Begonia

USE CASE 5:

An ODP for interaction among EV owners, charging stations, and grid

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Use case identification

Table 1. Identification of use case 5.

ID	Name of Use Case	Geographical scope	Cross-sector domains			Interoperability layers
			Electric	Mobility	Data	
BEG.05	An ODP for interaction among EV owners, charging stations, and grid	☒ 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 5.

Scope and Objectives of the Use Case	
Scope	Charge Point Providers/Operators (CPPs) play a crucial role in the EV ecosystem by designing and managing the infrastructure for EV charging. Being primarily restricted to specific geographical locations, they enable monitoring and real time control of charging stations. EMSPs, on the other hand, focus on giving users access to a broader network of charging stations often managed by several CPPs, as well as providing related business services including predictive analytics, integrated energy management and enhanced grid services. They can have a stronger profile for flexible operations and deeper knowledge of regulatory compliance in different countries. The collaboration of EMSPs and CPPs for the cross-border coordination of charging and grid operations across the EU requires advanced digital tools for data storage, analysis and GDPR, as well as communication and business transactions. By combining these tools, the use case aims at building an ODP enabling high-quality booking and charging services for EV owners and real-time flexibility monitoring services for EMSPs. As a secondary objective, it would enable more profitable participation in the ancillary service market by the EMSPs.
Objective	The main goals of the use case are as follows: • Provide on-demand charging services to EV owners traveling between the member states, alleviating waiting times and improving logistics, • Providing optimal charging point selection, booking and managing services considering the location and trip plan, • Developing an EV roaming service and facilitating the cross-border payments, • Developing methods to use EVs flexibility for ancillary services to solve grid challenges at distribution and transmission levels.
Reference country(ies)	France, Belgium

Related Business Case	Grid operation, EV charging service, E-roaming
Possible stakeholders	DSOs, Aggregators, EV charging points, Facilities with CLs, Electricity customers

Narrative of the use case

The number of EVs on the roads is growing exponentially. EVs became the third most popular choice among buyers in 2023, with a 14.6% share. The European Automobile Manufacturers' Association (ACEA) reported that the overall volume of EV sales in the EU in 2023 surpassed 1.5 million units, reflecting a substantial 37% increase compared to 2022. This impacts different systems and stakeholders, creating both difficulties and potential benefits. With the increase in EVs comes a greater need for more charging points, making it crucial for EV owners to find available and affordable charging stations. However, simultaneous charging of many EVs can cause grid congestion. To address this, coordination methods at charging stations can be used to manage the load, reduce grid impacts, and even provide services for the DSO or TSO.

In this use case, a cross-border ODP is proposed to manage the interactions among EV owners, CPPs, and grid at the EU level offering:

- Booking services to EV owners that can choose charging locations based on their preferred route within the EU, plan their route based on the cheapest charging, or subscribe to roaming service with fixed charging prices within the EU,
- Real-time operation services to EMSP who gets better grasp on the future charging operations,
- Benefit to CPPs due to increased utilization of charging points.

A possible solution to the above operation requirements is by creating an ODP interface for EMSP to influence the charging speed of the booked location by agreement with local CPPs. The flexibility for more effective operation is unlocked through coordinated charging power regulation in all locations. The coordination schedule is calculated in real-time based on charging cost minimization under the SOC constraints fixed by the EV booking service in well-defined time periods.

To demonstrate the concept, Figure shows different transactions communicated at different times between the ODP services and physical actors (EVs, DSO/TSOs, and CPPs) connected through their UIs/APIs:

- An EV owner registers/authenticates with the ODP thereby identifying the type of user subscription. i.e. real-time dynamic price or E-roaming. In the first case, the dynamic local price at the charging point is used to calculate the charging cost. Using E-roaming, EV owners can buy subscriptions that guarantee a fixed predetermined price up to certain levels of charging anywhere for the subscribed consumers,
- An EV owner books the time slot on a charging network within a group of EU countries by sending the information about the vehicle, payment method, and

final SOC to the ODP. Alternatively, the user can define a route for the whole trip and get an estimation of the best price,

- The total estimated cost is automatically calculated and sent back to the consumer,
- When the end of charging is reported by CPP, the payment is transferred, and an electronic invoice is sent back to the consumer,
- If the regulations impose bidding flexibility in a day-ahead manner, a flexibility estimator tool calculates the available flexibility for the next day using AI and other advanced methods,
- A tool is required for procuring the flexibility for ancillary services in real time,
- A geographical data analysis tool will also be useful for managing flexibility in a location-based manner for providing grid services that require flexibility in certain locations.

