



## Business model analysis of OneNet solutions

### D11.6

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## About OneNet

The project OneNet (One Network for Europe) will provide a seamless integration of all the actors in the electricity network across Europe to create the conditions for a synergistic operation that optimizes the overall energy system while creating an open and fair market structure.

OneNet is funded through the EU's eighth Framework Programme Horizon 2020, "TSO – DSO Consumer: Large-scale demonstrations of innovative grid services through demand response, storage and small-scale (RES) generation" and responds to the call "Building a low-carbon, climate resilient future (LC)".

As the electrical grid moves from being a fully centralized to a highly decentralized system, grid operators have to adapt to this changing environment and adjust their current business model to accommodate faster reactions and adaptive flexibility. This is an unprecedented challenge requiring an unprecedented solution. The project brings together a consortium of over seventy partners, including key IT players, leading research institutions and the two most relevant associations for grid operators.

The key elements of the project are:

1. Definition of a common market design for Europe: this means standardized products and key parameters for grid services which aim at the coordination of all actors, from grid operators to customers;
2. Definition of a Common IT Architecture and Common IT Interfaces: this means not trying to create a single IT platform for all the products but enabling an open architecture of interactions among several platforms so that anybody can join any market across Europe; and
3. Large-scale demonstrators to implement and showcase the scalable solutions developed throughout the project. These demonstrators are organized in four clusters coming to include countries in every region of Europe and testing innovative use cases never validated before.



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## List of Abbreviations and Acronyms

Acronym	Meaning
ACER	European Union Agency for the Cooperation of Energy Regulators
aFRR	automatic Frequency Restoration Reserve
AMI	Advanced Metering Infrastructure
ASM	Active System Management
BM	Business Model
BRP	Balance Responsible Party
BSP	Balancing Service Provider
BUC	Business Use Case
CBA	Cost Benefit Analysis
DDEP	DSO Data Exchange Platform
DER	Distributed Energy Resource
DR	Demand Response
DSF	Demand Side Flexibility
DSO	Distribution System Operator
EHV	Extra High Voltage
FMO	Flexibility Market Operator
FP	Flexibility Platform
FPO	Flexibility Platform Operator
FR	Flexibility Register
FRO	Flexibility Register Operator
FSP	Flexibility Service Provider
FSPA	Flexibility Service Provider being Aggregator
FSR	Florence School of Regulation
HV	High Voltage
IMO	Independent Market Operator
ISR	Imbalance Settlement Responsible
KPI	Key Performance Indicator
LFC	Load Frequency Control
LV	Low Voltage
LMS	Load Management System
MCOM	Market Clearing Optimization Module
MDC	Metered Data Collector
MDR	Metered Data Responsible
mFRR	manual Frequency Restoration Reserve
MO	Market Operator

MO DSO	Market Operator Distribution System Operator
MO TSO	Market Operator Transmission System Operator
MOL	Merit Order List
MV	Medium Voltage
NEMO	Nominated Electricity Market Operator
OO	Optimization Operator
RA	Resource Aggregator
RO	Resource Owner
RP	Resource Provider
SA	Scheduling Agent
SO	System Operator
SU	Scheduling Unit
T&D CP	TSO-DSO Coordination Platform
TDEP	TSO Data Exchange Platform
TLS	Traffic Light System
TMO	Technical Market Operator
TSO	Transmission System Operator
VLL	Value of Lost Load
VPP	Virtual Power Plant
WFP	Weather Forecast Provider

## Executive Summary

Developing and coordinating markets to procure SO services requires that the stakeholders involved in the implementation of these markets and services are subject to the right conditions allowing and encouraging them to engage in this implementation process. In this deliverable, we discuss what the conditions should be for this to happen. We define, represent, and analyse BMs associated with each of the BUCs in the project. These BMs are focused on some stakeholders involved in the corresponding BUCs with the aim of having at least one BM focusing on each main stakeholder involved in the implementation of markets for SO services. The BMs defined are described according to structure of the BM Osterwalder's Canvas, defining 9 main building blocks in it: Key partnerships, Key activities, Value proposition, Customer, Customer relationships, Key resources, Channel, Cost structure, and Revenue stream.

Each of the BMs is analysed along three dimensions:

- Identification and engagement strategies of critical stakeholders, having large power over the implementation of the BM but low interest in contributing to it.
- Barriers posed by the regulation in a country and region to the successful implementation of this BM.
- Impact of the local regulation and conditions on the characterization of the business of main stakeholders involved in markets for SO services.

There may be several types of relevant regulatory barriers to the implementation of a BM:

- the lack of regulation enabling the development of markets for SO services, defining the main roles in them, or determining the main aspects of the functioning of markets for SO services;
- the lack of economic incentives for TSOs and DSOs to procure flexibility;
- the lack of additional schemes for the mobilization of flexibility, like appropriate pricing schemes, that markets should coexist with;
- the lack of appropriate regulation on the ownership and operation of DERs by the SOs;
- the barriers making difficult the access to markets of agents, especially the small ones;
- constraints on the access to relevant data by market agents.

Achieving the implementation of a BM requires overcoming those barriers, within the former ones, that are especially relevant for the corresponding business to be successful.

Those stakeholders that are critical to engage for the implementation of many of the markets for SO services addressed, and the successful provision of the associated services, include:

- the National regulatory authorities and governments;
- the local associations of consumers, authorities, or interest groups;

- the BRPs and Retailers;
- the TSOs and DSOs;
- the FSPs, especially the small ones;
- the conventional and large utilities; and
- the sectoral associations.

Achieving the engagement of all these critical stakeholders in the implementation of local flexibility solutions requires to allow these stakeholders to participate in these solution schemes and benefit from their implementation, but also to make each of these stakeholders aware of these benefits and provide these stakeholders with certainty about the conditions they will face in getting involved in these solution schemes.

Lastly, stakeholders and authorities should be aware that the conditions existing in a region or national system may affect the service that stakeholders engage in, the focus of their activities related to that service, the stakeholders with whom they relate in these activities, and even the main means and resources used to relate to them.

Regarding the quantitative analyses conducted to make an informed guess of the potential of the BM analysed, our literature review has quantified the multifaceted benefits derived from DER based flexibility services. We have classified these benefits according to two dimensions:

- service benefits, i.e. having the benefits classified by service where they are achieved, encompassing re-dispatch, balancing, and electricity wholesale. And
- secondly, benefits classified according to the associated cost component affected, encompassing investment savings, reduction in renewable energy curtailment, carbon emission savings, savings due to the reduction of energy not served, and variable production cost savings.

In summary, the service benefits of DER based flexibility services are undeniably profound, as our comprehensive literature review has revealed. Firstly, the savings related to balancing services alone, added up to a range between €0.3 and €0.7 billion. Please note that the term billion here refers to 1000 million €. Supplementarily, for the Mainstreaming RES scenario in [1] carried out with METIS, 7.7 GW of DSF and an additional 2.1 GW of batteries are mobilized for this purpose within the European Union.

Secondly, the findings for re-dispatch savings suggested that load shedding is decreased to a similar extent in both referenced studies due to flexibility mobilization (2.56 TWh in SmartEn [2] compared to 2.4 TWh in the METIS 2 S1 study [3]). However, the reduction in curtailment is notably less in the METIS 2 S1 study [3] than in SmartEn [2] (2.7 TWh in METIS 2 S1 study compared to 15.5 TWh in SmartEn [2]).

Thirdly, as the SmartEn [2] study states, there are substantial savings to be achieved due to the mobilization of flexibility in the wholesale market. Activating 397 TWh upward and 340.5 TWh downward DSF reduces wholesale market consumer expenditure by 48% (€301.5 billion less than no-DSF). Energy generation costs are

€4.6 billion lower (5%) due to the fact that deploying flexibility allows to integrate mostly additional amounts of renewable energy with zero marginal production costs. The DSF system ensures year-round demand fulfilment, saving €9 billion on lost load compared to a no-DSF system. Reducing energy not served through conventional investments in additional capacity, instead of using DSF, is contemplated in some studies from a CAPEX standpoint, but the analysis of the impact of this on generation costs is not carried out. Load curtailment and shifting significantly impact market dynamics, preventing high price spikes from occurring. Thus, while a modest 5% reduction in generation costs is achieved, the final cost of electricity to load nearly halves.

Stemming from these service benefits, the findings on the benefits per cost components, starting with the investment savings, were the following. The examined studies that spoke on this matter, SmartEn [2] and METIS 1 S1 [4], both find yearly investment savings of slightly above 10 billion euros for their conservative estimate. These savings for the best case for SmartEn [2] almost triple those of the METIS 1 S1 study [4]. This can be explained by the fact that the savings related to a lower number of technologies are being quantified in the later study. These annual investment savings only consider CAPEX. OPEX is to be considered separately.

Our analysis concerning RES curtailment in SmartEn [2] concluded that DSF results in renewable energy curtailment being reduced by 61%, which amounts to a 15.5 TWh reduction. In the scenario considering all types of load shifting available in the METIS 2 S1 study [3] (traditional load shifting and EV load shifting) simultaneously, generation curtailment is reduced by DSF in 2.7 TWh.

Furthermore, we have discussed the carbon emission savings achieved by the DER flexibility implementation. Two studies include quantitative information on these emission savings. However, the Eurelectric study [5] provides a significantly higher estimate of savings of this type than the SmartEn study [2]. This is probably due to the fact that the savings computed in the former study result from the implementation by the DSO of all the types of actions for the mobilization of flexibility and the undertaking of the corresponding investments, while those in SmartEn [2] are exclusively attributable to DSF. The total savings estimated in both studies amount to €1.125 billion (37.5 MT) and €17-22 billion (6500-8000 MT), respectively.

Finally, additional savings that can be achieved by reducing the amount of energy not served. In the SmartEn study [2], all the non-served energy is avoided in the DSF scenario, while in the Reference scenario the cost of non-served energy amounts to €9 billion approximately (the cost of VLL in this study is 3500€/MWh). In the METIS 2 S1 study [3], using all types of load-shifting simultaneously results in a load shedding reduction of 2.4 TWh. In the METIS 2 S1 report [3], the VLL considered in this study is not provided. If the same cost of non-served energy as in SmartEn [2] is used, the savings in energy not served achieved in METIS 2 S1 [3] would amount to €8.4billion, which is 6% less than in SmartEn [2].

As shown above, the business model potential for OneNet flexibility solutions is enormous. Even though the studies quantitative findings are not directly comparable, and the aggregated benefits related to individual services cannot simply be summed up, the ranges of savings provided give a good indication of the large





potential for cost reduction that flexibility from DER has. Future research could provide significant added value by analysing the quantitative flexibility benefits in a more comprehensive way. This involves, for example, studying the value of flexibility mobilized for different services individually as well as overall, considering a range of realistic scenarios that appropriately represent the related uncertainties.



## 1 Introduction

The implementation of markets for SO services and processes targeted within the BUCs in the project will not be possible unless there is a clearly defined way for all the partners directly and indirectly involved in this service to interact and their participation is deemed profitable for them. Hence, defining suitable BMs, at least, for the relevant stakeholders involved in the targeted services and processes and assessing the soundness of these BMs is of paramount importance. D11.6 reports on the work carried out within Task 11.5 of the project OneNet, focusing on the definition and analysis of BMs associated with the BUCs considered within the project. As detailed below, once the qualitative analysis of these BMs is carried out, we provide some overall estimates of the overall quantitative impact of the implementation of flexibility solutions for the services targeted in the BUCs. This, in any case, is just a first attempt to provide quantitative evidence of the potential benefits for the deployment of the corresponding services, processes and market developments of the business models considered in OneNet project.

The emergence of the term ‘business model’ can be traced back to the advent of the Internet in the mid-1990s, when many startups were being created based on new and disruptive ways of creating value, and they struggled to find financing [6]–[8]. Nevertheless, the concept did not have any theoretical grounding in economics or business [6], and even if it started to be commonly used during those years, a certain amount of time was needed to be considered in academia [7].

Today, although there is a significant number of articles addressing business models, it is pretty complex to set a standard definition of what a business model is, with authors referring to this concept using a wide variety of definitions: a statement, a description, a representation, an architecture, a conceptual tool or model, a structural template... [8], [9]. Considering Osterwalder’s definition, it “is a rationale of how an organization creates, delivers and captures value” [10]. In other words, as Teece explains it, it “is a conceptual rather than financial, model of a business” [6]. Finally, Amit and Zott define it as “the content, structure and governance of transactions designed so as to create value through the exploitation of business opportunities” [9], considering that “the overall objective of a focal firm’s business model is to exploit a business opportunity by creating value for the parties involved, i.e., to fulfil customers’ needs and create customer surplus while generating profit for the focal firm and its partners” [11].

Teece explains that business models cover the gap between technical and economic domains [7], as technological innovation does not guarantee a business’s success [12]. To be successful, a business model defining ‘go to market’ and ‘value capture’ strategies should be developed for any new product, no matter how disruptive or creative a new idea may be considered [7]. To this extent, some typical examples of business models are the ‘razor-razor blade model’, used for many products such as jet engines, which prices razors cheaply but the blades expensively, the ‘freemium model’, used by Adobe and Skype, which allow free usage of

the software but add additional features that must be paid if used, and the ‘multiple revenue stream model’, which charges multiple agents with fees (advertisers, buyers...) and not only a single one [12].

Osterwalder considers that the business model must be a simplified and abstract representation of how the company works and that it must be differentiated from the process and the strategy [13]. He considers that the company can be seen as having different levels, where the top layer, or strategic one, represents the planning (vision, goals and objectives), the middle layer, or business model one, represents the architecture (money-earning logic), and the bottom layer, or process one, represents the implementation (workflow and organization). The business model intends to represent only the money-earning logic.

Based on what has just been mentioned, one can conclude that a Business Model must be focused on a certain entity, discussing the way it works and relates to others to create, deliver and capture value.

Table 1.1: The three different layers of a business as defined by Osterwalder.

Level	Layer	Purpose
Planning	Strategic	Vision, goals, and objectives
Architecture	Business model	Money-earning logic
Implementation	Process	Organization and workflow

Furthermore, in a 2010 working paper, Amit and Zott consider that the following aspects lie at the heart of business models [8]:

- focus on how business must be done rather than when, where or what;
- consider a holistic perspective and do not analyse particular functions;
- emphasize how the value is created and not how it is captured;
- recognize the activities that may be executed by partners.

Next, we describe the methodology applied in defining, describing and analysing the BMs considered within this activity.

## 1.1 Aim of Task 11.5 and general methodology applied to undertake the activities within it

The general objective of Task11.5 is the definition and analysis of BMs associated with the BUCs defined in the OneNet project. This, however, must be conducted in a sequence of steps that are identified and described below:

1. Definition of the BMs to analyse

2. Selection of the Methodology followed to describe, or represent, these BMs, as well as that to be employed to analyse them.
3. Description of the BMs, according to the methodology previously selected.
4. Qualitative analysis of the BMs, focusing on those aspects to potentially address that are most relevant and whose discussion is deemed feasible.
5. Quantitative analysis of the implementation of flexibility solutions for some selected services to provide some quantitative evidence of the suitability of the deployment of the corresponding services and processes.

The specific methodologies applied to represent BMs and analyse them are described in detail in section 2.

## 1.2 Objectives of the Work Reported in this Deliverable

D11.6 reports on the activities carried out within Task 11.5, focused on the description and analysis of BMs associated with the BUCs in the project. The general objective set for Task 11.5 is contributing to the successful deployment of the flexibility services analysed in the project through the definition, description and analysis of BMs for some of the most relevant stakeholders involved in the provision of these services. These BMs clearly outline the interactions taking place between these stakeholders and the rest of those involved in these markets for SO services and processes. The partial objectives of the work carried out coincide largely with the steps taken in our analyses, already identified in subsection 1.1.

## 1.3 Outline of the Deliverable

This deliverable is structured as follows. Section 2 provides the methodology employed in defining, describing and analysing a set of BMs associated with the BUCs in the project. Together with this, it addresses the definition of the specific BMs to consider. Then, the main body of the document is devoted to the description and analysis of the BMs defined for the BUCs in each Cluster. Thus, section 3 discusses those BMs for the Western cluster. Section 4 focuses on those for the Southern cluster. Section 5 is devoted to the description and analysis of the BMs for the Northern cluster. Section 6 focuses on the BMs for the Eastern cluster. Section 7 compares the descriptions of those BMs focused on the same stakeholders, for each of the main stakeholders, and draws conclusions based on these comparisons. Section 8 provides the results of the quantitative analysis of the implementation of flexibility services carried out. Finally, section 9 concludes.

## 1.4 How to Read this Document

When reading this document, the reader should have already got familiar with the description of the BUCs in the project [14]. There, the main stakeholders involved and interactions to take place among them are



described for each of the BUCs defined for each Cluster and Demonstrator within it. The basic information for the representation made of the BM focused on one main stakeholder within each BUC is drawn from there.



## 2 Methodology followed for the definition, description and analysis of the BMs

In this section we describe the approach followed to first define which BMs to explore, then, describe them, and, eventually, analyse these BMs from a qualitative and a quantitative point of view.

### 2.1 Methodology for the definition of the BMs to consider and application of it to determine the specific BMs to focus on

The Business Models to analyse in this project should be based on the BUCs defined and analysed within the project. When defining a Business Model, the actor that it is to focus on should be specified. Both the relation between the Business Models and the BUCs in the project and the identity of the actors that the former should focus on are defined in this section.

#### 2.1.1 Criteria to be applied to define the BMs to analyse

The allocation of business models to BUCs and the selection of the actor that each business model should focus on has been carried out based on the following rules:

- If an actor is considered only by one of the BUCs, the business model focused on this actor should be the one associated with this BUC.
- When possible, every role in markets for SO services should be analysed by at least one BM focusing on it.
- The number of business models corresponds to the number of BUCs that have been defined. One BM is defined per BUC, except for those BUCs that are not suitable to define a BM associated with them.
- Given their characteristics, some of the roles have not been considered for this purpose. A list of these follows:
  - FSPA and FSP have been considered as the same actor.
  - FPO and FRO have been considered as the same actor.
  - MO, IMO, and TMO have been considered as the same actor.
  - OO, BRP, BSP, RO, RP, ISR, and F-channel Platform Operator have not been considered.
  - DERs and Prosumer have been considered as the same actor.
  - MO TSO and MO DSO have been both considered as a MO.
  - SO has been considered either as TSO or DSO.
- A larger number of BMs should focus on the most important roles: TSO, DSO, FSP, and MO.

### 2.1.2 Application to the BUCs in the project: allocation of the business models to the BUCs in the project

One Business Model is defined for each of the BUC defined and analysed. Then, the weight of the BUCs within each country in the overall set of business models to analyse are shown in Table 2.1.

Table 2.1: Distribution of the business models by demonstrator

Simulator	BUCs and Business Models	
	Number	Percentage
Czech	2	9,5%
Cypriot	2	9,5%
France	2	9,5%
Greek	2	9,5%
Hungarian	1	4,8%
Northern	1	4,8%
Portuguese	3	14,3%
Slovenian	2	9,5%
Polish	4	19,0%
Spanish	2	9,5%
<b>TOTAL</b>	<b>21</b>	<b>100%</b>

### 2.1.3 Selection of the central actor in each business model

The allocation of the business models in each simulator to the specific actors that the former should focus on has been carried out as presented in Table 2.2.

Table 2.2: Definition of the business models by simulator and BUC.

Demonstrator	BUC	Central actor considered in the corresponding BM
Czech	EACL-CZ-01	Aggregator
	EACL-CZ-02	DSO

Demonstrator	BUC	Central actor considered in the corresponding BM
Cypriot	SOCL-CY-01	Aggregator
	SOCL-CY-02	DSO
French	WECL-FR-01	DERs
	WECL-FR-02	TSO
Greek	SOCL-GR-01	DSO
	SOCL-GR-02	WFP
Hungarian	EACL-HU-02	FSP
Northern	NOCL-01	FPO
Portuguese	WECL-PT-01	FSP
	WECL-PT-02	TSO
	WECL-PT-03	MO (Technical)
Slovenian	EACL-SL-01	FSP
	EACL-SL-02	MO
Polish	EACL-PL-01	MDC
	EACL-PL-02	TSO
	EACL-PL-03	FPO
	EACL-PL-04	TSO
Spanish	WECL-ES-01	MO
	WECL-ES-02	DER

Each of the roles will have a number of BMs, associated with different BUCs, focused on this role that is provided in Table 2.3.



Table 2.3: Number of business models focused on each role.

Role	Number of business models requested	
Aggregator	2	9,5%
DERs	2	9,5%
DSO	3	14,3%
FPO	2	9,5%
FSP	3	14,3%
MO	3	14,3%
MDC	1	4,8%
TSO	4	19,1%
WFP	1	4,8%
TOTAL	21	100%

## 2.2 Methodology for the representation of Business Models

By analysing the scientific literature we can infer that many different representations have been developed over the years to analyse business models, mostly at the beginning of the XXI century. Some of the different dimensions considered by business model analysis methodologies are pointed out in Table 2.4.

Table 2.4. Overview of some methodologies for business model representation

Business model methodology	Dimensions considered
Hamel, 2000 [6]	Core strategy, strategic resources, value network, and customer interface
Applegate, 2001[7]	Concept, capabilities, and value
Amit and Zott, 2001 [8]	Content, structure, and governance
Weill and Vitale, 2001 [9]	Strategic objectives, value proposition, revenue sources, success factors, channels, core competencies, customer segments, and IT infrastructure
Gordjin, 2002 (e <sup>3</sup> -value) [10]	Actor, value interface, market segment, value offering, value exchange, value port, value object

Rosenbloom and Chesbrough, 2002 [11]	Market, value proposition, value chain, cost and profit, value network, and competitive strategy
Afuah and Tucci, 2003 [12]	Profit site, customer value, scope, pricing, revenue sources, connected activities, implementation, capabilities, sustainability, and cost structure
Osterwalder, 2004 [13]	Key partners, key activities, key resources, value proposition, relationship, distribution channel, target customer, cost structure, and revenue model

Directed by Yves Pigneur, Alexander Osterwalder conducted an in-depth literature review of the existing business model methodologies during his Ph.D. and created his comprehensive business model in 2004 with the following 9 dimensions: key partners, key activities, key resources, value proposition, relationship, distribution channel, target customer, cost structure and revenue model .

Osterwalder’s business model offers all different dimensions that were considered in at least two precedent business model methodologies. Also, it includes dimensions that are relevant to OneNet’s project such as the partners involved in creating value, the sources of revenue, and the data key resources, which may be used to identify the data and the platforms as specified in the grant agreement.

Furthermore, some of the methodologies listed in Table 2.4 have created a canvas to allow for an easy graphical representation of the different aspects that must be considered. The business model canvas developed by Osterwalder and Pigneur in 2010, based on Osterwalder’s thesis, has gained traction and become the most widely used methodology for business modelling [13]. As shown by Lima and Baudier, the business model canvas methodology has some advantages such as: easy to visualize, clearly explaining the cognitive and functional benefits of using the tool and being easy to learn.

Last, Osterwalder and Pigneur’s business model canvas has been used for the analysis of business models in other projects such as InterGRIDy [16], where efficient schemes for the participation of DERs in electricity markets and the provision of grid services through them are devised. In this regard, it can be deemed a precursor of OneNet.

### 2.2.1 Description of Osterwalder and Pigneur’s business model canvas

Analysing Osterwalder’s methodology, one can realize that the description of a business model according to this methodology is structured considering three types of components: Groups, Building blocks and Elements. Each of these types of components is described next:

- **Groups:** there are four groups or main dimensions to analyse within a business model: i) the financial resources and financial outcome of the implementation of a business model, stating how the money is used (Financial aspects); ii) the definition of the client or party, making use of the product to deliver, the relationship with him, and how he is reached (Customer interface); iii) the definition of the product being offered and why it is creating value for the client, or the society as a whole (Product); and iv) the definition of elements that are needed to create value through the delivery of the product (Infrastructure management)
- **Building blocks:** each of them describes one main aspect of a Group within the business model. These comprise the following: value proposition; key partnerships; key activities; key resources; target customer; customer relationships; channel; cost structure; and revenue streams. Each building block is composed of multiple elements.
- **Elements:** they are the most basic components of a business model. Each of the building blocks is composed of elements of a specific type that are used to specify the characteristics of the building block.

The building blocks considered within each of the four Groups defined are listed next [13], and represented in Table 2.5, where each of the cells represents one of the Building Blocks and each colour a Group:

- Infrastructure management (blue): key partnerships, key activities, and key resources.
- Product (orange): value proposition.
- Customer interface (green): customer relationships, target customers, and distribution channel.
- Financial aspects (yellow): cost structure, and revenue streams.

