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# Electric Vehicles Management for carbon neutrality in Europe

# Deliverable D5.1
# Information Exchange needs to enable different UCs

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## Disclaimer



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## Executive Summary

The deliverable *Information Exchange needs to enable different UCs* collects information regarding the needs among actors or stakeholders in EV4EU demonstrators. D5.1 will provide a basis for the goal of Work Package 5, which is to define, design and implement the Open V2X Management Platform to support next-generation Vehicle-to-everything technology, user-friendly and ergonomic APIs and APPs.

The objective of this deliverable is to capture the information exchange needs and barriers between stakeholders within the EV4EU project demonstrators in Portugal, Denmark, Slovenia and Greece. To achieve this goal, the work extends the defined business use cases with a focus on the actors and the information exchange between them. The specificities of each demonstrator are considered, and information is collected in a standardised format. It is also crucial for the later development of the Open V2X Management Platform to identify any barriers to information exchange between the actors.

This deliverable takes the results of the deliverable D1.4 Business models centred in the V2X value chain and the deliverable D1.5 V2X Use-cases repository and transforms them to be suitable as a basis for the deliverable D5.2 Standardisation gap analysis for new V2X related Business Models. It can be considered as a bridge between the business level communication layer of the project and the technical communication layer. It is aimed not only as a blueprint for the demonstrators in the EV4EU project, but also as a guide for similar tasks in similar projects.

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## Keywords, Acronym

| | |
|---|---|
| BM | Business model |
| BUC | Business use case |
| CPO | Charging Point Operator |
| D1.4 | Deliverable 1.4 |
| D1.5 | Deliverable 1.5 |
| D5.2 | Deliverable 5.2 |
| DER | Distributed Energy Resources |
| DERMS | Distributed Energy Resources Management System |
| DR | Demand response |
| DSO | Distribution System Operators |
| EMRP | Electric Mobility Rooming Provider |
| EV | Electric Vehicle |
| EV4EU | Electric Vehicles Management for Carbon Neutrality in Europe |
| FMO | Flexibility Market Operator |
| FO | Flexibility Operator |
| KPI | Key Performance Indicator |
| OPF | Optimal Power Flow |
| PV | Photovoltaic |
| RES | Renewable Energy Sources |
| TSO | Transmission System Operators |
| V2G | Vehicle-to-Grid |
| V2X | Vehicle-to-Everything |
| VPP | Virtual Power Plants |
| WP | Work Package |

# 1 Introduction

The Electric Vehicles Management for Carbon Neutrality in Europe (EV4EU) project proposes and implements user-centric Vehicle-to-Everything (V2X) management strategies that set the stage for mass deployment of electric vehicles (EVs). Large-scale adoption of EVs can be successful if information is exchanged between all stakeholders. This deliverable intends to identify the information exchange needs between all the actors or stakeholders that will be involved in development of the information platforms, which will be tested in the selected demonstrators of EV4EU.

## 1.1 Scope and Objectives

This document collects the information exchange needs and the barriers between the actors within the EV4EU project demonstrators, located in Portugal, Denmark, Slovenia, and Greece. The objective of this work is to collect how actors exchange information in selected BUCs with specific technical details related to the platform development.

To achieve this objective there will be a focus on the actors and the information exchange needs between them. The specifics of each individual demonstrator are considered, and thus all relevant information will be collected. For the development of an Open V2X management platform (O-V2X-MP) it is also crucial to identify any barriers in the information exchange between the actors.

## 1.2 Structure

This deliverable can be divided into three interconnected parts. Chapter 2 collects an overview of how the information exchange relates to the previously developed work. It will give a brief overview of the contributions made on tasks T1.4 and T1.5 of EV4EU. This is followed by Chapter 3 where a presentation of the information exchange needs and barriers for each BUC is given. Finally, in Chapter 4, the information exchange needs and barriers are identified for all BUCs, while information is summarized in Table 12. This chapter will also identify the following needed steps.

## 1.3 Relationship with other deliverables

This document was prepared in parallel with the deliverable **D1.4 Business models centred in the V2X value chain** and the deliverable **D1.5 V2X Use-cases repository**. These deliverables main contributions are shortly summarized in Chapter 2 allowing the reader to have sufficient information. Given that task 5.1 is completed at a very early stage of the project, before deliverables D1.4 and D1.5 have been completed, there might be some information that is not available in this document.

This deliverable is also related to deliverable **D5.2 Standardisation gap analysis for new V2X related Business Models** and can be considered as a bridge between the business level communication of the project (T1.4 and T1.5) and the technical level of communication (T5.2). Therefore, the technical details missing in this deliverable are made available in deliverable D5.2.

# 2 Inputs from other tasks and background theory

To identify the information exchange needs and barriers, there is the need to identify the stakeholders or actors, their relationships, required interactions, and underlying communication channels. The outline of this chapter corresponds to the steps in Figure 1.

This deliverable will briefly introduce the demonstrators and the actors, followed by an overview of the selected BMs and BUCs, which are in the scope of **D1.4** and **D1.5,** and finally an overview of the information exchange needed between the actors, together with needs and barriers related to each of the pilots.

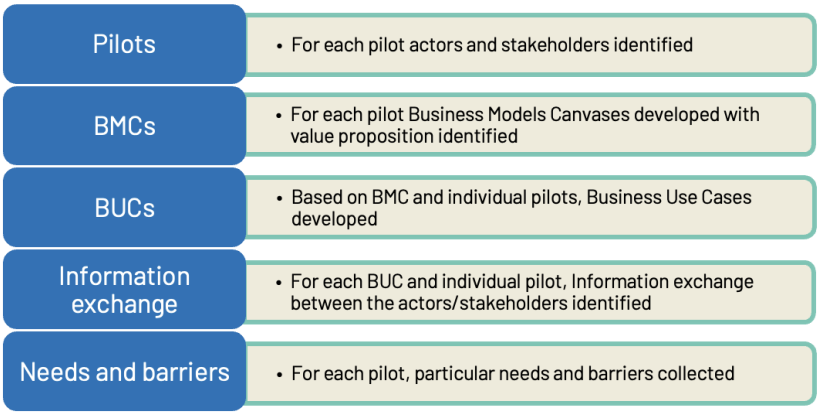


**Figure 1: Process of identifying Information exchange needs and barriers**

## 2.1 Definition of actors and stakeholders

The actors or stakeholders involved in power generation, transportation, distribution, etc., have been the subject of previous research. There are twelve stakeholders identified in the application of Vehicle-to-Grid (V2G) technology in a generic power grid (Sovacool, Kester, Lance, & Zarazua de Rubens, 2020). Figure 2 presents stakeholders applicable to EV4EU project.

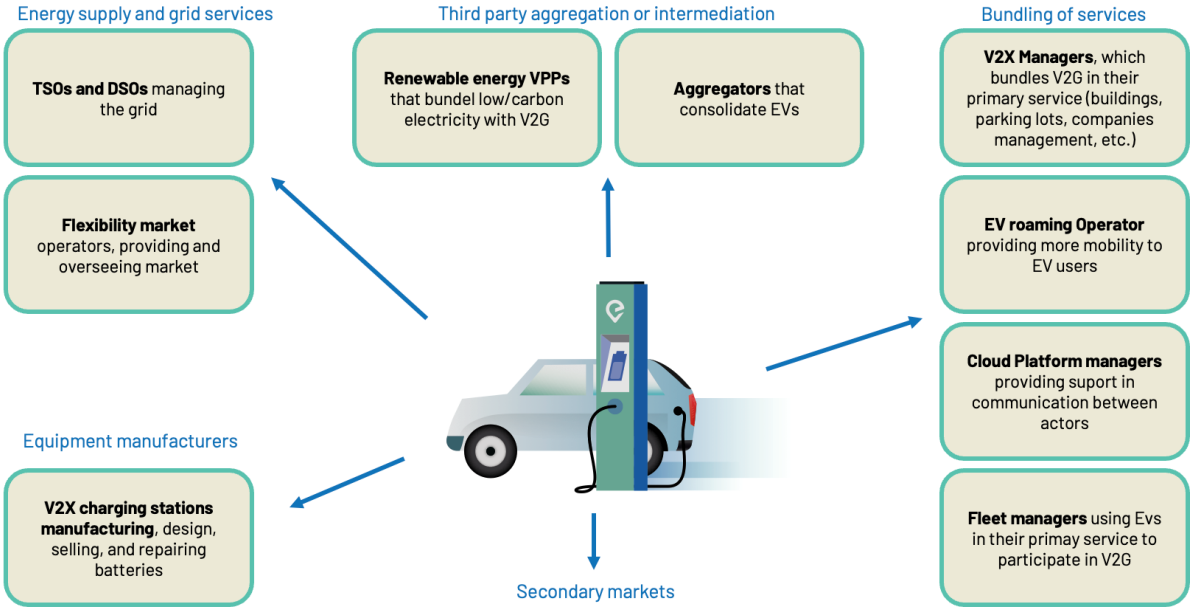


**Figure 2: Stakeholders in V2X based business model applicable for EV4EU project. Based on (Sovacool, Kester, Lance, & Zarazua de Rubens, 2020)**

The actors identified by Sovacool et at. (Sovacool, Kester, Lance, & Zarazua de Rubens, 2020) apply to a general case on the implementation of V2G. In this deliverable the interactions between the actors and stakeholders will be investigated, allowing the development of BUCs and all the specifics on each of the four demonstrators in this project that will occur in Portugal, Denmark, Slovenia, and Greece.

