Begonia

USE CASE 6:

A cross-border recommender tool and flexibility procurement mechanism for grid services

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Use case identification

Table 1. Identification of use case 6.

ID	Name of Use Case	Geographical scope	Cross-sector domains			Interoperability layers
			Electric	Mobility	Data	
BEG.06	A cross-border recommender tool and flexibility procurement mechanism for grid services	☒ Local ☒ Regional ☒ National ☒ Cross-border ☐ Outermost	☒ Customer ☒ DER ☒ Distribution ☒ Transmission ☐ Generation	☐ Customer information ☒ Vehicle ☒ Energy station ☒ Infrastructure ☐ Traffic and logistic	☒ Edge ☐ Fog ☒ Cloud	☒ Component ☒ Communication ☒ Information ☒ Function ☒ Business

The scope and objectives of the use case

Table 2. Scope and objectives of use case 6.

Scope and Objectives of the Use Case	
Scope	The goal of this use case is to introduce an ODP for facilitating the cross-border participation of CLs and end-user customers in distribution and transmission grid services. The ODP allows different types of CLs to connect the platform directly or indirectly via aggregators. It also allows the customers to react to ODP calls for services manually via mobile apps. Two types of services are defined for the ODP, 1) a recommender service that analyzes the supply and demand at each state and determines how vulnerable the grid is and sends recommendations to loads and end-users to prevent imbalances or cutting the output power of RESs, 2) a balancing service that acts as a aggregator in EU level that is used as a tool parallel with existing mechanisms to provide ancillary services for TSOs and DSOs. Allowing cross-border flexibility trading provides market opportunities for aggregators and demand-side flexibility and reduce the costs of procuring flexibility from traditional resources.
Objective	The main goals of the use case are as follows: • Introducing a mechanism for procuring demand-side flexibility at the EU level taking into account the existing mechanisms, • Proposing a recommender service for analyzing the grid vulnerability and benefiting from demand-side flexibility for preventing power imbalances and RESs' power cuts, • Proposing a tool for aggregation and classification of the demand-side flexibility at the EU level, • Providing new market opportunities for aggregators, • Reducing the need for conventional flexibility resources, • Providing services for TSOs and DSOs.
Reference country(ies)	Denmark
Related Business Case	E. g. Distribution grid operation, transmission system operation, load aggregation, flexibility market

Possible stakeholders	Aggregators, TSOs, DSOs, end-user customers,

Narrative of the use case

European electric power systems are undergoing important changes. With the adoption of the European Green Deal, the EU aspires to become the world first's climate-neutral continent by 2050. RESs are the key driver for achieving this goal. Due to the unpredictable nature of RESs, the power system needs innovative solutions to continue keeping energy injections and withdrawals in balance instantaneously, ensuring a stable and secure operation. On the other hand, increased penetration of RESs in the distribution grid level together with electrification of heat and transport sectors are posing challenges to the distribution system operation. So, both transmission and distribution systems are affected by new changes in power system generation and consumption.

To overcome these issues two types of actions can be taken, 1) prevent the issues from happening as much as possible, and 2) react fast enough to reduce and mitigate the impacts of issues. Taking preventive actions not only reduces the stability risks of the grid but can also be cost-effective by reducing the need for reserves and preventing the RES output power cuts.

In addition to the existing mechanisms for grid services, demand-side flexibility is introduced as a promising solution for balancing the power system and solving distribution grid issues. Any controllable device such as EVs, HVAC systems, batteries, etc. can contribute to flexibility services. Since demand-side flexibility is small in scale and large in number, aggregation and coordination mechanisms are used by aggregators, and then the aggregated flexibility can be offered to the DSO or TSO. The point is that TSOs' ancillary service markets of different countries act in an independent manner, which allows the aggregators to be in contact with one TSO. This limits market opportunities for CLs and aggregators. Also, regulations might not allow them to provide grid services in some countries while other countries could be open to demand-side flexibility. On the other hand, providing the possibility of interaction between aggregators and TSOs in different countries and looking into the congestion and balancing issues as problems at the EU level can facilitate solving these issues. Even when the ancillary services are procured in a central way in the EU, the proposed flexibility capacity of many aggregators might not be enough to participate in these markets due to the regulations on minimum capacity. In this case, a re-aggregation of aggregators' capacity can be useful for both TSOs and aggregators.

