

## edgeFLEX

### D6.4 V1.0

## Engaging with policy makers, with organisations and experts in regulation and standardisation (V2)

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### Abstract

This deliverable is reporting on the actions taken and the outcome by engaging with policy makers, with organizations and experts in regulation and standardization, to support the implementation of edgeFLEX solutions, considering both the technical challenges and the "route to market". It provides a comprehensive analysis on the regulatory framework, linked to the overall project context and results, by engaging with the relevant stakeholder categories.

### Keyword list

edgeFLEX services, DSOs, Regulatory framework, Standards and regulations, Stakeholders consultations, Policy makers, Ancillary services, Providing Inertia, Frequency and Voltage control, ICT, Innovative solutions, Network Codes, Workshops

### Disclaimer

All information provided reflects the status of the edgeFLEX project at the time of writing and may be subject to change.

## Executive Summary

The edgeFLEX project has the goal of combining hardware and software solutions, supported by research activities on different areas to develop new fast and slow dynamics ancillary services, and a new market for trading them to VPPs and grid operators. It aims at involving Virtual Power Plants and Energy Communities in the grid management, by enabling slow and fast dynamics services and fostering a new local energy and flexibility market.

During the 3 years of project implementation, the energy system entered a very dynamic period of change, which comes with the challenge of ensuring the stability of power supply in Europe and provide more flexibility to the grid. There is a diversification of roles and involvement for grid management, the small prosumers and energy communities gaining an active role.

The evolution of the power sector is a continuous process, with challenges, but also with answers given by the increasingly complex and effective solutions supported by the technological progress. A variety of distributed energy resources and improving computation, communication, and control technologies create an unprecedented degree of choice for the electricity actors, choices that are poorly guided by incentives and other support measures from the perspective of regulations. Through appropriate regulations and policies, we must address both the technical challenges of the adopted technological solutions, as well as the market challenges that may arise, including the potential waiver of certain types of subsidies.

Beyond regulatory and standardization issues to be considered in the general context of new technologies and technological progress, we aimed to identify some specific aspects of dynamically controlled VPP solutions – VPP2.0, to be supported through an appropriate regulatory and standardization framework. In this sense, we followed a process of identification and analysis of all relevant aspects that can support the implementation of edgeFLEX solutions, pursuing a local impact, conducted in close collaboration, and based on a permanent dialogue with stakeholders.

In the last two years, which also corresponds to the reference period for this report, the regulatory authorities, both at the European and local level, intensified their analysis and substantiation of measures to support renewables integration, and national laws are constantly evolving on the topics of VPPs and Energy Communities.

At the same time, there are several challenges and limitations, both from the perspective of transposing the provisions of European directives into national legislations, and from the perspective of the holistic approach to the energy transition, the integration of ICT solutions, digitalization of energy, as in the case of edgeFLEX solutions.

In the more than 30 participations and interactions with stakeholders, carried out during the reference period of this deliverable, we discussed our ideas and recommendations, starting from the general existing regulations, the technology advancement, and aspects that the regulators should consider facilitating the adoption and implementation of edgeFLEX solutions and other similar solutions within the same context and dynamic trend of the digitalization of energy.

In the same context of digital solutions for the efficient operation of energy systems and supporting flexibility, and from the perspective of regulations, we published two papers:

- Article published in *Frontiers* - "Supporting Regulatory Measures in the Context of Big Data Applications for Smart Grids".
- Article published in the context of participation in the Grid Service Market Symposium in Lucerne - "Regulatory support measures for smart grids and promoting flexibility".

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## 1. Introduction

The edgeFLEX project aims at defining a next level approach to offer flexibility to the grid with a new set of slow and fast dynamic ancillary services. We envisage a new market, an expanded role for VPPs, and the ability to enable active participation of small-scale RES and prosumer assets participating in Energy Communities. The standardization and regulation framework are representing an important lever and a source of concrete support actions both to respond to technical challenges and to those that accompany edgeFLEX solutions in a "route to market" process. The permanent dialogue, the exchange of ideas and the synergies thus created with a multitude of stakeholder categories, helps us to validate, substantiate and support the adoption and implementation of the impact measures locally, through policies and regulations.

### 1.1 Objectives of the Report

This is the second version of the report on stakeholder engagement, emphasizing on how the edgeFLEX project and results relate to the policy, regulatory and standardization framework.

Starting from our initial formulation of recommendations, aspects to be considered for the regulatory framework in relation to edgeFLEX context, this second version of the report is providing an update and a completion of the of the list of recommendations and suggestions addressed to regulatory authorities and policy makers, passed through the filter of stakeholder engagement activities. The completion of the regulatory assessment was based on the interaction with relevant stakeholders, in more than 30 workshops, conferences and bilateral meetings, in which the project team was involved, starting with the year 2 of project implementation – Service validation, according to the diagram below.

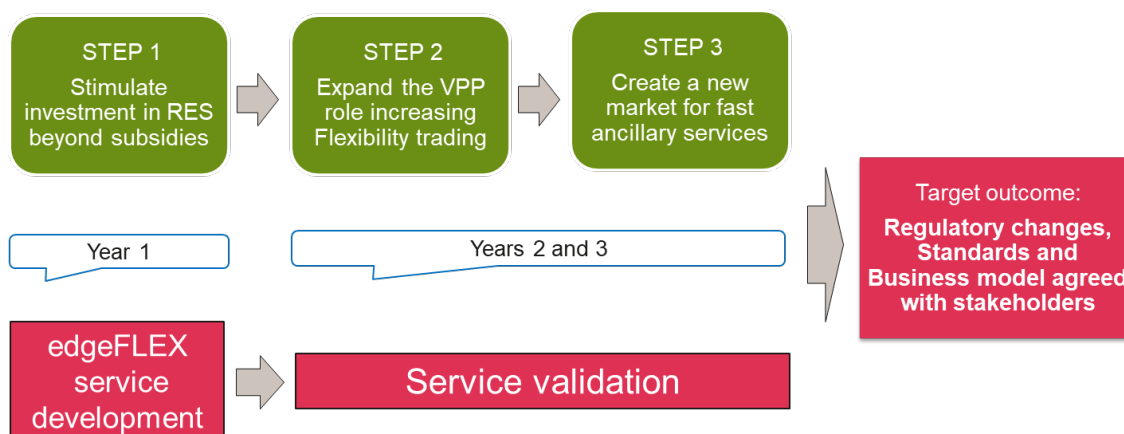


Figure 1-1 edgeFLEX communication and exploitation timeline

### 1.2 Outline of the Report

The introductory chapter of the deliverable specifies its objectives as well as its positioning within the project works, the relationship with other deliverables belonging to the same work package, as well as the relationship and interdependencies with the other work packages.

In chapter 2 we provide a brief update on the process and current status of policy, regulatory and standardization frameworks in Europe for the topics in focus in the edgeFLEX project, as well as an overview of the relevant institutions and organizations we've had interactions and consultations with for the reporting period of this deliverable, years 2 and 3 of the project implementation.

The updates on running the work plan and results on the policy, regulatory and standardization assessment are presented in the Chapter 3. This chapter includes an

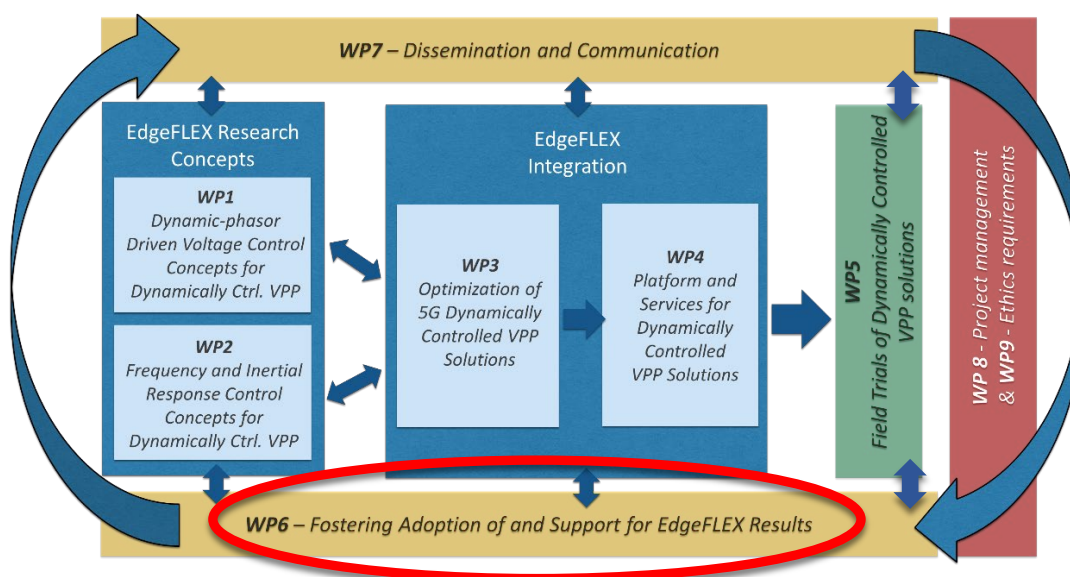
overview of the edgeFLEX concept and services and their mapping with the regulatory recommendations formulated to address both the technical and market challenges.

Chapter 4 presents an overview of the attended workshops and events, the interactions and consultations for engaging with policy makers, with organizations and experts in regulation and standardization, carried out in the years 2 and 3 of project implementation.

### 1.3 How to read this document

The project consists of four technical WPs, strongly interconnected, that carried out the design, implementation, testing and validation of the hardware/ software components revealing edgeFLEX VPP2.0 solution. WP1 developed a new dynamic-phasor driven voltage control algorithm for VPPs, while WP2 investigated new services for frequency control and inertia estimation. WP3 coped with the relevant ICT solutions and needs to support such new services and will also develop new VPP optimization approaches, based on advanced spatial-temporal models and forecasts. In WP4, the overall architecture, including data flows, communication protocols, and needed interfaces, were defined as a reference for the field trial implementation. Finally, WP5 was dealing with the deployment of the edgeFLEX solution in the pilots and in the laboratory trial.

In addition to the technical tasks, WP6 defined the business models conceivable for the turnkey edgeFLEX services alongside with the regulatory and standardization framework assessment, engaging with policy makers, with organizations and experts in regulation, standardization, and other stakeholder categories, while WP7 was promoting and disseminating the results of the project through the organization of dedicated events in close collaboration with WP6, during the entire project implementation cycle.



**Figure 1-2 edgeFLEX Work Packages interconnection**

The second version of the deliverable - D6.4 - Engaging with policy makers, with organizations and experts in regulation and standardization, represents the consolidated version of the initial version D6.3, based on further analysis of the regulatory, policy and standardization framework, and passed through the filter of the consultations carried out through an intense stakeholder engagement activity, within the reporting period of this deliverable, years 2 and 3 of the project implementation.

Regarding other relevant deliverables, we have the same type of interdependencies and implications, as in the case of the work packages to which they belong.

Specifically, for a better understanding of the D6.4 content, the following deliverables are relevant to be consulted:

- D6.3 - Engaging with policy makers, with organizations and experts in regulation and standardization (v1)
- D6.5 - A new financing model for RES, to simplify investments in RES beyond subsidy schemes.
- D6.2 - Comparative analysis of potential business impact (v2)
- D6.6 – Preparing exploitation.
- D1.3 - Dynamic-phasor driven voltage control concept for Energy Communities with future VPPs.
- D2.3 - Frequency Control Concepts for Energy Communities with future VPPs
- D2.4 - Inertia estimation concept for low inertia power system
- D2.1 - Scenario description for frequency and inertial response control for VPPs
- D3.2 - Report on VPP optimization
- D3.3 - Report on VPP Optimisation, v2
- D3.1 - 5G ICT requirements, development and testing for edgeFLEX solution
- D4.1 - Description of edgeFLEX platform design
- D4.2 - Description of edgeFLEX MVP
- D4.3 - Description of internal interfaces for control services
- D4.5 - Description of an advanced reactive energy flexibility aggregation and trading system
- D4.4 - Description of assessment of platform control service performance
- D5.1 - Initial report of the phase 1 of all field trials
- D5.5 - 5G use case validation results in laboratory tests.