On the island of São Miguel, Azores, Portugal, V2X strategies will be tested to facilitate EV charging in homes, buildings, and businesses. In Denmark, EV4EU will test different methods of energy management in buildings and parking lots, incorporating renewable energy sources (RES). At the Slovenian demonstrator site, this project will test the impact of V2X on the power grid, energy market, and system services. In Greece, EV4EU tests a more intuitive platform for managing charging stations and study the impact of EVs on the power grid. A general overview for all four demonstrators is presented in Figure 3.

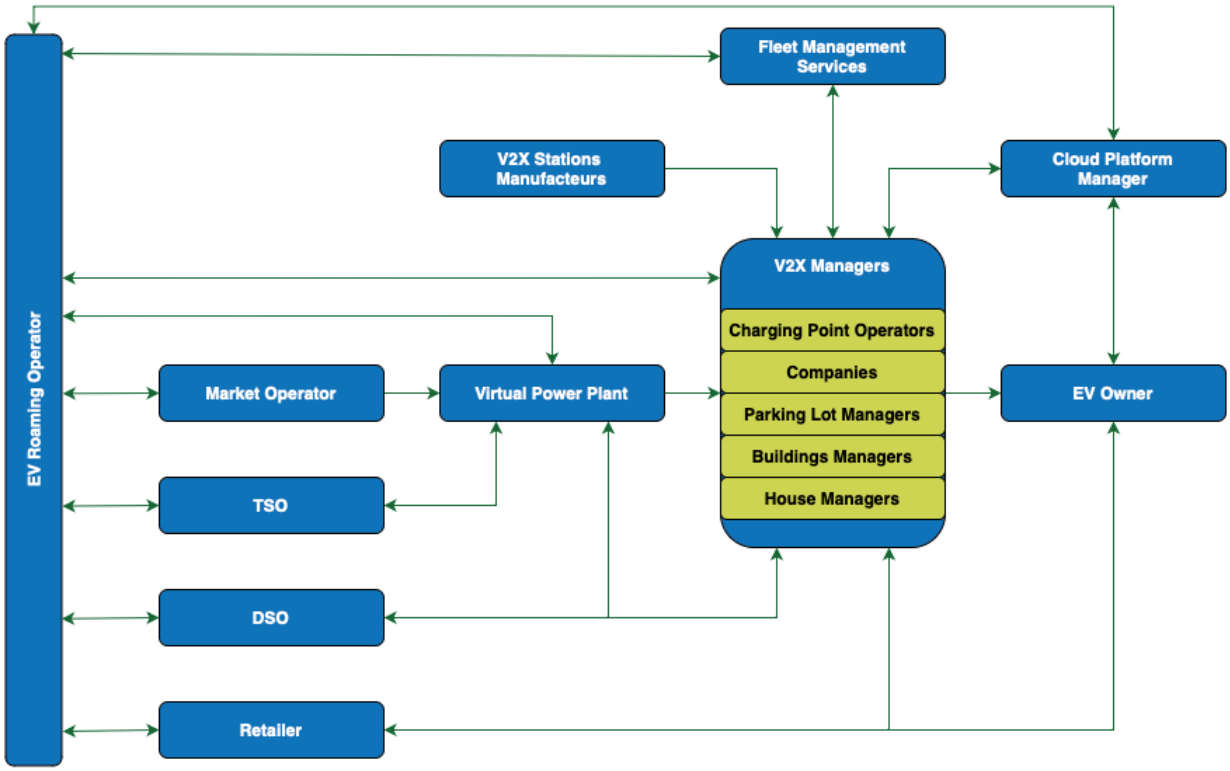


**Figure 3: Actors in EV4EU project and their connections**

In Figure 3 we can observe that in the EV4EU project, the actors range from transmission system operator (**TSO**), distribution system operator (**DSO**), **retailers** and end users, in this case the **EV owners**. Also, the actors that have emerged in recent decades, such as the virtual power plant (**VPP**) and the **market operator**, are present. The most recent actors in this diagram are the **V2X managers**, the **V2X station manufacturers**, and the **cloud platform managers**.

## 2.2 EV4EU Business Models

From the perspective of the actors in Figure 3, BMs can be developed (D1.4) using the Business Model Generation (Osterwalder, Pigneur, Bernarda, Smith, & Papadokos, 2014) and Value Proposition Design (Osterwalder, Pigneur, Clark, & Smith, 2010) methodologies.

EV4EU Task 1.4 focuses on the definition of the BMs for new services related to V2X and e-mobility. We identified twelve BMs, one for each of the involved actors (except the market operator), namely:

- BM for TSO Services,
- BM for DSO Services (Flexibility Services, DR Services Price Signals, and Dynamic Capacity Contracts),
- BM for V2X Manufacturers,

- BM for VPP Services,
- BM for Fleet Management Services,
- BM for Cloud Platform Services,
- BM for Charging Point Operator (CPO),
- BM for Companies,
- BM for Parking Lot Managers,
- BM for Electricity Communities Managers,
- BM for Building Managers, and
- BM for Houses managers.

A detailed description of the specific BM is available in D1.4.

## 2.3 EV4EU Business Use Cases

After defining BMs and how actors could create and deliver new value, the specific steps for developing BUCs must be defined. Specifically, the BUCs that regard the TSO, DSO, and VPP as the main actors. A general view for all four demonstrators is summarized in Figure 4. A more specific view for each demonstrator is provided in Figure 5 for the Slovenian demonstrator, Figure 6 for the Portuguese demonstrator, Figure 7 for the Danish demonstrator, and Figure 8 for the Greek demonstrator, all further elaborated in Chapter 3.

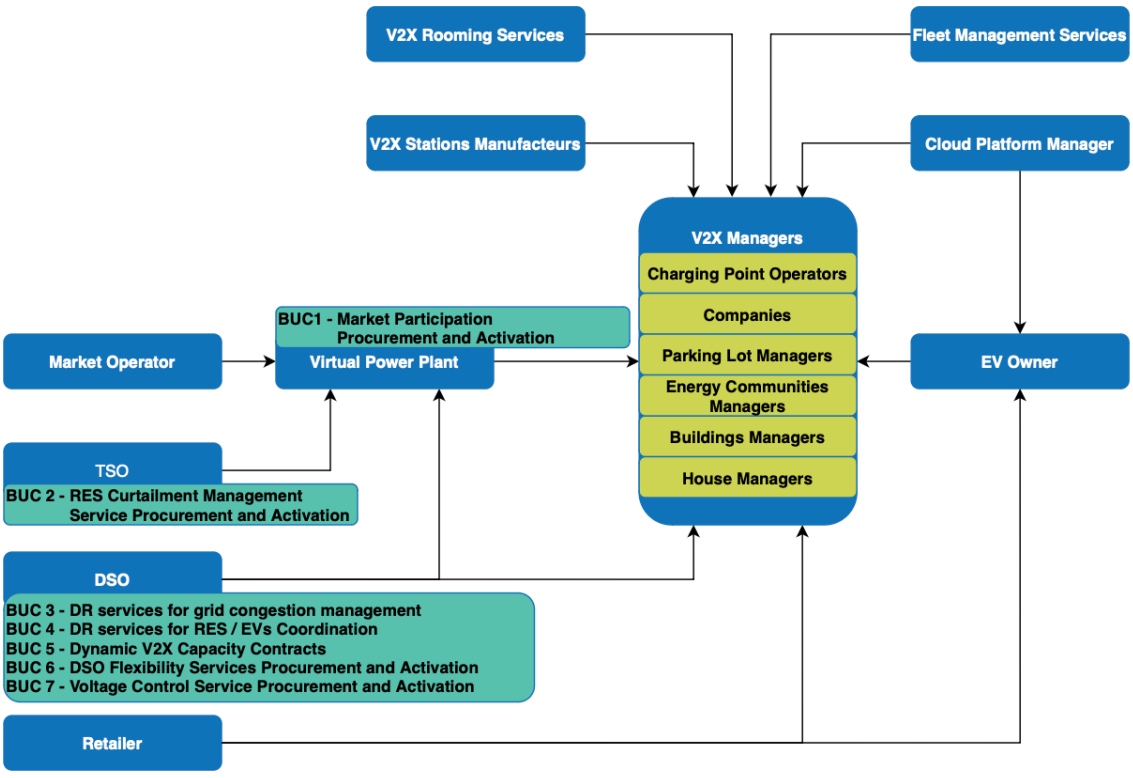


**Figure 4: General view of actors and selected BUCs.**

The BUCs were created in accordance with IEC 62559-2. The methodology could be used in numerous other areas as it provides a common understanding of functionalities, actors, and processes across different technical bodies or even different organizations (IEC 62559-2, 2015).