Table 2.5. Osterwalder’s business model canvas

Key partnerships	Key activities	Value proposition	Customer relationships	Target customer
	Key resources		Channel	
Cost structure			Revenue streams	

The characteristics of the Building Blocks are specified next. First, Table 2.6 provides the description and main elements making each building block. Then, Table 2.7 describes each of these elements and their attributes.

Table 2.6: Set of building blocks [13], [15]

Building block	Description	Set of ...	Typical possible questions to address within it
Cost structure	Most relevant costs incurred when operating a particular business model	Accounts	<ul style="list-style-type: none"> <li>• What are the most important costs of our business?</li> </ul>
Customer relationships	Type and characteristics of the relationship that the business establishes with the customer	Relationships	<ul style="list-style-type: none"> <li>• What relationship is created with the client and how this relationship integrates with the rest of the business?</li> </ul>
Channel	Method used by the company to communicate with and reach the target customer with its value proposition	Links	<ul style="list-style-type: none"> <li>• How do we reach the clients?</li> </ul>
Key activities (value configuration)	Most relevant actions that must be done by a company so that the business model works	Activities	<ul style="list-style-type: none"> <li>• Do we produce and distribute our product?</li> <li>• What activities are required for the value proposition?</li> </ul>
Key partnerships	Voluntary-initiated cooperative agreements formed by two or more	Agreements	<ul style="list-style-type: none"> <li>• What are the key partners and what are their roles?</li> <li>• Who are the key providers?</li> </ul>

Building block	Description	Set of ...	Typical possible questions to address within it
Key resources	Most relevant Input to the value-creation process	Resources	<ul style="list-style-type: none"> <li>• What key resources are needed for the value proposals?</li> <li>• And for the distribution channel?</li> <li>• What about the relationship with the clients and the revenue stream?</li> </ul>
Revenue streams	Revenue flows the company makes money through	Revenue streams and pricing	<ul style="list-style-type: none"> <li>• What value are clients paying and what are the revenue sources?</li> </ul>
Target customer	Segments of customers the business is oriented to	Criteria	<ul style="list-style-type: none"> <li>• To whom is it creating value?</li> <li>• Where are they located?</li> <li>• What size/consumption do they have?</li> </ul>
Value proposition	Products and service(s) that create value for a group of customers	Offerings	<ul style="list-style-type: none"> <li>• What value are you giving the client?</li> <li>• What problem of the client are you solving?</li> <li>• What client's needs the product satisfies?</li> </ul>

Table 2.7: Terms used on the building blocks [13], [15]

Term	Description	Set of ...	Attributes
Account	Registry of expenditures	-	<ul style="list-style-type: none"> <li>• Name</li> <li>• Description</li> <li>• Sum</li> <li>• Percentage</li> </ul>

Term	Description	Set of ...	Attributes
Activity	Action a company performs to achieve its goals	-	<ul style="list-style-type: none"> <li>• Name</li> <li>• Description</li> <li>• Activity level {primary activity, support activity}</li> <li>• Activity nature { <ul style="list-style-type: none"> <li>○ value chain {inbound logistics, operations, outbound logistics, marketing and sales, service}</li> <li>○ value shop {problem finding and acquisition, problem solving, choice, execution, control and evaluation}</li> <li>○ value network {network and promotion and contract management, service provisioning, network infrastructure operation}</li> </ul> </li> </ul>
Actor	Organization involved in the business model and integrated through a partnership	-	<ul style="list-style-type: none"> <li>• Name</li> <li>• Description</li> </ul>
Agreement	Function, terms, and conditions of a partnership with an actor	-	<ul style="list-style-type: none"> <li>• Name</li> <li>• Description</li> <li>• Reasoning {optimization and economies of scale, reduction of risk and uncertainty, acquisition of particular resources and activities}</li> <li>• Strategic importance</li> <li>• Degree of competition</li> <li>• Degree of integration</li> <li>• Substitutability</li> </ul>
Criterion	characteristic of a target customer	-	<ul style="list-style-type: none"> <li>• Name</li> <li>• Description</li> </ul>

Term	Description	Set of ...	Attributes
Link	specific channel role	-	<ul style="list-style-type: none"> <li>Name</li> <li>Description</li> <li>Customer buying cycle {awareness, evaluation, purchase, after sales}</li> </ul>
Offering	specific product, service, or feature of one of them	-	<ul style="list-style-type: none"> <li>Name</li> <li>Description</li> <li>Reasoning {use, risk, effort}</li> <li>Value level {me-too, innovative innovation, excellence innovation}</li> <li>Price level {free, economy, market, high-end}</li> <li>Life cycle {creation, purchase, use, renewal, transfer}</li> </ul>
Relationship (type of relationship)	relationship established with the customer segment	Relationship mechanism	<ul style="list-style-type: none"> <li>Name</li> <li>Description</li> <li>Customer equity {acquisition, retention, add-on selling}</li> </ul>
Relationship mechanism	Function a relation accomplishes between the company and the customer	-	<ul style="list-style-type: none"> <li>Function {personalization, trust, brand}</li> </ul>
Resource	Input to the value-creation process	-	<ul style="list-style-type: none"> <li>Name</li> <li>Description</li> <li>Resource type {physical, financial, intellectual, human, related to a platform or a network}</li> </ul>
Revenue stream and pricing	Describes an incoming money stream for the value offered by the company	-	<ul style="list-style-type: none"> <li>Name</li> <li>Description</li> <li>Stream type {asset sale, subscription fees, licensing, advertising, renting, brokerage fees, usage fee, ...}</li> <li>Percentage</li> <li>Pricing method {fixed, differential, market}</li> </ul>

## 2.2.2 Roles considered in the business model canvas

OneNet has further developed the existing ENTSO-e Harmonized Role Model 2020 that includes both the current and the new role models [17]: MO, BSP, MDR, MDC, Producer, Consumer, BRP, RA, ISR, RP, SA, TSO, DSO, Prosumer, FSP, Platform, Unit/Flexibility Provider, DER, WFP, LMS, IMO, FRO and OO and Aggregator. Note that we have assumed that the roles of SO, LFC Operator, and ISR are always played by the TSO. Therefore, we do not include them here as separate roles.

This set of roles must be considered in the filling of the business model canvas, particularly in the following blocks: key activities, key partnerships, customer relations, and target customers.

The list of roles mentioned in this section is not exhaustive.

## 2.3 Methodology for the qualitative analysis of Business Models

Two main aspects of the implementation of the BMs defined will be assessed qualitatively to explore their suitability in the context of the region where they are to be implemented. These follow:

- Identification of critical stakeholders and strategies to achieve their engagement
- Compatibility of this BM with the regulation in place in the corresponding region and country

Next, each of these two is discussed in detail.

Apart from this, we compare the description of all those BMs focused on the same stakeholder according to each of the main building blocks considered in the description of BMs. This is carried out to assess the relevance of the context on the features of a BM focused on each main stakeholder.

### 2.3.1 Stakeholder engagement strategies

Even if providing the business model canvas may be enough at the architecture level, as defined by Osterwalder in Table 1.1, the success of the business model may be hindered from relevant actors' decisions, if their interests are not aligned with the business'. Given that, we must:

1. Identify the several stakeholders involved in the implementation of the business model concerned.
2. Analyse their ability to affect the implementation of the business model and their interests and prioritize them accordingly.
3. Plan how to engage each of those stakeholders through an engagement plan.
4. Engage the stakeholders.

Nevertheless, it is relevant first to define who may be an interested party or stakeholder. As defined by the PRINCE2 methodology, a stakeholder is "anyone who thinks they will be affected by the project" [18].



Besides this, and finally, there is the need to define whether the regulation in place in a region or country may pose a challenge for the implementation of a business model. This regulatory analysis of the implementation of a business model makes the last step of the analysis of this business model and will be carried out using the same four steps defined above.

### 2.3.1.1 Stakeholder identification

Based on the CIVITAS Initiative and the Intergrid project, we have listed these potential stakeholders classified into 4 main groups for the purpose of identifying the ones that can be most impactful to the success of the business model [19], [20]:

- Governments and other authorities: European institutions, national ministries and energy agencies, regional and local governments, politicians, regulators, other decision-makers, and professional staff.
- Business and operators: utility companies, network operators, developers, engineers and contractors, retailers, commercial users, and other actors (if necessary, include any actor with one of the roles defined above).
- Communities, neighbourhoods, and other local stakeholders: environmental NGOs, media, authority forums, community organizations, citizens, and local interest groups.
- Others: research institutions, academia, universities, experts, and foundations.

This list should be used as a basis to identify all possible stakeholders.

### 2.3.1.2 Stakeholder analysis

Some literature research has been done to define a methodology to classify the different stakeholders and define how to interact with them, so as to achieve the engagement of those stakeholders that are relevant for the success of the implementation of the BM. Three articles define a matrix where we can classify the stakeholders into four groups [21]–[23]:

High influence challengers (high influence but low interest): given their high influence and power, they are critical for the BM, and when their interests collide with the business, they can jeopardize the success of the BM [23]. Their level of interest should be strengthened through dedicated engagement and by capturing their advice on key areas so that they become high-influence champions. In other words, their needs must be met [21]. It is interesting to quantitatively analyse the implications of their transformation into high-influence champions.

High influence champions (high influence and high interest): they are critical for the success of the BM, but they are aligned with its interest. Given that, they must be involved in the governance and

decision-making bodies and be regularly consulted [21]. Their interest must be proactively leveraged [23]. These are key players.

Low influence challengers (low influence and low interest): they are neither critical nor are their interests aligned with the BM’s, so even if it is interesting to be aware of their actions, their conversion to project supporters is not so relevant [23].

Low influence champions (low influence but high interest): They favour the BM, but their power is not so relevant, so less work must be done to maintain their high support [23]. They should be involved in aspects where there is reduced risk, and they may be potential ambassadors of the project [21].

The matrix to classify the stakeholders, named either stakeholder engagement matrix or power-interest matrix, is represented in Table 2.8 [21]–[23].

Table 2.8: Stakeholder engagement matrix

Stakeholder influence	High	High influence challengers (keep satisfied)	High influence champions (manage)
	Low	Low influence challengers (minimal contact)	Low influence champions (meet needs)
		Low	High
		Stakeholder interest	

After the stakeholder identification and the stakeholder analysis, an engagement plan will be drafted, taking into account each of the aforementioned stakeholder types and influence level, prioritizing measures aimed at the engagement of high influence challengers. Those measures will tend to create a favourable business model for those stakeholders.

### 2.3.2 Compatibility of Business Models with relevant regulation

As a last step of the analysis of a business model, one must identify which specific aspects of the regulation in place in the region, country, or area, where this business model is to be implemented may represent a barrier to its implementation and success. The type of regulatory barriers preliminarily identified as relevant follow:

- Administration barriers, including the lack of regulation that is deemed necessary, the market restrictions preventing the participation in the markets of relevant stakeholders, and the perverse, or misleading, policy and regulatory incentives, and charging or cost rules;

- Those barriers preventing the development of trust among the parties involved in the implementation of the business model;
- Barriers to the development of Standard solutions for the participation in markets or the simultaneous participation in several of them, which are needed to achieve a high-enough level of participation in these markets;
- Barriers imposing additional Costs on certain potential participants in markets for SO services and potentially discouraging them from participating in these markets.

Among other things, these barriers result in a large difficulty to engage FSPs without them participating in a project like OneNet. Taking these barrier types as a starting point, partners involved in Demonstrators were consulted on the relevance of these in their territories. According to the results of this consultation, the following were identified as relevant types of barriers to consider in the case of markets for SO services:

- Barriers related to the lack of definition of roles and responsibilities, including the definition of new roles for DSOs; the missing definition of local EHV; the missing definition of independent aggregators; the lack of definition of proper TSO-DSO interfaces; and the lack of operation rules of storage operation, including by TSO/DSO
- The lack of appropriate economic incentives, including the definition of remuneration schemes for DSOs to acquire flexibility; and the lack of regulation on guidelines for using procurement mechanisms; and
- The lack of additional enabling regulation, including that related to baseline methodologies; submetering regulation; the regulation protecting agents from market power abuse by access to information; and the one removing constraints on the participation of agents in markets for SO services.

Once the main regulatory barriers have been identified for each BM and country, the most relevant ones are identified in the form of a table. Lastly, the stakeholder in charge of addressing each of these main barriers is determined.

## 2.4 Methodology for the quantitative analysis of BMs

Here, the scope of the quantitative analysis of BMs carried out and the approach followed for this is described. The overall objective of this analysis is not assessing the implementation of each BM, since we lack the quantitative information required for this, but collecting some first evidence of the advisability of pursuing the implementation of flexibility solutions for system services through dedicated markets. This is carried out considering the information on costs and benefits of flexibility solutions and alternative ones available from previous studies conducted.

The objective of the analysis discussed in this section is to quantify the value created by the implementation of the OneNet business models in the context of the European Union. This value is mainly related to the delivery of DER-based flexibility when providing the services targeted within the BUCs these BMs are associated with. To provide the best possible quantification of this market potential in the European Union, for the business models identified in OneNet, the methodology shown in Figure 2.1 is applied. This methodology, as well as the results of the first steps of the methodology application, are described in the following.



Figure 2.1: Methodology for Business Model Quantification

Initially, the goal was to set the analysis in this chapter in relation to the KPIs for which values have been determined by the OneNet demos. Though unfortunately, this was not possible for the following reasons. First, almost none of the demonstrators provided the KPI on cost-effectiveness. Second, those that computed a value for that KPI argue that assessing this value for the KPI does not allow to draw conclusions as, in some cases, the bid price for flexibility services was agreed bilaterally between the DSOs and FSPs. Therefore, unfortunately assessing the few provided KPI values in relation to the findings of this analysis would not provide relevant insights. However, the quantitative estimates gathered when taking the last step of the methodology just outlined are discussed in relation to the OneNet business models.

### 2.4.1 Defining the main flexibility services within the power system potentially affected by DER flexibility

In the first step of application of the methodology, the type of information that is relevant with respect to the main flexibility services considered, that is congestion management, balancing and electricity wholesale markets is identified, for the later analysis. This step is crucial to efficiently and reliably identify high quality publications providing relevant quantitative data of this type, which are accessed and employed in the consecutive analytical steps.

As the body of knowledge on flexibility in power systems is extensive, the following focus has been set for knowledge condensation. The geographical scope of the analysis is set to be Europe, due to the technological as well as regulatory similarities among the systems in the region, and the fact that this coincides with the region of relevance for the project. From this perspective, relevant information with respect to the services for power system operation and planning is identified. The following services have been identified as relevant for further analysis:

- Congestion management:  
Problems related to congestion management in power system operation and planning.
- Power system balancing:  
Problems related to power system balancing and related capacities/volumes, as well as trends and existing and emerging new agents (such as DERs (DER)).
- Electricity wholesale services:  
Effects of flexibility from DER on electricity wholesale markets, capacities/volumes and trends.

According to the identified services, information related to benefits of achieving savings in the costs incurred in delivering these services are considered. Here the focus shall be laid upon the savings achieved through the mobilization of power system flexibility provided by DER.

### 2.4.2 Identifying and mapping high quality sources

In the second step of the methodology shown in Figure 2.1, an extensive literature review is undertaken with the aim to identify all relevant publications, with respect to the information defined in the previous step. The extensive review of publications from private actors as well as governmental bodies has resulted in a list of 20 relevant and recent publications, shown in Table 2.9.

Table 2.9: List of identified high quality resources to be reviewed

Author	Title	Pub. Date	Period	Geo. scope	Quant. results
SmartEn	Demand-side flexibility in the EU: Quantification of benefits in 2030	09.2022	2023 - 2030	EU27	X
Eurelectric	Connecting the dots	01.2021	2020-2030	EU27	X
ENTSO-E	Mid-term Adequacy Forecast 2019	2019	2019-2021-2025	ENTSO-E area	X
EC: DG ENER	Assessing the role and magnitude of different flexibility measures and assets in distribution and transmission grids: METIS 2: study S1	2023	2018-2030	EU27+UK+6	X
EC: DG ENER	Mainstreaming RES: flexibility portfolios: design of flexibility portfolios at Member State level to facilitate a cost-efficient integration of high shares of renewables	2017	2030	EU27 + UK	X
EC: DG ENER	The role and need of flexibility in 2030 focus on energy storage: study S07	2019	2030	AU, GER, UK	X
EC: DG ENER	Optimal flexibility portfolios for a high-RES 2050 scenario: METIS Studies: study S1	2018	2030	EU28+6	X
ENTSO-E	TYNDP 2022 - scenario report 2022	04.2022	2025-30-40-50	EU27	NONE
ACER	ACER Decision 23-2020 on VOLL CONE RS - Annex I	10.2023	n.a.	EU27	NONE
EC: DG JRC	Flexibility requirements and the role of storage in future European power systems	2023	2030, 2050	EU27	X
Linares and Rey	The costs of electricity interruptions in Spain. Are we sending the right signals?	10.2013	n.a.	Spain	X

Scheidler et al. 2018	DER Integration Study for the German State of Hesse - Methodology and Results for the Medium- and Low-Voltage Level	10.2018	2034	Hesse (DE)	X
ENTSO-E	Assessment of Future Flexibility Needs	09.2021	n.a.	ENTSO-E area	NONE
EC: DG ENER	ETIP SNET - Flexibility for Resilience How can flexibility support power grids resilience?	03.2022	n.a.	n.a.	NONE
Elia Adequacy	Flexibility study 2022-2023 (Belgium)	07.2021	2022-2032	Belgium	X
Scottish & Southern	Evaluating Flexibility as Alternative To Traditional Network Reinforcement	07.2020	2022	UK	X
SP Energy Networks	Procurement Statement for SP Distribution PLC and SP Manweb PLC	04.2023	2022	UK	X
UKPN	Flexibility Post Tender Reports	2018-2022	2022	UK	X
Heggarty et al.	Quantifying power system flexibility provision	2020	n.a.	n.a.	NONE
ISGAN	Flexibility needs in the future power system	02.2019	n.a.	n.a.	NONE

Making use of the 20 high-quality sources identified and listed in Table 2.9, the next step of the methodology in Figure 2.1 can be taken.

### 2.4.3 Analysing the sources collected

In this step of the methodology, the previously identified body of literature is analysed more closely, with the aim to identify quantitative information related to the business models defined and analysed in OneNet. Based on the relevant information specified in section 2.4.1, the 20 sources identified in section 2.4.2 are analysed looking for the presence of the following quantitative information.

- Balancing and congestion management problems for which DER-based flexibility can be valuable
- The quantitative aspects of the problems (cost, size, forecasts)
- The quantitative aspects of DER-based solutions (cost, size, forecasts)
- The quantitative aspects of non-DER-based solutions (cost, size, forecasts)

Having analysed those 20 relevant sources presented in Table 2.9, 14 (70%) have shown to contain relevant quantitative information. The results of this step are presented in the last column of Table 2.9.

As the number of publications containing quantitative results is too large for the available project scope, and both the planning timeline as well as geographical scope of the corresponding works vary significantly, the scope of our quantitative analysis has been further reduced. Out of those publications shown in Table 2.9, only those whose geographical scope is roughly the EU27 and where the planning horizon targeted is the year 2030 are considered for further analysis. This reduces the set of relevant publications to those five shown in Table 2.10.

Table 2.10: Final list of relevant publications to be used for business model quantification

Nr.	Author	Title	Pub. Date	Period	Geo. scope	Quant. results
1	SmartEn	Demand-side flexibility in the EU: Quantification of benefits in 2030	09.2022	2023 - 2030	EU27	X
2	Eurelectric	Connecting the dots	01.2021	2020-2030	EU27	X
3	EC: DG ENER	Assessing the role and magnitude of different flexibility measures and assets in distribution and transmission grids: METIS 2: study S1	2023	2018-2030	EU27+ UK+6	X
4	EC: DG ENER	Mainstreaming RES: flexibility portfolios: design of flexibility portfolios at Member State level to facilitate a cost-efficient integration of high shares of renewables	2017	2030	EU27 + UK	X
5	EC: DG ENER	Optimal flexibility portfolios for a high-RES 2050 scenario: METIS Studies: study S1	2018	2030	EU28+ 6	X

The five relevant publications with highly relevant quantitative information regarding the business models identified in the OneNet project are further analysed in the next step of the methodology presented in Figure 2.1.



#### 2.4.4 Mapping the results of previous step

In the second to last step of the methodology shown in Figure 2.1, specific categories of quantitative information are specified and the available information for each of the five high quality sources shown in Table 2.10 is benchmarked. A general overview of the categories for information classification is provided in the following. We first identify three main categories corresponding to the savings achieved when delivering the following specific services, which are the ones previously identified as relevant:

- Redispatch savings
- Balancing market savings
- Electricity markets benefits

The savings achieved for these services can be classified, or decomposed, into those that are related to several relevant system cost components potentially affected by the delivery of flexibility. These are the following:

- Investment savings
- Variable production cost savings
- Curtailment reduction
- Carbon emissions
- Energy not served

Having analysed the five relevant sources for the information categories listed above, the results are shown in Table 2.11, where the presence of relevant quantitative information in the respective source is indicated. One can see that quantitative information for the different services and costs components, or aggregated benefits across services or cost components, is sparsely present across the different studies. This is mostly due to the different nature and the related limited scope of these studies.

Table 2.11: Publications to be reviewed by categories of quantitative information

Publication	Service benefits			Benefits per cost components				
	Redispatch savings	Balancing savings	Electricity market benefits	Investment savings	Variable production cost savings	Curtailment reduction	Carbon emissions	Energy not served
SmartEn	X	X	X	X	X	X	X	X
Eurelectric	NONE	NONE	NONE	NONE	NONE	NONE	X	NONE

METIS 2 S1	X	NONE	NONE	NONE	NONE	X	NONE	X
METIS 1 Mainstreaming RES	NONE	NONE	NONE	NONE	X	NONE	X	X
METIS 1 S1	NONE	NONE	NONE	X	NONE	NONE	NONE	NONE

### 2.4.5 Quantification

Based on the mapping of quantitative information presented in the previous section, the quantitative range for each savings category is to be determined. This also includes an outlook into the future, if the respective quantitative information is available. These ranges shall also consider the size of the problem that a service is tackling, providing a kind of market potential. Furthermore, the findings are set in relation to the OneNet business models.

This analysis is provided section 8. Within it, subsection 8.1 provides the background and assumptions of the studies, helping the reader to understand the quantitative information provided and discussed afterwards, in subsection 8.2. As only one source covers all the services and cost component categories presented in subsection 2.4.1, the related study (SmartEn [2]) is used as the base case.

## 3 Description and analysis of the BMs associated with the BUCs defined for the Western Cluster

In this section, we provide the representation made and qualitative analysis conducted of each of the BMs within each of the Demos in the cluster: the Spanish Demo, the Portuguese Demo, and the French Demo. Those BUCs that do not provide room for the definition of a sensible BM associated with them are discarded. We address separately the description and analysis of the BMs for each Demo.

### 3.1 Description and analysis of the BMs for the Spanish Demo

Here we provide a representation and analysis of the BMs within the Spanish Demonstrator.

#### 3.1.1 Representation made the BMs

Within the Spanish Demonstrator, there are 2 BUCs defined, WECL-ES-01 and WECL-ES-02, focused on the ‘Long-term congestion management’ and the ‘Short-term congestion management’, respectively. These BMs are described according to the structure considered for the Ostewalder’s Canvas. Before describing the structure of the BM, the main relationships established within it, value created by it, and revenues and costs for the stakeholder that the BM focuses on resulting from its implementation, we remind the reader about some basic features of the BUC that the BM is associated with.

##### 3.1.1.1 Description of BM for BUC WECL-ES-01

###### Description of the BUC that this BM is associated with

As described in the document “Business Use Cases for OneNet”, from task D2.3, this BUC aims to manage long-term congestion and eliminate or delay the need for upgrades on the system [14]. To accomplish this objective, the DSO must be able to procure the flexibility it may need to solve specific local problems in advance using market-based coordination [14]. As indicated above, the central actor selected for this business model is the MO, which, in this case, is assumed to be an IMO.

###### Objectives

Based on the objectives of the demonstrator, we can state that this BUC is aimed at achieving the following:

1. Market procedures are applied to obtain tailored flexibility services given the requirements of the DSO;
2. Long-term agreements are accomplished amongst different DER;
3. The provision of flexibility is made through a MP;
4. Flexibility services are provided using the consumer’s DR.

5. Active power is managed predictively for congestion management

### Actors

We can identify four actors within this BUC:

- DSO: manages the distribution grid and may choose either to buy the flexibility through the IMO or to use traditional grid solutions as building a new piece of infrastructure depending on benefit cost analysis
- IMO: manages the market platform where both the DSO and the FSP may introduce their offers requirements and bids, respectively.
- FSP, or aggregator: aggregates a set of DERs and mediates between them, the market, and the DSO.
- DER: resources that could provide flexibility to the DSO by means of the FSP.