## 2. Policy, regulatory and standardization framework assessment – updates on the status and trends

In this Chapter, we provide a brief update on the process and current status of policy, regulatory and standardization frameworks in Europe for the topics in focus in the edgeFLEX project. An overview of the currently active European institutions working on these frameworks is provided as context information for efforts which edgeFLEX has made to position project recommendations in discussions on the evolution of European policy, regulation and standards.

### 2.1 The process of defining policy, regulatory and standardisation frameworks

The mechanism of adopting and implementing regulatory measures is a cumbersome one and involves going through a long-term elaboration process.

In recent years, RES integration has put a greater pressure on the regulatory authorities, which has given another dynamic towards the adoption of new measures and solutions appropriate to the new requirements of the energy transition. More than that, the regulatory measures target more the small generation units, the participants in the Energy Communities, solutions proposed and tested in the research projects aiming an increase in their role in grid management.

The solutions proposed by edgeFLEX assigning a next level role to VPPs, in relation to Energy Communities and small generation units, benefits from this context with a better dynamic in terms of regulation, which at the same time needs additions, especially from the perspective of integrating ICT solutions for grid management.

### 2.2 The evolving European policy, regulatory and standardization framework

#### The European level framework

Although 2021 was characterized by the continuing global pandemic and its associated impacts on individuals and the economy, energy policy discussions across state legislatures continued to address the highest energy-related priorities in each state.

In 2022, the same dynamic was maintained, the European Green Deal and REPOWEREU speeding up the energy transition and implicitly the necessary measures to intervene in the regulatory framework.

There is obviously the challenge of providing answers through appropriate regulatory measures for the new context in which small asset owners are growing exponentially, grouping into Energy Communities, and starting to play an active role in grid management.

In the area of electricity distribution, the organizational advances have been more limited mainly because distribution is in fact a much more local issue, there is not the same pressure for cooperation and standardization of regulations as we have in the case of electricity transmission.

#### The DSO framework

The regulatory framework concerning the electricity distribution has been developed mainly at national level, reflecting strictly the requirements and characteristics for each country. In Europe, there is a wide range of organizational structures of the electricity distribution activity (service). On one side, for instance, there is only one single company providing the electricity distribution service for the entire country in the Republic of Ireland. On the other side, there are hundreds of DSOs in countries like Germany and France. Obviously, the regulatory framework in the respective countries is developed in accordance with the existing realities and needs.

The lack of regulatory framework harmonization in different countries rises many operational issues especially for the large electricity distribution companies that have subsidiaries in more than one EU member states.

Moreover, DSOs are having a central role in the energy transition, highly affected by EU-policies but lack a formal representation.

### **New initiatives to address DSO framework at European level.**

The EU DSO entity was created at the initiative of the European Commission, having the goal to promote the completion, and functioning of the internal market for electricity, and to promote optimal management and a coordinated operation of distribution and transmission systems.

The EU DSO Entity is the only means of representation of the DSOs regarding the development of network codes and guidelines.

In this sense, EU DSO effectively entered the role for which it was created, through a series of actions and consultations, starting with the public consultation in relation to the Network Code on Cybersecurity in November 2021.

The foundations of cooperation with ENTSO-E were laid by signing the MoU on January 11, 2022, TSO-DSO cooperation on regulatory aspects, mostly initiated by ENTSO-E, being the main topics of involvement, to discuss the requirements and the impact at the distribution level.

### **The evolving TSO framework**

The power transmission sector is still quite advanced on the road to creating a set of common rules and methods at European level for all TSOs from the EU member countries. European Network of Transmission System Operators for Electricity (ENTSO-E) fulfills its role and considers the two key aspects that define the energy transition: the growth of renewables and distributed generation, as well as the digitization of energy. It considers the fact that in this context of the energy transition, TSO-DSO cooperation is critical and requires regulatory measures aimed at both energy transmission and distribution.

ENTSO-E, together with European Federation of Energy Traders (EFET) developed in 2022 the Harmonised electricity market Role Model (HRM), addressing the digitalization of energy. This is to facilitate the dialogue between the market participants from different countries through the designation of a common name for each role and related object that are prevalent within the European electricity market information exchange. It focuses essentially to enable a common terminology for IT supported information exchange. The document describes the roles that can be played for given objects within the European electricity market. It covers both the wholesale and retail electricity markets<sup>1</sup>.

This document, which provides a first definition of roles in the context of energy digitalization, is an open gate and at the same time an invitation addressed to the interested parties to provide relevant input.

Each year, the European Commission draws up an 'annual priority list' of areas to be included in the development of network codes for electricity, with input from a public consultation. The Commission, with further input from the Agency for the Cooperation of Energy Regulators (ACER) and the ENTSO-E, adopts proposals for network codes. The proposals for network codes are checked by an Electricity Cross-Border Committee of specialists from national energy ministries and then adopted with the approval of the Council of the European Union and the European Parliament.

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<sup>1</sup> <https://ec.europa.eu/energy/en/topics/wholesale-market/electricity-network-codes>

Sometimes the new rules are adopted as 'guidelines' rather than 'network codes.' These are adopted under a different provision of the Electricity Regulation but they have the same status – they are both legally binding regulations.

### The new 4<sup>th</sup> family of network codes of ENTSO-E on Cybersecurity

During the reference period, ENTSO-E added a new 4<sup>th</sup> family of codes to the 3 existing ones, on Cybersecurity, the integration of ICT solutions in the critical infrastructure, highly requires cybersecurity provisions.

**Table 2-1 edgeFLEX interaction with network codes**

Network Code family	Network Codes	Impact level of edgeFLEX project on each code
Connection codes	Requirements for Generators	Very strong
	Demand Connection Code	significant
	High Voltage Direct Current Connections	significant
Market codes	Capacity Allocation and Congestion Management	significant
	Forward Capacity Allocation	weak
	Electricity Balancing	strong
Operation codes	Emergency and Restoration	strong
	System Operations Guidelines	very strong
Cybersecurity	Network Code on Cybersecurity	very strong

## 2.3 Institutions and organizations targeted by edgeFLEX stakeholder engagement.

edgeFLEX focussed its stakeholder engagement activities on the key organisations in Europe, addressing the issues for which edgeFLEX can offer recommendations, based on the results of our technical work and field trials.

The most relevant organizations with whom we interacted and consulted during the implementation of the project, as part of the stakeholder engagement activity, are the following:

- **The Union of the Electricity Industry** – EURELECTRIC is the sector association which represents the common interests of the electricity industry at pan-European level, plus its affiliates and associates on several other continents. Currently, EURELECTRIC has over 34 full members, representing the electricity industry in 32 European countries.
- **European Distribution System Operators' Association** – E.DSO is the key-interface between Europe's DSOs and the European Institutions. E.DSO promotes the development and large-scale testing of smart grid technologies in real-life situations, new market designs and regulation. Starting as a Club of 11

CEOs, E.DSO is now gathering 42 leading electricity distribution system operators (DSOs) in 24 countries all over Europe, including 3 national associations, with a well-established secretariat in Brussels. That represents more than 350 million customers and no less than 7 million kilometers of distribution lines.

- **Transmission and Distribution in Europe** – T&D Europe is the European association of the electricity transmission and distribution equipment and services. The scope of the organization includes the complete range of products and services necessary to transmit and distribute electricity in high and medium voltages, between the producers and the end users. T&D Europe members provide all types of smart grid technologies, including advanced, smart systems suitable for interaction with renewable energies and ICT. The companies represented by T&D Europe account for a production worth over €25 billion and employ over 200,000 people in Europe.
- **Agency for Cooperation of Energy Regulators** – ACER was established in March 2011 by the Third Energy Package legislation<sup>2</sup> as an independent body to foster the integration and completion of the European Internal Energy Market<sup>3</sup> for electricity and natural gas. ACER is one of the EU decentralized agencies. Distinct from the EU institutions, agencies are set up as separate legal entities to perform specific technical and scientific tasks that help EU institutions and Member States to implement policies and take decisions. ACER's headquarters are in Ljubljana, Slovenia. EU Agencies also support the cooperation between the European Union and national governments by pooling technical and specialist expertise. By fostering cooperation among National Regulatory Authorities (NRAs), ACER ensures that the integration of national energy markets and the implementation of legislation in the Member States are met according to the EU's energy policy objectives and regulatory frameworks.
- **Council of European Energy Regulators** - CEER was established in 2000 for the cooperation of the independent energy regulators of Europe. It seeks to facilitate the creation of a single, competitive, efficient, and sustainable EU internal energy market. CEER's work complements (and does not overlap) the work of the Agency for the Cooperation of Energy Regulators (ACER). ACER, which has its seat in Ljubljana, is an EU Agency. CEER is a Belgian non-profit association. They share similar objectives. ACER's focus is on what is required in the legislation and CEER does everything else in energy regulation. CEER's motto is fostering energy markets, empowering customers. CEER's work includes international cooperation, smart grids, sustainability, Demand Side Operators, and customer issues.
- **National Regulatory Authorities** (i.e., Romanian Regulatory Authority – ANRE, Technical Regulator Organization in Germany - VDE/FNN, etc.)
- **EU DSO** - Recently created organization, at the end of 2020, at the initiative of the European Commission, for the representation of the DSOs regarding the development of network codes and guidelines, aiming at:
  - Reflecting the new central role of DSOs in the energy transition
  - Strengthening the cooperation between DSOs
  - Creating a forum of expertise and exchange of views between DSOs on a range of topics that relate to their business and the development of network codes.

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<sup>2</sup>[https://ec.europa.eu/energy/topics/markets-and-consumers/market-legislation/third-energy-package\\_en#:~:text=The%20previous%20round%20of%20EU%2cinto%20force%20in%20September%202009.](https://ec.europa.eu/energy/topics/markets-and-consumers/market-legislation/third-energy-package_en#:~:text=The%20previous%20round%20of%20EU%2cinto%20force%20in%20September%202009.)

<sup>3</sup>[https://ec.europa.eu/commission/priorities/energy-union-and-climate/fully-integrated-internal-energy-market\\_en](https://ec.europa.eu/commission/priorities/energy-union-and-climate/fully-integrated-internal-energy-market_en)

- Facilitating the DSO/TSO cooperation as well as the technical expertise dialogue with other stakeholders

In Europe, standards are developed and agreed by the three officially recognized European Standardization Organizations: **European Committee for Standardization** (CEN), the **European Committee for Electrotechnical Standardization** (CENELEC), and the **European Telecommunications Standards Institute** (ETSI).

## 2.4 Conclusions on the frameworks and organisations relevant to edgeFLEX

The current structure and ongoing evolution of the European, DSO and TSO policy, regulatory and standardisation organisations active on the topics of interest to edgeFLEX has been described. The formation of the new EU DSO organisation is placed in the context of both DSO policy evolution and the evolving interaction between DSOs and TSOs.

Although the evolution of these contexts is developing slowly, we see clear evidence of movement to address the need to accelerate the change in policies, regulation and standards required to support the key European policy initiatives such as the Green Deal and the RePowerEU initiatives.

### 3. Updates on running the work plan and results on the policy, regulatory and standardization framework assessment.

In this chapter, we describe how the edgeFLEX developments relates to the existing frameworks for policy, regulations, and standards and how we defined the set of recommendations for changes required in these frameworks to enable the full scope of the results of edgeFLEX and for the commercial implementation on a large scale.