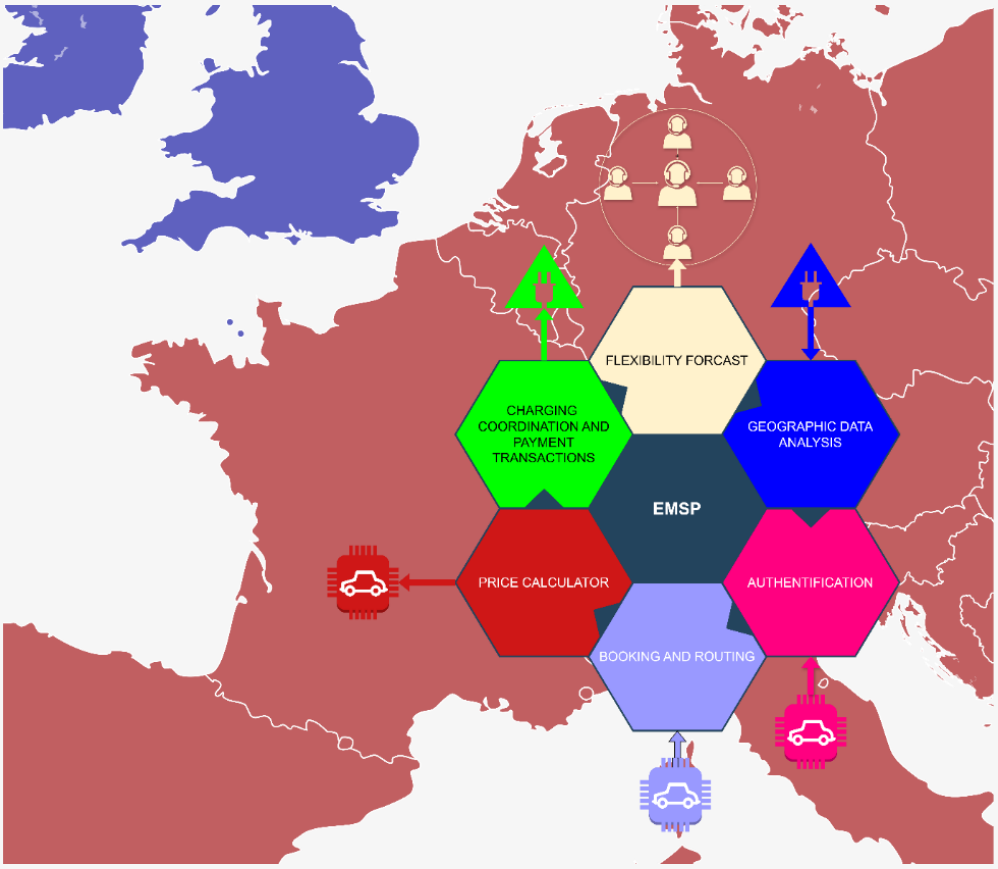

Figure 1. Time-snapshot of ODP transactions proposed by use case 5.

Depending on the country of service, different payment methods may be supported, but standard payment methods (VISA, MasterCard, bank transfer) are supported irrespective of the location of charging stations.

Successful implementation of the method requires some technical information about charging stations and connected EVs to the charging stations such as charging rates and Vehicle-to-grid (V2G) capability of the Vs.

In the case of providing grid services, the ODP will have revenue just like other ancillary service providers that can be included in the EV owners' bill as a discount.