### Procedure

The procedure applied in the demonstrator is structured in four steps, which are described next:

1. Preparation and prequalification: both the DSO and the IMO check if the FSP is capable of delivering the product it intends to sell. The DSO checks the technical requirements and the IMO the market requirements.
2. Plan and forecast: the DSO carries out internal analysis and identifies potential congestion in the grid, which may be solved by the procurement of long-term flexibility.
3. Market phase: given those needs, the DSO calls a local market using the market platform, which is managed by the IMO, and procures either one or both of these products:
  - a) Availability: a capacity band (power) with both a defined start and end.
  - b) Availability and activation: other than the capacity band, it also defines a duration of activation (energy).
4. Monitoring and activation of flexibility: the DSO monitors the conditions of the grid and activates the flexibility through the FSP.
5. Measuring: the DSO verifies whether the product has really been provided. To this extent, a baseline against which flexibility is measured has to be defined.

### **Description of this BM: the Business Model Canvas**

The BM associated with this BUC is focused on the stakeholder MO, which, in this case, has been deemed to be an IMO.

### Main assumptions made when describing this BM

Given that not all the information needed to elaborate the business model has been specified in the BUC, we have made the following assumptions:

- We assume that the cost structure for the IMO is similar to OMIE's one, the Spanish NEMO.
- We consider that the IMO acts as a central counterparty.
- We define two situations regarding the retribution of the IMO:
  - That both the FSP and the DSO pay just a fixed quota to access the market as it is currently done in OMIE [24].
- That the market is liberalized, and both a fixed and a variable quota is paid.
- The metering information is managed by the DSO, and there is no other possible option, so it is a key actor given its high importance and low substitutability.
- The channel used to reach the clients depends on the situation. We assume that meetings will be used to make the parties aware of the existence of this new service and that an online platform will be used for the purchase trading and the after-sales service (i.e., settlement).

The "agreement" element of the business model can be described using the following characteristics:

- Reasoning: specifies the motivation to conclude the agreement with the partner.
  - Optimization and economies of scale: the partnership is interesting because the partner offers economies of scale or specialized knowledge that the company cannot achieve on its own.
  - Reduction of risk and uncertainty: generally, an alliance with competitors allows the diversification of the risk among all the partners (this project is an example of this for the utilities).
  - Acquisition of resources: acquisition of data, customer access, knowledge...
- Strategic importance: indicates how relevant the partnership is for the company's success.
- Degree of competition: specifies if the partner is a competitor of the company itself.
- Degree of integration: indicates how close the partner and the company are linked.
  - Non-integrated: the partnership is done through third-party marketplaces.
  - Integrated: a franchise, for example.
- Substitutability: describes how easy it is to find a partner that offers the same product or service.

Next, the canvas of this BM is provided.

Table 3.1: BM canvas for BUC WECL-ES-01

<p>Key partnerships</p> <p>DSO:</p> <ul style="list-style-type: none"> <li>- Management of metering information (acquisition of particular resources or activities).</li> <li>- Pre-qualification of the grid product (acquisition of particular resources or activities).</li> </ul> <p>Customers:</p> <ul style="list-style-type: none"> <li>- Provision of flexible resources by the FSP (acquisition of particular resources or activities).</li> <li>- Possible Settlement of the provision of flexibility by the FSPs. (Optimization of economies at scale).</li> </ul>	<p>Key activities</p> <ul style="list-style-type: none"> <li>- Matches the request for flexibility of the DSO with the most cost-efficient offer (primary activity/value network). To accomplish that task, the constraints given by the DSO must be taken into consideration.</li> <li>- Pre-qualifies the market product (support activity/value shop)</li> <li>- Publishes the market results (support activity/value shop).</li> <li>- Manages the economic retribution of the different actors.</li> </ul>	<p>Value proposition</p> <ul style="list-style-type: none"> <li>- Provision of a platform for DSOs to procure competitive long-term flexibility products (both for availability and availability and activation) that allow the DSOs to manage long-term congestion in the most efficient way (effort/pricing / market / purchase) from years to weeks ahead.</li> <li>-To facilitate the participation of distributed resources in local markets</li> </ul>	<p>Customer relationships</p> <ul style="list-style-type: none"> <li>- Direct relationships (acquisition and retention / trust).</li> <li>-Web</li> <li>-Social media</li> </ul>	<p>Customer</p> <p>DSOs must have congestion to manage, which could be solved by using resource flexibility.</p> <ul style="list-style-type: none"> <li>- FSP must have resources (consumers) that may solve the congestions of the DSO and could get savings by offering their flexibility through the local market platform.</li> </ul>
	<p>Key resources</p> <ul style="list-style-type: none"> <li>- Financial guarantees, both for the DSO and the FSP (financial).</li> <li>- Market matching system (platform).</li> <li>- Meters that can measure whether the flexibility has been provided (physical).</li> <li>- Computer servers (physical).</li> </ul>		<p>Channel</p> <ul style="list-style-type: none"> <li>- Meetings (awareness &amp; evaluation).</li> <li>- Conferences</li> <li>- Online platforms for small DSO (purchase &amp; after sales (settlement))</li> </ul>	

<p>Cost structure<sup>1</sup></p> <ul style="list-style-type: none"><li>- Computer servers and other IT services (25%).</li><li>- Human resources to carry on the daily operations and code the market platform (50%).</li><li>- Other (25%).</li></ul>	<p>Revenue streams</p> <p>Option 1 (fixed payment):</p> <ul style="list-style-type: none"><li>- Regulated tariff where both the DSO and the FSP pay a fixed amount, whether they use this service or not (subscription fee / fixed pricing).</li></ul> <p>Option 2 (fixed + variable payments):</p> <ul style="list-style-type: none"><li>- Payment of a brokerage fee both by the DSO and the FSP each time the service is requested (brokerage fees /fixed pricing).</li><li>- Payment of a subscription fee both by the DSO and the FSP to be able to access the market (subscription fee / fixed pricing).</li></ul> <p>- Option 3 (paid through electricity tariffs):</p> <ul style="list-style-type: none"><li>IMO, costs are recovered through regulated tariffs paid by all electricity consumers (tax / fixed pricing).</li></ul>
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<sup>1</sup> The structure of the costs has been elaborated using OMIE's balance sheet.



### 3.1.1.2 Description of BM for BUC WECL-ES-02

#### Description of the BUC that this BM is associated with

This BUC is focused on Short-term congestion management. It covers the demonstration of the short-term local congestion management procurement of local flexibility by the DSO. Flexibility providers at both LV and MV are able to participate in this. Two-time frame markets are considered: Day ahead and intraday.

The objectives of this BUC follow:

- Apply market procedures to obtain flexibility services attending short term DSO requirements;
- Implement flexibility provision/usage through a market platform; and
- Use consumer's demand-response in efficient flexibility services.

#### Description of this BM: the Business Model Canvas

The Central actor of the BM defined are the DERs providing services to the DSO within the short-term market operated by OMIE. Next, the canvas of this BM is provided.

Table 3.2: BM canvas for BUC WECL-ES-02

partnerships - Energy advisor (acquisition of particular resources or activities). -DSO infrastructure (acquisition of particular resources or activities). -MO (optimization of economies of scale).	Key activities -Evaluation of potential flexibility to participate in local markets - Comply with the activation instructions (automatic or manual, sent by the DSO).	Value proposition - Flexibility: Provision of system services for the DSO.	Customer relationships - Relationship through the platform for the provision of the system services (acquisition and retention / trust).	Customer - MO: Must be an IMO that manages the short-term platform services market. -DSO interested to manage a congestion management with flexibility resources
	Key resources - Communication with the market (related to a platform). - Communication with the DSO (related to a platform). - Monitorization and control of the equipment (physical).		Channel - Online platforms (purchase & after sales (exchanged of meter information and settlement))	



<p><b>Cost structure</b></p> <ul style="list-style-type: none"> <li>- Human resources to carry on the system services provision.</li> <li>- Technical infrastructure for resources control and monitorization</li> <li>- Software development</li> <li>- Opportunity cost of shifting the production.</li> <li>- IMO fee.</li> </ul>	<p><b>Revenue streams</b></p> <ul style="list-style-type: none"> <li>- Market prices for the provided system services in €/MW and/or €/MWh (usage fee / market).</li> <li>- Efficiency: Opportunity revenue of shifting the energy schedules.</li> </ul>
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### 3.1.2 Qualitative analysis of these BMs

Once the two BMs associated with the BUCs in this Demonstrator have been described, we qualitatively analyse them. In this case, the analyses we make of them is common to both. We first discuss the identification made of the main stakeholders involved in the implementation of these BMs and the strategies to implement to achieve the engagement of critical stakeholders. Then, we analyse the compatibility of these BMs with the regulation in place in the country.

#### 3.1.2.1 Stakeholder engagement analysis (for each BM or common to all)

In this section, the main stakeholders involved in the implementation of the two BMs considered for the Spanish BUCs are identified and classified according to their ability to affect the implementation of these BMs and their interest in facilitating this implementation. An analysis matrix (or power-interest matrix) is built for this. Then, relevant strategies for the engagement of critical stakeholders, who have large power to affect the successful implementation of the BMs but low interest in favouring it, are provided. Note that both the power-interest matrix and the engagement strategies are deemed to be relevant for both BMs. If some are specific to a BM, this is indicated in the text.

#### Power-interest matrix

The power interest matrix for the BMs associated with the Spanish BUCs is provided next, classifying the relevant stakeholders according to their power to affect the implementation of BMs and their incentives to facilitate this implementation. For each stakeholder, its power to affect the implementation of these BUCs and interest in facilitating it is discussed within the matrix.

Table 3.3: Classification of the stakeholders for the BMs associated with the BUCs in the Spanish Demo: Power-interest matrix

Stakeholder influence/power	High	<ul style="list-style-type: none"> <li>• DSOs: they might be interested in this service to have additional tools to operate and expand the network. Nevertheless, current regulations might not provide any benefits to the DSO if it chooses flexibility over the construction of new infrastructures. The natural incentives for grid companies being subject to Capital-Expenditures-based remuneration schemes would be to prioritize investments over flexibility solutions delaying these investments that lead them to incur in operation expenditures not reflected in their remuneration scheme. Furthermore, the DSO must set up a system to measure whether the flexibility has been, indeed, provided.</li> <li>• National regulators: it must allow DER, aggregators, and independent aggregators to provide flexibility to the DSO. Moreover, the DSO has to be allowed to buy this kind of service and must receive a certain retribution to manage this service.</li> <li>• Local and regional governments: they are concerned about local development, the connection of new users, and local markets for SO services are tools to maximize the level of utilization of the networks and limit the required investments in them.</li> <li>• Local interest groups: in line with the local governments, their main interest is in local development.</li> </ul>	<ul style="list-style-type: none"> <li>• European Union: the development of flexibility services is included in the last electricity market directive and is being favoured politically, as it may provide both environmental and economic benefits to society, businesses, and final consumers.</li> <li>• National governments: sharing the European view on this subject, they may perceive this as an opportunity for society, businesses, and consumers.</li> <li>• FSPs and aggregators: the possible FSP are interested in the creation of flexibility services and related markets provided appropriate schemes for the remuneration of flexibility are in place. Nevertheless, they do not have any power, as they cannot change the regulation, and currently, they have no power to push the development of these services.</li> </ul>
	Low	<ul style="list-style-type: none"> <li>• Developers, engineers, and contractors: new business opportunities may be created, but also some may be affected by new activities. Therefore, the net effect is not clear. These groups are diverse and not organized, so it's expected that they are not decisive groups.</li> </ul>	<ul style="list-style-type: none"> <li>• Environmental organizations: they might favour local markets for SO services as one of the effects is the increase in the efficiency of the use of the networks, resulting in a larger level of use of them, which should have a positive effect on the environment.</li> <li>• Technology companies: as they develop the new applications needed to measure the energy, manage these new systems, and interconnect current platforms with new ones necessary to activate flexibility... They are beneficiaries of these new business models.</li> </ul>
		Low	High
Stakeholder interest/support			

## Strategies for the engagement of critical stakeholders

Effective strategies must be implemented to achieve the involvement of relevant stakeholders. These are discussed next, placing the focus on critical stakeholders. Note that the reasons justifying the classification of each stakeholder group in a certain category are provided within the power-interest matrix above.

### High influence challengers (high influence but low interest)

These four actors have strong influence but low interest, so their interest/support will need to be increased:

- DSO: the regulation has to provide a fair retribution for using flexibility and potentially delaying investments in the grid, when possible, so that the DSO can have an alternative to investments
- National regulators: the benefits and the increase in social welfare of new business models have to be clearly explained to the regulator so the corresponding regulation can be developed in a timely manner. Regulatory instruments such as Sandboxes can be a tool for regulatory learning and experience with innovation in a controlled environment.
- Local and regional governments: they must perceive that citizens' satisfaction is going to be at least as good as it would have been if traditional solutions. The potential benefits have to be clearly explained to them.
- Local interest groups: while flexibility services are not widely used and their benefits materialized, it also has to be explained to local interest groups to gain their support.

### High influence champions (high influence and high interest)

These actors are already interested in the BUC, but they must not be taken for granted:

- European Union: is proposing the development of business models related to flexibility, but the implementation of the solutions needs to be aligned with the objectives of the approved regulation.
- National governments: as for the European Union, national governments need to perceive that business models will provide benefits for citizens and gains shared among stakeholders.
- FSPs and aggregators: their interest is to create flexibility services, as their business model is based on successful implementation. Their ideas must be considered to improve the business model and maintain that engagement.

### Low influence challengers (low influence and low interest)

They have no power nor interest in these business models. Nevertheless, they should be identified and engaged to avoid opposition.

### Low influence champions (low influence and high interest)

The ideas of both the technological companies that may provide the equipment to manage flexibility and those of the environmental organizations must be heard to maintain their interest in the project.

### 3.1.2.2 Analysis of compatibility of with relevant regulation

This section provides the identification of the regulatory barriers to the implementation and success of the local market for SO services business models defined for Spain. The information discussed here has been obtained based on the WP3/WP11 Regulatory Questionnaire carried out for all the demonstrators. The regulatory barriers and possible measures to tackle them are presented below. The presented regulatory analysis is applicable for both BMs, for each barrier it is specified whether they are related to one of the BMs or to both.

The regulatory barriers are split into three main topics: definition of roles and responsibilities, economic incentives, and lack of additional enabling regulation to establish markets for SO services.

#### **Definition of roles and responsibilities**

Local markets for SO services are not currently in place in Spain. Therefore, the roles of relevant actors are not defined. Below some of the most relevant missing roles are discussed.

#### Definition of new roles for DSOs

Currently, DSOs do not have the role of procuring services such as local congestions mitigation, voltage control, or islanding operation using flexibility from users connected to their networks. This barrier is critical to both BMs, if DSOs do not have the option to contact flexibility both BMs will not be realized. The only possibility for DER would be to provide services to the TSO and participating in wholesale energy markets.

To perform such roles, forecasting procedures for determining flexibility needs and disclosing the needs to potential FSPs need to be defined.

The contractual relationships with operators of markets for SO services to use the platform for collecting bids and performing the financial settlement of the services need to be specified.

#### Missing definition of local operator of the market for SO services

In Spain, no IMO has been defined yet for local markets for SO services. Markets for TSO services (balancing, congestion management, voltage control) are operated by the TSO (REE). For DSO (local) services, there is no regulation yet. The corresponding platforms for local services have been designed in the OneNet Spanish demonstrator by OMIE, the wholesale energy MO that is interested in extending its functions for local markets for SO services.

This barrier is critical to both BMs, of course, for the BUC WECL-ES-01 it is critical, while for BUC WECL-ES-02, DER could provide services to the TSO and participating in wholesale energy markets.

### Missing definition of independent aggregators

Currently in Spain, there are no independent aggregators, once they are established, the relationship between aggregators, retail companies, and balance responsible parties need to be defined. Some of the relevant aspects to be included in the allocation of roles to the aggregators and other actors are the methodology to define a baseline, the definition of information exchange requirements, data, and communication protocols, the process to become an aggregator, an FSP and those entities responsible for deviations from commitments.

A key aspect of aggregation models is the financial compensation scheme between aggregators and suppliers implemented, in the case where these are different entities, as well as the revenue sharing taking place between these and the owners of the resources. The general framework for these needs to be established and will be part of the aggregation models defined in the DR Network Code.

This barrier is critical for BUC WECL-ES-02, as small DER cannot meet certain requirements for providing services while through aggregation those requirements could be met. However, having small DERs participating in markets for SO services is certainly relevant for these markets and, therefore, also for BUC WECL-ES-01.

### TSO-DSO interfaces

There are different interfaces and roles that need to be further defined between TSO and DSOs to use flexibility resources. For instance, common rules are needed for the registration of FSPs which can provide services to both TSO and DSOs. Some of these requirements are stated in the ACER Framework Guideline on DR:

1. The product prequalification procedures to be performed by DSO and TSO need to be revised to consider services for both entities.
2. Principles for data requirements and product attributes
3. Product verification and grid prequalification. Information exchange for activation of flexibility used and activated by DSOs to address the TSO needs is still to be determined.
4. Coordination requirements between markets to avoid distortions, minimize withholding capacities, and increase liquidity, use of unused bids

Furthermore, the role of DSOs for the use of resources providing services to cover the TSO needs must be further specified for balancing, but also for other services such as adequacy and system restoration.

TSO-DSO interfaces are more relevant for BUC WECL-ES-02 as it allows maximizing value stacking of resources.

### Operation rules of storage operation, including by TSO/DSO

Energy storage facilities cannot be operated in Spain by TSO or DSO, but their operation for providing services needs to be determined. To increase the value stacking of storage units, they may provide services to both TSO and DSOs, and therefore the rules under which they are operated need to be defined.

This barrier is not as relevant as others but potentially it can have an impact on BUC WECL-ES-02 as DER can have storage facilities.

### **Economic incentives**

The appropriate economic incentives need to be provided to all the actors involved in the provision and procurement of flexibility services for them to contribute to these in an efficient manner. The main economic incentives necessary are described below.

### Definition of remuneration schemes for DSOs to acquire flexibility

Traditional remuneration schemes for DSOs are based on capital expenditure (CAPEX). DSOs' actions are, therefore, capital-based, while operational expenditures are not equally reflected in the remuneration applied. Therefore, remuneration schemes need to be upgraded to consider the costs involved in the mobilization of flexibility through different mechanisms, including local markets for SO services.

This barrier affects both BMs, remuneration for DSOs to acquire flexibility affects the use of IMO's platform and the possibility for DER to provide flexibility services to the DSOs.

### Regulation on guidelines for using procurement mechanisms

The barrier identified is the lack of regulation on a framework that guides suitable set of mechanisms for the procurement of flexibility.

Flexibility can be procured through different mechanisms rewarding the provision of flexibility (compensation mechanisms). The acquisition of flexibility may not rely only on one specific mechanism, but will rather involve applying a combination of them, depending on the characteristics of the needs and the resources that can provide them. These mechanisms include connection and access agreements, bilateral contracts, auctions, dynamic tariffs and others. The design of these mechanisms needs to be carefully considered in order for them to effectively complement each other, produce consistent signals, and optimize the utilization of all the resources. These mechanisms can span various timeframes ranging from long-term planning to real-time operation.

In a similar manner to the previous barrier, procurement mechanisms are essential for the development of local markets and DERs flexibility provision.

### **Lack of additional enabling regulation**

Besides the definition and implementation of roles, responsibilities, and economic incentives, additional regulation can be an enabler in implementing local markets for SO services, as described below.

#### Baseline methodologies

Baseline methodologies are required to measure the amount of flexibility delivered, while they are missing in the Spanish system. These methodologies must be agreed by the flexibility buyer (DSO and TSO) and the seller, who can be an aggregator who manages a portfolio of resources. For the definition of the baseline, there is no solution that fits all. The method to apply should depend on different aspects, such as the type of resources involved, the type of products, and the metering granularity available, among other aspects, see the CoordiNet Deliverable 2.1 [25]: Some of the alternative options are: High Y of X (selecting representative days as benchmark), regression methods, meter before- meter after, rolling average.

This barrier affects both the BUC WECL-ES-02 and the BUC WECL-ES-01, since the baseline definition affects measurement of the flexibility delivered, but it would also impact the settlement of the services, which concerns IMO related activities.

#### Submetering regulation

Dedicated meters can be an enabler for measuring the flexibility delivered by specific resources (e.g., electric vehicles), enabling aggregation business models specialized in a segment of resources (e.g., electric vehicles), and enabling more accurate baseline calculations. Submetering regulation is currently lacking in Spain. However, the European Commission, in the amending Regulations [26](EU) 2019/943 and (EU) 2019/942, as well as Directives (EU) 2018/2001 and (EU) 2019/944 to improve the Union's electricity market design, suggests making an amendment to the regulation on the free choice of supplier. This regulation aims at introducing new requirements to ensure that customers are able to have more than one supplier on their premises, by enabling multiple meters (sometimes called submeters) for a single connection point. Therefore, the regulation on the use of submetering, and the requirements these submeters need to fulfil, has to be further developed.

Similarly, as the previous barrier, submetering regulation mainly affects BUC WECL-ES-02 and the measurement of the flexibility delivered.

#### Lack of regulation protecting agents from market power abuse by access to information

To enable the development of local markets for SO services, the availability of data on the individual customers' profiles is required to assess the flexibility potential and develop new business models which can be offered to such customers. However, when regulating data access, privacy, cybersecurity considerations, and third-party access rules need to be established to protect the customers' rights.

This barrier affects both BUC WECL-ES-02 and BUC WECL-ES-01. Data access can relate to DER engagement strategies but also to the business of the IMO.

#### Constraints on the participation of agents in markets for SO services

Currently, in Spain, resources with a capacity <1MW cannot participate in any market, while those whose capacity is <0.1MW cannot participate in wholesale energy markets. As previously stated, aggregation rules are essential to overcome this barrier. At the DSO level, the lack of local markets for SO services prevents resources from providing flexibility locally in a competitive manner while being rewarded for this.

Currently, the definition of the market agents participating in the wholesale energy and TSO markets makes a clear distinction between load and generation units. This restricts the aggregation of demand and generation resources within a portfolio, which could be even more critical for the participation of resources in local markets for SO services.

This barrier largely affects BUC WECL-ES-02 as it is a limiting factor for small DERs to provide flexibility services or restrict aggregation rules by technology types, but it also affects BUC WECL-ES-01, since local markets managed by the IMO in general are affected by the participation of small agents. However, a different threshold could be implemented for local DSO markets.

## **3.2 Description and analysis of the BMs for the Portuguese Demo**

Here we provide a representation and analysis of the BMs within the Portuguese Demonstrator. Within the Portuguese Demonstrator, there are 3 BUCs defined, WECL-PT-01 - Exchange of Information for Congestion Management – Short Term, WECL-PT-02 - Exchange of Information for Congestion Management – Long Term and WECL-PT-03 - Exchange of Information for Operational Planning. In this case, the description and analysis are provided separately for each BM.

### **3.2.1 Representation and analysis made the BM for BUC WECL-PT-01**

#### **3.2.1.1 Representation made of the BM for BUC WECL-PT-01**

Before describing the structure of the BM for BUC WECL-PT-01, the main relationships established within it, value created by it, and revenues and costs for the FSP, which is the stakeholder that the BM focuses on, resulting from its implementation, we remind the reader about some basic features of the BUC WECL-PT-01.

#### **Description of the BUC WECL-PT-01**

This section provides the description and analysis for the OneNet's BUC WECL-PT-01, as described in [14], [27].



Flexible resources connected to the transmission and distribution systems can provide flexibility to SOs to eliminate congestions through a market mechanism. The BUC WECL-PT-01 applies to both transmission and distribution systems, and it aims at specifying the exchanges of information between SOs to enable flexibility provision, considering the different stages in the ASM report [28], except for the settlement process. Two different time frame markets will be examined: day ahead and intraday.

### Objectives

The main objectives of the BUC WECL-PT-01 are the following:

Design and detail each process phase of the ASM report [28] so that it can serve as a basis for future developments.

1. Coordinate the use of flexibility for different voltage levels.
2. Identify what information should be shared between DSO and TSO for each of the flexibility procurement process phases for short terms congestion management, namely for the technical selection and validation of the bids by the relevant SO.
3. Develop information exchange mechanisms to enable market-based procurement of flexibility products

### Actors

We find five actors in BUC WECL-PT-01:

- DSO: manages the distribution grid, including the procurement of flexibility for congestion management at the distribution level.
- TSO: manages the transmission grid, including the procurement of flexibility for congestion management at the transmission level.
- FSP: controls sufficient volume of flexibility resources and provides flexibility services to avoid grid congestion problems.
- MO DSO: provides a service to the DSO whereby the offers to sell electricity are matched with bids to buy electricity.
- MO TSO: provides a service to the TSO whereby the offers to sell electricity are matched with bids to buy electricity.