#### 3.1 Relating the edgeFLEX solutions to existing frameworks and our stakeholder engagement actions

Within the edgeFLEX project, a series of innovative solutions for VPP evolution were developed and applied for a more efficient use of the distributed generation capacities and promoting flexibility. Based on original algorithms, new services have been defined, as well as new approaches to some existing services. However, for fully taking advantage of the results and findings of edgeFLEX, we formulated a series of recommendations to be considered by regulators for potential updates and completion of the existing regulatory framework.

The edgeFLEX assessment, of how existing regulatory and standardization frameworks relate to the edgeFLEX solutions for VPP evolution, was complemented by many edgeFLEX stakeholder consultation actions regarding our draft recommendations on the evolution of these frameworks. The stakeholder consultation actions implemented a continuous edgeFLEX dialogue with practitioners, policy makers and regulators during the whole of the edgeFLEX project lifetime.

edgeFLEX defined the following objectives for stakeholder engagement:

- To understand the position of the stakeholders, the market needs and to correlate them with the activities carried out in the project.
- To support the implementation of the technical solutions and business models proposed by edgeFLEX through the regulatory framework and standardization.
- To obtain external expertise for validation and assessment of the edgeFLEX concepts, use cases and field trials and their implications.

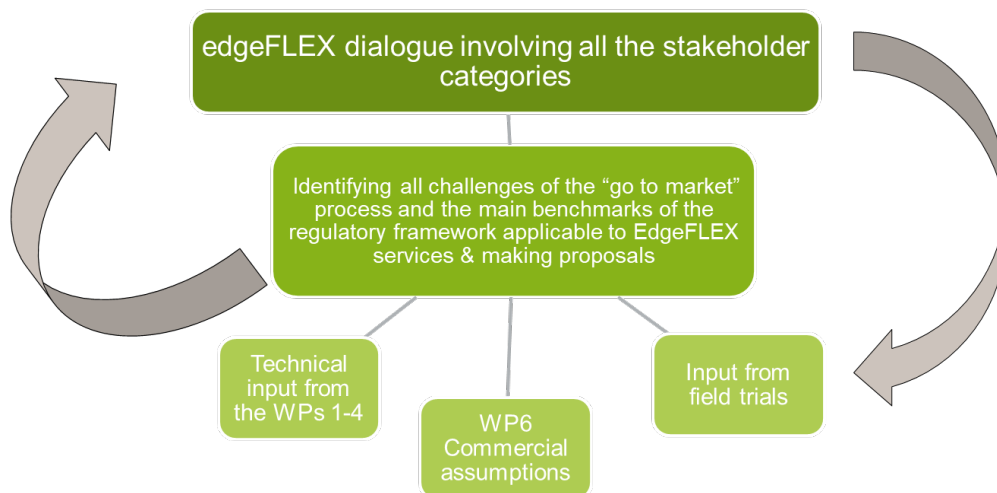
The process of running the consultations with all stakeholders implemented an iterative process of repeated presentation of our ideas, followed by validations with stakeholders. The outcome was the further development of our proposals based on stakeholder feedback and eventually to the final set of recommendations presented in this deliverable.

#### The stakeholder engagement activities in Year 1 of edgeFLEX

In the first year of the project implementation, we made the first projections regarding the aspects to be considered in regulations, in relation to edgeFLEX monitoring, control & planning optimization services.

We had the first interactions with stakeholders, in the first year of implementation, and we made the plan for the second phase of the project implementation - Service validation; the reporting actions on the first phase being included in the first version of this deliverable.

The process of running the edgeFLEX dialogue involving all stakeholder categories, was running in the same iterative manner, for both phases of the implementation, as shown in the diagram below, in Figure 3-1:



**Figure 3-1 The process of running edgeFLEX dialogue activities**

### The stakeholder engagement activities in Year 2 and 3 of edgeFLEX

Starting with the 2nd year of implementation, we entered the second phase - Service validation, and the stakeholder's engagement activity was entering an intense phase of information, consultation, validation, and lobbying.

Our initial ideas and recommendations regarding the regulatory framework were passed through the filter of stakeholder engagement activities, validated with them, completed, and regrouped, considering the initiatives and the progress registered in regulation at the European level.

We have participated in over 30 workshops, events, and bilateral meetings in the energy field, especially in those where energy regulatory aspects were discussed with key stakeholder categories, mentioned in the previous chapter. In more than 10 of these we assumed an active role, presenting the edgeFLEX project and the aspects we considered important regarding the regulatory framework.

We sought to build synergies with the initiatives regarding the improvement of the regulatory framework at the distribution level and Energy Communities, and the main added value we brought was to communicate our ideas and recommendations, formulated based on the experience from the edgeFLEX project to key regulatory organizations and a series of stakeholders in position to benefit from our input.

## 3.2 Mapping the edgeFLEX services to required regulatory evolution.

In this subchapter we briefly present the edgeFLEX services and how we related them to the aspects we consider relevant for the regulatory framework.

### 3.2.1 A brief overview of the edgeFLEX services

edgeFLEX aims at involving Virtual Power Plants and Energy Communities in the grid management, by enabling Slow and Fast dynamics services and fostering a new local energy and flexibility market. With all these changes expected to come, also the role of VPPs and Energy Communities will have to evolve. edgeFLEX aims at providing the ecosystem needed for future VPP to play an active role in grid management. Aggregating various, and sparse, distributed energy resources as a single VPP, providing a platform for data handling, service provisioning, a connection with the system operators who need fast a dynamic grid services and an interface to various markets (local flexibility, ancillary services, balancing). The following is a list of those services that can provide Monitoring, Planning and Optimisation, Control Services that can be linked to Ancillary Services and Voltage Control.

- Monitoring services:

- Frequency Regulation Metering: Is a service which implements a practical criterion to distinguish between devices that, in transient conditions, modify the frequency from those who do not. This service provides the criterion assesses the frequency regulation of the device based on its corresponding Rate-of-Change-of-Power (RoCoP) and thus makes it possible for TSOs to determine whether a device is providing frequency regulation to the electricity system or not.
- Inertia Estimation: The inertia estimation service developed within edgeFLEX serves as a monitoring tool for system operators. The inertia estimation is achieved by collecting frequency and active power measurements of the generating units providing inertia in the network and then performing parametric regression based on post-processing of these measurements. By doing this it enables system operators to quantify the amount of inertial response available
- Planning/ Optimization services:
  - Inertia Allocation
- Control services related to Ancillary Services:
  - Coordinated Frequency Control: This service coordinates the Fast Frequency Regulation (FFR) offered at the device level by the DERs of the VPP. It works by the controller employing the total active power injected into the transmission grid by the VPP as well as the frequency variation at the point of common connection. It does this to generate a signal that is then transmitted to the distributed energy resources that compose the VPP. The role of this signal is to amplify the sensitivity of fast frequency control with respect to the local frequency deviation by a coefficient that is proportional to the power generated by the VPP.
  - Secondary Frequency Control (Automatic Generation Control): This service works by having a controller employ the reference power signal sent by the Transmission System Operator (TSO) to the VPP as well as the measured active power of the distributed energy resources included in the VPP. It does this to generate a signal which is then used to coordinate the frequency control loops of the VPP resources proportionally to their droops. The purpose of the control is secondary frequency regulation and thus it operates in the time scale of tens of seconds up to tens of minutes.
  - Online Dynamic Inertia Estimation.
- Control Services not related to Ancillary Services
  - Online Voltage Control: This service receives voltage measurements from the nodes of the grid and calculates control signals for the distributed generators (DGs) if the voltage locally exceeds the limits defined by the grid codes or by the DSO. It is a DSO specific tool that coordinates different resources to keep the voltage in its limits.
  - MPC Voltage Control: This control service integrates the inputs of the forecast to calculate the control outputs for a prediction horizon. The results of the MPC calculation are transmitted to the market platform as flexibility requests to perform the voltage control. However, the MPC is not directly interfaced with the market since the requests need to be reformulated before submitting to the market. In edgeFLEX a combination of a brokerage solution called Policy Based Grid Management which provides an interface with a flexibility management platform of an energy community.

### 3.2.2 Mapping of edgeFLEX services to required regulatory evolution.

The mapping below, in Table 3-1, refers to the 5 relevant regulatory issues that we have formulated and that we have described in the following subsection. Two of the 7 initial topics in this context, "Virtual Power Plant (VPP) as new participant in the electricity

balancing market" and "New rules for the management of Renewable Energy Sources (RES) electricity generation", were integrated into the "Network Code (NC) for Demand-Side Flexibility (DSF)" proposal, as sharing good practices and recommendations.

**Table 3-1 Relevant regulatory issues for edgeFLEX project**

Regulatory aspects / edgeFLEX services, ICT & market related aspects	Monitoring services (FRM, Inertia estimation)	Ctrl. Services related to AS & Planning optimization services - Frequency & Inertia (CFC, SFC, IE, IA)	Ctrl. Services not related to AS - Voltage (OVC, MPC VC)	ICT & market related aspects
1 New ancillary service - Providing inertia	X	X		
2 New Voltage Regulation Market			X	
3 ICT chapter requirements updates within existing				X
4 Network Code (NC) for Demand-Side Flexibility (DSF)		X		X
5 The Network Code (NC) on Cybersecurity				X

### 3.3 edgeFLEX recommendations for the evolution of the regulatory framework

The substantial development of RES-based electricity generation, which we have all witnessed in the last 10 years across Europe, was the basis of relevant changes in the power systems operation. This is a common trend worldwide, but the EU may be considered as the leader in this respect. Distributed electricity generation is having implicitly a major impact on operational requirements, rules, methods, and practices.

In this context, the regulatory framework needs to be updated to provide the proper support to the power network operators, electricity generators, suppliers, and other participants in the operation of the power systems and associated electricity markets. New ancillary services must be defined, and new approaches are required for some of the existing ones. The definition of new components of the electricity markets is identified as necessary, together and in correlation with updates of the existing network codes.

The context of each of the 5 topics to be considered by relevant organizations in the field of regulations is presented in detail in this subchapter, as well as our recommendations, which have been communicated and validated with key stakeholders. Additionally, these recommendations are described from the following perspectives: novelty, value, link to VPP concepts, and how they relate to the edgeFLEX vision.

Of the 5 topics of our recommendations, edgeFLEX considers that the integration of ICT into power system operation is the most critical issue which the framework setting organizations need to address and implement the trend towards the digitalization of the energy system, both at transmission and distribution level.

#### 3.3.1 The ICT Network Code Continuum addressing missing ICT network code provisions.

edgeFLEX has investigated the topic of ICT integration in depth and we provide descriptions of our other recommendations in more general terms. The need to include an ICT Chapter in Network Code definitions is accepted by many relevant stakeholder organizations in recent years. However, until now, specific provisions for the content of such ICT Chapters have yet to be defined and agreed between stakeholders. Some

stakeholders, such as the ICT engineers, want to push this issue forward. Regulators need to understand how to implement the ICT Chapter and add provisions for the ICT Chapter. While partial descriptions of such provisions are available for the topic of cybersecurity, an agreed general ICT model and specific provisions have not yet been defined. The edgeFLEX proposals on the ICT Network Code Continuum are provided in this context as a broader, more comprehensive proposal for the provisions on ICT that are needed in network codes.

Distributed energy generation management relies on wireless connections between the generation units' locations and the distribution system control center, which integrates software solutions for data collection and processing to substantiate decisions. The implementation and sustained development of these solutions, which involve a high degree of digitalization, represented the trigger of the requirement to include specific regulations for ICT in the existing regulatory framework at distribution level.