The created BUCs are listed below and explained in detail in D1.5:

- BUC 1 Market Participation Procurement and Activation,
- BUC 2 RES Curtailment Management Service Procurement and Activation,
- BUC 3 DR services for grid congestion management and voltage control,
- BUC 4 DR Services for RES and EV coordination,
- BUC 5 Dynamic V2X Capacity Contracts Procurement and Activation,
- BUC 6 DSO Flexibility Services Procurement and Activation, and
- BUC 7 Frequency Control Services Procurement and Activation.

In this deliverable, basic information about BUCs is collected primarily to define the Information Exchange needs and the Information Exchange Requirements. The templates for the Information exchange are also part of Deliverable D1.5, however Section 5 and 6 of IEC 62559-2 are relevant for this deliverable. The standard also prescribes the form of delivery.

## 2.4 Information Exchange

The definition of both the needs and the barriers for the information exchange has taken the form of a table, following IEC 62559, with predefined columns: Information exchanged ID, Name of information, Description of information exchanged, Requirements.

Information is collected for each BUC (Figure 4) as well as for each demonstrator site following the standardised format, collected in:
- Table 1, and Table 2 for BUC 1 Market Participation Procurement and Activation,
- Table 3 for BUC 2 RES Curtailment Management Service Procurement and Activation,
- Table 4 for BUC 3 DR Services for Grid Congestion Management,
- Table 5, and Table 6 for BUC 4 DR Services for RES and EV coordination,
- Table 7, and Table 8 for BUC 5 Dynamic V2X Capacity Contracts Procurement and Activation,
- Table 9, and Table 10 for BUC 6 DSO Flexibility Services Procurement and Activation, and
- Table 11 for BUC 7 Frequency Control Services Procurement and Activation.

The collected information consists of the information ID, which refers to the particular information object, its name as a unique designation, followed by the description and requirements necessary for successful information exchange (Gottschalk, Uslar, & Delfs, 2017).

In the next chapter, each BUC is presented with its communication flow between the actors involved in particular BUC, information exchange needs and potential barriers.

# 3 Information exchange in BUC

In this chapter, the elements required to exchange information in each BUC will be defined. This will allow identifying needs and barriers that represent gaps between the current status and the final implementation of each demonstrator.

## 3.1 Market Participation Procurement and Activation

One of the practical demonstrations of this project is aggregation of EVs battery capacity with a VPP. A VPP will use this new type of local flexibility and place it on the market. Market Participation Procurement and Activation BUC will be tested in Slovenia. This demonstrator will take place in two locations, one in the office building of the GEN -I in Krško and the other on existing GEN-I customers in the DSO Elektro Celje area. The first facility has a PV system on the rooftop and is already part of the VPP portfolio managed by GEN-I. ABB, the manufacturer of V2X charging stations, will install 5 charging stations at this location. This site will allow to analyse the impact of V2X on the network and capacity. On the second site, Smart V2X charging stations will be installed for the participating households. All actors in the Slovenian demonstration and each of their connections are presented in Figure 5.

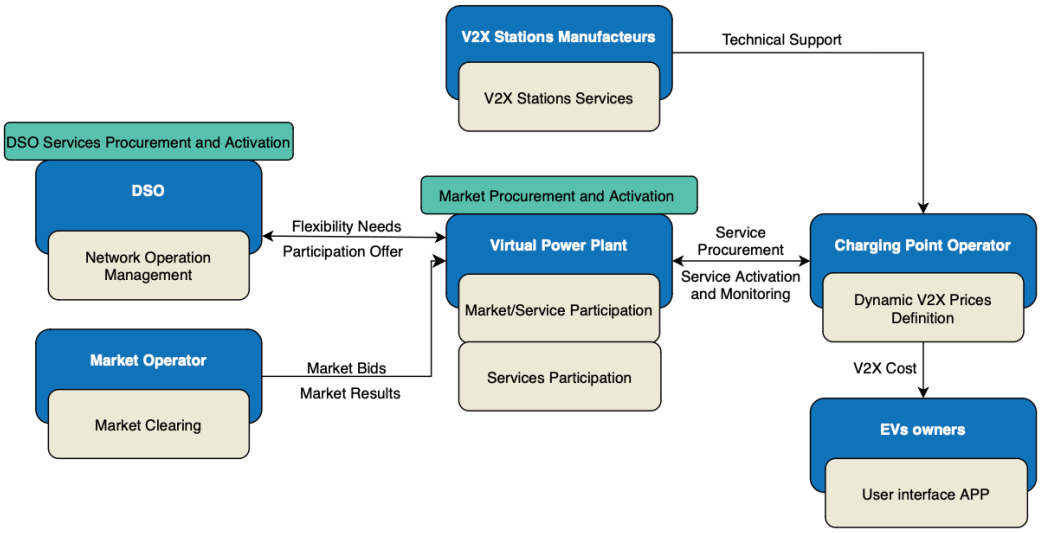


**Figure 5: Actors and selected BUCs in the Slovenian demonstrator**

### 3.1.1 Market Participation - Procurement

In the Slovenian demonstrator, GEN-I will play the role of an aggregator (VPP) and will use the V2X charging stations both in GEN-I office building in Krško and in selected households, area managed by the DSO Elektro Celje. The flexibility will be aggregated by the VPP and procured on the local and national markets. The local market is supervised by DSO Elektro Celje where the national market is supervised by the Slovenian TSO ELES.

The flexibility resources (in this case V2X CPOs) will be registered by the Flexibility market operator (FMO) and included in the flexibility register. The resources will be validated by the DSO through a prequalification protocol. The DSO will define requirements that each local flexibility product should meet. The FMO coordinates this procedure.

To prepare the bid and offer it to the market, the VPP will create a bid strategy based on data, such as consumption, generation, EV's battery state of charge (SoC), projected usage, etc. The bid will be sent to the FMO, who will then offer it to the market (ID 1.1.1). After the market clears the bid, the FMO informs the VPP about the results (ID 1.1.2).

Table 1 identifies the information exchange between the main actors (Figure 5, between the VPP (GEN-I) and the FMO, which can be either Elektro Celje (DSO) or ELES (TSO). The internal communication within each individual actor, describing collection of data from internal sources, is omitted from this description as it is beyond the scope of this deliverable.

The VPP offer contains information about the location, schedule the start and end, i.e. duration, the power offered and the price for it. Each bid also has a unique identification number. The FMO returns a message about the results, composed of the identification number, the timestamp, the market price and the market clearing information.

**Table 1: Detailed Information exchange for BUC 1.1: Market Participation – Procurement**

| Information exchanged ID | Name of information | Description of information exchanged | Requirements |
|---|---|---|---|
| ID 1.1.1 (VPP to Market Operator) | Send Bid | ID of the Bid, Timestamp, Bid Value (€/kW), Bid Power (kW), and Bid Location | Market |
| ID 1.1.2 (Market Operator to VPP) | Market results | ID Bid Selected, Timestamp, Market Price, and Market Clearing (P) | |

The basic prerequisite for the implementation of the BUC 1.1, Market Participation – Procurement, is the existence of a flexibility market, which is not yet fully established in Slovenia. As a result, current legislation allows DSOs to order flexibility services to improve efficiency in their operation and development of the distribution system[1] (Electricity Supply Act (original title Zakon o oskrbi z električno energijo, ZOEE, UL RS št. 172/21)). However, it is expected that the flexibility market will be in place by