### Procedure

The procedure applied in BUC WECL-PT-01 was structured in four steps, that are described next:

1. Prepare/Pre-qualification: The process in which it is checked whether a unit can deliver the product it intends to sell, considering the network conditions.
2. Plan/Forecast: Planning of grid utilisation and identifying potential congestions.

3. Market Phase: Bids collection and selection, short-term contracts (capacity products) and short-term products/services (selection of energy products).
4. Monitoring and Activation: Grid monitoring and flexibility bids activation to solve the forecasted congestion management.

#### **Description of the BM for BUC WECL-PT-01: the Business Model Canvas**

The BM associated with this BUC WECL-PT-01 is focused on the FSP as a stakeholder.

The canvas of the BM for BUC WECL-PT-01 is provided in Table 3.4.

Table 3.4: BM canvas for BUC WECL-PT-01

<p><b>Key partnerships</b></p> <ul style="list-style-type: none"> <li>- Interactions with the SOs in case of forecasted congestions in transmission and distribution systems for the following process phases of the ASM report [28]: i) pre-qualification ii) forecast iii) market phase iv) monitoring and activation (acquisition of particular resources or activities)</li> </ul>	<p><b>Key activities</b></p> <ul style="list-style-type: none"> <li>- Provides information to the connected SO to fill in the following process phases of the ASM report [28] (i) pre-qualification ii) forecast iii) market phase iv) monitoring and activation</li> <li>- Offers flexibility products to respond to SOs needs.</li> </ul>	<p><b>Value proposition</b></p> <ul style="list-style-type: none"> <li>- Enable market-based procurement of flexibility products</li> <li>- Allows FSPs to offer flexibility services to non-connected SOs</li> </ul>	<p><b>Customer relationships</b></p> <ul style="list-style-type: none"> <li>- As the FSPs will be simulated, the interactions with the SOs are not defined. Can be via market platform, FR or direct interaction.</li> </ul>	<p><b>Customer</b></p> <ul style="list-style-type: none"> <li>- TSO</li> <li>- DSO</li> </ul>
	<p><b>Key resources</b></p> <ul style="list-style-type: none"> <li>- TDEP</li> <li>- DDEP</li> <li>- DSO and TSO databases</li> <li>- Computer servers (physical)</li> </ul>		<p><b>Channel</b></p> <ul style="list-style-type: none"> <li>- As the FSPs will be simulated, the channel for the interactions with the SOs is not defined. Can be via market platform, FR or direct interaction</li> </ul>	
<p><b>Cost structure</b></p> <ul style="list-style-type: none"> <li>- Not applicable as the demo doesn't involve actual FSPs, so no costs for FSPs are considered</li> </ul>			<p><b>Revenue streams</b></p> <ul style="list-style-type: none"> <li>- Value being paid: network tariff</li> <li>- Revenue source: flexibility services payment</li> </ul>	

### 3.2.1.2 Analysis made of this BM

Next, the analysis made of the BM for BUC WECL-PT-01 is provided concerning both the classification of stakeholder and the definition of strategies for the engagement of critical stakeholders and the analysis of the compatibility of this BM with local regulation.

#### **Stakeholders' engagement analysis**

In this section, the main stakeholders involved in the implementation of the BM for BUC WECL-PT-01 are identified and classified according to their ability to affect the implementation of the BM and their interest in facilitating this implementation. Then, relevant strategies for the engagement of critical stakeholders, who have large power to affect the successful implementation of the BM for BUC WECL-PT-01 but low interest in favouring it, are provided.

#### Power-interest Matrix

The power interest matrix for the BM for BUC WECL-PT-01 is provided in Table 3.5, classifying in it the relevant stakeholders according to their power to affect the implementation of the BUC and their incentives to facilitate this implementation. For each stakeholder, its power to affect the implementation of BUC WECL-PT-01 and interest in facilitating it is discussed within the matrix.

Table 3.5: Classification of the stakeholders for the BM associated with the BUC WECL-PT-01: Power-interest matrix

Stakeholder influence/power	High	<p>National regulators: Must create the right regulatory framework for flexibility provision. This framework must allow participation by different FSPs, allowing aggregation of resources for a higher degree of participation. Different forms of explicit flexibility provisioning (market, bilateral) should be possible.</p> <p>Sectoral associations: Either European or national. Some positions may collide with fundamentals considered within the BM for BUC WECL-PT-01.</p>	<p>European Union: The development of flexibility services is included in the last electricity market directive and is being favoured politically, as it may provide both environmental and economic benefits to society, businesses, and final consumers. EU level institutions also build the required technical grounds not only for the provision of these services, but for the exchange of data and interoperability to be followed by other stakeholders.</p> <p>National governments: Sharing the European view on this subject, they may perceive this as an opportunity for society, businesses, and consumers.</p> <p>SOs: As main customers of Markets for SO Services and as entities responsible for the management and efficient operation of the networks, they have full interest in this use case. Nonetheless, their interest is dependent from the benefits/incentives from these solutions and from the existent of necessary regulatory framework to support it. The SOs need also to have implemented adequate tools for flexibility needs assessment and demand/generation forecast. Apart from this, CBA tools to evaluate flexibility options as replacement/deferral for network expansion investments shall also be implemented.</p>
	Low	<p>Developers, engineers, and contractors: New business opportunities may be created, but also some may be affected by new activities. Therefore, the net effect is not clear. These groups are diverse and not organized, so it's expected that they are not decisive groups.</p>	<p>Technology companies: They develop the new applications needed to exchange the data and procure flexibility for congestion management, manage these new systems, and interconnect current platforms with new ones necessary to activate flexibility. They are beneficiaries of these new business models, but don't have a significant influence/power, as the solution is tailored to SOs needs.</p> <p>Academic and Research Institutions: These groups can provide unbiased evaluations of the business model and possibly contribute to its improvement.</p>
		Low	High
		Stakeholder interest/support	

## Strategies for the engagement of critical stakeholders

Effective strategies must be implemented to achieve the involvement of relevant stakeholders. These are discussed next, placing the focus on critical stakeholders.

- High influence challengers (high influence but low interest)

These two actors have strong influence but low interest, so their interest/support will need to be increased:

### National regulators

Advocate near the regulators on the best regulatory approaches to drive flexibility and to allow wide participation of FSPs. This can be achieved through educational seminars and whitepapers, presenting conclusions from the demonstrators.

The benefits and the increase in social welfare of new business models have to be clearly explained to the regulator so the corresponding regulation can be developed in a timely manner. This can be achieved through educational seminars and whitepapers, presenting the results achieved in the demonstrators.

Regulatory instruments such as Sandboxes can be a tool for regulatory learning and experience with innovation in a controlled environment. While deploying a regulatory sandbox, regular check-ins with updates from the project and required changes in regulatory landscapes should be organized.

### Sectoral associations

Sectoral associations normally have strong connections with EU institutions and governments, and the interests may collide with solutions proposed. Therefore:

It's important to clearly communicate the benefits and reasoning behind the proposed solutions. This can be done by leveraging from industry events and seminars to establish dialogue with these organizations.

Make sure the project objectives align with sectoral associations', which can be done not only through dedicated workshops but also by seeking partnerships with these organizations.

- High influence champions (high influence and high interest)

These actors are already interested in the BUC, but they must not be taken for granted:

### European Union

The development of business models that support flexibility provisioning are thoroughly promoted within the EU policy, and these must of course follow the EU regulatory framework developed (and being discussed). Thus, there is need to:

- Guarantee alignment with EU framework and objectives. This can be done by directly aligning the business case objectives and Key Performance Indicators (KPIs) with existing EU frameworks and objectives.
- Identify use cases where similar solutions were adopted (best practices).
- Utilize channels like EU-sponsored innovation events to showcase how the business case aligns with EU policy's objectives and existing best practices.

### National governments

Sharing the European view on this subject, the national governments need to perceive the benefits that the BM would bring to society, businesses, and consumers. Therefore, there is need to:

Communicate the benefits from the implementation of proposed solutions. This can be done through engagement with governmental advisory bodies and think tanks to validate and disseminate these findings.

Work on developing policy briefs and success stories that showcase how the business model can positively affect national economies, employment, and sustainability.

### SOs

The regulation has to provide a fair retribution for using flexibility and potentially delaying investments in the grid so that the SOs do not prioritize any of the investments in comparison to flexibility options.

A regulatory framework more supportive of innovative investments must also be conceived.

- Low influence challengers (low influence and low interest)

These actors have no power nor interest in this business model:

### Developers, engineers, and contractors:

Developers, engineers, and contractors may be affected by the BM for BUC WECL-PT-01, thus:

- They should be early involved in discussions and developments to understand their needs and challenges better.
- Training and knowledge exchange sessions should be organized to show how the business model could eventually benefit them too.

- Low influence champions (low influence and high interest)

These actors have no power but have interest in the business models:

#### Technology companies

As technology companies will be the ones providing some of the solutions, they must also be heard, thus:

Engage technology companies in the ideation and prototyping phases, as they could offer invaluable insights into the technological feasibility of development plans for the business model.

#### Academic and Research Institutions

Academic and Research Institutions can provide unbiased evaluations of the BM for BUC WECL-PT-01 and possibly contribute to its improvement, thus:

- Partner with them for third-party validations and research publications to build credibility.
- Sponsor or collaborate on academic research related to the business model developed.

### **Analysis of the compatibility of the BM for BUC WECL-PT-01 with local regulation**

This section provides the identification of the regulatory barriers to the implementation and success of the BM for BUC WECL-PT-01. The information discussed here has been obtained based on the WP3/WP11 Regulatory Questionnaire carried out for all the demonstrators. The regulatory barriers and possible measures to tackle them are presented below.

Three different types of regulatory barriers are identified: Technical rules, Data access and availability, and Lack of incentives for smart/digital developments.

#### Technical rules

The actual implementation of this use case is strongly dependent from the establishment of necessary technical rules for flexibility provision for congestion management in Portugal. The regulatory framework foresees these services by TSOs and DSOs, and the participation by different players, including DR with and without aggregation, however, the final technical rules and processes are yet to be published.

Allowing different forms of explicit flexibility provisioning is not only one way to increase the level of participation in these services, but also a way to better respond to the network needs, in a more targeted way. The Portuguese legislation, doesn't close the explicit flexibility provision for non-frequency services to Markets for SO Services, leaving an "open door" for bilateral agreements to take place. However, this is still not clear, as well as the how, which will be further defined by complementing regulation.



### Data access and availability

To fully unlock the potential from flexibility resources, a higher degree of observability is needed, not only to assess this potential but also to accurately assess the network needs. There is currently no framework supporting the access to grid edge data, which would allow a better observability of the network at lower voltage levels. The same issue can be applied to the TSO related to the lack of observability upon the DERs in the MV and LV voltage networks.

And more specifically, when the eventual use of sub-meter data for providing flexibility services has impact on the settlement of the supply point, the DSO must be the entity responsible for the sub-meter, including ownership, management and data collection.

### Lack of incentives for smart/digital developments

The implementation of the BM for BUC WECL-PT-01 benefits from a regulatory framework that is supportive to smart investments, and from the national perspective, some barriers can be identified. From one side, there is a relatively low investment cap allowed for the network investment and development plan, for which a significant portion is normally directed to priority activities for SOs, aiming for a secure quality of supply, therefore, leaving a short room for smart and digital investments. In the current context of the energy transition, more room is required for this type of investments.

Secondly, the regulatory approach used in Portugal is TOTEX, not distinguishing between CAPEX and OPEX expenditures. Nonetheless, this approach fixes the formulation for the determination of the revenues for the regulatory period of 4 years and is independent from the actual costs from the solutions implemented. This model tends to be riskier for investments in innovative solutions, that are more uncertain.

Apart from that, it is also worth mentioning that in Portugal there is no dedicated incentive for the investment on digital and smart solutions, meaning, no additional compensation for the risk, which may impact the actual interest and cost efficiency, when compared with conventional investments.

Also, the deployment of CBA methodologies to assess other options (such as flexibility provision) to traditional investments are also foreseen in the legislation, however, the actual methodology for this assessment is still to be published. It is important to mention that this methodology should only be applicable under certain types of investments. Actually, there are several cases where flexibility is not a suitable option, for instance projects whose objectives are specifically oriented towards improving the quality of technical service, reducing technical losses, and renovating or rehabilitating assets.

## 3.2.2 Representation and analysis made the BM for BUC WECL-PT-02

### 3.2.2.1 Representation made of this BM

Before describing the structure of the BM for BUC WECL-PT-02, the main relationships established within it, value created by it, and revenues and costs for the TSO, which is the stakeholder that the BM focuses on, resulting from its implementation, we remind the reader about some basic features of the BUC WECL-PT-02.

#### Description of the BUC WECL-PT-02

This section provides the description and analysis for the OneNet's BUC WECL-PT-02, as described in [14], [27].

BUC WECL-PT-02 describes the exchanges of information and the rules that should be established between DSO and TSO in case of forecasted congestions in transmission and/or distribution systems to keep power flows within the acceptable thermal limits. DSOs and TSOs should procure flexibility in advance to solve a specific system loading issue on the distribution and transmission system, thus deferring/eliminating the need for traditional system upgrades. This kind of flexibility service can also be used to support the network during planned maintenance actions.

#### Objectives

The objectives of the WECL-PT-02 are the same as for the BUC WECL-PT-01, since the main difference is the timeframe considered. Thus, BUC WECL-PT-02 aims to:

Design and detail each process phase of the ASM report [28], so that it can serve as a basis for future developments.

1. Coordinate the use of flexibility for different voltage levels.
2. Identify what information should be shared between DSO and TSO for each of the flexibility procurement process phases for short terms congestion management, namely for the technical selection and validation of the bids by the relevant SO.
3. Develop information exchange mechanisms to enable market-based procurement of flexibility products.

#### Actors

We find five actors in BUC WECL-PT-02:

- DSO: manages and operates the distribution grid, including the procurement of flexibility for congestion management at the distribution level.
- TSO: manages and operates the transmission grid, including the procurement of flexibility for congestion management at the transmission level.

- FSP: controls sufficient volume of flexibility resources and provides flexibility services to avoid grid congestion problems.
- MO DSO: provides a service to the DSO whereby the offers to sell electricity are matched with bids to buy electricity.
- MO TSO: provides a service to the TSO whereby the offers to sell electricity are matched with bids to buy electricity.

### Procedure

The procedure applied in BUC WECL-PT-02 was structured in four steps, that are described next:

1. Prepare/Pre-qualification: The process in which it is checked whether a unit can deliver the product it intends to sell, taking into account the network conditions.
2. Plan/Forecast: Planning of grid utilisation and identifying potential congestions.
3. Market Phase: Bids collection and evaluation, long-term contracts (availability or capacity products) and long-term products/services (activation of energy products).
4. Monitoring and Activation: Grid monitoring and flexibility bids activation of bids for congestion management.

BUC WECL-PT-02 is related to WECL-PT-01 since the phases covered are the same but in a different time frame. Although some of the phases may be similar for both BUCs, others will have to be adapted.

### **Description of the BM for BUC WECL-PT-02: the Business Model Canvas**

The BM associated with BUC WECL-PT-02 is focused on the TSO.

The canvas of this BM is provided in Table 3.6.

Table 3.6: BM canvas for BUC WECL-PT-02

<p><b>Key partnerships</b></p> <ul style="list-style-type: none"> <li>- Provision of information by the DSO in case of forecasted congestions in distribution systems for the following process phases of the ASM report [28]: i) pre-qualification ii) forecast iii) market phase iv) monitoring and activation (acquisition of particular resources or activities / strategic importance: 5 / competition: 0 / integration: 5 / substitutability: 0)</li> </ul>	<p><b>Key activities</b></p> <ul style="list-style-type: none"> <li>- Coordinates the use of flexibility for different voltage levels with the DSO</li> <li>- Receives information from the DSO in case of forecasted congestions in distribution systems for the following process phases of the ASM [28]: i) pre-qualification ii) forecast iii) market phase iv) monitoring and activation</li> <li>- Provides information to the DSO in case of forecasted congestions in transmission systems for the following process phases of the ASM report: i) pre-qualification ii) forecast iii) market phase iv) monitoring and activation</li> </ul> <p><b>Key resources</b></p> <ul style="list-style-type: none"> <li>- TDEP</li> <li>- DDEP</li> <li>- DSO and TSO databases</li> <li>- Computer servers (physical)</li> </ul>	<p><b>Value proposition</b></p> <ul style="list-style-type: none"> <li>- Enhance information exchange to enable an efficient use of flexibility resources</li> <li>- Enable the procurement of flexibility in advance to solve a specific system loading issue on the transmission system</li> <li>- Keep power flows within the accepted thermal limits of the lines</li> <li>- Eliminate congestions through a market mechanism</li> <li>- Deferring/eliminating the need for traditional system upgrades</li> </ul>	<p><b>Customer relationships</b></p> <ul style="list-style-type: none"> <li>- Direct interaction via data exchange platform</li> </ul> <p><b>Channel</b></p> <ul style="list-style-type: none"> <li>- DDEP</li> <li>- TDEP</li> </ul>	<p><b>Customer</b></p> <ul style="list-style-type: none"> <li>- DSO</li> </ul>
<p><b>Cost structure<sup>2</sup></b></p> <ul style="list-style-type: none"> <li>- Computer servers and other IT services (20%)</li> <li>- Human resources to carry on the operations on the Data Exchange Platform (80%)</li> </ul>		<p><b>Revenue streams</b></p> <ul style="list-style-type: none"> <li>- Value being paid: platform establishment and maintenance fees</li> <li>- Revenue source: incentive for network losses, network tariffs, incentive for quality of service</li> </ul>		

<sup>2</sup> For the cost structure we have considered the costs from T9.2 related to PMs, development costs with sub-contracting and open-call, and azure operation costs for the platforms, assuming operation from mid-2022 to end-2023.



### 3.2.2.2 Analysis made of this BM

Next, the analysis made of the BM for BUC WECL-PT-02 is provided concerning both the classification of stakeholder and the definition of strategies for the engagement of critical stakeholders and the analysis of the compatibility of this BM with local regulation.

#### **Stakeholders' engagement analysis**

In this section, the main stakeholders involved in the implementation of the BM for BUC WECL-PT-02 are identified and classified according to their ability to affect the implementation of the BM and their interest in facilitating this implementation. Then, relevant strategies for the engagement of critical stakeholders, who have large power to affect the successful implementation of the BM for BUC WECL-PT-02 but low interest in favouring it, are provided.

#### Power-interest Matrix

The power interest matrix for the BM for BUC WECL-PT-02 is provided in Table 3.7, classifying in it the relevant stakeholders according to their power to affect the implementation of the BUC and their incentives to facilitate this implementation. For each stakeholder, its power to affect the implementation of BUC WECL-PT-02 and interest in facilitating it is discussed within the matrix.

Table 3.7: Classification of the stakeholders for the BM associated with the BUC WECL-PT-02: Power-interest matrix

Stakeholder influence/power	High	<p><b>FSPs:</b> The actual deployment of this use case is of course dependent from the actual participation of FSPs in the provision of flexibility services, for which the benefits of this provision might not be enough.</p> <p><b>National regulators:</b> Must create the right regulatory framework for flexibility provision and to foster digital investments by SOs.</p> <p><b>Sectoral associations:</b> Either European or national. Some positions may collide with fundamentals considered within the BM for BUC WECL-PT-02.</p>	<p><b>European Union:</b> The development of flexibility services is included in the last electricity market directive and is being favoured politically, as it may provide both environmental and economic benefits to society, businesses, and final consumers. EU level institutions also build the required technical grounds not only for the provision of these services, but for the exchange of data and interoperability to be followed by other stakeholders.</p> <p><b>National governments:</b> Sharing the European view on this subject, they may perceive this as an opportunity for society, businesses, and consumers.</p> <p><b>DSOs:</b> As main customers of Markets for SO Services and as entities responsible for the management and efficient operation of the networks, they have full interest in this use case. Nonetheless, their interest is dependent from the benefits/incentives from these solutions, from the existent of necessary regulatory framework to support it and from limitations that may exist regarding confidentiality of data to be exchanged. The DSOs need also to have implemented adequate tools for flexibility needs assessment and demand/generation forecast.</p>
	Low	<p><b>Developers, engineers, and contractors:</b> New business opportunities may be created, but also some may be affected by new activities. Therefore, the net effect is not clear. These groups are diverse and not organized, so it's expected that they are not decisive groups.</p>	<p><b>Technology companies:</b> As they develop the new applications needed to exchange the data and procure flexibility for congestion management, manage these new systems, and interconnect current platforms with new ones necessary to activate flexibility. They are beneficiaries of these new business models, but don't have a significant influence/power, as the solution is tailored to SOs needs.</p> <p><b>Academic and Research Institutions:</b> These groups can provide unbiased evaluations of the business model and possibly contribute to its improvement.</p>
		Low	High
Stakeholder interest/support			

## Strategies for the engagement of critical stakeholders

Effective strategies must be implemented to achieve the involvement of relevant stakeholders. These are discussed next, placing the focus on critical stakeholders.

- High influence challengers (high influence but low interest)

These three actors have strong influence but low interest, so their interest/support will need to be increased:

### FSPs

- FSPs must perceive the benefits of the BM for BUC WECL-PT-02, so there should be early engagement through surveys, focus groups, and public meetings to gauge interest and concerns.
- The solutions implemented should be simple and usable by FSPs and not overburden them. So, a feedback mechanism should be established for continuous improvement based on FSPs' experience.
- The regulatory framework shall also be drafted so it doesn't discriminate participation from some FSPs.

### National regulators

- Advocate near the regulators on the best regulatory approaches to drive flexibility and to allow wide participation of FSPs. This can be achieved through educational seminars and whitepapers, presenting conclusions from the demonstrators.
- The benefits and the increase in social welfare of new business models have to be clearly explained to the regulator so the corresponding regulation can be developed in a timely manner. This can be achieved through educational seminars and whitepapers, presenting the results achieved in the demonstrators.
- Regulatory instruments such as Sandboxes can be a tool for regulatory learning and experience with innovation in a controlled environment. While deploying a regulatory sandbox, regular check-ins with updates from the project and required changes in regulatory landscapes should be organized.

### Sectoral associations

Sectoral associations normally have strong connections with EU institutions and governments, and the interests may collide with solutions proposed. Therefore:

- It's important to clearly communicate the benefits and reasoning behind the proposed solutions. This can be done by leveraging from industry events and seminars to establish dialogue with sectoral associations.

- Make sure the project objectives align with sectoral associations', which can be done not only through dedicated workshops but also by seeking partnerships with these organizations.
- High influence champions (high influence and high interest)

These actors are already interested in the BUC, but they must not be taken for granted:

#### European Union

The development of business models that support flexibility provisioning are thoroughly promoted within the EU policy, and these must of course follow the EU regulatory framework developed (and being discussed). Thus, there is need to:

1. Guarantee alignment with EU framework and objectives. This can be done by directly aligning the business case objectives and KPIs with existing EU frameworks and objectives.
2. Identify use cases where similar solutions were adopted (best practices).
3. Utilize channels like EU-sponsored innovation events to showcase how the business case aligns with EU policy's objectives and existing best practices.

#### National governments

Sharing the European view on this subject, national governments need to perceive the benefits that the BM for BUC WECL-PT-02 would bring to society, businesses, and consumers. Therefore, there is need to:

- Communicate the benefits from the implementation of proposed solutions. This can be done through engagement with governmental advisory bodies and think tanks to validate and disseminate these findings.
- Work on developing policy briefs and success stories that showcase how the business model can positively affect national economies, employment, and sustainability.

#### DSOs

1. The regulation has to provide a fair retribution for using flexibility and potentially delaying investments in the grid so that the SOs do not prioritize any of the investments in comparison to flexibility options.
  2. A regulatory framework more supportive of innovative investments must also be conceived.
- Low influence challengers (low influence and low interest)

These actors have no power nor interest in this business model:



### Developers, engineers, and contractors

Developers, engineers, and contractors may be affected by the BM for BUC WECL-PT-02, thus:

1. They should be early involved in discussions and developments to understand their needs and challenges better.
  2. Training and knowledge exchange sessions should be organized to show how the business model could eventually benefit them too.
- Low influence champions (low influence and high interest)

These actors have no power but have interest in the business models:

### Technology companies

As technology companies will be the ones providing some of the solutions, they must also be heard, thus:

1. Engage them in the ideation and prototyping phases, as they could offer invaluable insights into the technological feasibility of development plans for the business model.

### Academic and Research Institutions

Academic and Research Institutions can provide unbiased evaluations of the business model and possibly contribute to its improvement, thus:

1. Partner with them for third-party validations and research publications to build credibility.
2. Sponsor or collaborate on academic research related to the business model developed.