### **The role of the ICT component in edgeFLEX VPP evolution solutions**

In the specific context of the project, the ICT component is one of the pillars of edgeFLEX solutions, which will act as a powerful enabler:

- It will enable the new technique for voltage stability control in the power grid by connecting a huge number of communication end points in the future.
- It will enable the new technique for online inertia estimation, and provide solutions for synthetic inertia, that will solve the current problems, i.e., decreased system inertia because of penetration of distributed energy sources that do not have inertia. This will be even more critical in the future and 5G communications will improve the quality of online inertia estimation service by providing superior performance in terms of latency and will ensure data security and integrity.
- It will enable the new technique for frequency stability control that will solve the existing power grid challenge, i.e., to reduce the frequency variance. Frequency control will consider the information gathered from the energy market. 5G will be able to support the stringent communication requirements of the technique that are not possible to meet with 4G.
- ICT, specifically 5G and edge cloud computing, will enable the new concept of low-cost PMU devices that request extremely high sampling data rates and ultra-low latency communications performance.
- It will enable the advanced technique for optimization of VPP operations that will improve current energy market trading. Currently, energy distribution and dispatch are planned in intervals of 1 hour that will be shorten to 15 minutes. Central point of failure will be avoided by service logic deployment in distributed edge cloud.
- ICT will enable the advanced energy flexibility aggregation and trading system, i.e., the new interactions between energy market and DSO fast dynamics techniques that will further improve stability of the power grid. Furthermore, ICT will enable reactive power trading. 5G communications will enable reactive power management that is started 1 minute or less before the problem occurs. This flexibility management puts stringent communication performance requirements towards 5G.

ICT, though there is no official definition, is generally accepted to mean all devices, networking components, applications and systems that combined allow people and organizations to interact in the digital world. In the sense of edgeFLEX and to broadly relate it to the smart grid is the transmission of data between two or more systems or devices for the purposes of monitoring, control and intra device engagement for the purpose of awareness. This data transmission in edgeFLEX mainly focuses on data used for our grid management techniques, like Voltage Control, Frequency Control and Inertia Estimation, our VPP centered, Optimisation, Forecasting and Modelling, techniques,

edge devices like the edgePMUs developed and deployed and the cross-sector engagement cloud hosted tools like the Policy Based Grid Management and FlexOffers.

These services are supported by 4G and 5G communications and enabled by the edgeFLEX Platform which is a flexible microservice based architecture that allows edge devices and other systems connect and both send and receive data using a unified data bus.

The scope of this document is to define at a high level what a network code on ICT would look like, but the specifics of the network code would require a wider forum and future work in terms of in-depth investigation and external consultations.

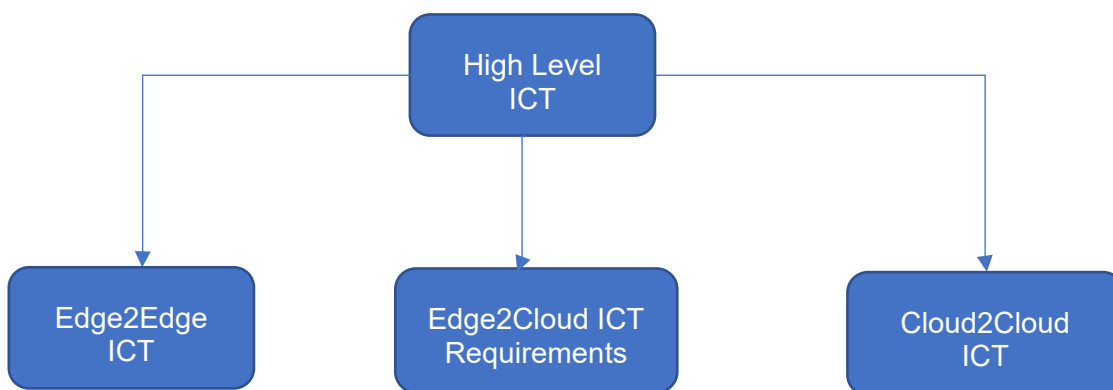
For a network code on ICT to be extensible and to enable it to be used on a broad range of services there is a need to abstract the application from the communications. What this means is that the focus of the network code needs to be on how the data is sent rather than what is sent and why. This is to allow the network Code to be transferring to any application that has to send data.

### **The ICT Network Code Continuum recommendation defined by edgeFLEX.**

The following section presents the concept of an ICT Network Code Continuum in which a generic network code is proposed covering the basics provisions needed regarding ICT integration into solutions, and then a subset of network codes specific to the architecture inherit that generic network code.

A point of note is that this network code proposal is in a continuous process of analysis and substantiation, and our work in edgeFLEX provides benchmarks for how we envision a network code on ICT related to the grid-specific techniques developed in our project. At the same time, it is also important how it is transferable to the techniques and interactions commonly used in ICT used more and more in today's grid.

A continuum, as defined in the Oxford Dictionary is a continuous sequence in which adjacent elements are not perceptibly different from each other, but the extremes are quite distinct. In terms of a suggested Network Code for ICT this is linked to the different architectures that are prevalent in modern ICT systems. All ICT architectures have at their core, data transfer from one point to another. This commonality and all related architectures have a common set of requirements to be fulfilled by the specific implementations of each architecture.



**Figure 3-2 ICT Network Code Continuum recommendation defined by edgeFLEX**

If we look at the top level of the diagram above, in Figure 3-2, the generic Network Code considers the basic communications requirements of ICT systems, such as reliability, security, the basic data transfer protocols, like MQTT, REST, SOAP and the data transfer formats like JSON and XML.

The sub codes are more nuanced in terms of their requirements, where the Cloud2Cloud would have different requirements compared to for example the Edge2Edge case. Taking two particular edgeFLEX services as examples:

- the edgePMU, which is at the edge, which is connected to the grid (Edge2Edge) and transmits it to the cloud (Edge2Cloud) and the
- Policy Based Grid Management which is a Cloud2Cloud application,

while both these applications share the basic ICT requirements for reliability, security etc., they have very different requirements on other issues.

The fact that the edgePMU is a physical device deployed to the edge of the grid, means that it has physical security requirements and potentially standards that the connection point to the grid that the device needs to comply with. The Cloud2Cloud has different requirements, which govern where that cloud is located. For example, if the data generated is stored in Germany, the data center where the data is, processed, used, and held should be in Germany and in the case of cross border data sharing certain criteria should be met.

The descriptions of the differences between the two examples described above are far from exhaustive. In fact, they are just examples but illustrate the need for a network code continuum in which the basic requirements are common and for applications which are lower down in the continuum more detailed requirements need to be defined. This continuum concept would require further work and consultations in which detailed requirements are identified for each layer and subsequent layers identified. Their addition to the Network Code for ICT would make it extensible and useable for the largest possible number of smart grid operations.

#### **A summary of some key aspects of this recommendation**

In Table 3-2 below, we provide a description of the edgeFLEX proposal for the ICT Network Code Continuum in relation to its novelty, value to stakeholders, its link to the edgeFLEX concepts for VPP evolution and how it relates to the edgeFLEX vision.

**Table 3-2 edgeFLEX proposal for the ICT Network Code Continuum**

<b>Topic: ICT Network Code Continuum</b>	
<b>Novelty</b>	In general, smart energy applications for the distribution grid relies on wireless connections between the generation units' locations and distribution system control center, which integrates software solutions for data transmission, data collection and processing to substantiate decisions. The implementation and sustained development of the energy digital solutions represented the trigger to include ICT chapter requirements within the existing grid codes, or to go to the next level of having a distinct and comprehensive approach – ICT Network Code Continuum. A generic ICT chapter within existing grid codes would consider the basic communications requirements of ICT systems, like reliability, security, the basic data transfer protocols, like MQTT, REST, SOAP and the data transfer formats like JSON and XML. The novelty in this context is given by the possibility of including ICT provisions in existing grid codes, to properly respond to the trend of digitalization of energy. In addition, the fact that this trend has a high dynamic, implies a continuous process of updating the provisions of the ICT chapters, according to the technology advancement, to support the implementation and operation of smart energy solutions, based on a functional framework.
<b>Value</b>	The value is given by addressing the existing and potential requirements of smoothly integrating and operating ICT

	solutions, as advanced grid management techniques, in the energy systems.
<b>Link to VPP concepts</b>	This regulatory provision acts in support of the adoption, implementation and operation of smart energy solutions, as in the case of edgeFLEX solution on advancing the role of VPP with the use of advanced grid management techniques, effective optimisation, flexibility provision and trading.
<b>How do they relate to the edgeFLEX vision</b>	It relates to the EF vision by specifically addressing the requirements of edgeFLEX VPP2.0 smart grid solution.

The continuum could be extended further to account for nuances below the architecture specific layer to maybe include, grid connected and not grid connected for the Edge2Cloud applications, or cross border data transfer or not cross border transfer for the Edge2Cloud applications.

### 3.3.2 A new ancillary service to address the growing need to provide inertia in the grid.

#### The changing context of inertia in the grid

The replacement of the spinning generators with inverter-based generators has many technical consequences, and one of the most important consequences is the reduction of the power system inertia which was formerly provided by the very large spinning generators used for fossil fuel power generation.

Nowadays, the power system inertia is provided by the kinetic inertia stored in the rotors of the synchronous generators. In case of a perturbation (e.g., a short circuit), the system uses a part of this stored energy by reducing the speed of the rotors accordingly, from all the synchronous generators connected to the grid in that instant, and proportionally with their rated power and electrical distance from the generator to the perturbation location. This wide distribution of efforts helps to maintain the synchronism during the perturbation and after the outage by the protection systems.

The converter-based generators do not have this technical characteristic. Wind turbines have a rotating part but with low speed and reduced mass. Moreover, the connection to the grid is performed using a converter, and there will be no natural reaction to any perturbation in the electricity network.

#### Synthetic Inertia as a possible solution

In these conditions, it is obvious that each replacement of a synchronous generator with a converter-based generator will reduce the kinetic energy stored in the power system. Thus, it will increase the efforts for each synchronous generator to stay connected to the grid and make more and more difficult for them to maintain the synchronous operation after large outages. This effect is called “reduction of power system inertia”. The synchronous generators operating in power systems with low inertia are in danger of losing their stability after an outage. To prevent this, the synthetic inertia needs to be provided by other facilities in case it is needed.

The necessary technical capabilities for providing synthetic inertia have been defined previously and tested in RESERVE project, and “Providing synthetic inertia” has been proposed as a new ancillary service. This proposal is currently under ENTSO-E consideration. This is a critical measure for allowing increased penetration of RES while maintaining the system stability.

#### How VPPs can provide inertia

In general, the VPP has a quite complex structure, potentially including wind and/or photovoltaic electricity generation, biomass or/and bio-gas electricity generation, storage facilities, consumption, heat pumping, and others. In these conditions, and with an

appropriate coordination of the above-mentioned assets, the VPPs are able from technical perspective to provide synthetic inertia when needed.

### A summary of some key aspects of this recommendation

In Table 3-3 below, we provide a description of the edgeFLEX proposal for synthetic inertia in relation to its novelty, value to stakeholders, its link to the edgeFLEX concepts for VPP evolution and how it relates to the edgeFLEX vision.