[1] This is unofficial translation of the article 75. of the Electricity Supply Act (original title Zakon o oskrbi z električno energijo, ZOEE, UL RS št. 172/21):
(1) DSO orders flexibility services, including congestion management, in its system to improve the efficiency of the operation and development of the distribution system. DSO may order these services from aggregators, distributed generation providers, demand response providers, or energy storage providers connected to the distribution system and promote energy efficiency measures if these services reduce the need to upgrade or replace electricity capacity in a cost-effective manner and support the efficient and secure operation of the distribution system.
(2) The DSO shall order these services in accordance with transparent, non-discriminatory and market-oriented procedures, unless the Agency (the national regulatory authority of the Republic of Slovenia in the field of the energy market), upon request of the DSO or on its own initiative, determines by decree that the ordering of these services is not economical or would lead to serious market distortions or major congestion.
(3) The DSO shall, in a transparent procedure involving all network users concerned and the TSO, define the specifications for the ordered flexibility services and, if necessary, for standardized market products for those services, at least at national level.
(4) The Agency shall give its consent to the specifications from the previous paragraph.
(5) The specifications from the third paragraph of this Article shall ensure effective and non-discriminatory cooperation of all market participants, including market participants offering energy from renewable sources, market participants dealing with demand response, energy storage operators and aggregators. The DSO shall exchange all necessary information and coordinate with the TSO to ensure optimal use of flexibility resources and safe and efficient operation of the grid and facilitate market development.
(6) The costs of providing the services referred to in paragraph 1 of this Article, including the costs of the necessary information and communication technologies and infrastructures, shall be eligible costs of the DSO in accordance with the criteria for eligible costs set out in the general legislative act by which the Agency sets out the methodology for defining the regulatory framework.

the time the demonstrator starts. In this sense, the market must be considered as a prerequisite, but at the same time, its nonexistence could be viewed as a barrier. If the market is not fully established at the beginning of the demonstrator, it will be simulated.

### 3.1.2 Market Participation - Activation

BUC 1.2 The Market Participation - Activation will also be tested in the Slovenian demonstration. Together with BUC 1.1 Market Participation - Procurement, they could be considered as two sub-scenarios of BUC 1. While in the BUC 1.1 Market Participation - Procurement the VPP considers end user perspective, the consumers of electric energy, BUC 1.2 Market Participation - Activation is focused on the electricity generation.

In the Slovenian demonstrator, GEN-I will have multiple roles representing several actors identified in Figure 5. In addition to managing the VPP, GEN-I also manages V2X flexibility as a CPO, both at the office building and at the households. Through these roles of V2X manager, GEN-I will work with EV owners to generate the desired flexibility.

Before the flexibility is offered and activated, the VPP will check if the status matches the prediction. To achieve this, a request is sent to the CPO, which operates the charging stations on the premises of both the office building and the households (ID 1.2.1). In response, the VPP will receive the current production and consumption data of a flexibility unit (ID 1.2.2). This means that it will receive the information regarding the power generated by the installed Photovoltaic (PV) systems in the office building and in the households, the status of the EVs, whether they are connected, if they are charging, the SoC and also data about the active (P) power, voltage, and frequency.

The DSO will identify the needed flexibility service to the FMO that published the request for bids. The FMO then collects the bids from flexibility service providers and selects the optimal bids. After this, the FMO will send information about the selected bid to the flexibility service provider and the flexibility register.

For each of the selected bids, activation will be initiated by the DSO, sending an activation signal to the VPP, which will activate the required flexibility units, in order to meet the requirements of the bid, and acknowledges it to the DSO. This signal is addressed to the CPO (ID 1.2.4). It will contain the indication of the type of service requested, ID of the user requested to participate, a timestamp, i.e. start and end time, and the active power needed. After confirmation, CPO will send information to the EV owners about participating in the service (ID 1.2.5). This signal should include some of the previously mentioned data, such as the type of service, the time stamp, the power provided or demanded, and the benefit for participating in the services.

The DSO informs the TSO about the activated flexibility resources in the distribution grid in order to avoid collision and double activation on the balancing market. During the activation, the FMO collects the measurements from the DSO and the VPP (ID 1.2.6).

When the activation is concluded, the FMO calculates the base line from the measurements received from the DSO and the VPP. After the required flexibility has reached its destination, the delivered volume is calculated by the VPP, and the information is sent to the DSO. The DSO and the VPP validate the delivered volume, the FMO monetizes the delivered flexibility and sends the bill to the DSO, which pays the service to the VPP (ID 1.2.7).

All actors in the Slovenian demonstration and their connections are presented in Figure 5. The Information exchange described in the previous paragraphs is summarized and presented in Table 2.

**Table 2: Detailed Information exchange for BUC 1.2: Market Participation - Activation**

| Information exchanged ID | Name of information | Description of information exchanged | Requirements |
|---|---|---|---|
| ID 1.2.1 (VPP to CPO) | Data request | ID of the request, type of request, timestamp | Digital platform |
| ID 1.2.2 (CPO to VPP) | Data measurements | ID of the request, production measurements, status of the EVs (connected, charging/discharging, SoC, etc.), active power demand (P), voltage (U) and frequency (f) | V2X chargers |
| ID 1.2.3 (DSO to VPP, and VPP to CPO) | Activation signal | ID of the activation, type of service, timestamp, and the active power provided | Digital platform |
| ID 1.2.4 (VPP to DSO) | Confirmation | ID of the activation | Digital platform |
| ID 1.2.5 (CPO to EV owner) | Participation information | ID of the activation, type of service, timestamp, and the active power provided, benefits for participating | Digital platform, contract, V2X chargers |
| ID 1.2.6 (DSO and VPP to FMO) | Measurements collection | ID of the activation, type of service, timestamp, and the active power provided | Digital platform |
| ID 1.2.7 (FMO to DSO and VPP) | Billing | monetizes the delivered flexibility and sends the bill | |

For BUC 1.2 Market Participation – Activation, there are numerous requirements. The relations between the actors, in this BUC, needs to be solved contractually[2] (Electricity Supply Act (original title

[2] This is unofficial translation and summary of here applicable information from the article 79. of the Electricity Supply Act (original title Zakon o oskrbi z električno energijo, ZOEE, UL RS št. 172/21):
(1) If there is no suitable flexibility offer on the market for a certain part of the distribution system in accordance with Article 75 of this Act, the DSO may agree with the system users in that part of the distribution system, by means of a special contract for cooperation in ensuring the operation of the distribution system, to adjust consumption or generation by directly controlling certain user equipment, such as charging stations for electric vehicles, heat pumps, electric heaters, solar panels, etc., and to temporarily interrupt or limit the supply or consumption of electricity to such equipment.
(2) The DSO may join the agreement from the previous paragraph if the safe and reliable operation of the distribution network is at risk or if it is possible to improve the quality of supply to a larger number of end customers.
(3) The conclusion of agreements under the first paragraph of this Article shall be approved by the Agency solely on the basis of the exception provided for in Article 75, paragraph 2 of this Act, namely, at the request of the DSO on the basis of a cost-benefit analysis and verifiable information that sufficient flexibility resources are available for the congestion point for the comprehensive provision of the system service in question, which are not included in other demand response programs.
( 4) In the contract referred to in the first paragraph of this Article, the DSO and the system user shall agree on at least the following
- the duration of the contract, limited to a maximum of two years;
- the longest duration of interruption or restriction of electricity supply or consumption;
- the manner of interruption or restriction of electricity supply or consumption;
- the compensation received by the system user in case of interruption or restriction of electricity supply or consumption; and any other benefits received by the system user for its willingness to cooperate in ensuring the operation of the distribution system.

Zakon o oskrbi z električno energijo, ZOEE, UL RS št. 172/21)). The EV owners are planned to be involved in these services with minimum interaction.

For communication between the VPP, the CPO, household managers and EV owners a digital platform will be established. As mentioned above, GEN-I will have several roles in the Slovenian demonstrator. In this way, communication through internal channels will be set up. Given that the goal of the demonstrator is to develop transferable solutions for cases when these roles are not united in one actor, communication in case of multi-actors will be delivered via digital platform.

## 3.2 RES Curtailment Management Service Procurement and Activation

In BUC 2 RES Curtailment Management Service Procurement and Activation will be tested in the Portuguese demonstrator. Figure 6 is overall architecture from Figure 4, presenting only actors and BUCs that are relevant for the Portuguese demonstrator.