## **Analysis of the compatibility of the BM for BUC WECL-PT-02 with local regulation**

This section provides the identification of the regulatory barriers to the implementation and success of the BM for WECL-PT-02. The information discussed here has been obtained based on the WP3/WP11 Regulatory Questionnaire carried out for all the demonstrators. The regulatory barriers and possible measures to tackle them are presented below.

Two types of regulatory barriers are identified: Technical rules, and Lack of incentives for smart/digital developments.

### Technical rules

The actual implementation of this use case is strongly dependent from the establishment of necessary technical rules for flexibility provision for congestion management in Portugal. The regulatory framework foresees these services by TSOs and DSOs, and the participation by different players, including DR with and without aggregation, however, the final technical rules and processes are yet to be published.

### Lack of incentives for smart/digital developments

The implementation of the BM for BUC WECL-PT-02 benefits from a regulatory framework that is supportive to smart investments, and from the national perspective, some barriers can be identified. From one side, there is a relatively low investment cap allowed for the network investment and development plan, for which a significant portion is normally directed to priority activities for SOs, aiming for a secure quality of supply, therefore, leaving a short room for smart and digital investments. In the current context of the energy transition, more room is required for this type of investments.

Secondly, the regulatory approach used in Portugal is TOTEX, not distinguishing between CAPEX and OPEX expenditures. Nonetheless, this approach fixes the formulation for the determination of the revenues for the regulatory period of 4 years and is independent from the actual costs from the solutions implemented. This model tends to be riskier for investments in innovative solutions, that are more uncertain.

Apart from that, it is also worth mentioning that in Portugal there is no dedicated incentive for the investment on digital and smart solutions, meaning, no additional compensation for the risk, which may impact the actual interest and cost efficiency, when compared with conventional investments.

Also, the deployment of CBA methodologies to assess other options (such as flexibility provision) to traditional investments are also foreseen in the legislation, however, the actual methodology for this assessment is still to be published. It is important to mention that this methodology should only be applicable under certain types of investments. Actually, there are several cases where flexibility is not a suitable option, for instance projects whose objectives are specifically oriented towards improving the quality of technical service, reducing technical losses, and renovating or rehabilitating assets.

## **3.2.3 Representation and analysis made the BM for BUC WECL-PT-03**

### **3.2.3.1 Representation made of this BM**

Before describing the structure of the BM for BUC WECL-PT-03, the main relationships established within it, value created by it, and revenues and costs for the technical MO (DSO), which is stakeholder that the BM focuses on, resulting from its implementation, we remind the reader about some basic features of BUC WECL-PT-03.

#### **Description of the BUC WECL-PT-03**

This section provides the description and analysis for the OneNet's BUC WECL-PT-03, as described in [14] and [27].

The increase in generation from renewable sources and the expected increase in electricity demand means that SOs must improve their grid management strategies to avoid unnecessary investments. In BUC WECL-PT-

03, the strategy is to optimise coordination between DSO and TSO by identifying and sharing the information that enables better operational planning for their networks.

BUC WECL-PT-03 explores and intends to define the information exchange principles between TSO and DSO to improve the operation of both networks in multiple domains and timeframes. The final goal is to set greater cooperation in information exchanges between TSO-DSO within a common observability area for operational planning purposes and identify future flexibility needs in the transmission and distribution networks.

### Objectives

The main objectives of the BUC WECL-PT-03 are the following:

1. Identify the scheduled/forecasted information exchanged between DSO and TSO in order to improve the programming of DSO operation.
2. Identify the scheduled/forecasted information exchanged between DSO and TSO in order to improve the programming of TSO operation.
3. Anticipate and solve distribution grid constraints.
4. Anticipate and solve transmission grid constraints.
5. Develop information exchange mechanisms to share the identified information.

### Actors

We find three actors in BUC WECL-PT-03:

- DSO: manages and operates the distribution grid, being also responsible for its maintenance and development.
- MO: entity that provides a service whereby the offers to sell electricity are matched with bids to buy electricity.
- TSO: manages and operates the transmission grid, being also responsible for its maintenance and development.

### Procedure

The procedure applied in BUC WECL-PT-03 was structured in four steps, that are described next:

- Creation of a web-Services link between both operators.
- Definition of the observability area between TSO and DSO.
- The DSO and TSO forecast the load and distributed generation disaggregated by technology type, 72 hours ahead and with an update rate in each 24 hours.
- The TSO and DSO forecasts the connection state and schedule maintenance actions of transmission and distribution assets respectively (lines, transformers, capacitor banks, etc.) in medium term period (monthly) and updates it regularly until short-term period.
- Both operators commute the short-circuit power in the TSO-DSO interface EHV/HV substations).

- The capacity and availability for load connection and capacity of transfer power between injectors in the EHV/HV is forecasted annually and revised in medium and short-term.

**Description of the BM for BUC WECL-PT-03: the Business Model Canvas**

The BM associated with BUC WECL-PT-03 is focused on the DSO, as a TMO.

The canvas of the BM for BUC WECL-PT-03 is provided Table 3.8.

Table 3.8: BM canvas for BUC WECL-PT-03

<p><b>Key partnerships</b></p> <ul style="list-style-type: none"> <li>- Provision of information by the TSO on i) the short-circuit current forecast at the TSO/DSO interface; ii) scheduled maintenance actions in the observability area (acquisition of particular resources or activities).</li> </ul>	<p><b>Key activities</b></p> <ul style="list-style-type: none"> <li>- Coordinates operational planning activities with the TSO</li> <li>- Provides information to the TSO on i) the short-circuit current forecast at the TSO/DSO interface; ii) scheduled maintenance actions in the observability area; iii) aggregated consumption and production forecast by technology (solar, wind, hydro, etc).</li> </ul>	<p><b>Value proposition</b></p> <ul style="list-style-type: none"> <li>- Enhance information exchange to enable a better operational planning</li> <li>- Keep power flows within the accepted thermal limits of the lines</li> <li>- Support the network during planned maintenance actions</li> </ul>	<p><b>Customer relationships</b></p> <ul style="list-style-type: none"> <li>- Direct interaction via data exchange platform.</li> </ul>	<p><b>Customer</b></p> <ul style="list-style-type: none"> <li>- TSO.</li> </ul>
	<p><b>Key resources</b></p> <ul style="list-style-type: none"> <li>-TDEP.</li> <li>-DDEP.</li> <li>-DSO and TSO databases.</li> <li>-Computer servers (physical).</li> </ul>		<p><b>Channel</b></p> <ul style="list-style-type: none"> <li>- DDEP;</li> <li>- TDEP.</li> </ul>	
<p><b>Cost structure<sup>3</sup></b></p> <ul style="list-style-type: none"> <li>- Computer servers and other IT services (20%).</li> <li>- Human resources to carry on the operations on the Data Exchange Platform (80%).</li> </ul>		<p><b>Revenue streams</b></p> <ul style="list-style-type: none"> <li>- Value being paid: platform establishment and maintenance fees.</li> <li>- Revenue source: incentive for network losses, network tariffs, incentive for quality of service.</li> </ul>		

<sup>3</sup> For the cost structure we have considered the costs from T9.2 related to PMs, development costs with sub-contracting and open-call, and azure operation costs for the platforms, assuming operation from mid-2022 to end-2023.

### 3.2.3.2 Analysis made of this BM

Next, the analysis made of the BM for BUC WECL-PT-03 is provided concerning both the classification of stakeholder and the definition of strategies for the engagement of critical stakeholders and the analysis of the compatibility of this BM with local regulation.

#### Stakeholders’ engagement analysis

In this section, the main stakeholders involved in the implementation of the BM for BUC WECL-PT-03 are identified and classified according to their ability to affect the implementation of the BM and their interest in facilitating this implementation. Then, relevant strategies for the engagement of critical stakeholders, who have large power to affect the successful implementation of the BM for BUC WECL-PT-03 but low interest in favouring it, are provided.

#### Power-interest Matrix

The power interest matrix for the BM for BUC WECL-PT-03 is provided in Table 3.9, classifying in it the relevant stakeholders according to their power to affect the implementation of the BUC WECL-PT-03 and their incentives to facilitate this implementation. For each stakeholder, its power to affect the implementation of BUC WECL-PT-03 and interest in facilitating it is discussed within the matrix.

Table 3.9: Classification of the stakeholders for the BM associated with the BUC WECL-PT-03: Power-interest matrix

Stakeholder influence/power	High	<p>National regulators: Must create the right regulatory framework to foster digital investments by SOs, also envisaging greater observability of the network and access to grid-edge data.</p> <p>Sectoral associations: Either European or national. Some positions may collide with fundamentals considered within the BM for BUC WECL-PT-03.</p>	<p>European Union: EU level institutions build the required technical grounds not only for the provision of flexibility services, but for the exchange of data and interoperability to be followed by other stakeholders.</p> <p>National governments: Sharing the European view on this subject, they may perceive this as an opportunity for society, businesses, and consumers.</p> <p>TSOs: As entities responsible for the management and efficient operation of the networks, they have full interest in this use case. Nonetheless, their interest is dependent from the benefits/incentives from these solutions and from the existent of necessary regulatory framework to support it.</p>
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	Low	<p>Developers, engineers, and contractors:</p> <p>New business opportunities may be created, but also some may be affected by new activities. Therefore, the net effect is not clear. These groups are diverse and not organized, so it's expected that they are not decisive groups.</p>	<p>Technology companies:</p> <p>They develop the new applications for data exchange, manage these new systems, and interconnect current platforms with new ones. They are beneficiaries of these new business models, but don't have a significant influence/power, as the solution is tailored to SOs needs.</p> <p>Academic and Research Institutions:</p> <p>These groups can provide unbiased evaluations of the business model and possibly contribute to its improvement.</p>
		Low	High
	Stakeholder interest/support		

### Strategies for the engagement of critical stakeholders

Effective strategies must be implemented to achieve the involvement of relevant stakeholders. These are discussed next, placing the focus on critical stakeholders.

- High influence challengers (high influence but low interest)

These two actors have strong influence but low interest, so their interest/support will need to be increased:

#### National regulators

1. The benefits and the increase in social welfare of new business models have to be clearly explained to the regulator so the corresponding regulation can be developed in a timely manner. This can be achieved through educational seminars and whitepapers, presenting the results achieved in the demonstrators.
2. Regulatory instruments such as Sandboxes can be a tool for regulatory learning and experience with innovation in a controlled environment. While deploying a regulatory sandbox, regular check-ins with updates from the project and required changes in regulatory landscapes should be organized.

#### Sectoral associations

Sectoral associations have strong connections with EU institutions and governments, and the interests may collide with solutions proposed. Therefore:

1. It's important to clearly communicate the benefits and reasoning behind the proposed solutions. This can be done by leveraging from industry events and seminars to establish dialogue with these organizations.

2. Make sure the project objectives align with theirs, which can be done not only through dedicated workshops but also by seeking partnerships with these organizations.
- High influence champions (high influence and high interest)

These actors are already interested in the BUC, but they must not be taken for granted:

#### European Union

The development of business models that support flexibility provisioning are thoroughly promoted within the EU policy, and these must of course follow the EU regulatory framework developed (and being discussed). Thus, there is need to:

1. Guarantee alignment with EU framework and objectives. This can be done by directly aligning the business case objectives and KPIs with existing EU frameworks and objectives.
2. Identify use cases where similar solutions were adopted (best practices).
3. Utilize channels like EU-sponsored innovation events to showcase how the business case aligns with EU policy's objectives and existing best practices.

#### National governments

Sharing the European view on this subject, national governments need to perceive the benefits that the BM for BUC WECL-PT-03 would bring to society, businesses, and consumers. Therefore, there is need to:

1. Communicate the benefits from the implementation of proposed solutions. This can be done through engagement with governmental advisory bodies and think tanks to validate and disseminate these findings.
2. Work on developing policy briefs and success stories that showcase how the business model can positively affect national economies, employment, and sustainability.

#### TSOs

1. The regulatory framework must be drafted in a way that is more supportive of innovative investments.
- Low influence challengers (low influence and low interest)

These actors have no power nor interest in this business model:

#### Developers, engineers, and contractors

Developers, engineers, and contractors may be affected by the BM for BUC WECL-PT-03, thus:

1. They should be early involved in discussions and developments to understand their needs and challenges better.



2. Training and knowledge exchange sessions should be organized to show how the business model could eventually benefit them too.
- Low influence champions (low influence and high interest)

These actors have no power but have interest in the business models:

#### Technology companies

As technology companies will be the ones providing some of the solutions, they must also be heard, thus:

1. Engage them in the ideation and prototyping phases, as they could offer invaluable insights into the technological feasibility of development plans for the business model.

#### Academic and Research Institutions

Academic and Research Institutions can provide unbiased evaluations of the business model and possibly contribute to its improvement, thus:

1. Partner with them for third-party validations and research publications to build credibility.
2. Sponsor or collaborate on academic research related to the business model developed.

### **Analysis of the compatibility of the BM for BUC WECL-PT-03 with local regulation**

This section provides the identification of the regulatory barriers to the implementation and success of the BM for BUC WECL-PT-03. The information discussed here has been obtained based on the WP3/WP11 Regulatory Questionnaire carried out for all the demonstrators. The regulatory barriers and possible measures to tackle them are presented below.

Two different types of regulatory barriers are identified: Data access and availability, and Lack of incentives for smart/digital developments.

#### Data access and availability

To fully unlock the potential from flexibility resources, a higher degree of observability is needed, not only to assess this potential but also to accurately assess the network needs. There is currently no framework supporting the access to grid edge data, which would allow a better observability of the network at lower voltage levels. The same issue can be applied to the TSO related to the lack of observability upon the DERs in the MV/LV voltage networks.

And more specifically, when the eventual use of sub-meter data for providing flexibility services has impact on the settlement of the supply point, the DSO must be the entity responsible for the sub-meter, including ownership, management and data collection.

### Lack of incentives for smart/digital developments

The implementation of this BM benefits from a regulatory framework that is supportive to smart investments, and from the national perspective, some barriers can be identified. From one side, there is a relatively low investment cap allowed for the network investment and development plan, for which a significant portion is normally directed to priority activities for SOs, aiming for a secure quality of supply, therefore, leaving a short room for smart and digital investments. In the current context of the energy transition, more room is required for this type of investments.

Secondly, the regulatory approach used in Portugal is TOTEX, not distinguishing between CAPEX and OPEX expenditures. Nonetheless, this approach fixes the formulation for the determination of the revenues for the regulatory period of 4 years and is independent from the actual costs from the solutions implemented. This model tends to be riskier for investments in innovative solutions, that are more uncertain.

Apart from that, it is also worth mentioning that in Portugal there is no dedicated incentive for the investment on digital and smart solutions, meaning, no additional compensation for the risk, which may impact the actual interest and cost efficiency, when compared with conventional investments.

## **3.3 Description and analysis of the BMs for the French Demo**

This document provides a description and analysis of the Business Models for the BUC WECL-FR-02 - Improved TSO-DSO information exchange for DER activation. No BM has been defined for BUC WECL-FR-01 - Improved monitoring of flexibility for congestion management, since it did not involve the provision of a service by one entity to another and consists of a more instrumental BUC, focused on the development of a back-office platform to optimize transactions associated with renewable curtailments. On the other hand, the BUC WECL-FR-02 considered, despite not focusing on the provision of services, it consists of a study that will be instrumental to improve the coordination between the DSO and TSO to enhance and optimize flexibility usages, thus, the BM associated to it has been considered and described within this document.

### **3.3.1 Representation and analysis made the BM for BUC WECL-FR-02**

#### **3.3.1.1 Representation made of this BM**

Before describing the structure of the BM for BUC WECL-FR-02, the main relationships established within it, value created by it, and revenues and costs for the TSO, which is stakeholder that the BM focuses on, resulting from its implementation, we remind the reader about some basic features of the BUC WECL-FR-02 that the BM is associated with.

## Description of the BUC WECL-FR-02

This section provides the description and analysis for the OneNet's BUC WECL-FR-02, as described in [14], [27].

RTE and Enedis are regularly required to activate flexibilities on the transmission and/or distribution network for various reasons (e.g., voltage management and congestion following network sizing methods). These activations are carried out either manually or automatically, through various mechanisms (direct activations and/or market mechanisms) and are expected to play an increasingly important role in the management of networks and the power system, on the different time scales. Both Enedis and RTE support the development of these flexibilities' use at the lowest cost for the community, from the network sizing phase to the activation of these flexibilities. Whatever the chosen scheme, the activation of a flexibility must be done while guaranteeing that the impacts for each TSO on its perimeter are controlled (safe and secure operation of the networks and more widely of the power system), thus calling for coordination between actors.

BUC WECL-FR-02 aims at defining and listing the main flexibility usages of both SOs, illustrating what coordination issues it could entail now or in the future, and highlighting leads of further cooperation between TSO and DSO to tackle them.

### Objectives

The main objectives of the BUC WECL-FR-02 are the following:

1. Defining and listing the main flexibility usages of both SOs
2. Illustrating what coordination issues it could entail now or in the future
3. Highlighting leads of further cooperation between TSO and DSO to tackle them

### Actors

We find two actors in BUC WECL-FR-02:

- DSO: manages and operates the distribution grid, being also responsible for its maintenance and development.
- TSO: manages and operates the transmission grid, being also responsible for its maintenance and development.

### Procedure

The procedure applied in BUC WECL-FR-02 was structured in one step, that is described next:

- TSO and DSO will study the most efficient ways to identify the required information exchange or cooperation methods to be explored to solve coordination issues exposed in examples.

## Description of the BM for BUC WECL-FR-02: the Business Model Canvas

The BM associated with BUC WECL-FR-02 is focused on the TSO.

The canvas the BM for BUC WECL-FR-02 is provided in Table 3.10.

Table 3.10: BM canvas for BUC WECL-FR-02

<b>Key partnerships</b> - TSO/DSO workshops	<b>Key activities</b> - Defining and listing the main flexibility usages of both SOs - Illustrating what coordination issues it could entail now or in the future - Highlighting leads of further cooperation between TSO and DSO to tackle them	<b>Value proposition</b> - Highlights of possible leads of future cooperation between TSO and DSO	<b>Customer relationships</b> - Direct interaction via communication infrastructure.	<b>Customer</b> - DSO or TSO.
	<b>Key resources</b> - Flexibilities usage analysis for both SOs. - Literature recommendations		<b>Channel</b> - TSO/DSO communication infrastructure	
<b>Cost structure</b> - Human resources to carry on the operations (study)			<b>Revenue streams</b> - None	

### 3.3.1.2 Analysis made of this BM

Next, the analysis made of the BM for BUC WECL-FR-02 is provided concerning both the classification of stakeholder and the definition of strategies for the engagement of critical stakeholders and the analysis of the compatibility of this BM with local regulation.

#### Stakeholders' engagement analysis

In this section, the main stakeholders involved in the implementation of the BM for BUC WECL-FR-02 are identified and classified according to their ability to affect the implementation of the BM and their interest in facilitating this implementation. Then, relevant strategies for the engagement of critical stakeholders, who have large power to affect the successful implementation of the BM but low interest in favouring it, are provided.

#### Power-interest Matrix

The power interest matrix for the BM for BUC WECL-FR-02 is provided next, classifying in it the relevant stakeholders according to their power to affect the implementation of the BUC WECL-FR-02 and their incentives to facilitate this implementation. For each stakeholder, its power to affect the implementation of BUC WECL-FR-02 and interest in facilitating it is discussed within the matrix.

Table 3.11: Classification of the stakeholders for the BM associated with the BUC WECL-FR-02: Power-interest matrix

Stakeholder influence/power	High	<p>National regulators: Must create the right regulatory framework to reflect conclusions on TSO/DSO cooperation measures.</p>	<p>Industry Associations: They normally have strong connections with EU institutions and governments and can provide valuable best practices and guidelines on TSO/DSO cooperation that could be followed.</p> <p>National governments: Sharing the European view on this subject, they may perceive this as an opportunity for society, businesses, and consumers.</p> <p>DSOs: As entities responsible for the management and efficient operation of the networks, they have full interest in this use case. Nonetheless, their interest is dependent from the benefits/incentives from these solutions, from the existent of necessary regulatory framework to support it and from limitations that may exist regarding confidentiality of data to be exchanged.</p>
	Low	<p>Developers, engineers, and contractors: New business opportunities may be created, but also some may be affected by new activities. Therefore, the net effect is not clear. These groups are diverse and not organized, so it's expected that they are not decisive groups.</p>	None
		Low	High
		Stakeholder interest/support	

### Strategies for the engagement of critical stakeholders

Effective strategies must be implemented to achieve the involvement of relevant stakeholders. These are discussed next, placing the focus on critical stakeholders.

- High influence challengers (high influence but low interest)

This actor has strong influence but low interest, so their interest/support will need to be increased:

#### National regulators

1. The benefits of new business models have to be clearly explained to the regulator so the corresponding regulation can be developed in a timely manner. This can be achieved through educational seminars and whitepapers, presenting the results achieved in the demonstrators.
- High influence champions (high influence and high interest)

These actors are already interested in the BUC, but they must not be taken for granted:

#### Industry Associations

Industry Associations normally have strong connections with EU institutions and governments and can provide valuable best practices and guidelines on TSO/DSO cooperation that could be followed. Therefore:

1. Make sure the project objectives align with theirs, which can be done through dedicated workshops, seeking also to collect success stories and best practices on TSO/DSO cooperation that could be followed.
2. Make use of their channels to disseminate the conclusions from Business Case as recommendations.

#### National governments

After gathering the conclusions from the study, the national governments need to perceive, in a future stage, the benefits that the BM for BUC WECL-FR-02 would bring to society, businesses, and consumers. Therefore, there is need to:

1. Communicate the benefits from the implementation of proposed solutions. This can be done through engagement with governmental advisory bodies and think tanks to validate and disseminate these findings.
2. Work on developing policy briefs and success stories that showcase how the business model can positively affect national economies, employment, and sustainability.

#### DSOs

1. The regulatory framework must be drafted in a way that is not only more supportive of innovative investments, but also aligned with the cooperation needs from SOs.
  2. Regular interactions with the DSO, so that an aligned position for the cooperation measures that should be implemented.
- Low influence challengers (low influence and low interest)

These actors have no power nor interest in this business model:

### Developers, engineers, and contractors

Developers, engineers, and contractors may be affected by the BM for BUC WECL-FR-02, thus:

1. They should be early involved in discussions and developments to understand their needs and challenges better.
  2. Training and knowledge exchange sessions should be organized to show how the business model could eventually benefit them too.
- Low influence champions (low influence and high interest)

These actors have no power but have interest in the business models. No actors under this category were identified for the BM for BUC WECL-FR-02.

### **Analysis of the compatibility of the BM for BUC WECL-FR-02 with local regulation**

No regulatory barriers to the implementation of the BM for BUC WECL-FR-02 have been identified. This is due to the fact that BUC WECL-FR-02 only consists of a study on future possible coordination methods not implemented for now.

## 4 Description and analysis of the BMs associated with the BUCs defined for the Southern Cluster

In this section, we provide the representation made and qualitative analysis conducted of each of the BMs within each of the Demos in the cluster: the Greek Demo, and the Cypriot Demo. Those BUCs that do not provide room for the definition of a sensible BM associated with them are discarded. We address separately the description and analysis of the BMs for each Demo.

### 4.1 Description and analysis of the BMs for the Greek Demo

Here we provide a representation and analysis of the BMs within the Greek Demonstrator. Within the Greek Demonstrator, there are 2 BUCs defined, SOCL-GR-01 and SOCL-GR-02. In this case, the description and analysis is provided separately for each BM.

#### 4.1.1 Representation and analysis made the BM for BUC SOCL-GR-01 (Enhanced Active/Reactive Power Management for TSO-DSO coordination)

##### 4.1.1.1 Representation made of this BM

Before describing the structure of the BM, the main relationships established within the BM, the value created, and revenues and costs for the stakeholder that the BM focuses on resulting from its implementation, we remind the reader about some basic features of the BUC that the BM is associated with.

##### **Description of the BUC that this BM is associated with**

This section provides the description and analysis for the OneNet's BUC SOCL-GR-01, named: Enhanced Active/Reactive Power Management for TSO-DSO coordination, as described in the documents "D2.3 - Business Use Cases for OneNet".

The main scope of the BUC is the improvement of identification of available flexibility resources, focused on DSO voltage level, along with the improvement of identification of the power system flexibility needs, focused on TSO voltage level grid, on the longer time horizon and the wider geographical scope than the ones typically utilised at the moment, done through the simultaneous market and grid simulations backed up by AI based calculation engines. For that to happen, however, the needed input data, among other information, encompasses the measurements of the climate parameters that are supposed to be as accurate as possible in order to enable the successful forecasts of the weather indicators in the future and, by that, the technical limitations of the power system elements such as the renewable sources and the lines. In accordance with the provided description and roles that each of these participants was given in the process, DSO was selected as the



main actor in discussed business model. Its relationship with the other participants will be analysed in the appropriate section of this document.