**Table 3-3 edgeFLEX proposal for synthetic inertia**

<b>Topic: New ancillary service – Providing inertia</b>	
<b>Novelty</b>	The main challenge for inertia is given by the replacement of the spinning generators with inverter-based generators, having one of the most critical consequences the reduction of power system inertia, within the context of the unpredictability of DERs. The edgeFLEX VPP2.0 solution, integrating Frequency & Inertia monitoring, planning and optimization services, should allow to the grid operator to provide an inertial response as ancillary service to transmission system operators (TSOs) by coordinating the operation of many DRESs. For this purpose, at the distribution grid level, through the New ancillary service - Providing inertia, we need to properly accommodate ICT integrated solutions providing tools to quantify and control the provision of inertial response.
<b>Value</b>	New ancillary service - Providing inertia makes the transition from the classic ancillary services in energy to innovative ancillary services, whose value consists in incorporating the necessary updates required by the challenges of DERs and the integration of Cloud-based ICT monitoring and control solutions, in the context of energy digitalization.
<b>Link to VPP concepts</b>	Inertia estimation and inertia allocation, as components of edgeFLEX monitoring, control & planning optimization services, aiming to advance the role of the VPP with the use of advanced grid management techniques, effective optimisation, flexibility provision and trading combined with enabling solutions such as Service Level Agreement Monitoring tools, edgePMU devices and 5G capabilities
<b>How do they relate to edgeFLEX vision</b>	The regulatory aspects of Providing inertia relate to the challenges of the edgeFLEX vision aiming at involving Virtual Power Plants and Energy Communities in the grid management, to advance the role of the VPP with the use of advanced grid management techniques, effective optimisation, flexibility provision and trading.

### 3.3.3 A new approach to local Voltage regulation based on integrating ICT solutions.

Currently, the approach for voltage regulation is rather well harmonized among EU member states. The electricity network operators are the only providers of this type of service, and they are remunerated accordingly. The payment is fully regulated, and it is in fact a fixed amount included in the transmission and/or distribution tariff assessed by the national regulatory authority, to cover the costs generated by the provision of the service.

The efficiency of the existing system is more and more reduced by the development of the distributed electricity generation, especially in case of LV electricity grids. The

continuation of the trend for installing electricity distributed generation, which may be easily foreseen, it is expected to create more difficulties to properly ensuring the voltage control. The solution is to involve other participant profiles, beside electricity grid operators in the process of voltage regulation.

VPPs characterized by a diversified structure (generation, storage, consumption, etc.), scattered on large geographic areas, and with their components mainly connected to LV electricity grid, have the great potential to be a relevant future provider of Voltage Regulation Service.

### A summary of some key aspects of this recommendation

In Table 3-4 below, we provide a description of the edgeFLEX proposal for voltage regulation in relation to its novelty, value to stakeholders, its link to the edgeFLEX concepts for VPP evolution and how it relates to the edgeFLEX vision.

**Table 3-4 edgeFLEX proposal for voltage regulation**

<b>Topic: New Voltage regulation market</b>	
<b>Novelty</b>	Voltage control services are required when there are sudden changes in demand. This is because the amount of reactive power changes, which affects the voltage and quality of supply. The increasing penetration of non-synchronous, renewable energy in modern power systems replaces synchronous generation and affects voltage stability. This drives the need for additional voltage control sources. A market for voltage control services allows DERs connected to the distribution grid to provide reactive power support through an ICT platform. The advantage of DERs is that reactive power can be produced where voltage problems occur, thereby providing a more suitable solution to the problem. The degree of novelty refers to the fulfillment of the requirements for the optimal provision of voltage control, in the context of using ICT solutions, as advanced grid management techniques, with the involvement of VPP and energy communities, as is the case of the edgeFLEX VPP2.0 solution.
<b>Value</b>	The value of this proposal is given by the novelty it brings, by fulfilling the requirements for the optimal provision of voltage control, in the context of using ICT solutions, as advanced grid management techniques
<b>Link to VPP concepts</b>	Ctrl. Services not related to AS - Voltage (OVC, MPC VC), as component of edgeFLEX monitoring, control & planning optimization services, aiming to advance the role of the VPP with the use of advanced grid management techniques, effective optimisation, flexibility provision and trading combined with enabling solutions such as Service Level Agreement Monitoring tools, edgePMU devices and 5G capabilities.
<b>How do they relate to edgeFLEX vision</b>	New Voltage Regulation Market relates to the edgeFLEX vision by addressing the challenges of involving Virtual Power Plants and Energy Communities in the grid management, to advance the role of the VPP with the use of advanced grid management techniques, effective optimisation, flexibility provision and trading, fostering a new local energy and flexibility market.

### 3.3.4 A Network Code (NC) for Demand-Side Flexibility (DSF) taking in small assets.

Demand-side flexibility refers to the portion of demand in the system (including via electrified heat and transport) that can be reduced, increased, or shifted within a specific duration. Demand-side flexibility must be harnessed to ensure the smooth integration of large shares of variable renewable energy (VRE) into power systems. Flexibility can be achieved on the demand side by allowing the system operator to control, or provide price signals to, various sources of electricity demand, including power-to-heat, power-to-hydrogen, electric-vehicle charging, smart appliances, and industrial demand response<sup>4</sup>s

Through the research concepts and proposed solutions, edgeFLEX project integrates into this broader context, of course.

Initially, in the first year of the project operation, we promoted a series of recommendations on sharing good practices related to the Virtual Power Plant (VPP) as a new participant in the Electricity Balancing Market, new rules for the management of Renewable Energy Sources (RES) electricity generation – the German initiative Redispatch 2.0.

Through both the EU Green Deal and Clean Energy Package, the European Commission has committed itself to an ambitious CO2 reduction agenda. Decarbonisation and decentralisation increase the system's need for demand-side flexibility (DSF), which is urgently needed to make the energy transition possible and cost efficient. The Electricity Market Design Directive and Regulation remains a priority for the European Commission and European TSOs and DSOs, as they already contain valuable provisions to eliminate regulatory barriers to demand-side flexibility. Among others, the framework for the participation of demand response, including through aggregation, to all electricity markets, as well the principles of market-based congestion management, local energy communities and non-wire alternatives to grid extension, set ambitious measures for the inclusion of new actors to the markets.

At the EU level, the market for DSF is still fragmented, and almost non-existent at local level. A legally binding technical framework should be in place to properly complement the provisions set by the existing regulatory framework for the Electricity Market Design.

All of this supports the need for a Network Code for Demand Response and Flexibility. In this direction, synergies are already being created with relevant initiatives at European level, such as the Joint Task Force (JTF) composed of ENTSO-E and the four European associations representing DSOs (CEDEC, E.DSO, Eurelectric, GEODE), aiming to provide recommendations on the DSF Network Code, based on the report titled "Roadmap on the Evolution of the Regulatory Framework for Distributed Flexibility" [2].

This report analyses the regulatory requirements to integrate Distributed Energy Resources (DERs) into the grid and system services both at transmission and distribution level, providing analysis and recommendations in support of this approach, focused on topics divided into 4 clusters:

- Market access and rules for aggregation
- Product design and procurement
- Market processes and transmission and distribution (T&D) coordination
- Measurement, validation, and settlement of flexibility services

Initially, we independently promoted two recommendations related to the regulatory framework, which are directly linked and integrated into the broader approach of the DSF

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<sup>4</sup><https://www.irena.org/publications/2019/Dec/Demand-side-flexibility-for-power-sector-transformation#:~:text=Demand%2Dside%20flexibility%20refers%20to,shifted%20within%20a%20specific%20duration>

Network Code. We then promoted our ideas and recommendations to feed in this Network Code.

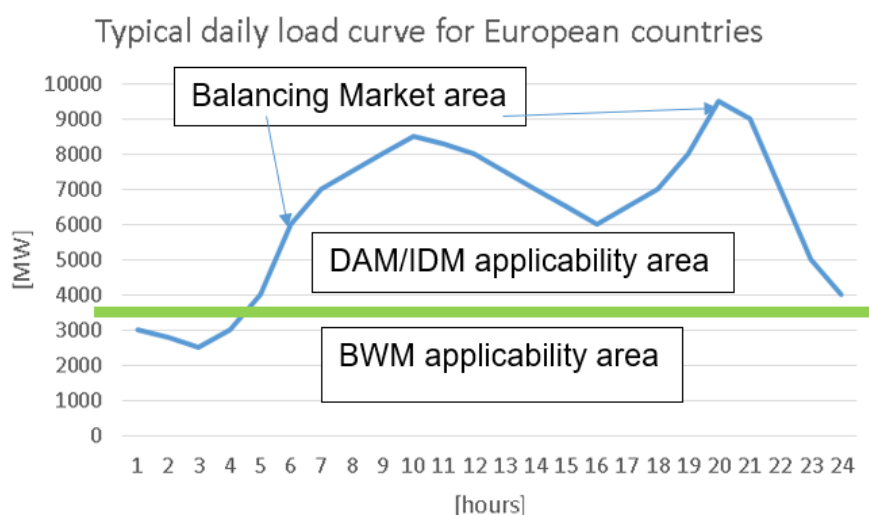
- The two recommendations in the context of DSF Network Code are the following: Virtual Power Plan (VPP) as new participant in the Electricity Balancing Market (EBM)
- New rules for the management of Renewable Energy Sources (RES) electricity generation – Sharing best practices.

### Virtual Power Plant (VPP) as new participant in the Electricity Balancing Market

The main components of the electricity market are the following:

- the bilateral wholesale market (involving long-term bilateral transactions validated by contracts) [1]
- the day ahead market and/or intraday market (involving stock exchange-type transactions in a time frame of 24 hours or less)
- the balancing market involving stock exchange-type transactions implemented in a time frame of minutes, including two main components: the ancillary services market, and the electricity for balancing.

For a better understanding of the interactions between different markets, please see below a typical (for European countries) daily load curve, as shown in Figure 3-3.



**Figure 3-3 The typical daily load curve and the applicability areas for the electricity markets [2]**

Nowadays, the Electricity Balancing Market (EBM) is a very important component of the power systems operation. By the instrumentality of this structure, the power system operators are provided with the necessary tools for controlling the frequency, both in normal operational conditions and in case of outages. This is also critically required to improve the power balance in power systems with high penetration of non-synchronous devices.

Considering the importance of the EBM in the nowadays power systems operation, the requirements for acceptance as a participant are very detailed and strict. The status of participant allows the firms to make offers and receive payments on this market. Once a legal entity receives the status of participant on the EBM, its behavior is carefully monitored by the power system operator, which is normally the EBM operator as well. In case the participant is not fulfilling its contractual obligations, the penalties start from financial fines and may go up to the cancellation of the participant status.

Until recently, the VPPs have not been considered as reliably enough to be accepted as EBM participant. However, the developments in the software platforms used for coordination of the VPP's components operation have led to a greater acceptance from this perspective.

There are a series of initiatives by some national regulatory authorities in some European states, which regulated VPP as an Aggregator and from this perspective it was also assigned a role in EBM. Even in the context of these initiatives to regulate the role of VPP, large generation units are targeted, but not the specific aspects of the integration of small generation units and Energy Communities.

Therefore, our recommendation refers both to sharing good practices to regulate VPP with the role of Aggregator and specially to consider the specific aspects of the integration and active participation in the grid management of small generation units and Energy Communities.

### **New rules for the management of Renewable Energy Sources (RES) electricity generation – Sharing good practices.**

Starting from the example of such an initiative in Germany, where there are extensive changes ahead for grid operators in terms of redispatch and feed-in, the legislature has extensively revised the requirements for the curtailment of generation plants in the event of grid bottlenecks and voltage problems with effect from 01.10.2021. It refers to the management with the passing of the Network Expansion Acceleration Act 2.0 (NABEG 2.0).

In the future, all grid operators will be in position to solve their grid congestions using market-oriented actions, by providing financial compensations. In addition, new contracts will have to be drafted, negotiated, and concluded. The burden on each grid operator is expected to be high.

All generation facilities, including RES plants and Combined Heat and Power (CHP) plants from 100 kW installed power, as well as plants that can be remotely controlled by a grid operator at any time (this essentially concerns controllable PV plants up to and including 100 kW installed power), will be included in the redispatch. According to initial assessments, this includes more than 100,000 plants. The implementation mechanisms for the redispatch of RES and CHP plants have also been redefined, and the balancing group manager of the generation balancing group will be entitled to perform balance adjustments. In addition, the plant operator is entitled to receive financial compensation for the lost revenue, as has been the case in the past. In the future, shutdowns will be based on planned values and forecast data.