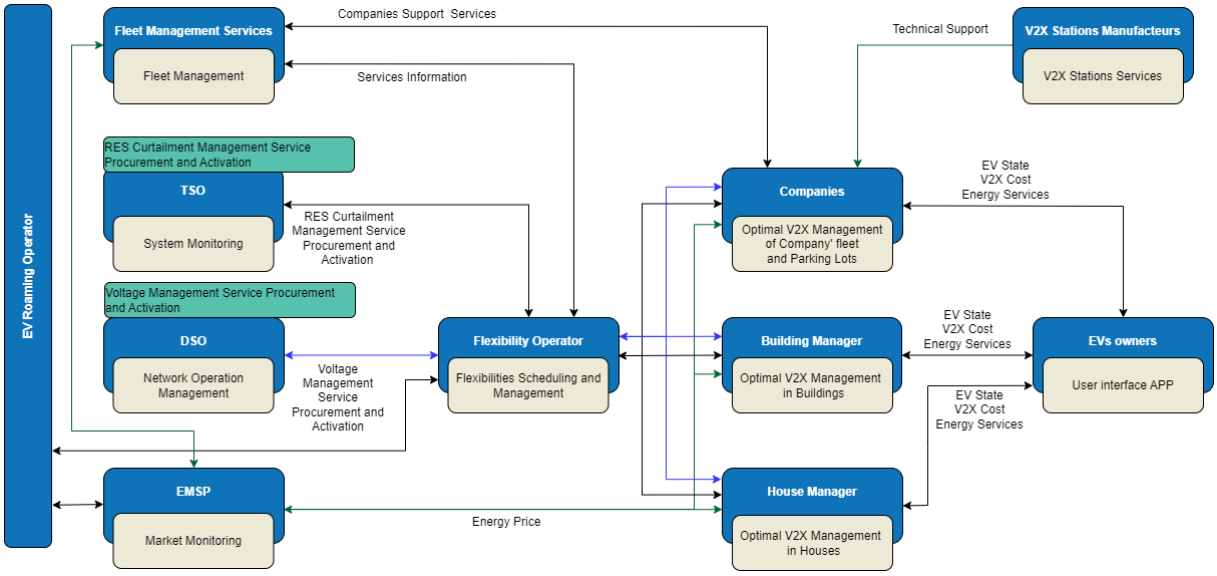


**Figure 6: Actors and selected BUCs in the Portuguese demonstrator.**

The main objective of BUC 2 RES Curtailment Management Service Procurement and Activation is to coordinate the V2X management with the wind generation to reduce wind power curtailment. Portuguese demonstrator will be developed in São Miguel Island (Azores) where a significant amount of production is supplied by geothermic power plants, hydropower plants and wind farms (Direção Regional de Energia, n.d.). However, as stated in (Setas Lopes, Castro, & Ferreira de Jesus, 2016), wind curtailment can occur in some periods, mainly during the evening. Fortunately, during this is the period when EVs are typically parked. This BUC intends to schedule the charging of EVs when the production is higher than the consumption (not including EVs).

(5) The compensation referred to in the fourth indent of the previous paragraph shall be limited by the methodology of the DSO set forth in Article 136 of this Act and shall prevent market speculation.
(6) The provisions of the first indent of paragraph 4 of Article 94 of this Act shall apply to the possible reimbursement of the suppliers' costs for energy not delivered.

Considering the specificities of the power systems in the Azores, EDA is both the TSO and DSO. EDA will collect the information concerning the power consumption and generation every 15 minutes and the very-short term forecast for the following 15 minutes (ID 2.1). In a general power system, this would be done solely by the TSOs.

At the same time, a flexibility operator (FO) will send information concerning the available flexibility that can be provided by the EVs (ID 2.2). Based on the operating conditions and forecast information, the TSO will determine the need for flexibility activation to avoid/limit wind generation curtailment. A service activation signal will be sent to the FO with the information on the active power consumption that should be increased (ID 2.3).

The FO is responsible for the coordination of the participation of EVs in this service. The FO will, first, send a request to the V2X manager to participate in the service (ID 2.4). In the case of the Portuguese demonstrator, the V2X managers are the management systems that will be implemented in houses, buildings, and companies (ID 2.5). Each V2X manager will process the information and send information about their availability to participate in the service. After this procurement, the FO should define the EVs that will participate in the service and, at the correct moment, send the service activation signal to the V2X managers (ID 2.3). This information should also be sent to the electric mobility rooming provider (EMRP), allowing the invoicing of the different services by the different actors.

During the service participation, measurement information should be sent by the V2X manager to the FO and by the FO to the TSO (ID 2.1).

As mentioned, the service is updated every 15 minutes. When the service is no longer needed, a deactivation signal should be sent by the TSO to the FO and, consequently, by the FO to the V2X managers and by FO to the EMRP (ID 2.3).

Table 3 presents a detailed description of the information exchange needs in the BUC 2 RES Curtailment Management Service Procurement and Activation.

**Table 3: Detailed Information exchange for BUC 2: RES Curtailment Management Service Procurement and Activation**

| Information exchanged ID | Name of information | Description of information exchanged | Requirements |
|---|---|---|---|
| ID 2.1 (Producer to TSO) | Measurements | Timestamp, ID Request, Pprod (Production), Pev (EV Active Power Consumption), P (Active Power Demand), Q (Reactive Power Demand), U (Voltage), f (Frequency) | Digital platform |
| ID 2.2 (Flexibility Aggregator to TSO) | Flexibility information | Timestamp, ID User, Type of Service, Power, Energy, SOC in %, SOC in kWh, Charging Rate, Energy required to achieve the objective | Digital platform |
| ID 2.3 (TSO to Flexibility Aggregator, Flexibility Aggregator to V2X Manager, Flexibility Aggregator to EMSP) | Service Activation / Deactivation Signal | Timestamp, ID User, Type of Service, P Power, Q Power, Type of Signal, Start time; Duration | Digital platform |
| ID 2.4 (Flexibility Aggregator to V2X Manager) | Service Participation Request | Timestamp, ID Request, ID User, Type of Service, Power, start time; Duration, Location, Charging Cost; Discharging Remuneration | Digital platform |

It is important to notice that this service implies a variation in the charging prices that are not included in the Portuguese legislation. Afterwards, the TSO should be involved in the invoicing process managed by the EMRP that is not the case for the moment.

## 3.3 DR Services for Grid Congestion Management

The Danish demonstration will take place in two locations, Campus Bornholm and DTU campus Risoe in Roskilde. At both locations Circle Consult will provide EV Chargers, on-board firmware and optional coordination software. Figure 7 is a simplified overall architecture from Figure 4, having only actors and BUCs that are defined in the Denmark demonstrator.

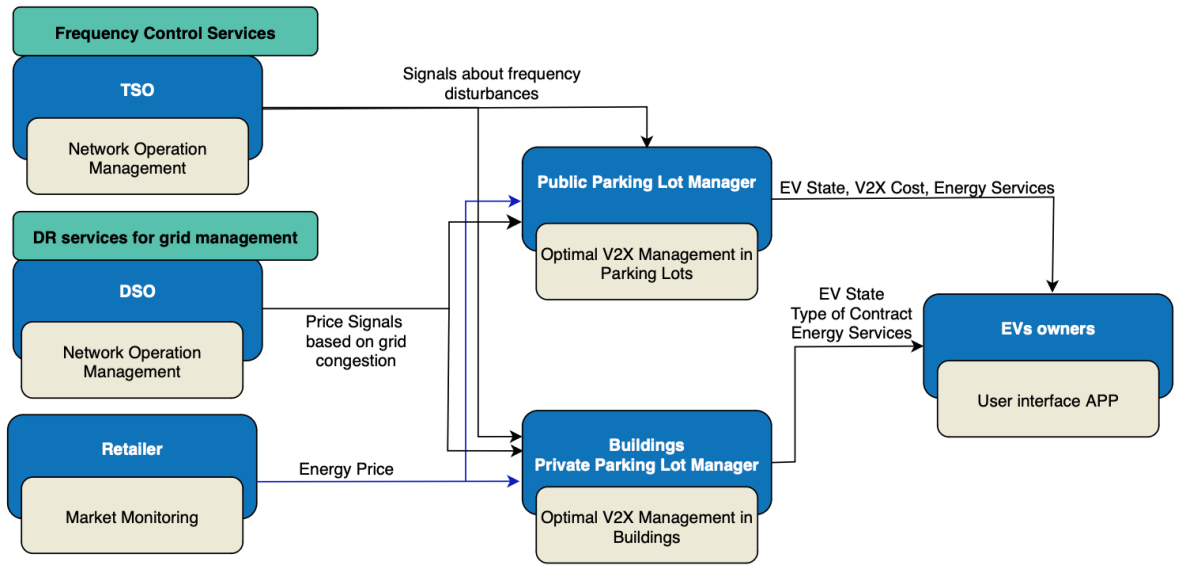


**Figure 7: Actors and selected BUCs in the Denmark demonstrator**

The demonstrations will be a collective effort of the Danish partners, DTU, Campus Bornholm, Bornholms Energiforsyning (BEOF) and Circle Consult. Since Circle Consult is technology provider, they will coordinate with DTU and Campus Bornholm on how to install and set up the charging stations. BEOF, DTU and Circle Consult will strategize and find a solution how to participate in Demand Response (DR) programs, coordinate with local RES while having local congestions points and user needs in priority. This will be strengthened by testing the system with cases based on the actual applications, such as retailer electricity price changes and real time changes to congestion signal level.