### Objectives

In the respective BUC, the following objectives have been stated as relevant:

- Frequency stability;
- Load flow and contingency monitoring and predictions;
- Predictive congestion management for maintaining secure and stable power system operation;
- Cost-effective operation of the system;
- Early warning of the hazardous power system regimes;
- Better FSP planning and managing flexibility resources;
- Better energy and power system state predictions;
- Improved identification of the available flexibility resources on all power system levels;
- Improved prediction of the system flexibility needs.

Even though this document refers primarily to the business model that is assigned to the mentioned BUC and not to the BUC itself, it can be claimed that the goals in this list can be projected on the business model without any relevant modifications.

### Actors

The respective BUC related to this business model recognizes the large number of the actors in the described processes, with the simplified list given below for the sake of readability of the document. This does not harm the precision with which the relations between the actors will be shown, nonetheless, since most of the actors represent the relevant units inside TSO and/or DSO, with the main assumption used for simplifying the list of actors being the aggregation of all units in the TSO into one actor and all of the units in the DSO into another actor. The actors in the shortened list are:

- WFPs – either the particular units inside the TSO/DSO or the outsourced WFP companies responsible for weather forecasts for chosen weather parameters and locations in grid.
- TSO – the TSO in the area of interest for the business model (this includes all involved individual units in the TSO).
- DSO – the DSO in the area of interest for the business model (this includes all involved units in the DSO) – main actor in the model.
- MO – the operator of the electricity market in the area of interest for the discussed business model.
- FSPs – the FSPs, whether or not they are represented by the appropriate aggregator.

### Procedure

The procedure described in the BUC can be divided into five logical steps, with more details regarding each of them available in that document. Those steps are:

- Step 1: 1st forecasting phase (including the provision of the weather forecast, done by applying the cutting-edge AI-based algorithms, making it the vital part of the process for one of the selected main actors in the business model);
- Step 2: Prequalification phase;
- Step 3: 2nd forecasting phase;
- Step 4: Market phase;
- Step 5: Monitoring and activation phase.

### **Description of this BM: the Business Model Canvas**

The BM associated with this BUC is focused on the DSO.

Even though most of the information needed for the development of business model canvas for this document have been included in the aforementioned BUC, there were still some minor assumptions that had to be made before the canvas itself was created, with the most prominent of those claiming that the shares of costs in the cost structure remain the same in case in which the weather forecast is provided by external units and in case in which this task is performed by the assigned units in the TSO and DSO.

Next, the canvas of this BM is provided.

Table 4.1: BM canvas for BUC SOCL-GR-01

Key partnerships	Key activities	Value proposition	Customer relationships	Customers
<ul style="list-style-type: none"> <li>WFP delivers the forecasts of the weather parameters to the TSO and DSO .</li> <li>TSO and DSO use forecast to check the needs and the availability of the flexibility in the grid .</li> <li>FSPs offer the needed services to TSO and DSO .</li> <li>TSO and DSO use the data from the weather forecasts and FSPs to ensure proper grid operation .</li> </ul>	<ul style="list-style-type: none"> <li>Obtaining the weather data forecast;</li> <li>Modelling perspective grid;</li> <li>Determining the needs for flexibility;</li> <li>Communicating with MO to consider bids;</li> <li>Choosing the FSPs;</li> <li>TSO – DSO coordination.</li> </ul>	<p>The weather data forecasts made with the precision and the resolution higher than the ones offered by the available tools for this task, which will aid the TSO and DSO with:</p> <ul style="list-style-type: none"> <li>Detecting and mitigating the congestions in the system;</li> <li>Identifying and solving the potential problems related to voltages out of bounds;</li> <li>Improving power regulation through mFRR and RR;</li> <li>Providing the benchmark approach for the future implementation within the existing market.</li> </ul> <p>Since this enhances security of supply and grid reliability value of solution is verified.</p>	<ul style="list-style-type: none"> <li>Direct communication is set to improve the relations and develop the trust among the participants in the process;</li> <li>Additional calls and the web meetings will make the flow of the process smooth.</li> </ul>	<ul style="list-style-type: none"> <li>Demand that gets electrical energy from the distribution system, since it will see the improve in the security of supply once the solution is fully implemented.</li> <li>Generation connected to the distribution grid, as the more reliable operation of the system will also make the evacuation of produced energy into the grid easier.</li> <li>FSPs (with or without aggregator) that will have much simpler and more efficient methods of communicating with the SO after all of the described steps are taken.</li> </ul>
	Key resources		Channels	
	<ul style="list-style-type: none"> <li>Financial and other support needed for implementation of the developed solution;</li> <li>Weather measurements of the high enough quality;</li> <li>DSO and TSO voltage level forecasted grid models.</li> </ul>		<ul style="list-style-type: none"> <li>Presentation of the benefits to the DSO customers;</li> <li>Personal meetings with the customers to clarify some of the troublesome points;</li> <li>Public promotion of the new solution to gain attention;</li> <li>F-channel platform.</li> </ul>	
Cost structure		Revenue streams		

<p>From the experience on some of the other solutions of the comparable scale, the following estimations regarding the costs needed for implementing the solution were made:</p> <ul style="list-style-type: none"><li>• 25% - computer and other IT services;</li><li>• 25% - needed hardware (servers and equipment);</li><li>• 40% - necessary human resources;</li><li>• 10% - other costs.</li></ul>	<p>Based on the conducted analyses, the possible revenue streams have been identified:</p> <ul style="list-style-type: none"><li>• Better utilization of the flexibility resources allows the optimal selection of the offers, thus avoiding unnecessary costs for the same purposes.</li><li>• The easier resolution of the potential congestions in the grid will enable either the delay or shelving of the construction of the new infrastructure.</li><li>• The increased security of supply will prevent possible fees that would need to be paid to customers left without the power due to sub-optimal operation of the grid.</li></ul> <p>However, it should be stated that the DSO could not expect all of these revenues to come directly to it, since the DSO service is a regulated one and the costs are covered primarily by the network users. Hence, the network users would see the benefits from listed revenue streams. Nonetheless, DSO could expect at least a part of these revenues to come to it from the potential efficiency incentive schemes in which this solution could be included.</p>
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#### 4.1.1.2 Analysis made of this BM

Next, the analysis made of this BM is provided concerning both the classification of stakeholders and the definition of strategies for the engagement of critical stakeholders and the analysis of the compatibility of this BM with local regulation.

##### Stakeholders' engagement analysis

In this section, the main stakeholders involved in the implementation of this BM are identified and classified according to their ability to affect the implementation of the BM and their interest in facilitating this implementation. Then, relevant strategies for the engagement of critical stakeholders, who have large power to affect the successful implementation of the BM but low interest in favouring it, are provided.

##### Power-interest Matrix

The power interest matrix for this BM is provided next, classifying in it the relevant stakeholders according to their power to affect the implementation of the BUC and their incentives to facilitate this implementation. For each stakeholder, its power to affect the implementation of this BUC and interest in facilitating it is discussed within the matrix.

Table 4.2: Classification of the stakeholders for the BM associated with the BUC SOCL-GR-01: Power-interest matrix

		Stakeholder interest / support	
		Low	High
Stakeholder interest / power	High	<ul style="list-style-type: none"> <li>National regulatory agency: Some issues could arise from the potential adaptations of the legislation that will allow the implementation of the described procedure.</li> <li>Local authorities: Even though the avoidance of the unnecessary investments can be seen as advantage from national point of view, from the local perspective it can be perceived that operators do not invest enough in improving the power infrastructure.</li> </ul>	<ul style="list-style-type: none"> <li>European Union: Since this solution revolves around the flexibility services that were strongly supported by the latest political decisions, the similar approach can be expected for this solution as well.</li> <li>National ministries and governments: This solution will allow more efficient usage of available resources, thus giving an opportunity to avoid unnecessary costs, which is</li> </ul>
	Low		

			<p>certain to get support from these bodies.</p> <ul style="list-style-type: none"> <li>• SOs (TSO and DSO): The proposition will provide the operators with the chance to resolve the problems in the system in a simple and almost instant way, enhancing the performances of the existing grid.</li> </ul>
	<p>LOW</p>	<ul style="list-style-type: none"> <li>• Local population: Similar to the local authorities, the local population could understand the lack of the new infrastructure (that is, actually, a benefit from the entire solution) as the lack of activity from the TSO and DSO side, leading to the potential backlash.</li> </ul>	<ul style="list-style-type: none"> <li>• Environmental activists: The suggested solution will enable the better efficiency of the power system and the optimal usage of the distributed flexibility services, so it is aligned with the targets of sustainable principles.</li> <li>• Technology providers: The proposed solution is sure to bring the need for procurement of the technology that will enable the proper application, with the support also expected from the producers of needed components.</li> <li>• FSPs: This solution will provide the FSPs with unique opportunity to offer services in the simple and efficient way, enhancing the communication between the FSPs and the power SOs.</li> </ul>

Strategies for the engagement of critical stakeholders

Effective strategies must be implemented to achieve the involvement of relevant stakeholders. These are discussed next, placing the focus on critical stakeholders.

As can be seen, the largest number of the stakeholders that were identified as relevant for the discussed solution can be placed in the high-support category, regardless of their level of influence. Among these, the

support can be divided in two categories: the political support, which should come from relevant national and international bodies and authorities, and the technical support, set to arrive from the users of the developed solution themselves. In order, however, to make the transition to this solution smooth, it is necessary to pay attention to the communication with national regulatory agencies and the local authorities to let them know of the numerous benefits and improvements that can be expected if the proposed solution gets approved and applied.

Since the different stakeholders can be placed in the different categories based on the level of influence that they possess and the level of support that can be expected from them once the topic of implementing the developed solution in the everyday practice, each of these categories also requires the particular manner of communication:

- High influence challengers (high influence but low interest)

As NRAs and local Authorities represent the most obstructive group, it is vital for success of the solution to convince them of the usefulness and possible benefits of the integration of the proposal into the standard procedures, which could possibly be done either through the public consultations or the private meetings.

The optimal methodology for dealing with the identified challengers depends on the reasons behind the expected opposition on their side, so it would be the best to make an effort to detect those reasons before going further. There is a total of two critical challengers that have been mentioned in the canvas above, so it will not be too difficult to try to see the proposed novelty from each of their points of view. First of all, the regulatory agency could, as stated above, start questioning whether or not are the effort and the resources that will have to be dedicated to the modifications of the existing methodologies and regulations worth the benefits that can be expected from the implementation of novelty. In order to relieve the concerns and ensure the seamless integration of the novel solution, the one-on-one meetings would most likely be the optimal way to go, with each of the meetings dedicated to one of the troublesome points related to the proposed solution, determined before the meeting by the regulator itself.

On the other hand, the local authorities are foreseen to have entirely different perspective and, thus, entirely different motivation for potentially opposing the proposed solution. Namely, backlash here could actually come from one of the main benefits of the application of the developed tool – the avoidance of new investments in the system if the need for those investments doesn't exist once the solution is integrated. Although this represents a massive benefit from the point of view of the SO and society as a whole, it could, through the eyes of the local authorities, be perceived as the lack of activities regarding the reinforcements of the grid in region under their governance. Depending on the importance and the connections of persons that understand the avoidance of the investments as the

passive behaviour of the operator, they could make the process of integrating the proposed solution rather difficult or, even, cancel it completely. For this to be avoided, the public consultations and presentations could be relevant in order to explain to the local authorities that the lack of the investments of the SO does not mean that the region is neglected or that there will be any issues in the system regarding the security of supply, but that there is just a more cost-efficient way to substitute the new investments and achieve the same effects in the process. It could also be followed by the proclamation that the avoided investments in the affected area can even make room in the budget for the additional projects that could make the situation in the region even better than it would have been if the original investment stayed in the plans of the SO. Hopefully, this would be sufficient for them to stop the opposition to the novel solution and maybe even start supporting it.

- High influence champions (high influence and high interest)

As these stakeholders (EU, national authorities, ministries and SOs) are expected to use their power and influence in order to make the transition to the new solution quick and efficient, it is necessary to keep their interest in the proposal and let them know of any progress that has been made or is set to be made in the respective periods of time.

- Low influence challengers (low influence and low interest)

This group of stakeholders (local population) is not expected to have any real impact on the success of the solution's implementation, but it would be good to present the benefits of the developed solution to them as well, just to avoid any possibility of issues related to the resistance of the local population down the path. Even though it is not expected for the population to have any reason to oppose the suggested solution, there is still a slight possibility that the opinion of people could be the same as the opinion of the local authorities, making the point of the relevance of the proper communication with both the local authorities and the population via the presentations and the consultations even more understandable. As the support of this conclusion, one should consider the situations in power sector in which the integration of new technologies needed to be stopped due to the public backlash. For this kind of undesired outcome to be avoided, it would be good to simply ensure that the population has the insight into the positive sides of the proposed tool, turning them from the potential foes into potential allies.

- Low influence champions (low influence and high interest)

As these stakeholders (technology providers, environmental activists, FSPs) are seen as rather positively oriented towards the solution, their support should not be taken for granted and should be used to enhance solution further through maintaining the periodical communication with them and considering their opinions when updating developed tools and channels.



## **Analysis of the compatibility of this BM with local regulation**

This section provides the identification of the regulatory barriers to the implementation and success of the local Market for SO Services business model defined here. The information discussed here has been obtained based on the WP3/WP11 Regulatory Questionnaire carried out for all the demonstrators. The regulatory barriers and possible measures to tackle them are presented below.

Four different types of regulatory barriers are identified here: Administration barriers, barriers related to the development of standard solutions, barriers imposing additional costs, and barriers related to development of trust among the parties. The identification of the regulatory barriers to the implementation and success of this business model will be conducted based on the current state of play in Greece, with the definition of measures that could help in mitigating the following barriers. However, if this solution was to be applied anywhere else, a similar analysis would need to be conducted while considering the regulatory framework of the respective country.

Currently in Greece, there is neither a Market for SO Services in place nor a complete regulatory framework for its operation. As a result, the roles and actors and their responsibilities within such a market are not fully defined, while extra enabling regulation for its successful operation is missing. In the following, the main regulatory barriers that encumber the implementation of a Market for SO Services in Greece are provided and analysed.

### Administration barriers

- Missing Local Market for SO Services regulation, roles and responsibilities

In Greece, the MO role and the relevant regulation has not yet been defined for Markets for SO Services since currently no Market for SO Services exists. The market for balancing services is the only defined and operated by the TSO in a non-market-based, centralized manner giving importance to system security. Congestion management and voltage control issues should be dealt with through such a market. Currently, congestion management and voltage control are performed in a non-market-based manner. Both are based on static security assessment according to N-1 criterion. Congestion management is performed in the balancing market by means of constraints imposed per case on the total group of units that need to be re-dispatched based on unit production and commitment. Voltage control issues are addressed by proper unit dispatch (alter generation and load patterns of generators >2MW to change physical flows in the transmission system) and shunt element activation.

- Aggregator model, and role not fully defined

Within Greece, independent aggregators are allowed but not yet active in the country. They can manage RES generation and demand resources and, in the future, they will be able to manage storage resources. They can be different from retail companies but currently they are within the latter

(subsidiaries). However, the relationship between independent aggregators and BRPs need to be further defined. Also baseline techniques, information exchange requirements, data and communication protocols need to be clearly outlined.

In addition, the remuneration schemes between aggregators, FSPs, and SOs need to be further defined, according to Incentives for the use of flexibility in distribution networks: Art. 44 +48 +54 Law<sup>4</sup> 4986/2022.

Furthermore, balancing responsibility is only defined at a unit level [29]. Considering the possibility that this is defined at a portfolio level would foster the development of aggregators.

- Missing operation rules of storage devices

In Greece, the TSO, currently, cannot operate storage (Art. 54 944/2019 + Art. 64 Law 4951/2022)<sup>5</sup> and it cannot operate generation either. The TSO can only apply constraints – curtailments on wind and solar parks. Analogously, the DSO is currently not allowed to operate neither storage [26], nor generation, apart from the case of backup gensets which are used under emergency situations (i.e. loss of supply by the upstream network). DSO also is allowed to apply constraints/curtailments for DER when it is necessary (i.e. emergency situation or as a preventive security measure). Defining further specific conditions under which the operation of storage/generation devices by the SO would be allowed could provide them with additional flexibility procurement mechanisms to address the system needs.

- Barriers to the participation of agents in Markets for SO Services

In Greece, demand resources can only participate in the balancing market (real-time) but not in other Markets for SO Services yet. End-user residential aggregators and customers cannot participate in the markets yet, as the main barrier is the lack of smart meters. DR is explicitly limited to the balancing market (Real Time Balancing Market) by law and is not allowed to participate in the other electricity markets. The Greek TSO recently released for public consultation an initial set of guidelines for aggregated demand participation in the balancing market to provide FCR, aFRR, and mFRR products. Residential load aggregators are allowed to participate in the market under these principles, once they have fulfilled several requirements, like issuing a minimum bid of 1 MW. (DR through aggregation[31].

#### Barriers related to the development of standard solutions

- Lack of TSO-DSO coordination scheme

In Greece, the TSO-DSO coordination scheme (harmonized rules and requirements) is not defined yet. There is not a common interface in place for TSO-DSO coordination. Regarding the TSO-DSO planning

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<sup>4</sup> <https://www.taxheaven.gr/law/4986/2022>

<sup>5</sup> <https://www.taxheaven.gr/law/4951/2022>

and operation coordination, there is only some information exchange in a non-standard manner for the maintenance schedules of their units, featuring a 10-year planning of IPTO, and a 5-year planning of HEDNO. Besides, some common flexibility registry, common product attributes, prequalification process, and type of information exchange (there is an initial regulatory attempt) need to be defined.

- Lack of submetering regulation

Dedicated meters can be an enabler for measuring the flexibility delivered by specific resources (e.g., electric vehicles), enabling aggregation business models specialized in a segment of resources (e.g., electric vehicles), and enabling more accurate baseline calculations guiding to a more standard service provision. However, within Greece, there is a lack of a submetering infrastructure and regulatory framework. No formalized rules for submetering exist in Greece. The entity currently responsible for collecting the metered data is the TSO for assets connected to the transmission system, and the DSO for assets connected to the distribution system (different practices; i.e. data types, protocols, etc. – non harmonized).

#### Barriers imposing additional costs

- Lack of suitable regulation for flexibility procurement mechanisms

Within Greece, there is a lack of regulation on mechanisms for procurement of flexibility. This is only defined within the balancing market – in an auction-based format – and for frequency products. The acquisition of flexibility may not rely only on one specific mechanism, but will rather involve applying a combination of them, depending on the characteristics of the needs and the resources that can provide this flexibility. These mechanisms, which can span various timeframes ranging from long-term planning to real-time operation, include connection and access agreements, bilateral contracts, auctions, dynamic tariffs and others. The design of these mechanisms needs to be carefully considered in order for them to effectively complement each other, produce consistent signals, and optimize the utilization of all the resources leading to cost minimization related to flexibility provision.

#### Barriers related to development of trust among the parties

- Lack of regulation protecting prosumers from market power abuse exerted by limiting access to information.

In Greece, there is a lack of regulation that protects stakeholders from market abuse by incumbent access to information. To enable the development of local Markets for SO Services, the availability of data on the individual prosumers profiles is required to assess the flexibility potential and develop new business models which can be offered to such prosumers.

## 4.1.2 Representation and analysis made of the BM for BUC SOCL-GR-02 (Enhanced severe weather condition management and outage management for TSO, DSO and microgrid operator)

### 4.1.2.1 Representation made of this BM

Before describing the structure of the BM, the main relationships established within it, value created by it, and revenues and costs for the stakeholder that the BM focuses on resulting from its implementation, we remind the reader about some basic features of the BUC that the BM is associated with.

#### Description of the BUC that this BM is associated with

This section provides the description and analysis for the OneNet's BUC SOCL-GR-02, as described in the documents "D2.3 - Business Use Cases for OneNet".

This BUC is named Enhanced severe weather condition management and outage management for TSO, DSO and micro grid operator, related to the Greek Demo of the Southern Cluster. The main target of this BUC is enhancement of severe weather condition management with predictive maintenance algorithms, accompanied by improved storm and icing predictions in order to preserve power system from running into dangerous topological or operational regimes. The process is based on obtaining the weather forecast of the high enough resolution, derived from the application of the cutting-edge AI algorithms, and using them to foresee the potential critical states of the system that could happen due to the severe weather conditions. Along with the detection of the hazardous work regimes and topologies of the system, the BUC includes the development of the Early warning mechanism that will allow SO sufficient time to react and prevent or, at least, mitigate any unwanted consequences. For that to happen, however, the needed input data, among other information, encompasses the measurements of the climate parameters that are supposed to be as accurate as possible in order to enable the proper forecasting of the weather parameters and, by that, the technical limitations of the system elements such as the renewable sources and the lines. In accordance with the stated roles that were given to participants in the process, the central actor in this business model is the WFP. Its relations with the other actors in the model will be explained in the upcoming appropriate sections of this document.

#### Objectives

In the respective BUC, the following objectives have been stated as relevant:

- Predictive maintenance and outage management;
- Enhanced severe weather condition management;
- Outage management optimisation for increased system adequacy,
- Early warning on a potentially hazardous power system topology and regimes;
- Avoidance of a damages caused by the severe weather conditions;

- Improved prediction of the system flexibility needs.

Even though this document refers primarily to the business model that is assigned to the mentioned BUC and not to the BUC itself, it can be claimed that the goals in this list can be projected on the business model without any relevant modifications.

### Actors

The respective BUC related to this business model recognizes the large number of the actors in the described processes, with the simplified list given below for the sake of readability of the document. This does not harm the precision with which the relations between the actors will be shown, nonetheless, since most of the actors represent the relevant units inside TSO and/or DSO, with the main assumption used for simplifying the list of actors being the aggregation of all units in the TSO into one actor and all of the units in the DSO into another actor. The actors in the shortened list are:

- WFP – either the units inside the TSOs/DSOs or the outsourced WFP companies responsible for weather forecasts for chosen weather parameters and locations in grid – main actor.
- TSO – the TSO in the area of interest for the business model (this includes all involved individual units in the TSO).
- DSO – the DSO in the area of interest for the business model (this includes all involved individual units in the DSO).
- MO – the operator of the electricity market in the area of interest for the discussed business model.
- FSPs – the FSPs, whether or not they are represented by the appropriate aggregator.

### Procedure

The procedure described in the BUC can be divided into seven logical steps, with more details regarding each of them available in that document. Those steps are:

- Step 1: Weather forecast;
- Step 2: Energy predictions;
- Step 3: Update of the grid model;
- Step 4: Severe power system regime detection;
- Step 5: Mitigation measure identification;
- Step 6: Providing the information of interest to FSPs, aggregators and so on;
- Step 7: Confirmation of the receiving the information.

### **Description of this BM: the Business Model Canvas**

This BM is focused on the WFP as the central stakeholder.

### Assumptions for the business model canvas

Even though most of the information needed for the development of business model canvas for this document have been included in the aforementioned BUC, there were still some minor assumptions that had to be made before the canvas itself was created, with the most prominent of those claiming that the shares of costs in the cost structure remain the same in the case in which the weather forecast is provided by external units and in the case in which this task is performed by the assigned units in the TSO and DSO.

### Canvas

Next, the canvas of this BM is provided.