In the event of a grid bottleneck or voltage problems, the grid operator having this problem in the grid, must decide which generation plants in its grid or in other grids are to be curtailed to eliminate or avoid the problem. In addition to the effectiveness of the measure, the grid operator must also consider the costs caused by the curtailment (on both sides of the bottleneck, if applicable) as part of an overall assessment and form a "merit order" (deployment sequence) for the redispatch on this basis. The measures that are "expected to cause the lowest costs overall" are then to be selected. For RE plants and CHP plants, imputed (i.e., fictitious) costs should be used as a reference in this respect. These imputed costs are determined with the help of a factor to be defined by the national regulator which is to be selected in such a way that RES and CHP plants are only derated if otherwise five to fifteen times the non-priority generation would have to be curtailed. The factor can be determined differently for RES plants on the one hand and CHP plants on the other.

By applying this type of rules, adapted to the requirements of VPPs and standardization at European level, a new source of income is effectively created for VPPs and its components.

### **A summary of some key aspects of this recommendation**

In Table 3-5 below, we provide a description of the edgeFLEX proposal for a network Code on Demand Side Flexibility in relation to its novelty, value to stakeholders, its link to the edgeFLEX concepts for VPP evolution and how it relates to the edgeFLEX vision.

**Table 3-5 edgeFLEX proposal for a Network Code on DSF taking in small assets**

<b>Novelty</b>	<p>The Electricity Market Design Directive and Regulation remains a priority for the European Commission and European TSOs and DSOs, as they already contain valuable provisions to eliminate regulatory barriers to demand-side flexibility. Among others, the framework for the participation of demand response, including through aggregation, to all electricity markets, as well the principles of market-based congestion management, local energy communities and non-wire alternatives to grid extension, set ambitious measures for the inclusion of new actors to the markets. In this direction, synergies are already being created with relevant initiatives at European level, such as the Joint Task Force (JTF) composed of ENTSO-E and the four European associations representing DSOs (CEDEC, E.DSO, Eurelectric, GEODE), aiming to provide recommendations on the DSF Network Code, based on the report titled “Roadmap on the Evolution of the Regulatory Framework for Distributed Flexibility”. In practice, there are regulatory support measures for demand response and flexibility context, such as solving grid congestions using market-oriented actions - the German initiative Redispatch2.0. We propose Redispatch2.0 as a good practice solution in this context, to be considered by other national regulatory authorities from other European countries, nevertheless the DSF Network Code has a broader approach integrating all relevant aspects regarding the efficient management of demand response and flexibility.</p> <p>Likewise, another recommendation of ours related to this Network Code is to integrate provisions related to regulating the Virtual Power Plant (VPP) as a new participant in the electricity balancing market. It refers to the important role of the Electricity Balancing Market (EBM), and given the context and implication of distributed generation, that is critically required to improve the power balance in power systems having the context of with high penetration of non-synchronous devices. Until recently, the VPPs have not been considered reliable enough to be accepted as EBM participants, however, there are initiatives in different European states regarding the regulation of VPPs as participants in EBM, from the perspective of having the role of Aggregator. Our recommendation is more about sharing the good practices on regulating the role of VPP as new participant in the EBM, having the Aggregator role, and considering in the same time the challenges and additional requirements given by involving Energy Communities together with VPPs in the grid management.</p>
<b>Value</b>	<p>The value of this topic is given by the broader approach integrating all relevant aspects regarding the efficient management of demand response and flexibility. An additional valuable proposition, as input for the NC on DSF, refers to both our recommendations, on Redispatch 2.0 German approach, as a good practice on solving the grid congestions through market-</p>

	oriented actions, and the role of VPP as a participant in EBM, together with addressing the requirements of the involvement of the Energy Communities through the regulatory framework.
<b>Link to VPP concepts</b>	The edgeFLEX solution, proposing the advanced role of VPP with the use of advanced grid management techniques, including by fostering a new local energy and flexibility market, it obviously falls within the regulatory sphere belonging to this Network Code, which is predicted to have a large impact in all aspects of flexibility in energy, including local energy markets, and properly considering the context of Energy communities. This is also about regulating the role of VPP as a participant in the EBM, and addressing further requirements related to the context of edgeFLEX VPP2.0 solution.
<b>How do they relate to edgeFLEX vision</b>	The Network Code on DSF will be able to ensure the regulatory framework on which to support exactly the edgeFLEX vision to advance the role of the VPP with the use of advanced grid management techniques, effective optimisation, flexibility provision and trading. It is about supporting the provision of management solutions for RES electricity generation, that can be remotely controlled by the grid operator, involving all size generation units, according to the edgeFLEX VPP2.0 vision and solution.

### 3.3.5 Network Code on Cybersecurity

With the context of the exponential increase in the digitalization of energy systems, ENTSO-E had the initiative to develop a new network code on cybersecurity, adding at the same time the fourth family of codes to the three existing ones. The Network Code on Cybersecurity aims to set a European standard for the cybersecurity of cross-border electricity flows. It includes rules on cyber risk assessment, common minimum requirements, cybersecurity certification of products and services, monitoring, reporting and crisis management.

The input brought by ENTSO-E for the Energy Transmission area must be completed considering the specific aspects of the Energy Distribution area, and the TSO-DSO collaboration. The implications regarding cyber security are not limited to cross-border electricity flows, and should consider the overall context of smart energy, ICT solutions and services with applicability both cross-border, but also at the distribution level. In this sense, input and recommendations associated with the electricity distribution area are needed.

Within the same reference period, the EU DSO entity was established at European level, targeting the fulfillment of the role that ENTSO-E is having, but for the area of electricity distribution. EU DSO, like any newly created entity, has recently entered its role, in 2022, starting to have an effective contribution to public consultations and the collection of input, regarding the regulatory aspects relevant to the energy distribution, including involvement in the elaboration of this Network Code.

The current status is that ENTSO-E and EU DSO Entity have launched a preparation for the Cybersecurity Network Code implementation phase which is expected to start after the entry into force.

Our recommendation for the elaboration of this Network Code refers to the fact that the provisions for Cybersecurity Issues, at the level of electricity distribution, must be considered at all levels and actors involved in the use of ICT solutions, down to the level of prosumers and energy communities.

#### **A summary of some key aspects of this recommendation**

In **Table 3-6** below, we provide a description of the edgeFLEX proposal for cybersecurity in relation to its novelty, value to stakeholders, its link to the edgeFLEX concepts for VPP evolution and how it relates to the edgeFLEX vision.

**Table 3-6 edgeFLEX proposal for cybersecurity**

<b>Topic: Network Code on Cybersecurity</b>	
<b>Novelty</b>	The Network Code on Cybersecurity aims to set a European standard for the cybersecurity issues. As in the case of DSF NC, this NC on Cybersecurity is also in the process of elaboration, the main role in the coordination of all efforts, aiming to provide recommendations, being assumed by ENTSO-E. and EU DSO. This Network Code provides a clear definition of the roles and responsibilities of the different stakeholders for each activity, linked to the solutions applicable to cross-border electricity flow. Our proposal is that the provisions of this NC should properly consider the roles and responsibilities belonging to the stakeholders involved in the use of smart energy solutions at the level of distribution grid and energy communities, a context in which the smallest prosumer can have a role.
<b>Value</b>	This Network Code is in the process of being developed, the added value of our proposal consists in including the cybersecurity aspects involved in the use of smart energy solutions at the local level, up to the prosumer level, of the small participants of the energy communities.
<b>Link to VPP concepts</b>	Cybersecurity aspects are very important in the broad context of the use of ICT solutions and technologies, targeting all types of users involved, and the context of the edgeFLEX solution, which aims to involve VPP and Energy Communities in the grid management, makes the connection between VPP and cybersecurity.
<b>How do they relate to edgeFLEX vision</b>	It relates to the edgeFLEX vision by addressing the cybersecurity requirements of edegFLEX VPP2.0 ICT solution deployment and integration,

### **3.4 Conclusion on how edgeFLEX is contribution to the evolution of frameworks.**

The need for changes in the policy, regulatory and standardization framework have been described and show that the new recommendations based on the edgeFLEX solutions for the evolution of VPPs can make a good contribution to the modernization of European policy, regulatory and standardization frameworks. In particular, our proposal in relation to the content of the ICT Chapter to be added to Network Codes offers a comprehensive approach to the definition of the ICT aspects of network codes complementing the ongoing approaches of sector organisations to define the cybersecurity aspects of the Network Codes.

## 4. Engaging with policy makers, with organizations and experts in regulation and standardization

We carried out the stakeholder engagement activity throughout the entire lifecycle of the project, building a dialogue bridge between edgeFLEX project and the relevant stakeholder categories.

Starting with the second year of project implementation, our set of recommendations regarding the regulatory framework, from the perspective of supporting research concepts and edgeFLEX solutions, have gone through an iterative process of validation and completion.

Depending on the calendar of events attended by representatives of the target segment, we have adapted our concrete actions of feedback collection and consultations, considering several levels of involvement:

- Attending events where topics from the edgeFLEX area of interest have been potentially addressed.
- Collaborations with different organizations and participation with dedicated edgeFLEX sessions in their events.
- Active involvement in organizing our own consultation events
- Bilateral consultations.

During the reference period of this report, we were having more than 30 interactions with stakeholders, in workshops, consultation events and bilateral meetings, in more than 10 of these we assumed an active role, presenting our recommendations in relation to the policies and regulations, both as organizers and as an invited speaker.

Our actions were directed towards the collection of further input, feed-back, and lobbying by focusing especially on key stakeholder categories, the relevant organizations for policies, regulation, and standardization at the European level, that were mentioned in chapter 2 of this deliverable.

### 4.1 Engaging with relevant stakeholders, presenting edgeFLEX proposals in events and bilateral meetings

In more than 10 interactions with stakeholders, we had a high level of involvement, both as organizers and speakers presenting the edgeFLEX project and our policy and regulatory recommendations in support of the adoption and implementation of edgeFLEX solutions, but also other energy digitalization solutions.

#### 4.1.1 Bilateral meeting with VDE-FNN, Germany

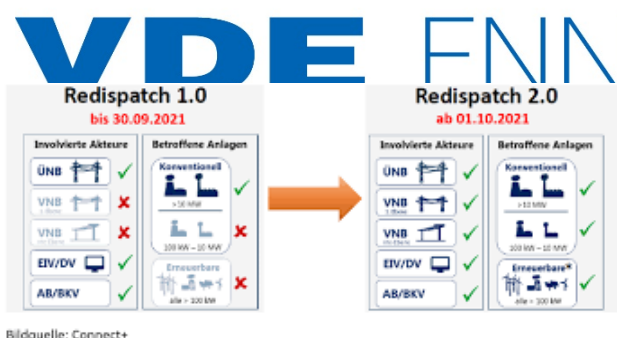
**Type of interaction:** bilateral meeting

**Date:** June 16, 2021

**Location:** online

**Information and outcome:**

In accordance with its role of actively getting involved in driving the fundamental transformation of the power grid brought about by the energy transition, VDE-FNN was part of the committee for the development of Redispatch 2.0 under the coordination of the German regulatory authority, BNetzA.



We set up this bilateral meeting with the aim of being informed about this good practice in Germany, addressing grid congestions using market-oriented actions, in the context of our recommendation to adopt new rules for the management of Renewable Energy Sources (RES) electricity generation.