DTU will oversee and monitor the demonstration site in Risoe while Campus Bornholm will handle day to day at Bornholm. This is aided by data collection software from Circle Consult.

The DSO is in charge of monitoring the flow of electricity on the network and identifying any issues with congestion. The V2X Manager is requested, by the DSO, to address the congestion problem after it has been identified (ID 3.1). Finding a solution to the congestion problem, such as redistributing the flow of electricity on the network. The V2X Manager defines the “Merit order list of Flexibility Activations” when it receives the request from the DSO to solve its congestion problems. This list contains potential solutions to the congestion problem, sorted with the most preferred alternatives at the top and the least preferred solution at the bottom. The V2X Manager then delivers the request to customers, the customers decide whether to take action to assist in solving the networks congestion problem (ID 3.2).

When the request is received, the V2X Manager employs a decision algorithm to decide whether it will take part in aiding in the congestion problem solving. The algorithm considers variables like availability of resources, if customer is willing to participate, the cost of participating, and the potential benefits of participating.

The V2X Manager will receive a service signal from the DSO when the service is no longer required (ID 3.3). This signal indicates that the service is no longer needed because the congestion issue has been resolved. Once the V2X Managers are informed by this signal they will stop providing the service and resume their normal operations.

**Table 4: Detailed Information exchange for BUC 3: DR Services for Grid Congestion Management**

| Information exchanged ID | Name of information | Description of information exchanged | Requirements |
|---|---|---|---|
| ID 3.1 (DSO to V2X Managers) | Request congestion solving | DSO requests for help in solving its network congestion problems with type of service, power reduction amount, duration of service, discharging and reduction price per kWh info | V2X chargers |
| ID 3.2 (V2X Managers to customers) | Send a request to customers | List of flexibility activations sent to customers with type of service, power reduction amount, duration of service, discharging and reduction price per kWh info | V2X chargers, digital platform |
| ID 3.3 (DSO to V2X Managers) | Cancel service | DSO sends a signal to deactivate service with type of service, active and reactive power provided, signal duration info | V2X chargers |

For BUC 3 DR Services for Grid Congestion Management and Voltage Control the EV owners should be involved in the services. The relations in this BUC are between the DSO and V2X Managers, and the V2X Managers and EV owners.

## 3.4 DR Services for RES and EV coordination

### 3.4.1 Voltage Constrains Management

BUC 4.1 DR Services for RES and EV coordination – Voltage Constrains Management intends to model the information exchange needs allowing the participation of V2X in DSO services. In the case of the Portuguese demonstrator, one of the main concerns that should be a reality in the near future is the voltage variations in the distribution system (mainly in low-voltage networks). Two main factors are changing the operation of these networks, namely, the accelerated increase of PV installations and the mass penetration of EVs. This means that in periods with high generation, the voltages can be higher than the established limits and in the periods without production and high consumption motivated by the charge of EVs, the voltages can be lower than the defined limits.

BUC 4.1 DR Services for RES and EV coordination – Voltage Constrains Management start with the detection/prediction of the voltage constraints by the DSO. This process is performed every 15 minutes, considering the information available in the distributed energy resources management system (DERMS). In case of voltage constraints, the DSO will activate a DR service changing the grid use tariff and, consequently, the charging/discharging prices.

After the identification/anticipation of the voltage constraint, the DSO send this information to the FO (ID 4.1). The FO will identify the V2X managers that are connected to the feeder with voltage constraints and request their participation in service (ID 4.2). After an internal validation, each V2X manager will send their availability to participate in the service (ID 4.2). At the moment when the service should be activated, the FO will send an activation signal to the V2X managers (ID 4.3). This information is also sent to the EMRP for invoicing procedures. During the service, the V2X managers

should send measurements concerning participation in the service and, after aggregation of information, the FO will send similar information to the DSO (ID 4.4).

When the voltage constraints are solved, the DSO will send a deactivation service signal and the FO will "cancel" the service sending this information both to V2X managers and EMRP (ID 4.1).

**Table 5: Detailed Information exchange for BUC 4.1: DR Services for RES and EV coordination – Voltage Constrains Management**

| Information exchanged ID | Name of information | Description of information exchanged | Requirements |
|---|---|---|---|
| ID 4.1.1<br>DSO to FO<br>FO to V2X Manager | Service Activation / Deactivation Request | Timestamp, ID Request, ID User, Type of Service, Power, Time start, Duration, Location, Charging Cost, Discharging remuneration | Digital platform |
| ID 4.1.2<br>V2X Manager to FO | Service Participation Response | Timestamp, ID Request, ID User, Type of Service, Response, Energy, Duration | Digital platform |
| ID 4.1.3<br>FO to V2X Manager<br>FO to EMRP | Service Activation Signal | Timestamp, ID User, Type of Service, P Power, Q Power, Type of Signal, Duration | Digital platform |
| ID 4.1.4<br>V2X Manager to FO, FO to DSO | Participation Info | Timestamp, ID User, Type of Service, Power, Energy, SOC in %, SOC in kWh, Charging Rate, Energy required to achieve the objective | Digital platform |

At the moment, only a few secondary substations are monitored. Nevertheless, in the future, it is expected the installation of more sensors and smart meters allowing better monitoring and control of the system. In the present use case, it is assumed that measures, jointly with state estimation algorithms, can provide this information.

### 3.4.2 Test of the Open V2X Management Platform

BUC 4.2 DR Services for RES and EV coordination - Test of the Open V2X Management Platform is also related to the application of a *green charging* functionality available to the EV users. More specifically, in this BUC, EV users will be motivated to charge on specific hours and location in order to contribute to the integration of RES in the power system. In the Greek case, the BUC 4.2 DR Services for RES and EV coordination - Test of the Open V2X Management Platform is associated with the public charging infrastructure operated by a CPO, PPC in case of the Greek demonstrator, and the EV users are clients to the CPOs public charging network. The goal is to motivate them to charge their EVs in locations that are convenient in terms of alleviation RES-related issues.

The process is initiated with the detection of reverse power flows in the distribution network by the DSO. For a number of reasons, the DSO desires to limit these reverse flows and increase local consumption. To this end, the DSO lowers network prices on the desires locations and notifies the CPO (ID 4.2.1). In turn, the CPO locates affected charging stations and updates the cost of charging on those stations (ID 4.2.2). The new prices are shared with the EV owners, some of which might be motivated to modify their decisions and charge at these locations.

**Table 6: Detailed Information exchange for BUC 4.2: DR Services for RES and EV coordination – Test of the Open V2X management Platform**

| Information exchanged ID | Name of information | Description of information exchanged | Requirements |
|---|---|---|---|
| ID 4.2.1 (DSO to CPO) | Network price reduction and location | The DSO sends the locations affected by the price reduction and the corresponding reduction | Open V2X platform |

BUC 4.2 DR Services for RES and EV coordination - Test of the Open V2X Management Platform is mainly based on the smooth interoperability between the CPO's Open V2X management platform and the DSO's management systems as well as EV user end devices.

## 3.5 Dynamic V2X Capacity Contracts Procurement and Activation

With the increasing presence of Distributed energy resources (DER), DSO's need to have tools in their disposal to motivate or orchestrate flexibility, as temporary or permanent alternatives to grid expansion. The presence of TSO level energy markets and the more complex nature of DERs bring forward the need for distribution level flexibility products that DSOs can realistically use without disrupting the existing framework. One such family of products is power-based flexibility and, more specifically, flexible capacity contracts. These are products where an aggregator or prosumer offer to cap their available capacity in exchange for incentives or compensation.

In the Greek demonstrator, there will be executed and tested an overall framework for the deployment of such products. The actors in the Greek case are the DSO, who buys the offered flexibility, the CPO, who aggregates EV flexibility from a Charging Station, the FMO and the EV owner. The overall framework has two phases, the procurement, and the activation phase. Figure 8 is a simplified overall architecture from Figure 4, having only actors and BUCs that are defined in the Greek demonstrator.