Table 4.3: BM canvas for BUC SOCL-GR-02

Key partnerships	Key activities	Value proposition	Customer relationships	Customers
<ul style="list-style-type: none"> <li>WFP delivers the forecasts of the weather parameters to the TSO and DSO .</li> <li>TSO and DSO use forecast to model the state of system and potentially spot regime in which the problems may occur .</li> </ul>	<ul style="list-style-type: none"> <li>Obtaining hardware tools;</li> <li>Obtaining software tools;</li> <li>Weather data measuring;</li> <li>Weather data forecasting;</li> <li>Providing the forecast to the SOs.</li> </ul>	<p>From the perspective of the SOs, having the accurate weather forecast is equivalent to being able to look into the future regarding the state of the grid, so the solutions for the issues can be found in a timely manner. This will reduce the fees that need to be paid to repair the damaged elements of grid and cover the losses of the customers connected to the grid. In turn, this also means that the SOs will have the resources to spend on the weather services, so the process will be beneficial from the WFP point of view.</p>	<ul style="list-style-type: none"> <li>Direct communication is set to improve the relations and develop the trust among the participants in the process;</li> <li>Additional calls and the web meetings will make the flow of the process smooth.</li> </ul>	<ul style="list-style-type: none"> <li>SOs (both the DSO and the TSO) that will experience the benefits of having accurate forecasts of the climatic indicators at their disposal. The forecast can, then, be used in order to build perspective models of the grid (regardless of the voltage level corresponding to the observed part of the system) and give operators a chance to spot issues and react in time to avoid some of the consequences which would potentially harm not only the grid, but also the customers connected to it.</li> </ul>
	Key resources		Channels	
	<ul style="list-style-type: none"> <li>Financial and other support needed for implementation of the developed solution;</li> <li>Necessary tools (hardware and software) for the job;</li> <li>Weather measurements of the high enough quality.</li> </ul>		<ul style="list-style-type: none"> <li>Personal meetings that will be used to discuss some of the more prominent topics;</li> <li>Web meetings for resolving some of the minor issues;</li> <li>F-channel platform, once it gets completely developed.</li> </ul>	
Cost structure		Revenue streams		

<p>From the experience on some of the other solutions of the comparable scale, the following estimations regarding the costs needed for implementing the solution were made:</p> <ul style="list-style-type: none"><li>• 25% - computer and other IT services;</li><li>• 40% - needed hardware (servers and equipment for measuring the weather parameters);</li><li>• 25% - necessary human resources;</li><li>• 10% - other costs.</li></ul>	<p>Based on the conducted analyses, the revenue streams for the WFP, as the main actor of the suggested business model, have been identified:</p> <ul style="list-style-type: none"><li>• Incomes based on the currently signed contracts, due to which the forecasts of the high resolution and accuracy get delivered to the SOs, are expected, with the amounts of cash inflow depending on the previously agreed terms.</li><li>• The positive sides of the new algorithms are bound to reflect on the reputation of the WFP, ensuring extensions of the currently valid contracts and giving the solid basis for negotiations with other clients that may be interested.</li><li>• Moreover, confirmed enhanced reliability of the obtained forecasts reduces chance of negative feedback that could have consequences varying from the loss of the future job opportunities to legal actions and lawsuits against the service provider.</li></ul>
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#### 4.1.2.2 Analysis made of this BM

Next, the analysis made of this BM is provided concerning both the classification of stakeholders and the definition of strategies for the engagement of critical stakeholders and the analysis of the compatibility of this BM with local regulation.

##### Stakeholders' engagement analysis

In this section, the main stakeholders involved in the implementation of this BM are identified and classified according to their ability to affect the implementation of the BM and their interest in facilitating this implementation. Then, relevant strategies for the engagement of critical stakeholders, who have large power to affect the successful implementation of the BM but low interest in favouring it, are provided.

##### Power-interest Matrix

The power interest matrix for this BM is provided next, classifying in it the relevant stakeholders according to their power to affect the implementation of the BUC and their incentives to facilitate this implementation. For each stakeholder, its power to affect the implementation of this BUC and interest in facilitating it is discussed within the matrix.

Table 4.4: Classification of the stakeholders for the BM associated with the BUC SOCL-GR-02: Power-interest matrix

		Stakeholder interest / support	
		Low	High
Stakeholder influence / power	High	<ul style="list-style-type: none"> <li>National regulatory agency: Some issues could arise from the potential adaptations of the legislation that will allow the implementation of the described procedure.</li> <li>Local authorities: Even though the avoidance of the unnecessary investments can be seen as advantage from national point of view, from the local perspective it can be perceived that operators do not invest enough in improving and repairing the power infrastructure.</li> </ul>	<ul style="list-style-type: none"> <li>European Union: Since this solution revolves around the system efficiency and optimal usage of the existing infrastructure in order to improve the security of supply, strong support can be expected for the solution.</li> <li>National ministries and governments: This solution will allow more efficient usage of available resources, thus giving an opportunity to avoid unnecessary costs, which is certain to get support from these bodies.</li> </ul>
	Low		

			<ul style="list-style-type: none"> <li>• SOs (TSO and DSO): The proposition will provide the operators with the chance to resolve the problems in the system in a simple and almost instant way, enhancing the performances of the existing grid.</li> </ul>
	Low	<ul style="list-style-type: none"> <li>• Local population: Similar to the local authorities, the local population could understand the lack of the new or refurbished infrastructure (that is, actually, a benefit from the entire solution) as the lack of activity from the TSO and DSO side, leading to the potential backlash.</li> </ul>	<ul style="list-style-type: none"> <li>• Environmental activists: The suggested solution will enable the better efficiency of the power system and the optimal usage of the distributed flexibility services, so it is aligned with the targets of sustainable principles.</li> <li>• Technology providers: The proposed solution is sure to bring the need for procurement of the technology that will enable the proper application, with the support also expected from the producers of needed components.</li> <li>• FSPs: This solution will provide the FSPs with unique opportunity to offer services in the simple and efficient way, enhancing the communication between the FSPs and the power SOs.</li> </ul>

### Strategies for the engagement of critical stakeholders

Effective strategies must be implemented to achieve the involvement of relevant stakeholders. These are discussed next, placing the focus on critical stakeholders.

As can be seen, the largest number of the stakeholders that were identified as relevant for the discussed solution can be placed in the high-support category, regardless of their level of influence. Among these, the

support can be divided in two categories: the political support, which should come from relevant national and international bodies and authorities, and the technical support, set to arrive from the users of the developed solution themselves. In order, however, to make the transition to this solution smooth, it is necessary to pay attention to the communication with national regulatory agencies and the local authorities to let them know of the numerous benefits and improvements that can be expected if the proposed solution gets approved and applied.

Since the different stakeholders can be placed in the different categories based on the level of influence that they possess and the level of support that can be expected from them once the topic of implementing the developed solution in the everyday practice, each of these categories also requires the particular manner of communication:

- High influence challengers (high influence but low interest)

As these stakeholders (national regulatory agency, local authorities) represent the most obstructive group, it is vital for the success of the solution to convince them of the usefulness and possible benefits of the integration of the proposal into the standard procedures, which could possibly be done either through the public consultations or the private meetings.

The optimal methodology for dealing with the identified challengers depends on the reasons behind the expected opposition on their side, so it would be the best to make an effort to detect those reasons before going further. There is a total of two critical challengers that have been mentioned in the canvas above, so it will not be too difficult to try to see the proposed novelty from each of their points of view. First of all, the regulatory agency could, as stated above, start questioning whether or not the benefits that can be expected from the implementation of the considered solution are worth the effort and the resources that will have to be dedicated to modifying the existing methodologies and regulations. In order to relieve the concerns and ensure the seamless integration of the novel solution, the one-on-one meetings would most likely be the optimal way to go, with each of the meetings dedicated to one of the troublesome points related to the proposed solution, determined before the meeting by the regulator itself.

On the other hand, the local authorities are foreseen to have an entirely different perspective and, thus, a entirely different motivation for potentially opposing the proposed solution. Namely, backlash here could actually come from one of the main benefits of the application of the developed tool – the avoidance of new investments in the system if the need for those investments doesn't exist once the solution is integrated. Although this represents a massive benefit from the point of view of the SO and society as a whole, it could, through the eyes of the local authorities, be perceived as the lack of activities regarding the reinforcements of the grid in the region under their governance. Depending on the importance and the connections of persons that understand the avoidance of the investments as

the passive behaviour of the operator, they could make the process of integrating the proposed solution rather difficult or, even, cancel it completely. For this to be avoided, the public consultations and presentations could be relevant in order to explain to the local authorities that the lack of the investments of the SO does not mean that the region is neglected or that there will be any issues in the system regarding the security of supply, but that there is just a more cost-efficient way to substitute the new investments and achieve the same effects in the process. It could also be followed by the proclamation that the avoided investments in the affected area can even make room in the budget for the additional projects that could make the situation in the region even better than it would have been if the original investment stayed in the plans of the SO. Hopefully, this would be sufficient for them to stop the opposition to the novel solution and maybe even start supporting it.

- High influence champions (high influence and high interest)

As these stakeholders (EU, national authorities, ministries and SOs) are expected to use their power and influence in order to make the transition to the new solution quick and efficient, it is necessary to keep their interest in the proposal and let them know of any progress that has been made or is set to be made in the respective periods of time.

- Low influence challengers (low influence and low interest)

This group of stakeholders (local population) is not expected to have any real impact on the success of the solution's implementation, but it would be good to present the benefits of the developed solution to them as well, just to avoid any possibility of issues related to the resistance of the local population down the path. Even though it is not expected for the population to have any reason to oppose the suggested solution, there is still a slight possibility that the opinion of people could be the same as the opinion of the local authorities, making the point of the relevance of the proper communication with both the local authorities and the population via the presentations and the consultations even more understandable. As the support of this conclusion, one should consider the situations in power sector in which the integration of new technologies needed to be stopped due to the public backlash. For this kind of undesired outcome to be avoided, it would be good to simply ensure that the population has the insight into the positive sides of the proposed tool, turning them from the potential foes into potential allies.

- Low influence champions (low influence and high interest)

Although these stakeholders (technology providers, FSPs and environmental activists) are seen as positively oriented towards the solution, their support should not be taken for granted and should be used to enhance solution further through maintaining the periodical communication with them and considering their opinions when updating tools and channels.

## Analysis of the compatibility of this BM with local regulation

This section provides the identification of the regulatory barriers to the implementation and success of the local Market for SO Services business model defined here. The information discussed here has been obtained based on the WP3/WP11 Regulatory Questionnaire carried out for all the demonstrators. The regulatory barriers and possible measures to tackle them are presented below.

Four different types of regulatory barriers are identified here: Administration barriers, barriers related to the development of standard solutions, barriers imposing additional costs, and barriers related to development of trust among the parties.

### Administration barriers

- Missing Local Market for SO Services regulation, roles and responsibilities

In Greece, the MO role and the relevant regulation has not yet been defined for Markets for SO Services since currently no Market for SO Services exists. The market for balancing services is the only defined and operated by the TSO in a non-market-based, centralized manner giving importance to system security. Congestion management and voltage control issues should be dealt with through such a market. Currently, congestion management and voltage control are performed in a non-market-based manner. Both are based on static security assessment according to N-1 criterion. Congestion management is performed in the balancing market by means of constraints imposed per case on the total group of units that need to re-dispatched based on unit production and commitment. Voltage control issues are addressed by proper unit dispatch (alter generation and load patterns of generators >2MW to change physical flows in the transmission system) and shunt element activation.

- Aggregator model, and role not fully defined

Within Greece, independent aggregators are allowed but not yet active in the country. They can manage RES generation and demand resources, and in the future, they will be able to manage storage resources. They can be different from retail companies but currently they are within the latter (subsidiaries). However, the relationship between independent aggregators and BRPs need to be further defined. Also baseline techniques, information exchange requirements, data and communication protocols need to be clearly outlined.

In addition, the remuneration schemes between aggregators, FSPs, and SOs need to be further defined, according to Incentives for the use of flexibility in distribution networks: Art. 44 +48 +54 Law 4986/2022<sup>6</sup>.

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<sup>6</sup> <https://www.taxheaven.gr/law/4986/2022>

Furthermore, balancing responsibility is only defined at a unit level [29]. Considering the possibility that this is defined at a portfolio level would foster the development of aggregators.

- Missing operation rules of storage devices

In Greece, the TSO, currently, cannot operate storage. Art. 54 944/2019 + Art. 64 Law 4951/2022<sup>7</sup> and it cannot operate generation either. The TSO can only apply constraints – curtailments on wind and solar parks. Analogously, the DSO is currently not allowed to operate neither storage [26], nor generation, apart from the case of backup gensets which are used under emergency situations (i.e. loss of supply by the upstream network). DSO also is allowed to apply constraints/curtailments for DER when it is necessary (i.e. emergency situation or as a preventive security measure). Defining further specific conditions under which the operation of storage/generation devices by the SO would be allowed could provide them with additional flexibility procurement mechanisms to address the system needs.

- Barriers to the participation of agents in Markets for SO Services

In Greece, demand resources can only participate in the balancing market (real-time) but not in other Markets for SO Services yet. End-user residential aggregators and customers cannot participate in the markets yet, as the main barrier is the lack of smart meters. DR is explicitly limited to the balancing market (Real Time Balancing Market) by law and is not allowed to participate in the other electricity markets. The Greek TSO recently released for public consultation an initial set of guidelines for aggregated demand participation in the balancing market to provide FCR, aFRR, and mFRR products. Residential load aggregators are allowed to participate in the market under these principles, once they have fulfilled several requirements, like issuing a minimum bid of 1 MW. (DR through aggregation: Art. 23 +32 Law 4986/2022.

#### Barriers related to the development of standard solutions

- Lack of TSO-DSO coordination scheme

In Greece, the TSO-DSO coordination scheme (harmonized rules and requirements) is not defined yet. There is not a common interface in place for TSO-DSO coordination. Regarding the TSO-DSO planning and operation coordination, there is only some information exchange in a non-standard manner for the maintenance schedules of their units, featuring a 10-year planning of IPTO, and a 5-year planning of HEDNO. Besides, some common flexibility registry, common product attributes, prequalification process, and type of information exchange (there is an initial regulatory attempt) need to be defined.

- Lack of submetering regulation

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<sup>7</sup> <https://www.taxheaven.gr/law/4951/2022>

Dedicated meters can be an enabler for measuring the flexibility delivered by specific resources (e.g., electric vehicles), enabling aggregation business models specialized in a segment of resources (e.g., electric vehicles), and enabling more accurate baseline calculations guiding to a more standard service provision. However, within Greece, there is a lack of a submetering infrastructure and regulatory framework. No formalized rules for submetering exist in Greece. The entity currently responsible for collecting the metered data is the TSO for assets connected to the transmission system, and the DSO for assets connected to the distribution system (different practices; i.e. data types, protocols, etc. – non harmonized).

#### Barriers imposing additional costs

- Lack of suitable regulation for flexibility procurement mechanisms

Within Greece, there is a lack of regulation on mechanisms for procurement of flexibility. This is only defined within the balancing market – in an auction-based format – and for frequency products. The acquisition of flexibility may not rely only on one specific mechanism, but will rather involve applying a combination of them, depending on the characteristics of the needs and the resources that can provide this flexibility. These mechanisms, which can span various timeframes ranging from long-term planning to real-time operation, include connection and access agreements, bilateral contracts, auctions, dynamic tariffs and others. The design of these mechanisms needs to be carefully considered in order for them to effectively complement each other, produce consistent signals, and optimize the utilization of all the resources leading to cost minimization related to flexibility provision.

#### Barriers related to development of trust among the parties

- Lack of regulation protecting prosumers from market power abuse exerted by limiting access to information

In Greece, there is a lack of regulation that protects stakeholders from market abuse by incumbent access to information. To enable the development of local Markets for SO Services, the availability of data on the individual prosumers profiles is required to assess the flexibility potential and develop new business models which can be offered to such prosumers.

## **4.2 Description and analysis of the BMs for the Cypriot Demo**

Here we provide a representation and analysis of the BMs within the Cypriot Demonstrator. Within the Cypriot Demonstrator, there are 2 BUCs defined, SOCL-CY-01: Active power flexibility and SOCL-CY-02: Reactive power flexibility and power quality. In this case, the description and analysis is provided separately for each BM.

## 4.2.1 Representation and analysis made the BM for BUC SOCL-CY -01

### 4.2.1.1 Representation made of this BM

Before describing the structure of the BM, the main relationships established within it, value created by it, and revenues and costs for the stakeholder that the BM focuses on resulting from its implementation, we remind the reader about some basic features of the BUC that the BM is associated with.

#### **Description of the BUC that this BM is associated with**

This section provides the description and analysis for the OneNet's BUC SOCL-CY-01, as described in the document "D2.3 - Business Use Cases for OneNet".

This BUC exploits the flexible resources of the distribution grid (large energy storage systems, PV parks, prosumers) under an aggregator to provide active power related services in the framework of primary reserve such as droop control of flexible resources to support frequency.

The frequency support service will be procured by the DSOs to the TSO market where the aggregator will bid the procured offers by the TSO. The energy market will allocate the services to the aggregators according to the market rules. The activation of these services will be automatically coordinated by the operator and/or based on the grid operating conditions. As indicated above, the central actor selected for this business model is the Aggregator, which, in this case will have a portfolio of flexible resources. The benefits of the aggregator in this BUC will be to increase their revenues through the provision of frequency support services.

#### Objectives

Based on the objectives of the demonstrator, we can state that:

1. The TSO aims to maintain the frequency stability of the grid in case of a disturbance
2. Provision of frequency support services from DERs through an aggregator

#### Actors

We find four actors in this BUC:

- TSO: will procure products related to frequency support services.
- DSO: will prequalify the aggregator bids to the TSO Central market in order to avoid congestion to the distribution grid.
- Aggregator: will provide frequency support services through the flexible resources having in its portfolio such as flexible service providers, prosumers.
- IMO (IMO): will award market products related to frequency and congestion management services.



## Procedure

The procedure applied in the demonstrator was structured in seven steps, that are described next:

1. Procurement of products: TSO sends procured products to TSO market and DSO local market through the OneNet System
2. Prequalification: DSO and TSO determines the admissible limits (for having a safe operation of the grid) at the MV/LV and HV/MV interface respectively. This is done through using Active Balancing Congestion Management for TSO and DSO (ABCM-D and ABCM-T) platforms. The limits are sent to TSO and local DSO market through the OneNet system.
3. Bidding: Aggregators in the distribution level bid for the frequency procured products in the market through the OneNet system.
4. Market clearing: TSO central market is cleared and the awarded bids are sent through the OneNet system to the Aggregator.
5. Trigger of the event: A grid fault occurs, the protection mechanisms clear the fault, but a generation unit is lost and as a consequence an intense frequency disturbance occurs risking the frequency stability of the power system.
6. Provision of frequency support: The aggregators (FSP, aggregators, prosumers) provide automatic frequency support and synthetic inertia to balance the frequency.
7. Online evaluation of the frequency stability and the response of the FSPs to the frequency event: TSO through the ABCM-T platform evaluate the response of the FSPs to the frequency event. The evaluation is based on real time monitoring data. The evaluation is sent to TSO market.

## **Description of this BM: the Business Model Canvas**

The BM associated with this BUC is focused on the Aggregator.

## Assumptions

Even though most of the information needed for the development of business model canvas for this document has been included in the aforementioned BUC, there are still some minor assumptions that had to be made before the canvas itself was created. Since there is not a TSO market, an artificial TSO market was created for the case of the demonstration where the TSO will procure frequency support services in this market and the Aggregator will submit its bid in this market. Next, the canvas of this BM is provided.

Table 4.5: BM canvas for BUC SOCL-CY-01

<p><b>Key partnerships</b></p> <ul style="list-style-type: none"> <li>- TSO market (acquisition of particular resources and activities).</li> <li>- Pre-qualification of the grid product by the DSO (reduction of risk and uncertainty).</li> <li>- Provision of frequency support by the FSPs (acquisition of particular resources or activities).</li> </ul>	<p><b>Key activities</b></p> <ul style="list-style-type: none"> <li>- Monitor the offers in the TSO market</li> <li>- Provide bids in the TSO market</li> <li>- Send the requested offers to the FSPs under aggregator's jurisdiction</li> </ul>	<p><b>Value proposition</b></p> <ul style="list-style-type: none"> <li>- Provision of competitive frequency support products (both for availability and availability and activation) that allow the TSO to stabilize the frequency after a frequency event in the primary control framework.</li> </ul>	<p><b>Customer relationships</b></p> <ul style="list-style-type: none"> <li>- License agreement between the aggregator and the MO to participate in the market (acquisition and retention / trust).</li> </ul>	<p><b>Customer</b></p> <ul style="list-style-type: none"> <li>- Must be a TSO</li> <li>- If it is a TSO, must have a frequency instability to solve (frequency event where the frequency is increased or decreased more than the predefined limits).</li> </ul>
	<p><b>Key resources</b></p> <ul style="list-style-type: none"> <li>- Financial guarantees to be provided to the aggregator by the TSO (financial), as well as to the FSPs by the aggregator.</li> <li>- Market clearing system (platform).</li> <li>- Meters that can measure whether the flexibility has been provided (physical).</li> <li>- Computer servers (physical).</li> </ul>		<p><b>Channel</b></p> <ul style="list-style-type: none"> <li>- Personal meetings (awareness &amp; evaluation).</li> <li>- Online platforms for application in participation to the market (purchase &amp; after sales)</li> </ul>	

<p>Cost structure</p> <ul style="list-style-type: none"><li>- Computer servers and other IT services (10%).</li><li>- Human resources to carry on the daily operations of the aggregator platform, communication with the TSO and MO, as well as communication with the FSPs (10%).</li><li>- Subscription fee paid to the MO for the participation to the market (10%)</li><li>- Payment to the FSPs for their provisioned services (70%).</li></ul>	<p>Revenue streams</p> <p>Option 1 (market clearing cost):</p> <ul style="list-style-type: none"><li>- Aggregator remuneration through the market for the provision of flexibility services</li></ul>
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#### 4.2.1.2 Analysis made of this BM

Next, the analysis made of this BM is provided concerning both the classification of stakeholders and the definition of strategies for the engagement of critical stakeholders and the analysis of the compatibility of this BM with local regulation.

##### **Stakeholders' engagement analysis**

In this section, the main stakeholders involved in the implementation of this BM are identified and classified according to their ability to affect the implementation of the BM and their interest in facilitating this implementation. Then, relevant strategies for the engagement of critical stakeholders, who have large power to affect the successful implementation of the BM but low interest in favouring it, are provided.

##### Power-interest Matrix

The power interest matrix for this BM is provided next, classifying in it the relevant stakeholders according to their power to affect the implementation of the BUC and their incentives to facilitate this implementation. For each stakeholder, its power to affect the implementation of this BUC and interest in facilitating it is discussed within the matrix.

Table 4.6: Classification of the stakeholders for the BM associated with the BUC SOCL-CY-01: Power-interest matrix

Stakeholder influence/power	High	<ul style="list-style-type: none"> <li>Owners of fossil fuel generation plants: They might be economically affected as their market share for them will be decreased.</li> </ul>	<ul style="list-style-type: none"> <li>SOs: The TSOs are interested in the frequency support service through the distribution FSPs, since they are going to have more flexibility services available for overcoming frequency events. Further, DSOs can be benefitted by the regulations for frequency support services and can establish new regulations for congestion management services.</li> <li>European Union: the provision of flexibility services from the distribution grid is supported by the European Union since it might accelerate the green transition of the electricity sector.</li> <li>National governments: sharing the European view on this subject, they may perceive this as an opportunity for society, businesses, and consumers</li> <li>FSPs and aggregators: the FSPs and aggregators are highly interested in the provision of flexibility services in the grid. This provides the opportunity to the aggregators and FSPs to participate in the TSO market for providing frequency support services. This will also provide the opportunity for increasing their revenues since it is another market opportunity.</li> <li>Energy Regulatory Authorities: They have the power to establish a framework for allowing the participation of DERs to frequency support services and this will be beneficial for grid resilience to have more DERs for frequency support</li> </ul>
	Low	<ul style="list-style-type: none"> <li>Developers, engineers, and contractors: they might perceive that their profit will shrink because the investment in power infrastructures will lessen. Therefore, they might oppose this change, but they are not essential to the power system, so they have no influence.</li> </ul>	<ul style="list-style-type: none"> <li>Environmental organizations: provision of frequency support services through DERs will favor the installation of more residential PVs decreasing the CO2 footprint from the fossil fuels plants.</li> <li>Technology companies: can benefit through the development of new techniques to enable (technically) the provision of flexibility services to the grid. This can increase their revenue but they have not the influence/power to create new regulations for this direction.</li> </ul>
		Low	High
Stakeholder interest/support			

#### Strategies for the engagement of critical stakeholders

Effective strategies must be implemented to achieve the involvement of relevant stakeholders. These are discussed next, placing the focus on critical stakeholders.

- High influence challengers (high influence but low interest)

#### Owners of fossil fuel generation plants

They have high influence but low interest, so their interest/support will need to be increased. A set of actions and measures in order to achieve their highly engagement is outlined below.

- Clear Value Proposition

Clearly communicate the benefits of transitioning to the proposed BM model, including potential cost savings, improved environmental performance, and access to new revenue streams.

- Collaborative Approach

Foster a collaborative approach where fossil fuel generation plant owners are seen as partners rather than competitors. Highlight the potential for coexistence and mutual benefit.

- Diverse Revenue Streams

Show how participation in the proposed business model can provide multiple revenue streams, such as capacity payments, energy payments, and participation in ancillary service markets, reducing reliance on a single income source.

- Regulatory Support

Advocate for regulatory frameworks that incentivize or mandate participation in frequency support services using renewable energy. This could include preferential treatment, subsidies, or emissions-related incentives.

- High influence champions (high influence and high interest)

These actors are already interested in the BUC, but they must not be taken for granted, therefore a set of actions should be taken to keep their interest high. Some actions are outlined below for each type of stakeholder.

#### SOs

- Understand Grid Operator Needs and Requirements

Conduct thorough research to understand the specific needs and requirements of grid operators in the BM target regions.

- Compliance with Regulations

Ensure that the BM services comply with the regulatory framework and standards set by the relevant grid operator and regulatory authorities.