In addition, we had the opportunity to present our vision and the recommendations targeting the regulatory framework, in relation to the requirements for the adoption and implementation of edgeFLEX solutions. Given the close collaboration between VDE-FNN and the German regulator BNetzA, VDE-FNN facilitated the transmission of the information formulated about regulations in edgeFLEX to BNetzA.

#### 4.1.2 Bilateral meeting with the Agency for the Cooperation of Energy Regulators (ACER)

**Type of interaction:** bilateral meeting

**Date:** July 20, 2021

**Location:** online

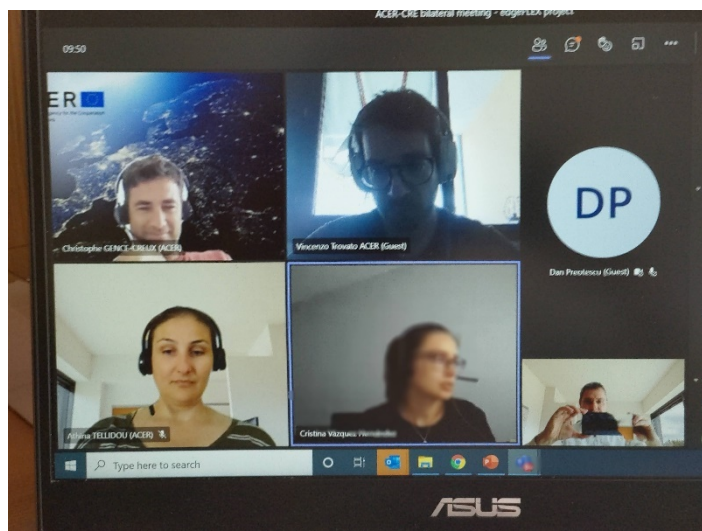
**Information and outcome:**

The Agency for the Cooperation of Energy Regulators (ACER) is one of the main European organizations, with whom we had the opportunity to interact within workshops and events we attended in relation to edgeFLEX project implementation.

In addition, given its important role in European energy regulation, we requested a bilateral meeting in which to discuss on all the regulatory topics and recommendations related to the edgeFLEX context.

ACER showed interest in our project, the Head of the Electricity Department European Union attended the meeting, along with 4 other specialists from the organization.

They appreciated the topics that we presented and confirmed their importance for the current context of the energy transition, as well as the need to create synergies and joint communication actions on the discussed topics, in order to bring them to the attention of the regulatory authorities belonging to different EU member states.



Following the meeting with ACER, a calibration of our recommendations took place and we also received input regarding the ongoing steps and approaches of some European regulatory authorities in relation to the topics presented by us:

- ACER considers that in the dynamic context of the energy digitalization it is necessary to have ICT provisions and requirements within existing Network Codes, that it is truly a challenge to harmonize the opinions of ICT engineers with the traditional vision and the rules of the regulators, and that concerted actions are needed for these messages to reach the regulators.
- With reference to our recommendation that the VPPs be recognized as participants in the Electricity Balancing Market, the ACER representatives

mentioned that the regulation of the VPP with the role of Aggregator is a solution in this direction, some national regulatory authorities already having this concern.

- In addition, both concerning the above-mentioned topic, and in the case of new rules for the management of Renewable Energy Sources (RES) electricity generation - German initiative Redispatch 2.0, the approach proposed by us of sharing good practices is one of the most suitable for raising awareness of regulatory authorities and putting them in position undertake concrete actions.

#### 4.1.3 Workshop on standardization with CEN/ CENELEC

**Type of interaction:** workshop

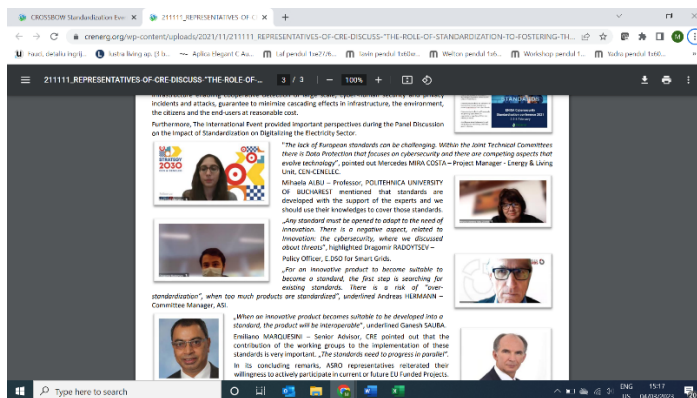
**Date:** November 3, 2021

**Location:** Permanent Representation of Romania to the European Union, Brussels (Hybrid)

**Information and outcome:**

Given the context of implementing several projects in digitalization of energy systems, in which the Romanian Energy Center has the quality of project partner, we organized a hybrid workshop in Brussels to discuss on the potential standardization impact.

The event was organized in collaboration with the Romanian Authority for Standardization - ASRO, which ensured the participation of the representatives of the European standardization organization CEN-CENELEC, including herewith General Director of CEN-CENELEC - Elena Santiago.



The discussions focused on the current status and the way to respond through appropriate standards for the dynamic context of energy digitalization.

Reference was made to the relevant committees and working groups in the field of standardization and the following points were made by the speakers:

- “Academia plays a key role in the standardization activity, and standards have a fundamental role in the digitalisation and innovation of Europe”
- “Standardization support the development of power systems and there is a coordination between the standards requirements and technical regulation”
- "The lack of European standards can be challenging. Within the Joint Technical Committees there is Data Protection that focuses on cybersecurity and there are competing aspects that evolve technology”
- There is in the same time a risk of having “over-standardization”, when too many products are standardized”, that should be properly assessed and avoided.

From the perspective of the edgeFLEX solutions and other energy digital solutions, a significant impact on the standardization is foreseen on the following: Cybersecurity, Type and Quality of Services provided/ included in the Software, Internal structure of the Software (modularity rules), and Transmission of Data and information.

#### 4.1.4 FlexCommunity – 1<sup>st</sup> FlexGroups meeting

**Type of interaction:** workshop

**Date:** April 28, 2022

**Location:** online

**Information and outcome:**

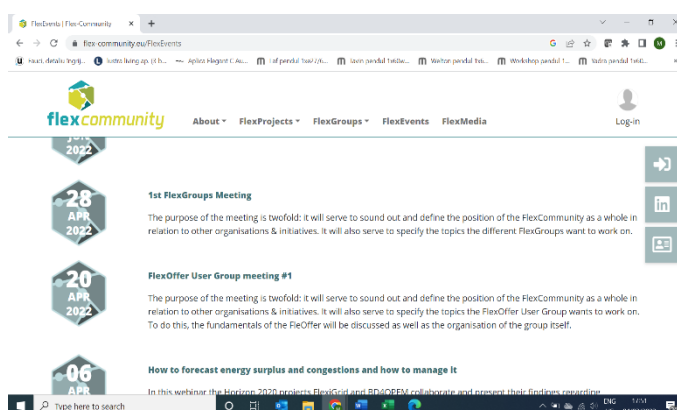
The founding members of the FlexCommunity are the consortia of the H2020 funded projects FEVER, edgeFLEX and Platone, sharing the vision of an energy system which is based on 100 % renewable energies and decentral energy resources and believe that flexibilities are one of the key enablers to make this happen.

With the FlexCommunity, the above-mentioned EU H2020 projects are introducing a platform to collaborate with other projects and stakeholders that work on exploiting flexibilities in the energy system.

In April of 2022, the 1st FlexGroups Meeting took place, in the virtual environment, as a starting point for activities under the scope of FlexCommunity:

- facilitate targeted & efficient networking between stakeholders & projects
- exchange knowledge & learn from each other
- align the terminology & communication efforts
- better understand similarities & differences of technical approaches
- push for advanced standardisation & regulation
- strengthen cooperation in innovative organisational structures and business models, including energy communities

In the panel on policy and regulations, and with the involvement of E.DSO, we discussed with DSO representatives and other categories of stakeholders about the key aspects to consider regarding the regulatory framework, including the recommendations we formulated to facilitate the adoption and implementation of edgeFLEX solutions.



We shared a common vision on the aspects related to regulation that will contribute to supporting the digitalization of energy systems, promoting flexibility and facilitating the effective involvement of VPP, energy communities and small generation units in the grid management.

#### 4.1.5 Romanian Energy Day (RED) 2022

**Type of interaction:** conference

**Date:** June 21, 2022

**Location:** Stanhope Hotel, Brussels, Belgium (Hybrid)

**Information and outcome:**

The European Union is crossing uncharted territories. After two years of COVID-19 pandemic and subsequent health and economic crises, the year 2022 started with a military conflict at its borders. Consequently, two debates took first stage, namely the most severe energy prices crisis in decades and the high dependence on one major external energy supplier, overlapping with and impacting the Green Deal and the Fit for

55 frameworks. These represented the main points of discussion and debate within RED 2022.

With the relaxation of anti-Covid restrictions, the event organized annually, traditionally by CRE, was organized in 2022 in Brussels through a physical meeting.

A wide range of energy actors participated physically, including policy makers and representatives of European institutions involved in the energy field.



The event had a section and a panel dedicated to European projects. We discussed on the holistic approach of CRE involvement in research projects, in the context of energy transition and energy digitalization.

The edgeFLEX project was brought to the attention of the audience and we communicated our recommendations regarding the regulatory framework in the above-mentioned context.

#### 4.1.6 Grid Service Market Symposium 2022

**Type of interaction:** symposium

**Date:** July 05, 2022

**Location:** KKL in Lucerne, Switzerland (Hybrid)

**Information and outcome:**

GSM 2022 – 6th Grid Service Markets symposium – aimed to outline recent developments in the European grid service markets, to highlight advancements and challenges in international cooperation and to reflect the technological progress.

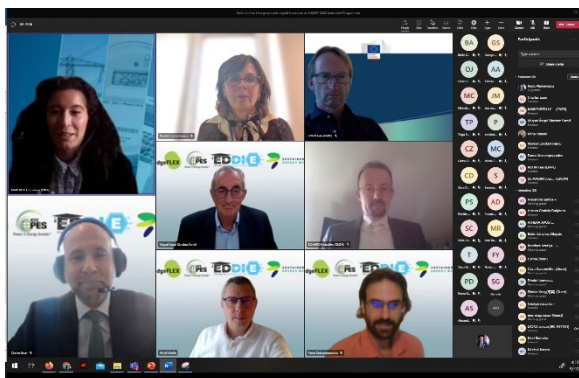
The presentation given at the GSM Symposium in Lucerne was preceded by a call for papers and the acceptance of the work "Regulatory support measures for smart grids and promoting flexibility" [3].

This symposium was attended by energy representatives, both from the distribution and transmission levels, providers of digital solutions in the energy field and representatives of the regulatory authorities. We had the opportunity to discuss our regulatory recommendations with the representative of the regulatory authority in Ireland, involved as speaker at the event as well.



The digital solutions proposed by other H2020 projects such as SOGNO were also presented, as well as the implicit requirements for training and getting appropriate knowledge and skills by the energy employees, for the efficient use of digital solutions - EDDIE project.

At our online event, under the auspices of EUSEW, a wide range of energy actors, both from distribution and transmission, participated, including the representatives of several key European organizations in energy and energy regulation: Council of European Energy Regulators (CEER), ENTSO-E, and E.DSO.



Our ideas and recommendations stemming from the edgeFLEX project regarding regulatory topics that need to be updated and completed, were subsequently transmitted by CEER and E.DSO to their members, actively supporting the awareness process. This is representing one of the main outcomes of organizing the information and consultation event by involving with key stakeholder categories and creating synergies for further awareness and lobbying.