Diagram of the use case

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

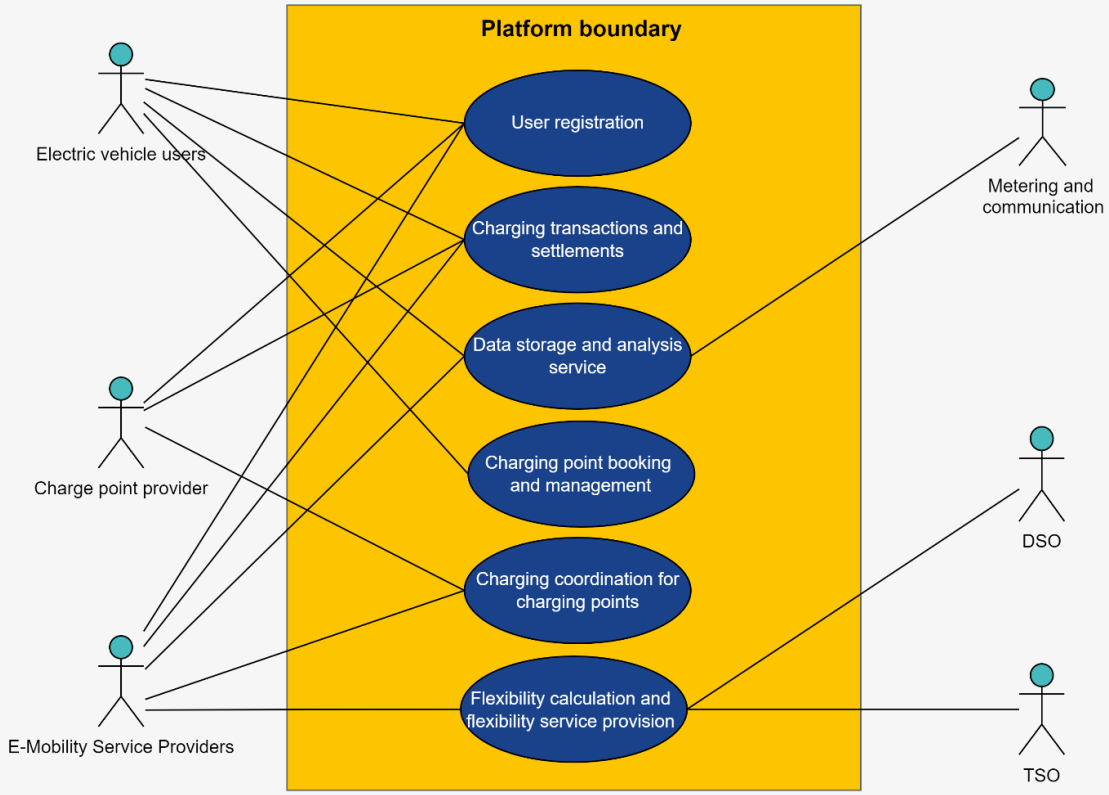

Figure 2. Diagram of the use case 5.

Actors of the use case

Table 3. Description of the actions of use case 5 actors.

Actor Name	Actor Type	Actor description	Actions	Standards
Metering and communication devices	System	Devices used to record specific types of data and communicate those data to the platform.	Meters at charging points record the energy consumption data and send them to the data storage system in the platform.	No
EV users	Role	The owners of EVs.	EV owners register in the platform, share their location data, and receive offers from charging points close to the location of their requested location. They can also manage their booking. In the end, they receive the invoice for the service.	No

EMSP	Role	EMSPs are companies that offer services related to EV charging. They typically focus on providing users with access to a network of charging stations, which may include routing, access and payment solutions, roaming, value-added, and customer support services.	EMSP accepts the registration of new devices, performs the calculations of charging cost, applies charging coordination methods, calculates flexibility, and offers it to the ancillary service markets.	No
CPP	Role	The operator of the charging station. Modern charging stations from CPPs collect detailed data on energy consumption, usage patterns, and grid interactions. This data is invaluable for CPOs in predicting energy needs and optimizing procurement strategies.	CPP registers in the platform, provides the availability data of charging points to the platform, receives charging coordination service from the platform, and information about charging transactions.	
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.	Receives flexibility bids from EMSP.	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 can receive location-based flexibility offers and services from EMSP, as well as information about the available capacity from the EMSP to ensure stable grid operation.	No

Scenarios

Table 4. Description of use case 5 scenarios.

S.No	Scenario Name	Triggering Event	Scenario Description	Primary Actor
BEG.05.S1	User registration	An EV or CPP joins the platform	When an EV or CPP request for using the platform, the related information is received and registration is completed.	EV owner or CPP
BEG.05.S2	Charging transactions	At the end of charging an EV	After the period of charging ended, the total cost is calculated considering the	EMSP

	and settlements		price type selected by EV owner, and the invoice is sent to the EV owner.	
BEG.05.S3	Data storage and analysis service	The data from CPP or EV is received	Provides services for storing the data of EVs and CPPs and analyzing the data for instance based on EVs or CPPs geographical location. These analyses can be used later for calculating flexibility in different locations in the grid.	EMSP
BEG.05.S4	Charging point booking and management	EV owner decides to charge the car	EV owner checks the options and book a charging point. He/she can also manage the booking i.e., cancelling or changing the parameters.	EV owner
BEG.05.S5	Charging coordination for charging points	When a new EV books a charging point or a flexibility service is provided	The platform provide charging coordination service for CPPs. This charging coordination can be for minimizing the total cost or providing grid services.	EMSP
BEG.05.S6	Flexibility calculation and flexibility service provision	Continuous, in specific time intervals	Based on data received from EV owners, available flexibility is calculated and offered to the ancillary service market. Prediction methods can estimate available flexibility for the next day if required to offer flexibility in a day-ahead manner.	EMSP

Policy and digitalisation needs

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

Policy needs	The main policy concerns for this use case are about data sharing. • Data-sharing agreements must be made with renewable energy producers, EVSE and mobility fleet owners, or traffic operators, considering GDPR. • Regulations are required to allow data sharing among stakeholders. • There are concerns about if the companies are willing to share their internal data such as the produced energy, the energy consumption from EVSEs, and the daily route and charging habit of their EVs, • Regulations are required to allow the participation of the EMSP as aggregators in ancillary service markets.
Digitalisation needs	Digitalization needs for this use case primarily include the access of the ODP to • Real-time and historical data of the renewable energy producers, EVSE, and mobility fleet owners. • Communications channel to EV users (like the fleet's or traffic management's mobile apps).