DSOs can also benefit from interaction with different aggregators and CLs in their area to solve distribution grid issues.

Considering all the above explanations, a use case is defined to develop a cross-border ODP for providing the following services:

- A recommender service that sends recommendations to the CLs directly (via mobile apps or energy management systems (EMS)) or indirectly (via aggregators) to inform about the vulnerability of the grid at each member state or region and ask for suitable reaction to reduce the risk of occurring any issues or cutting output power of RESs. The risk assessment is done using historical and real-time data and applying advanced data-driven and AI-driven methods,
- A demand-side flexibility procurement service for solving distribution or transmission grid issues at the EU level. This service aggregates and classifies the flexibility capacity of the devices that are connected to this service directly or indirectly and uses them to solve grid issues.

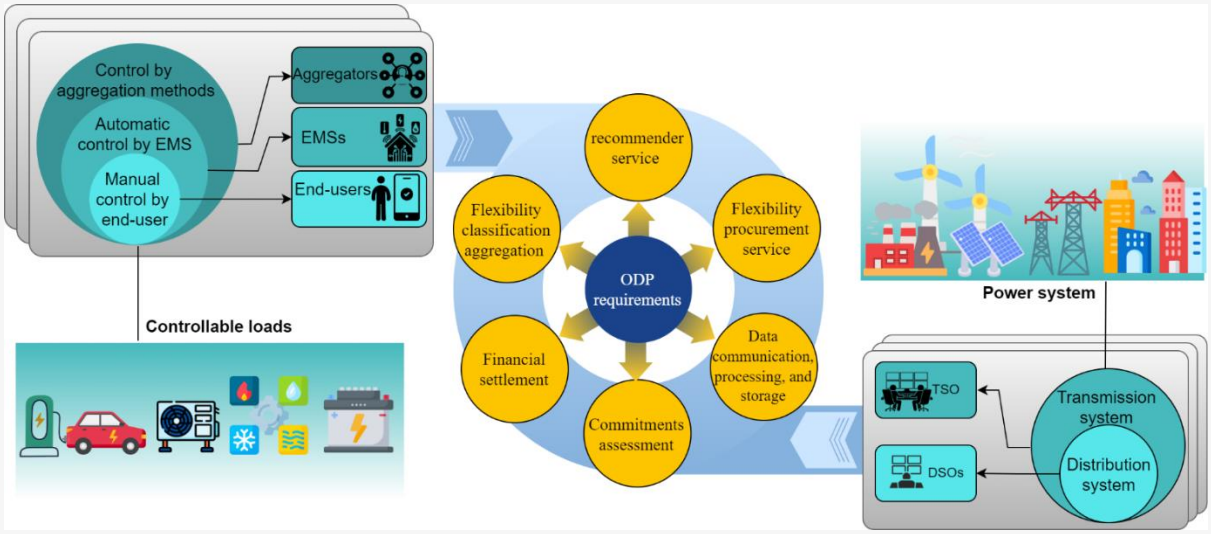

Figure 1. Requirements of the proposed ODP for use case 6.

A block diagram of the use case requirements is presented in Figure 1. The ODP allows access to any user including end-user customers that can interact with ODP manually via mobile apps, controllable devices connected to EMSs, and aggregators that control a group of devices. End-users that connect to the platform via the mobile app are suggested to participate only in the recommender service voluntarily. This is because these devices are not connected to the platform and their operation cannot be assessed and included in the technical and financial transaction. CLs and aggregators can participate in both above-mentioned services, So, in addition to receiving recommendations for changing their power consumption, they should also report their available flexibility capacity and respond to flexibility requests received from the platform. This needs some hardware and software requirements at the device level that should be considered.