#### 4.1.8 2nd Advisory Board meeting

**Type of interaction:** workshop

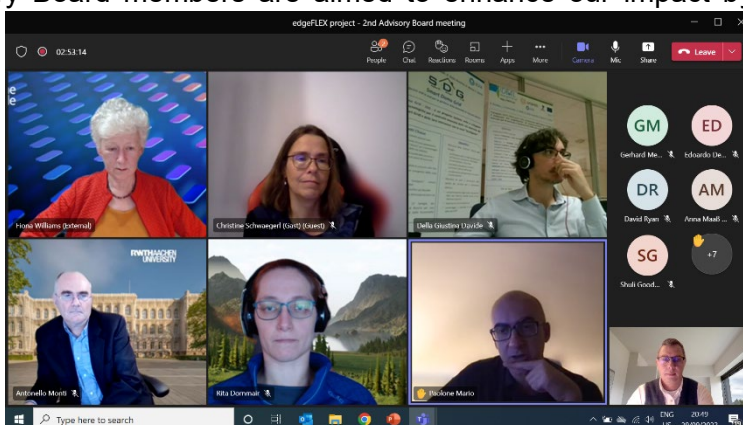
**Date:** September 29, 2022

**Location:** online

**Information and outcome:**

The Advisory Board (AB) met 2 times along the edgeFLEX project lifecycle, tracking on the project activities and providing advise to serve as an opportunity to identify changes in the external framework and new challenges and opportunities.

Discussions with the Advisory Board members are aimed to enhance our impact by regularly reviewing our plans and giving us the benefit of their considerable insight to improve the effectiveness of our actions. edgeFLEX has established a focused AB of leading representatives of the Critical Energy Infrastructure and ICT sector, providing valuable input and advised on the project strategic directions in the sector.



The 2<sup>nd</sup> Advisory Board meeting was mostly focused on the results of running the field trials, according to the second phase of the project implementation – Service validation. Likewise, AB advised us on the communication of results to stakeholders, business modelling and preparation for exploitation. At the same time, the AB supported us in the activity of communication and dissemination of the project results and insights, and thereby helped on ensuring European wide acceptance and usability of the edgeFLEX project outcomes.

The E.DSO representative, joined the AB team for the second meeting of this advisory group, and provided support for our stakeholder engagement activity by distributing a questionnaire and informing their own members, the DSOs, about our recommendations regarding the favorable regulatory framework associated with the edgeFLEX project.

The following members participated in the second meeting of the AB:

- Prof. Mario Paolone, Chair of the Distributed Electrical Systems laboratory and Head of the Swiss Competence Center for Energy Research (SCCER) FURIES (Future Swiss Electrical infrastructure), Swiss Federal Institute of Technology
- Ondřej Černý, Senior Projects Officer, E.DSO, Belgium
- Shuli Goodman, Executive Director, LF Energy, USA
- Christine Schwägerl, Professor, Augsburg University, Germany
- Dr. Davide Della Giustina, Head of Networks and Systems Operations, Unareti
- Dr. Werner Friedl, Head of the research field "Integrated Energy Systems", AIT Austrian Institute of Technology

Regarding our stakeholder engagement activity, the subject of this deliverable, AB members were impressed by our sustained activity in interaction and consultation with all categories of stakeholders.

#### 4.1.9 Expo-conference Factory4.0 on the digital transformation

**Type of interaction:** expo-conference

**Date:** November 9, 2022

**Location:** Palace of Parliament, Bucharest, Romania (Hybrid)

**Information and outcome:**

The FACTORY 4.0 Expo Conference 3rd Edition was an event dedicated to digital transformation with a special focus on digital skills and Industry 4.0.

Our contribution to this event was to bring to the fore the energy sector and the digital transformation in this sector, based on the experience and the outcome of the research projects, among which the context of the edgeFLEX project being very relevant.

The presentation focused on the role of regulations in supporting the implementation of digital energy solutions, highlighting our recommendations formulated within the framework of the edgeFLEX project.



#### 4.1.10 Digital4Energy 1<sup>st</sup> conference

**Type of interaction:** conference

**Date:** January 19, 2023

**Location:** Petroleum-Gas University of Ploiesti, Romania (Hybrid)

**Information and outcome:**

Digital4Energy is a training project for the acquisition of digital skills, intended for employees working in the energy field. This was the first of a series of 7 events scheduled in 2023 in order to promote this project.

The edgeFLEX project was presented in front of DSO representatives and other energy company profiles, as an important landmark from the perspective of digital solutions in energy, generating the training need for the digital skills of energy employees.



Our recommendations regarding the regulatory framework were also presented, in this dynamic context of the energy transition and the digitalization of the energy sector.

DSO representatives showed interest in edgeFLEX solutions and confirmed that the current regulatory framework in Romania include provisions for the operation of VPPs, but does not take into account the specific aspects of the involvement of small generation units and Energy Communities. Although the trend of involvement in the power grid of small generation units is obvious and has a high dynamic in Romania, the regulatory authorities must be aware of these limitations that must be removed by completing the regulatory framework.

#### 4.1.11 Digital4Energy – 2nd conference

**Type of interaction:** conference

**Date:** March 14, 2023

**Location:** Sinaia, Romania

**Information and outcome:**

The conference was organized in collaboration with the Association of Energy Suppliers from Romania, and more than 80 energy companies, including aggregators, participated.

Also, on this occasion, a second meeting and consultation with the Romanian Energy Regulatory Authority took place, one of the vice-presidents of the organization having an important role in the discussions.

Both the participants and the representative of the energy regulatory authority showed interest in edgeFLEX solutions and consider that our recommendations regarding the regulatory framework should be considered by the regulators in the context of the energy transition. It was discussed that smart grid solutions, in general, are not followed in a timely manner by updates required for



the regulatory framework, which would support their adoption and implementation. Even if there are response initiatives in regulation, they must be supported with arguments and additions constantly.

## 4.2 Participation in workshops and events

In the reference period of this second report on stakeholders' engagement, we participated in more than 20 other events, in addition to those mentioned in the previous sub-chapter. We sought to participate in the conferences and workshops either organized by relevant organizations for the field of energy and energy regulations, or in those in which representatives of organizations from the categories of stakeholders targeted by us participated.

The goal was to inform us about the trends, solutions and challenges related to the context and our activity in the edgeFLEX project. We sought to establish to what extent the edgeFLEX solutions as well as the recommendations formulated in relation to the regulatory framework are in accordance with the trends in the field, to validate them, and to look for synergies to be created with other projects and initiatives, to have a more significant impact.

The events we participated in, completing the list of 10 already mentioned in the previous subchapter, are the following:

- Trends, opportunities, and choices in designing a cyber resilient EPES infrastructure – April 15
- CyberWatching EU – May 2021
- Power Summit 2021, Rewriting the grid for our future together, Eurelectric – May, 25-26, 2021
- 10th Innogrid Edition - June 11, 2021
- RESISTO – Critical infrastructure – October 12-13, 2021
- A consumer-centric energy transition conference – October 22, 2021
- Romanian Energy Day 2021 – October 26, 2021
- EUSEW Policy Conference – October 27, 2021
- Climate Change and Environmental Sustainability conference – November 9-11, 2021
- CoordiNet stakeholders Forum – November 25, 2021
- Power to the people, Eurelectric event – November 29, 2021
- Digitopia 2021: Where electricity meets data – November 30, 2021
- E.DSO event – December 1st, 2021
- Global DSO – Sessions 1 and 2 – January 27-28, 2022
- E Vision 2022 – February 8-9, 2022
- ECSI Workshop on Critical infrastructure – April 27-29, 2022
- Presentation of the ACER Final Assessment of EU Electricity Market Design – May 5, 2022
- Net Zero Grid Day – May 16, 2022
- ACER-CEER Public workshop – May 25, 2022
- InnoGrid 2022 – Policy conference – ENTSO.E – June 29, 2022
- Webinar: Digitally enabled renewable energy communities: the role of citizens in the clean energy transition – September 7, 2022
- EUSEW Policy conferences - September 29-30, 2022
- A multi-scale calibration approach for a digitalised energy system – November 22, 2022
- The Coming Storm: Building electricity resilience to extreme weather – December 7, 2022

- Shocks, stability, and sustainable markets – A live recording of the Watt Matters Podcast co-hosted with Eurelectric – December 8, 2022

### **4.3 Conclusions regarding edgeFLEX stakeholder engagement**

Participation in events lower than in previous years, in which there were many large international events, due to Covid-19, ...

Despite this, we reached the key stakeholder organisations and individuals and made good progress with remote meetings, presenting and promoting our recommendations. European organisations such as ACER, CEER and E.DSO shared the presentations we made to them with their many National member organisations, greatly increasing the reach of our activities.

Stakeholders have been slow to adapt in recent years. Now that Covid-19 is receding as a problem restricting events, progress can be expected to accelerate.

## 5. Conclusion on the success of edgeFLEX stakeholder engagement

edgeFLEX went beyond defining results in field trials and research papers and standards contributions to bringing the implications of our results to the key policy, regulatory and standardisation organisations in Europe.

We formulated our recommendations in relation to the many challenges faced by these organisations as they, and their member organisations, address the energy crisis, the need to digitalise the energy sector and to cope with climate change.

The strong relationship between the results of the edgeFLEX project and the main policy initiatives at the European level (The Green Deal and RePowerEU initiatives, the Clean Energy for all Europeans package) created the opportunity for the project results to contribute to many aspects of the evolution of policy, regulatory and standardisation frameworks. The project made extensive efforts to engage with key stakeholders maximising the opportunities we had for interaction with good results. In the reference period of this report, which coincides with the second phase of project implementation - edgeFLEX services validation, we have participated in over 30 workshops, events and bilateral meetings in the energy field, especially in those where energy regulatory aspects were discussed with key stakeholder categories. In more than 10 of these we assumed an active role, presenting the edgeFLEX project and the aspects we considered important regarding the regulatory framework.

We sought to build synergies with the initiatives regarding the improvement of the regulatory framework at the distribution level and Energy Communities, and the main added value we brought was to communicate our ideas and recommendations, formulated on the basis of the experience from the edgeFLEX project to key regulatory organizations and a series of stakeholders in position to benefit from our input.

The regulatory stakeholders were interested in the work of the project and in its recommendations. They were not actively working on some of these topics yet, in the context of defining changes, but they see the need for them to consider the issues.

Dissemination and communication activities and stakeholder engagement activities made excellent progress during the final project year providing the project with valuable feed-back and supporting our exploitation preparations. Stakeholder engagement with consumers and with people playing key roles in DSO and VPP organisations were fruitful and assisted in exploitation planning and the promotion and uptake of our results. Stakeholder engagement with regulatory and power standardisation organisations provided feed-back on our recommendations for change and demonstrated the interest of sector actors to consider the edgeFLEX recommendations.

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## 8. References

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## 9. List of Abbreviations

AB	Advisory Board	ICT	Information and Communications Technology	SLA	Service Level Agreement
API	Application Programming Interface	IoT	Internet of Things	TSO	Transmission System Operator
CIG	Converter-Interfaced Generation	LV	Low Voltage	VPP	Virtual Power Plant
DER	Distributed Energy Resource	MV	Medium Voltage	WP	Work Package
DG	Distributed Generator	MVP	Minimum Viable Product	WPL	Work Package Leader
DSO	Distribution System Operator	PMU	Phasor Measurement Unit	ACER	European Union Agency for the Cooperation of Energy Regulators
EMS	Energy Management System	REMS	Reactive Energy Management System	CEER	Council of European Energy Regulators
ESS	Energy Storage System	RES	Renewable Energy Sources	ENTSOE	European Network of Transmission System Operators
FMAN	Flex-Offer Manager	RFMAN	Reactive Flex-Offer Manager	E.DSO	European Distribution System Operators
FMAR	Flex-Offer Market	RFMAR	Reactive Flex-Offer Market	CHP	Combined Heat & Power
FOA	Flex-Offer Agent	SG	Synchronous Generator		