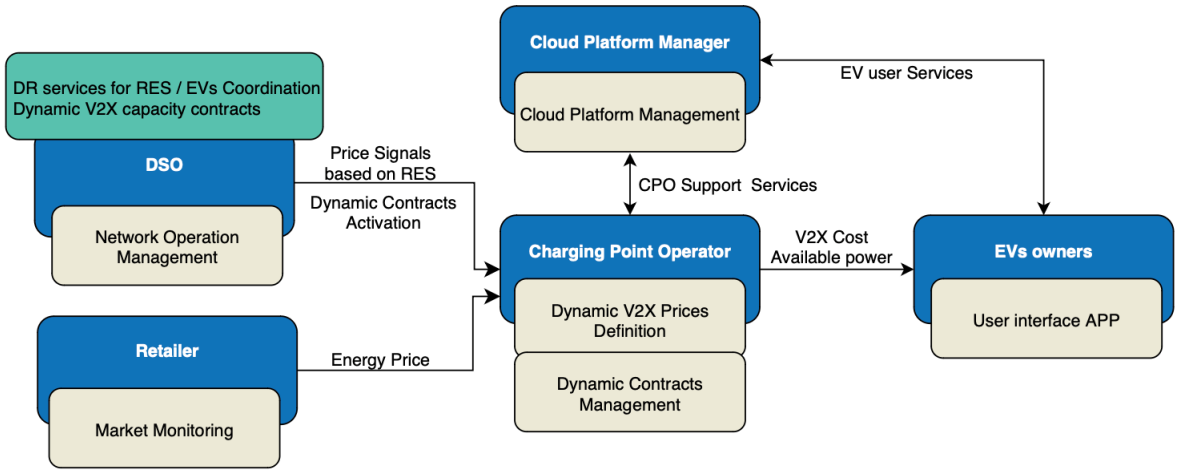


**Figure 8: Actors and selected BUCs in the Greek demonstrator**

### 3.5.1 Dynamic V2X Capacity Contracts - Procurement

In the procurement phase, the DSO will request buying capacity limitation services from the CPO, hence a monopsony market is set. The CPO will then offer a bid curve for capacity limitation. Both

actors will need to look into the future in order to make their decision with the lowest cost/highest benefit as possible. The CPO will need to identify the price of the offered service and the DSO will need to procure the service while considering network conditions/constraints for the duration of the product. The duration of the products is an open research question to be defined, however, medium term (weeks, months) seems the more appropriate methodology.

BUC 5.1 Dynamic V2X Capacity Contracts - Procurement starts with the DSO performing preliminary analysis and forecasts with regards to the period for which capacity limits will be auctioned. The details of the market are sent to the FMO for verification and from there to the CPO (ID 5.1.1, ID 5.1.2). Then, the CPOs perform their own analysis and construct their capacity limit bid curves. The capacity limit marginal cost is in most cases the opportunity cost of an aggregator due to limited capacity. After the CPOs submit their bids, the DSO performs an Optimal Power Flow (OPF) based stochastic analysis for the auction period to decide on the procurement of the service, including volume and location (ID 5.1.3, ID 5.1.4). Finally, the CPOs are notified about the DSOs decisions (ID 5.1.5, ID 5.1.6).

For the implementation of BUC 5.1 Dynamic V2X Capacity Contracts - Procurement, the regulatory framework must have provisions for local flexibility markets, including power-based products. Moreover, both the DSO and the CPO should have access to historical data for their respective analyses. The procurement phase does not require real-time communication between the DSO and the CPO, hence, dedicated platform infrastructure is not a priority. However, any form of automation of the process is a positive addition. Furthermore, no amendment of the typical relation between CPO and EV owner is required as the essentials of the offered service, to the EV owner, doesn't affect the BUC 5.1 Dynamic V2X Capacity Contracts - Procurement.

**Table 7: Detailed Information exchange for BUC 5.1: Dynamic V2X Capacity Contracts - Procurement**

| Information exchanged ID | Name of information | Description of information exchanged | Requirements |
|---|---|---|---|
| ID 5.1.1 (DSO to FMO) | Event trigger, participation info | The DSO sends the attributes of the bid curves required for participation in the local flexibility market to the FMO | Market |
| ID 5.1.2 (FMO to CPO) | Event trigger, participation info | The FMO checks, approves and sends the attributes to the CPO | Market |
| ID 5.1.3 (CPO to FMO) | Bid info | The CPOs send their bid curves to the FMO | Market |
| ID 5.1.4 (FMO to DSO) | Bid info | The FMO checks, approves and send the bid curve offers to the DSO | |
| ID 5.1.5 (DSO to FMO) | Capacity procurement decisions | The DSO sends its decision of procured volume and location of flexibility (market clearing) to the FMO. | Market |
| ID 5.1.6 (FMO to CPO) | Capacity procurement decisions | The FMO checks, approves and then sends the procured volume and location of flexibility (market clearing) to the CPO. | Market |

### 3.5.2 Dynamic V2X Capacity Contracts - Activation

Continuing from previous, BUC 5.1 Dynamic V2X Capacity Contracts - Procurement, BUC 5.2 Dynamic V2X Capacity Contracts - Activation focuses on the activation phase of the flexible capacity contracts. This phase takes place day-ahead, where the DSO performs analysis and forecasts for the coming day and projects that activation of some of the procured capacity limitation is required. The DSO communicates this activation decision to the CPOs, which adjust their charging station capacities accordingly (ID 5.2.1). During the next day, EV owners request for charging suggestions, which are affected by the capacity limitations activated day-ahead, thus affecting the CPOs offered service (ID 5.2.2, ID 5.2.3).

**Table 8: Detailed Information exchange for BUC 5.2: Dynamic V2X Capacity Contracts - Activation**

| Information exchanged ID | Name of information | Description of information exchanged | Requirements |
|---|---|---|---|
| ID 5.2.1 (DSO to CPO) | Capacity limit | DSO activates some of the capacity limit procured ex-ante | Contract |
| ID 5.2.2 (EV user to CPO)* | Charging request | The EV owner requests to receive charging options nearby | Open V2X platform |
| ID 5.2.3 (CPO to EV user) | Charging choices | The CPO sends charging session choices to the EV owner (affected by day-ahead capacity limit activation) | Open V2X platform |
| ID 5.2.4 (EV user to CPO | Charging choice selection | TH EV owner selects one of the charging choices | Open V2X platform |

*Later, platform will be adjusted for DSO

Conditions and requirements that apply to BUC 5.1 Dynamic V2X Capacity Contracts - Procurement described before, apply also to BUC 5.2 Dynamic V2X Capacity Contracts - Activation. Additionally, during the activation phase, the Open V2X management platform should be operational and able to handle the charging session requests.

## 3.6 DSO Flexibility Services Procurement and Activation

Similarly as BUC 1, also BUC 6 will be split in two parts, procurement - BUC 6.1 DSO Flexibility Services – Procurement, and activation - BUC 6.2 DSO Flexibility Services - Activation.

### 3.6.1 DSO Flexibility Services - Procurement

The main focus of BUC 6.1 DSO Flexibility Services – Procurement is to solve the problems detected in the network. The main actor of this BUC is the DSO, which in the Slovenian demonstrator, is represented by Elektro Celje. This BUC is carried in the LV electrical grid, managed by Elektro Celje. The VPP, operated by GEN-I, is another actor in BUC 6.1. They will provide flexibility services to solve the detected problems, that could either be congestion, maintaining the set voltage level or set the value of reactive power. All actors in Slovenian demonstrator and their connections are presented in Figure 5.

When the DSO detects congestions or voltage increase in the grid, a pool for bids will be open so that the VPPs can submit their bids (ID 6.1.1). However, before opening the pool, the DSO must determine the maximum price they are willing to pay, based on internal data. The DSO should inform the VPPs about the opening of the pool. And after the VPPs receive this information, they will evaluate their flexibility, determine their bidding strategy, and submit bids (ID 6.1.2).

Table 9 shows the information exchange between the actors, the DSO Elektro Celje and the VPP operated by GEN-I. Their internal decision making, as described in the previous paragraph, is not included. The communication between them consists of the DSO informing the VPP about the open pool and the VPP responding to that pool by submitting a bid.

**Table 9: Detailed Information exchange for BUC 6.1: DSO Flexibility Services - Procurement**

| Information exchanged ID | Name of information | Description of information exchanged | Requirements |
|---|---|---|---|
| ID 6.1.1 (DSO to VPP) | Informs the pool | ID of the pool, type of service, timestamp, location, maximum price (€/kW), and Power needed (kW) | Market |
| ID 6.1.2 (VPP to DSO) | Market bid | ID of the pool, ID of its Bid, Timestamp, Market Price, and Market Clearing (P) | |

According to the T1.5, the project is confronted with the requirement that a flexibility market must be established. In case the market is not established by the time the practical demonstration begins, it will be simulated.