Since some of the services are location-based such as congestion management or voltage regulation, when a new device is added to the system, its geographical data should be registered. This data should be stored at the member state level and is not shared among member states. Also, the detailed flexibility capacity of each device should not be shared

among states and only the aggregated values should be reported. These considerations are for data security and privacy reasons.

Any DSO or TSO at the EU level can get connected to this ODP. DSOs can receive location-based services. However, TSOs can receive balancing services from any device in the synchronous area. The power transfer capacities between member states should also be considered when flexibility is procured in a cross-border way.

A financial settlement method should be defined to incentivize aggregators and end-users to join the ODP. Additionally, an evaluation method is required to assess the commitment of users to their obligations.

Diagram of the use case

The diagram of the use case 6 is presented in Figure 2. Actors' actions and scenarios' descriptions are presented in Table 3 and Table 4, respectively.

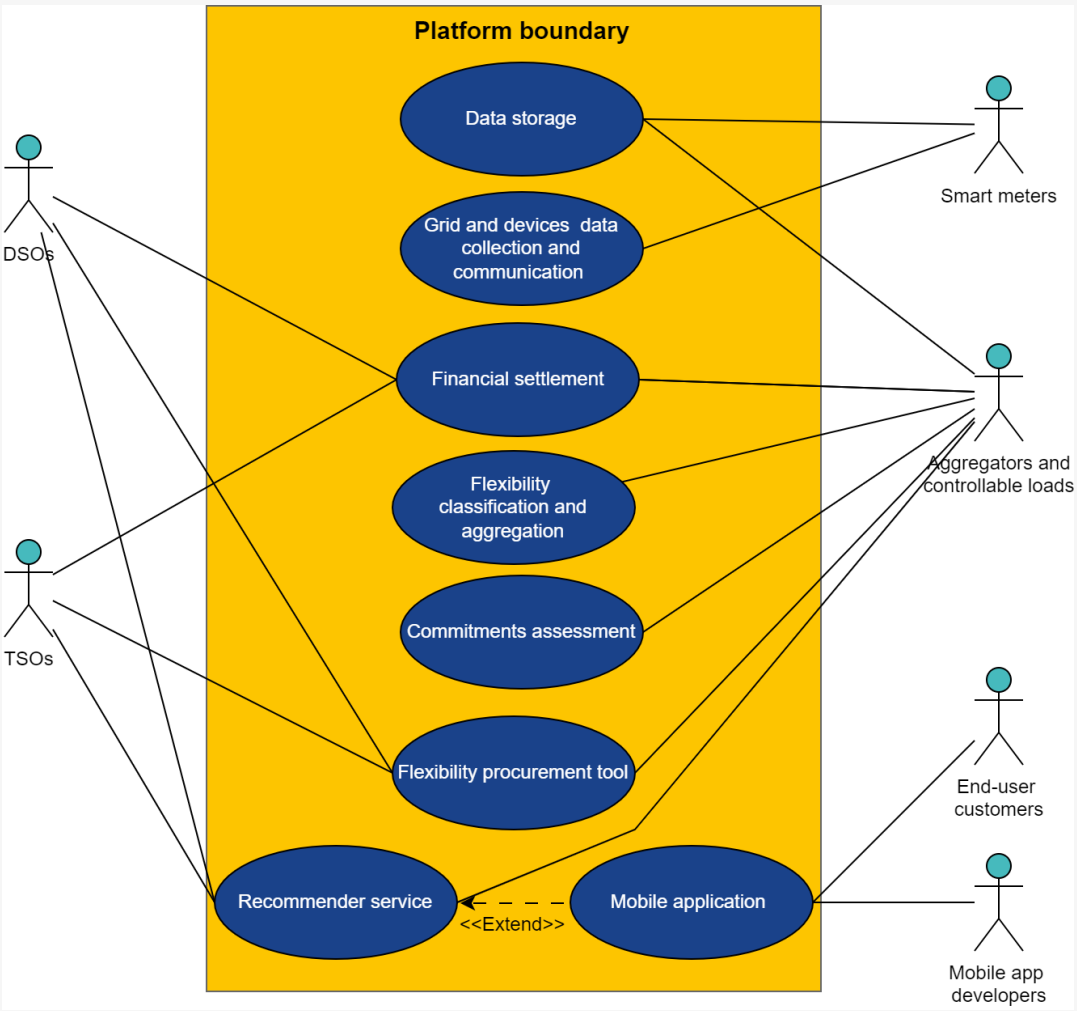

Figure 2. Diagram of use case 6.

Actors of the use case

Table 3. Description of the actions of use case 6 actors.

Actor Name	Actor Type	Actor description	Actions	Standards
Smart meters	System	A smart meter is an electronic device that records information and communicates the information to a supplier.	Smart meters record grid and controllable devices and send the measurements to the data storage.	No
Aggregators and CLs	Role/system	An aggregator pools electricity supply and/or demand and sells this capacity in the electricity markets. A controllable device is an electric device that its power consumption can be controlled by control signals.	Aggregators and controllable devices report their available flexibility capacity to the ODP and receive recommendations when the grid is at risk and flexibility requests when an incident occurs.	No
DSO	Role	An entity 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.	DSOs monitor their grid and collaborate with ODP in providing recommender and flexibility services. They also contribute to the financial settlement of flexibility services.	No
TSO	Role	An entity responsible for operating, ensuring the maintenance of and, if necessary, developing the transmission 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 transmission of electricity.	TSOs monitor transmission systems and collaborate with ODP in providing recommender and flexibility services. They also contribute to the financial settlement of flexibility services.	No
