexibility	Algorithm, formula, rule, specific model	

Annex A – List of Actor Subcategories

Category	Type	Subcategory	Definition	Example
Actors	Role	DSO	Responsible for operating, ensuring the maintenance of and, if necessary, developing the distribution system in a given area	Avacon, CEZ, E.ON, Enexis, Enedis
Actors	Role	Industrial partner	All industrial partners involved in InterFlex project at a DEMO level	- GE - Siemens - Schneider …
Actors	Role	University and research partner	All university or research partners involved in InterFlex project at a DEMO level	- RWTH - AIT etc
Actors	Role	Retailer	Licensed supplier of electricity to an end-user	- EDF - Engie...
Actors	Role	Legal Client	A legal client of a DSO that is involved at Demo scale	- Company producer - Municipalities - Tertiary service providers
Actors	Role	Physical client	A physical client of a DSO that is involved at Demo scale	- Residential client
Actors	System	Charging facilities	Facilities to charge electrical vehicles	- Charging facilities
Actors	System	DER installation	Power plant that use renewable technology and are owned by a legal person	- Photovoltaics panels - Biomass farm - Wind power, …
Actors	System	In house device	All devices working on electricity that can be find in a customer's dwelling.	- Heater - Meter - Local display - Customer's battery
Actors	System	Communication infrastructure	All the infrastructure that are used for communication at all level (from customer's place to power command)	- Modem - Routers
Actors	System	Network device	All devices placed on MV/LV network for monitoring or gathering information on grid's situation or electrical parameters values. It also include the IS associated	- Secondary Substation control infrastructure - RTU : Remote terminal units - Circuits breakers - sensors
Actors	System	IS IT	All the hardware and software associated, used at power command to control and monitor the network	- SCADA - Central database - Control operation center
Actors	System	Interactive communication device	All device used to interact with customers in order to involved him in the Demo	- Web portal - Display used for communication

Annex B – List of Information Subcategories

Category	Type	Subcategory	Definition	Example
Data	Document	Internal document	All the documentation made by Demo to run operation, to monitor and conduct the project's good development	- Meeting minutes - Report on the cost's impact of selected flexibility plans
Data	Document	InterFlex deliverable	All the deliverables that Demo have to produce during the project's time as agreed in the DOW	- Risk analysis - Documentation on KPI - Detailed Use Case - Report on technical experimentation, market research, …
Data	Document	Communication material	All the documentation that describe the project to the public and can be put on the future website	- Purpose of the DEMO (leaflet) - Brief description of Use Case - Location of Use Case
Data	Financial data	Project financial data	All the financial data that are produced during the project and that are used to make financial report for European Commission and internal report	- Invoices - Cost and time imputation
Data	Financial data	Solution cost and selling price	All the financial data that can be made concerning estimation prices of solution for replication	- Unit product cost of hardware developed by Demo - Sell price of the solution develop (software,…)
Data	Parameter	Condition parameter	All the external parameters that may influence the success of the Use Case	- Weather - Time of day - Day of week …
Data	Parameter	Scenario assumption	All the stated parameters that are necessary to determinate a scenario for the Use Case	- Location of islanding - Experiment's location
Data	Parameter	Electrical parameter	All the electrical parameters that are used to supervise the network and its good state	- Intensity - Voltage - Frequency - Quality
Data	Parameter	Algorithm, formula, rule, specific model	All the intellectual data that are created during the project to made software's contents	- Algorithm to optimize flexibility plan - Simulation to determine location of circuit breaker - Voltage regulation algorithm
Data	Parameter	Optimized value	Values of parameters that optimized the Use Case or the demo‘s performance	- Optimization time of islanding
Data	Parameter	Forecast data	All the data used to forecast consumption or production of customer	- Forecast customer's consumption - Forecast photovoltaic panels' production
Data	Facility data	Network topology	All information on network devices and their location and interaction, mainly coming from GIS (Geographic Information System)	- Map of the network - Substations location - All the other data found in the GIS (Geographical Information System)
Data	Facility data	Network state	All information concerning the network's status (global or local) at a precise moment useful to monitor the network	- Feeding situation in a distribution area - State of network regarding Limit value violation - Location of constraint - Flexibility needs of DSO
Data	Facility data	Customer's meter state and output	All the information concerning customer’s meter state and outputs information	- Customer’s consumption or production

Category	Type	Subcategory	Definition	Example
Data	Facility data	Other device state and output	All the information concerning device's state and outputs information	- State of charge of batteries - Consumption data coming from meter - Production data coming from meter - State of charge of storage components
Data	Parameter	Information exchanged between IS or sent to device	All automated information sent between facilities in order to send information or order for monitoring	- Order sent to breaker devices (open, close,…) - Information on local network status coming from sensors - Order and roadmap sent to network devices (batteries, aggregator,…)
Data	Parameter	Detailed specification on devices	All detailed information (reference components, specification, process,…) useful to build the devices	- Detailed specification of the telecommunication infrastructure - Detailed specification of interactive sensor network
Data	Network data	Network topology	All information on network devices and their location and interaction, mainly coming from GIS (Geographic Information System)	- Map of the network - Substations location - All the other data found in the GIS (Geographical Information System)
Data	Network data	Network state	All information concerning the network's status (global or local) at a precise moment useful to monitor the network	- Feeding situation in a distribution area - State of network regarding Limit value violation - Location of constraint - Flexibility needs of DSO
Data	KPI	Data for KPI (input raw data)	All raw data that are used to calculate the final KPI	- Duration of experiment - Customer response to DSO's demand - Electrical parameter used for KPI
Data	KPI	KPI (KPI values)	All the KPI values and the way to calculate them	- Economic KPI - System Efficiency KPI
Data	Customer data	Customer contract’s data	All the data in customer's contact that are used for contact or make payment	- Address - Phone number - Bank account details
Data	Customer data	Information sent to /received from customer	All the information and data that are exchanged between the DEMO and the customer in order to involve customer in the experiment	- Customer's response to DSO's request to reduce consumption - Information and data available to customer in order to visualize its consumption - Advices and encouragement sent to encourage a smart consumption
Data	Customer data	Customer analysis (profile analysis, studies on client reactivity,…)	All the data that are produced in order to better understand the customer's behaviour regarding the possibility to adopt smarter habits in their electricity consumption	- Customer's typology and behaviour patterns - Analysis on customer's response to DSO's request