### 3.6.2 DSO Flexibility Services - Activation

BUC 6.2 DSO Flexibility Services – Activation is as BUC 1.2 based on participation in the market and cooperation based on the contract. In this BUC, the DSO activates the services by informing the VPP about the needs for flexibility services (ID 6.2.1). The VPP will send a signal, addressed to the CPO, to participate in the V2X services (ID 6.2.2). This signal will contain the indication of the type of service requested, ID of the user requesting to participate, a timestamp, i.e. start and end time, and the active power provided. The CPO will then send information about their participation in the service to the EV owners (ID 6.2.3). This signal should include some of the previously mentioned data, such as the type of service, the timestamp, the power provided or requested, and the benefit for participating in the services. In addition, they will inform the VPP of the EV owner's decision to participate. The VPP will then offer the available amount of flexibility to the DSO (ID 6.2.5).

All actors in the Slovenian demonstration and their connections are shown in Figure 5. And the information exchange is described in the previous paragraph and presented in Table 10.

In order for BUC 6.2 DSO Flexibility Services - Activation to be implemented, a contract between the DSO and the VPP must be in place to provide flexibility services when there are constraints in the grid.

Again, there should be a digital platform through which DSO, VPP, CPO, households and EV owners can communicate. Also worth mentioning is that the charging stations should support V2X, which will be the case in the Slovenian demonstrator.

**Table 10: Detailed Information exchange for BUC 6.2: DSO Flexibility Services - Activation**

| Information exchanged ID | Name of information | Description of information exchanged | Requirements |
|---|---|---|---|
| ID 6.2.1 (DSO to VPP) | Activation signal | ID of the activation, type of service, timestamp, location, maximum price (€/kW), and Power needed (kW) | Contract |
| ID 6.2.2 (VPP to CPO) | Activation signal | ID of the activation, type of service, timestamp, location, maximum price (€/kW), and Power needed (kW) | |
| ID 6.2.3 (CPO to EV owners) | Participation info | ID of the activation, type of service, timestamp, and the active power provided, benefits for participating | Digital platform, contract, V2X chargers |
| ID 6.2.4 (CPO to VPP) | Activation response | ID of the activation, info about acceptance or decline | |
| ID 6.2.5 (VPP to DSO) | Activation response | ID of the activation, info about acceptance or decline | |

## 3.7 Frequency Control Services Procurement and Activation

The same setup, partners, and locations as described in BUC 3 will be part of the Danish demonstration in BUC 7 Frequency Control Services Procurement and Activation (Figure 7). However, in BUC 7 the emphasis will be on frequency control services rather than grid congestion services.

The V2X Manager plays an important role in this process by requesting participation in the frequency control services (ID 7.1). The system must be approved in order to participate in the FCR program in Denmark. Prequalification testing is carried out in close coordination with the TSO in order to receive approval. When testing new units or control concepts, the TSO must be permitted to be present. In accordance with the agreement and subject to the submission of thorough documentation, the service provider may independently conduct follow-up tests. The TSO will typically request to be present during all tests, though.

The primary goal of prequalification tests for the provision of reserves is to ascertain whether the unit or system can be approved for provision. A maximum threshold is also established, if the unit or system is approved, for the amount of power that the unit or the combined portfolio of units can offer in the relevant reserve capacity market. The service provider must be the only one to cover the cost of IT connections, maintenance, grid tariffs, etc. for energy provisions, tests, and reliability testing.

There will be no external activation signal for units responsible for providing FCR, so they must measure the frequency and automatically activate reserves on their own. The maximum unit sensitivity is 10mHz, and the resolution should be better than or equal to 1 second. Certain signals must be recorded and kept for at least two weeks. In the event of a meter error, disconnection, or something similar, an alternative method is necessary when using a central frequency meter. This could be a backup frequency meter that is installed elsewhere to provide redundancy in the event of a power outage or similar situations.

The EV owners are informed of the FCR services participation status through the digital platform allowing them to monitor the status of their vehicle (ID 7.2). Additionally, the V2X Manager has the option to stop participating in the FCR service. In other words, if the V2X Manager notifies the TSO, it will always be able to stop offering the service or modify its participation (ID 7.3).

All actors in the Denmark demonstration and their connections are shown in Figure 7. And the information exchange described in the previous paragraph is presented in Table 11.

**Table 11: Detailed Information exchange for BUC 7: Frequency Control Services Procurement and Activation**

| Information exchanged ID | Name of information | Description of information exchanged | Requirements |
|---|---|---|---|
| ID 7.1 (V2X Manager to TSO) | Participation request | The owner of the V2X manager request to participate in FCR services. | Contract |
| ID 7.2 (V2X Manager to EV Owners) | Participation information | The EV owners are informed of the status of participation in FCR. | Digital platform |
| ID 7.3 (V2X Manager to TSO) | Cancel participation | The owner of the V2X chargers ask to cancel its participation. | |

In BUC 7 Frequency Control Services Procurement and Activation V2X Manager owner should be involved in deciding whether to participate in FCR services or not. The relations between the roles in BUC 7 are TSO and V2X Managers, and V2X Managers and EV owners. A contract agreement should be established between the TSO and V2X Managers to cooperate flexibly in resolving frequency disturbances using V2X technology.

# 4 Conclusions

Work Package (WP) 5 aims to define, design and implement the Open V2X Management Platform to support next-generation V2X, user-friendly and ergonomic APIs and APPs. The first task T5.1 of WP5 identified key information exchange requirements between stakeholders' roles and systems as well as potential barriers they might face when exchanging information, based on T1.4 and T1.5.

In this document, we have outlined how the stakeholders will exchange the information, identified the channels through which the stakeholders will communicate both in the practical demonstrations and later in the real-world scenarios, the data needed to be exchanged for successful operation, the current and future requirements for doing so, and whether there are barriers to the implementation of the demonstrators and later in the real operation.

## 4.1 Summary

This subchapter presents all identified needs and barriers per specific BUC, listed in Table 12.

From an economic perspective, some of the BUCs presented in this deliverable require a flexibility services market in which multiple actors could participate or that contractually obligates actors to provide flexibility. The absence of such markets could be seen as a barrier. Nevertheless, if such commodity is not yet established at the time of practical implementation of the project, it will be simulated. In this way, the results are not limited to a specific demonstrator.

The technical requirements for BUCs described here are a digital platform, V2X chargers, and an Open V2X Management Platform. The development of the Open V2X Management Platform is one of the goals of EV4EU and will be completed by the time the demonstrators start. It will be optimized throughout the remaining part of the project. Based on the current information V2X chargers will be available for all the demonstrators. The only identifiable obstacle could be that the manufacturers may not provide them on time. For this case alternative scenarios are also being prepared.

In summary, almost all the information exchange requirements are viable for the practical demonstrations of the EV4EU project. The stakeholders in the power systems are already planning the needed extensions to their platforms to provided required data exchange.

**Table 12 : Information exchange needs and barriers**

| Requirement | Description | BUC | Info ID |
|---|---|---|---|
| **Market** | A market where pools are opened for bids for requested flexibility or where existing flexibility is offered to customers who need it. | BUC 3.1.1, BUC 3.5.1, BUC 3.6.1 | 1.1.1, 5.1.1, 5.1.2, 5.1.3, 5.1.5, 5.1.6, 6.1.1 |
| **Contract** | The stakeholders involved contractually agree to provide and use the flexibility as needed. | BUC 3.1.2, BUC 3.5.2, BUC 3.6.2, BUC 3.7 | 1.2.5, 5.2.1, 6.2.1, 6.2.3, 7.1 |
| **V2X charger** | Charging station that supports the V2X system and offers the possibility of bidirectional charging. | BUC 3.1.2, BUC 3.3, BUC 3.6.2 | 1.2.2, 1.2.5, 3.1, 3.2, 3.3, 6.2.3 |
| **Digital platform** | Is the hardware and software used to streamline business processes and IT systems under agreed standards. | BUC 3.1.2, BUC 3.2, BUC 3.3, BUC 3.4.1, BUC 3.6.2 | 1.2.1, 1.2.3, 1.2.4, 1.2.5, 1.2.6, 2.1, 2.2, 2.3, 2.4, 3.2, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 6.2.3 |
| **Open V2X management platform** | Open platform for V2X management developed in the EV4EU project. | BUC 3.4.2, BUC 3.5.2 | 4.2.1, 5.2.2, 5.2.3, 5.2.4 |

## 4.2 Next deliverables

This task is related to tasks T1.4, V2X Related Business Models, T1.5, Use Case Specifications, and T5.2, Standards and Interoperability Assessment. The deliverables of these tasks are:

- **D1.4** Business models centred in the V2X value chain, due in **March 2023**,
- **D1.5** V2X Use-cases repository, due in **May 2023**, and
- **D5.2** Standardisation gap analysis for new V2Xrelated Business Models, due in **February 2023**.

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