End-user customers	Role	The final consumers of electricity.	They receive recommendations via mobile apps and react manually and voluntarily	No
Mobile app developers	Role	Companies that develop mobile applications	They develop mobile apps that allows end-users to receive notifications of grid status and react	No

Scenarios

Table 4. Description of use case 6 scenarios.

S.No	Scenario Name	Triggering Event	Scenario Description	Primary Actor
BEG.06.S1	Grid and device data collection and communication	Continuous	The grid and device parameters are recorded and sent to the data storage	Smart meters
BEG.06.S2	Data storage	When new data is received	Data is preprocessed and stored in the data center	Smart meters
BEG.06.S3	Flexibility classification and aggregation	A flexibility capacity is announced by aggregators or controllable devices	Flexibility capacity of the aggregators and controllable devices for a specific period is aggregated and classified based on location	Aggregators and controllable devices
BEG.06.S4	Commitments assessment	After providing a service	After the period of flexibility provision, the accuracy of following the commitments is evaluated	Aggregators and controllable devices
BEG.06.S5	Flexibility procurement tool	Continuous, when flexibility is needed	A tool needs to be developed to determine how the flexibility should be procured considering the available capacities.	TSO/DSO
BEG.7.S6	Recommender service	When the system is in potential stability and reliability risks	Data-driven and AI-driven methods are used to measure the vulnerability of the system and send recommendations to users	TSO/DSO
BEG.7.S7	Financial settlement	After providing a service	Considering the procured flexibilities and agreed prices, the financial settlement is done.	TSO/DSO
BEG.7.S7	Mobile application	Once when the platform is developed	A mobile app is developed for end-user customers to participate in the recommender service	Mobile app developers

Policy and digitalisation needs

Table 5. Description of use case 6 policy and digitalisation needs.

Policy needs	• New policies for facilitating the participation of demand side and aggregators in ancillary service markets, • Ensuring the possibility of sharing flexibility data among EU member states, • Defining a mechanism for measuring the flexibility provided by CLs and aggregators
Digitalisation needs	• Providing the possibility of data communication between all market players and the platform, • Interoperability of different ODP components, • Affordable hardware and software tools for CLs to interact with ODP