- Reliability and Quality Assurance

Demonstrate the reliability and quality of the BM services since grid operators prioritize the stability of the grid.

- Collaborative Partnerships

Establish collaborative partnerships with grid operators. Engage in regular discussions and meetings to understand their evolving needs and provide tailored solutions.

- Data Sharing and Transparency

Offer transparent data sharing mechanisms that provide grid operators with real-time information about the services' performance. This can build trust and facilitate better coordination.

- Flexibility and Customization

Design the BM services to be flexible and customizable to meet the specific requirements of different grid operators since not all operators will have the same needs, so adaptability is crucial.

#### European Union

- Understand EU Regulations and Policies

Familiarize with EU regulations related to frequency support services and grid operation. Furthermore, the BM should be updated based on changes and developments in EU energy policy to ensure compliance.

- Compliance with Grid Codes

Ensure that the BM complies with EU grid codes and requirements, which specify technical standards and operational procedures for frequency support service providers.

- Market Integration

Explore opportunities to apply the BM in pan-European electricity markets and cross-border trade to provide frequency support services.

- Renewable Energy Integration

Showcase how the services provided by the BM can facilitate the integration of renewable energy sources into the grid since EU places a strong emphasis on renewable energy to meet its clean energy targets.

#### National governments

- Value Proposition

Clearly state how the frequency support services contribute to grid stability, reliability, and efficiency and highlight the economic and environmental benefits of the services, such as reducing downtime, minimizing energy waste, and supporting renewable energy integration.

- Implement small-scale pilot projects

Showcase the effectiveness of the BM frequency support services and use these pilot projects as tangible evidence of the BM capabilities and benefits.

- Financial viability

Present the BM as a means to enhance the government's energy infrastructure without the need for significant public expenditure.

#### FSPs and aggregators

- Market Incentives

Enable the creation of attractive market incentives for FSPs and aggregators to participate. This could include offering competitive pricing, subsidies, or other financial incentives to make their involvement financially rewarding.

- Clear Regulations and Standards

Have clear and transparent regulations and technical standards that govern the participation of FSPs and aggregators. Certainty and consistency in rules help build trust and encourage investment.

- Interoperability

Promote interoperability of FSP and aggregator systems with the grid infrastructure and market platforms. This simplifies integration and encourages more players to enter the market.

#### Energy Regulatory Authorities

- Industry Expertise

Develop a deep understanding of the energy industry and the specific regulations that govern frequency support services. Stay updated on changes and developments in the regulatory landscape.

- Transparent Operations

Clearly communicate how the BM services contribute to grid stability, reliability, and efficiency.

- Grid Impact

Demonstrate the positive impact of the BM services on the distribution grid. Provide evidence of how the BM services enhance grid stability, reduce congestion, and improve power quality.

- Cost-Benefit Analysis



Conduct a comprehensive cost-benefit analysis to show how the BM services can provide economic benefits to both grid operators and consumers and highlight any potential cost savings and efficiency improvements.

- Low influence challengers (low influence and low interest)

Developers, engineers, and contractors

They have no power nor interest in these business models. Nevertheless, they should be identified. Keep them informed about any future developments regarding this BM.

- Low influence champions (low influence and high interest)

Technology companies

- Develop a Clear Value Proposition

Clearly show the value that the BM services bring to technology companies. Highlight how the services can enhance their technology solutions, improve efficiency, reduce costs, or drive innovation.

- APIs and Integration

Ensure that the BM services are designed to easily integrate with existing technology solutions and platforms used by the companies. Provide well-documented APIs and support for integration.

- Demonstrate ROI

Provide data and case studies that demonstrate the return on investment (ROI) that technology companies can expect from utilizing the BM services. Show how they can monetize these services or improve their own offerings.

Environmental organizations

- Environmental Impact Assessment

Conduct a comprehensive environmental impact assessment of the BM service. Demonstrate the commitment to sustainability and reducing the environmental footprint of the distribution grid. Share the findings and potential improvements with environmental organizations to seek their input and validation.

- Green Marketing

Clearly communicate how the BM services contribute to reducing greenhouse gas emissions and improving grid resilience.

- Participate in Environmental Events

Attend and participate in environmental conferences, workshops, and events to network and engage with environmental organizations. These events provide opportunities for learning and collaboration.

### **Analysis of the compatibility of this BM with local regulation**

This section provides the identification of the regulatory barriers to the implementation and success of the aggregator frequency support service business model defined here. The information discussed here has been obtained based on answers of the Cyprus TSO and DSO.

The regulatory barriers are identified that are related to the implementation at first stage and success at a later stage of the proposed business model. This analysis is based on the “current” state of the electrical system of Cyprus and the existing regulation and legislation. For the purposes of the analysis, any upgrades to the system or expected updates to the legislation and regulation to be implemented in the next months are considered as already implemented. Therefore, the fact that they are not implemented, or deployed, as of today is not considered a barrier for the implementation of the business model.

In any case, this regulatory analysis is performed taking into consideration only the local peculiarities of the Cyprus power system, and, therefore, the barriers defined are not meant to be relevant in any other system.

#### Regulatory barriers

The regulatory barriers that might prevent the implementation of this business model in the Cyprus power system are:

- Lack of operational market

The first and major barrier is that the fully operational electricity market is not yet implemented in Cyprus. The second dry run took place at the end of 2022 and another dry run is expected to take place before the opening of the market; however there is still no firm date for the next steps. A transitional market is effective currently where only bilateral contracts between independent producers and suppliers are allowed.

- Market access and participation rules

Upon the implementation, the market of Cyprus may have specific rules at least at the beginning of the market operation dictating who can participate in ancillary services, including frequency support. This might prevent aggregators to participate in the first version of the electricity market.

- Lack of ancillary service market

The provision of ancillary services requires an ancillary service market that might be dictated by different rules and constraints in comparison to the day ahead and intraday market. Since currently no

operational market exist in Cyprus, the operation of ancillary service market might delay further. This is also a regulatory barrier that need to be considered in this business model.

- Trading period of the Cyprus transitional market

As it is aforementioned a transitional market currently operates in Cyprus. The trading period of the transitional market is one month. Although ancillary services are to be included in the market in the next months, expected to allow the participation of distributed aggregators (storage with/and RES or only storage) in the transitional market, the monthly based trading period cannot fulfil the actual needs of the system in terms of frequency control in normal or abnormal conditions.

- Lack of a regulatory framework for storage devices

Battery storage systems are essential for the provision of frequency support services through the aggregators. In Cyprus, there is not yet a solid framework that is related to the installation and operation of the battery storage systems. This is a considerable barrier to the implementation of the business model as aggregators will need storage devices to provide frequency support to the grid.

- No licensing and certification procedures are established for the aggregators in Cyprus

The participation of aggregators to a future ancillary service market should be licensed and certified by a responsible body in Cyprus. The licensing and certification procedures should be established and approved by relevant entities in Cyprus. Such procedures are not yet decided and established; therefore, this might delay aggregator to participate in ancillary service market. In this context, a framework for the technical specifications that an aggregator should have for the participation in frequency support services is not yet established and this might delay the implementation of this business model. Furthermore, the design of the Cyprus electricity market may not explicitly accommodate aggregator-based models for frequency support.

- Baseline methodologies for the remuneration of aggregators

In order to assess the aggregator response for frequency support a baseline methodology should be agreed between the buyers and the sellers. The response of the aggregators for frequency support should be evaluated by comparing the pre-frequency support operation and the during-frequency support operation of the aggregator. A concrete baseline method should be agreed between the involved parties, which in Cyprus there is not any framework for baseline methods yet.

## 4.2.2 Representation and analysis made the BM for BUC SOCL-CY -02

### 4.2.2.1 Representation made of this BM

Before describing the structure of the BM, the main relationships established within it, value created by it, and revenues and costs for the stakeholder that the BM focuses on resulting from its implementation, we remind the reader about some basic features of the BUC that the BM is associated with.

### **Description of the BUC that this BM is associated with**

This section provides the description and analysis for the OneNet's BUC SOCL-CY-02, as described in [14].

This BUC aims to enable the provision of reactive power flexibilities and phase balancing services by flexible services providers to support the DSO for maintaining voltage stability, relieving the congestion of the system, increasing the system efficiency and the power quality.

Therefore, this BUC exploits the flexible resources of the distribution grid (large energy storage systems, PV parks, prosumers) to provide reactive power and phase balancing services. These services will be procured by the DSO to the local DSO ancillary services market. The energy market will allocate the services to the different flexible actors (aggregators, flexible services providers, and prosumers) according to the market rules. The activation of these services will be coordinated by the DSO based on the grid operating conditions.

The central actor selected for this business model is the DSO. Through this BUC, the DSO is directly benefitted since the operator will be able to exploit available flexibility services to ensure the proper operation of the grid and to relieve congestion. As a result, the utilization of existing grid capacity can be maximized, avoiding or reducing the required investment for infrastructure upgrades, while the system power quality can be significantly improved providing high quality power to the consumers.

### Objectives

Based on the objectives of the demonstrator, we can state that:

1. The DSO can exploit flexibility services by flexible resources to:
  - a. manage the congestion in distribution grid;
  - b. maintain voltage stability; and
  - c. enhance the power quality and efficiency.

### Actors

We find three actors in this BUC:

- DSO: procures products related to congestion management, power quality and voltage stability services to the Local Ancillary Services MO. Furthermore, the DSO is also responsible for real-time coordination of the flexible resources, available at each time frame according to the local market clearing.
- Local MO: manages the market platform where both the flexible resources (aggregators, FSPs, prosumers) and the DSO may introduce their offers and bids for ancillary services provision at the local level.

- Flexible Resources: include FSP, aggregators, DERs, and prosumers that can provide reactive regulation and phase balancing services to the DSO through the local ancillary services market.

### Procedure

The procedure applied in the demonstrator was structured in four steps, which are described next:

- Procurement of products: DSO sends procured products to the DSO local market through the OneNet System.
- Bidding: FRs in the distribution level bid their offers for the congestion management procured products in the market through the OneNet system.
- Market clearing: DSO local ancillary services market is cleared, and the awarded bids are sent through the OneNet system to the FRs and the DSO.
- Distribution grid monitoring and coordination: Measurements from distribution substations are received by the DSO SCADA. Measurements from smart meters are received by the DSO AMI. The ABCM-D platform will process the measurement based on monitoring schemes and alarms will be provided in case of thermal limits, power quality, or power factor limit violation. Furthermore, based on the location of the congestion (thermal limits, power quality and power factor limit violation) the DSO defines the coordination set-points for the activation of the flexible resources through the ABCM-D platform. The coordination signals are sent to the flexible resources through the OneNet system.

### **Description of this BM: The Business Model Canvas**

This BM associated with this BUC is focused on the DSO.

### Assumptions

Even though most of the information needed for the development of the business model canvas for this document has been included in the aforementioned BUC, there were still some minor assumptions that had to be made before the canvas itself was created. Since there is not such local DSO ancillary services market in place in Cyprus at the moment, an artificial market has been developed for demonstration purposes where the flexible resources (aggregators, DERs, flexibility services providers, and prosumers) can participate, placing their bids regarding their generation offers for reactive regulation and phase balancing.

### BM canvas

Next, the canvas of this BM is provided.

Table 4.7: BM canvas for BUC SOCL-CY-02

Key partnerships	Key activities	Value proposition	Customer relationships	Customer
<ul style="list-style-type: none"> <li>- Procure services/products to the Local DSO Ancillary Service Market (acquisition of particular resources or activities)</li> <li>- Provision of flexibility services by Flexible Resources (acquisition of particular resources or activities)</li> </ul>	<ul style="list-style-type: none"> <li>- Defines the amount of flexibility to be procured and communicates the corresponding requests to the FMO.</li> <li>- The DSO monitors the real-time operation of the grid and coordinates the provision of ancillary services by sending coordination signal to the flexible resources to manage congestion in the distribution grid (primary activity / value shop).</li> </ul>	<ul style="list-style-type: none"> <li>- Enabling the DSO to manage short-term congestion in the most efficient way (effort / innovative innovation / market / purchase) from minutes to hours ahead in order to reduce investments for upgrading the infrastructure by coordinating the available flexibility services.</li> </ul>	<ul style="list-style-type: none"> <li>- The costumers of the DSO are the supplier and the consumers (and any network user) and the relationship with the customer is established through license agreements (acquisition and retention / trust).</li> </ul>	<ul style="list-style-type: none"> <li>- Must be the flexible resources (i.e., aggregators, flexibility services providers, DERs, producers) able to provide ancillary services</li> <li>- Must be all the consumers that are utilizing the grid (grid usage fee) to have access to electricity.</li> <li>- Must be all the generators producing electricity to inject this electricity to a grid operating in a stable manner.</li> </ul>
	<p>Key resources</p> <ul style="list-style-type: none"> <li>- Financial guarantees to be provided to flexible resources (financial) by the DSO.</li> <li>- Market clearing system (platform).</li> <li>- Meters (physical) to real-time measure the distribution grid operation (at the substation level) and store the measurements in the SCADA system (platform).</li> <li>- Computer servers (physical).</li> </ul>		<p>Channel</p> <ul style="list-style-type: none"> <li>- Personal meetings (awareness &amp; evaluation).</li> <li>- Online platforms managed by the MO for participating to the market (purchase &amp; after sales)</li> </ul>	

<p>Cost structure</p> <ul style="list-style-type: none"> <li>- Computer servers and other IT services (15%).</li> <li>- Human resources to carry out the daily operations for managing the distribution grid (5%).</li> <li>- Software development and maintenance for automatically manage the distribution grid (10%).</li> <li>- Payment to the flexible resources to provide the ancillary services for congestion management and power quality improvement (70%)</li> </ul>	<p>Revenue streams</p> <p>Grid usage fee:</p> <ul style="list-style-type: none"> <li>- The DSO is paid according to the grid usage fee (€/kWh) by the consumers that is serving.</li> </ul> <p>Alternative revenue streams:</p> <ul style="list-style-type: none"> <li>- Through the specific BUC, the DSO can reduce its operational cost (energy losses cost) and to potentially reduce the cost for grid expansion.</li> </ul>
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#### 4.2.2.2 Analysis made of this BM

Next, the analysis made of this BM is provided concerning both the classification of stakeholders and the definition of strategies for the engagement of critical stakeholders and the analysis of the compatibility of this BM with local regulation.

##### Stakeholders’ engagement analysis

In this section, the main stakeholders involved in the implementation of this BM are identified and classified according to their ability to affect the implementation of the BM and their interest in facilitating this implementation. Then, relevant strategies for the engagement of critical stakeholders, who have large power to affect the successful implementation of the BM but low interest in favouring it, are provided.

##### Power-interest Matrix

The power interest matrix for this BM is provided next, classifying the relevant stakeholders according to their power to affect the implementation of the BUC and their incentives to facilitate this implementation. For each stakeholder, its power to affect the implementation of this BUC and interest in facilitating it is discussed within the matrix.

Table 4.8: Classification of the stakeholders for the BM associated with the BUC SOCL-CY-02: Power-interest matrix

Stakeholder influence/power	High	<ul style="list-style-type: none"> <li>Local and regional governments or interest groups: they might perceive that the DSO is not constructing a necessary power line or is providing poorer services.</li> </ul>	<ul style="list-style-type: none"> <li>FSPs, aggregators, DERs, prosumers: all the flexible resources that are able to provide ancillary services to the distribution grids are highly interested since this BUC can increase their revenues. Nevertheless, they do not have any power, as they cannot change the regulation and currently, they have no power to push the development of these services.</li> <li>Energy Regulatory Authorities and National Regulators: These authorities have a significant power to establish a framework allowing the participation of small/medium flexible resources (e.g., DER, aggregators, FSPs and prosumers) to provide ancillary services to the grid and to allow DSO to buy these services; however, they will not have direct impact on their business.</li> <li>European Union: the development of flexibility services has been included in the last electricity market directive and is being favored politically, as it may provide both environmental and economic benefits to society, businesses, and final consumers.</li> <li>National governments: sharing the European view on this subject, they may perceive this as an opportunity for society, businesses, and consumers</li> </ul>
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	LOW	<ul style="list-style-type: none"> <li>Developers, engineers, and contractors: they might perceive that their profit will shrink because the investment in power infrastructures will lessen. Therefore, they might oppose this change, but they are not essential to the power system, so they have no influence.</li> </ul>	<ul style="list-style-type: none"> <li>Technology companies: as they develop the new products needed to manage these services (either from DSO perspective or from flexible resources perspective), they are interested in these types of business models.</li> <li>Environmental organizations: they might favor this approach as there will be fewer effects on the environment.</li> </ul>
		Low	High
Stakeholder interest/support			

### Strategies for the engagement of critical stakeholders

Effective strategies must be implemented to achieve the involvement of relevant stakeholders. Following what has been indicated in the description of the methodology and in the stakeholder analysis matrix, we must adopt different strategies for each of the following types of actors. These are discussed next, placing the focus on critical stakeholders.

- High influence challengers (high influence but low interest)

#### Local and regional governments and interest groups

They have high influence but low interest, so their interest/support will need to be increased. A set of actions and measures in order to achieve their highly engagement is outlined below.

- Stakeholder Analysis

Conduct a thorough stakeholder analysis to identify key players in the local and regional governments and interest groups that are relevant to the BM. This analysis will help to understand the concerns, interests, and influence of these stakeholders within the sector and design a strategy for increasing their interest.

- Transparency and Communication

Establish transparent communication channels with government officials and interest groups. This will include the regular updates on the business activities, plans, and the benefits that the BM will provide to the community.

- Public Relations and Outreach

Develop a public relations and outreach strategy to disseminate information about the services that will be provided by the application of this BM to the broader community. This can include

organizing public meetings, workshops, and informational sessions to educate stakeholders about the BM services and the benefits.

- Collaboration and Partnerships

Seek opportunities for collaboration and partnerships with local and regional governments. This could involve offering to support their renewable energy and sustainability goals through the ancillary services provided through the adoption of this BM.

- Policy Advocacy

Actively participate in the development of energy policies and regulations at the local and regional levels. Advocate for policies that promote the integration of the BM services into the grid and align with the interests of both governments and interest groups.

- High influence champions (high influence and high interest)

These actors are already interested in the BUC, but they must not be taken for granted, therefore a set of actions should be taken to keep their interest high. Some actions are outlined below for each type of stakeholder.

#### European Union

- Understand EU Regulations and Policies

Familiarize with EU regulations related to ancillary services and grid operation. Furthermore, the BM should be updated based on changes and developments in EU energy policy to ensure compliance.

- Compliance with Grid Codes

Ensure that the BM complies with EU grid codes and requirements, which specify technical standards and operational procedures for ancillary service providers.

- Market Integration

Explore opportunities to apply the BM in pan-European electricity markets and cross-border trade to provide ancillary services.

- Renewable Energy Integration

Showcase how the ancillary services provided by the BM can facilitate the integration of renewable energy sources into the grid since EU places a strong emphasis on renewable energy to meet its clean energy targets.

### National governments

- Value Proposition

Clearly state how the ancillary services contribute to grid stability, reliability, and efficiency and highlight the economic and environmental benefits of the services, such as reducing downtime, minimizing energy waste, and supporting renewable energy integration.

- Implement small-scale pilot projects

Showcase the effectiveness of the BM ancillary services and use these pilot projects as tangible evidence of the BM capabilities and benefits.

- Financial viability

Present the BM as a means to enhance the government's energy infrastructure without the need for significant public expenditure.

### SOs

- Understand Grid Operator Needs and Requirements

Conduct thorough research to understand the specific needs and requirements of grid operators in the BM target regions.

- Compliance with Regulations

Ensure that the BM ancillary services comply with the regulatory framework and standards set by the relevant grid operator and regulatory authorities.

- Reliability and Quality Assurance

Demonstrate the reliability and quality of the BM ancillary services since grid operators prioritize the stability of the grid.

- Collaborative Partnerships

Establish collaborative partnerships with grid operators. Engage in regular discussions and meetings to understand their evolving needs and provide tailored solutions.

- Data Sharing and Transparency

Offer transparent data sharing mechanisms that provide grid operators with real-time information about the services' performance. This can build trust and facilitate better coordination.

- Flexibility and Customization

Design the BM services to be flexible and customizable to meet the specific requirements of different grid operators since not all operators will have the same needs, so adaptability is crucial.

#### Energy Regulatory Authorities

- Industry Expertise

Develop a deep understanding of the energy industry and the specific regulations that govern ancillary services. Stay updated on changes and developments in the regulatory landscape.

- Transparent Operations

Clearly communicate how the BM services contribute to grid stability, reliability, and efficiency.

- Grid Impact

Demonstrate the positive impact of the BM services on the distribution grid. Provide evidence of how the BM services enhance grid stability, reduce congestion, and improve power quality.

- Cost-Benefit Analysis

Conduct a comprehensive cost-benefit analysis to show how the BM services can provide economic benefits to both grid operators and consumers and highlight any potential cost savings and efficiency improvements.

#### FSPs and aggregators

- Market Incentives

Enable the creation of attractive market incentives for FSPs and aggregators to participate. This could include offering competitive pricing, subsidies, or other financial incentives to make their involvement financially rewarding.

- Clear Regulations and Standards

Have clear and transparent regulations and technical standards that govern the participation of FSPs and aggregators. Certainty and consistency in rules help build trust and encourage investment.

- Interoperability

Promote interoperability of FSP and aggregator systems with the grid infrastructure and market platforms. This simplifies integration and encourages more players to enter the market.

- Low influence challengers (low influence and low interest)

#### Developers, engineers, and contractors

They have no power nor interest in these business models. Nevertheless, they should be identified. Keep them informed about any future developments regarding this BM.

- Low influence champions (low influence and high interest)

#### Technology companies

- Develop a Clear Value Proposition

Clearly demonstrate the value that the BM services bring to technology companies. Highlight how the services can enhance their technology solutions, improve efficiency, reduce costs, or drive innovation.

- APIs and Integration

Ensure that the BM services are designed to easily integrate with existing technology solutions and platforms used by the companies. Provide well-documented APIs and support for integration.

- Demonstrate ROI

Provide data and case studies that demonstrate the return on investment (ROI) that technology companies can expect from utilizing the BM services. Show how they can monetize these services or improve their own offerings.

#### Environmental organizations

- Environmental Impact Assessment

Conduct a comprehensive environmental impact assessment of the BM service. Demonstrate the commitment to sustainability and reducing the environmental footprint of the distribution grid. Share the findings and potential improvements with environmental organizations to seek their input and validation.

- Green Marketing

Clearly communicate how the BM services contribute to reducing greenhouse gas emissions and improving grid resilience.

- Participate in Environmental Events

Attend and participate in environmental conferences, workshops, and events to network and engage with environmental organizations. These events provide opportunities for learning and collaboration.

## Analysis of the compatibility of this BM with local regulation

This section provides the identification of the regulatory barriers to the implementation and success of the exploitation of the ancillary services by the DSO business model defined here. The information discussed here has been obtained based on responses of the Cyprus TSO and the DSO.

The regulatory barriers discussed here are related to the implementation at first stage and success at a later stage of the proposed business mode. This analysis is based on the “current” state of the electrical system of Cyprus and the existing regulation and legislation. For the purposes of the analysis, any upgrades to the system or expected updates to the legislation and regulation to be implemented in the next months are considered as already implemented. Therefore, the fact that they are not implemented, or deployed, as of today is not considered a barrier for the implementation of the business model. In any case, this regulatory analysis is performed taking into consideration only the local peculiarities of the Cyprus power system, and, therefore, the barriers defined are not meant to be relevant in any other system.

### Regulatory barriers

The regulatory barriers that might prevent the implementation of this business model in the Cyprus power system are:

- Lack of operational market

The first and major barrier is that the fully operational electricity market is not yet implemented in Cyprus. The second dry run took place at the end of 2022 and another dry run is expected to take place before the opening of the market; however, there is still no firm date for the next steps. A transitional market is effective currently where only bilateral contracts between independent producers and suppliers are allowed. Since the bulk electricity market is not yet operational a DSO market that will enable the provision of flexibility by the distributed flexibility resources will be further delay. This causes a major barrier for the implementation of this business model.

- Regulations regarding the role of the DSO

A regulatory framework that clearly defines the role of the DSO in the services procurement is not yet prepared. In this business model it is assumed that the DSO is able to procure services in a local DSO market. In the Cyprus case, the role of the DSO should be clearly defined among with its responsibilities in such a framework in order to enable the adoption of the proposed business model.

- Lack of DSO ancillary service market

The provision of ancillary services by the distributed FSPs requires an ancillary service market that might be dictated by different rules and constraints than the day ahead and intraday market. The design of a DSO ancillary service market should be implemented first, deciding certain rules for the products that

are going to be served from this market, the time horizon that this market will be cleared, the possible connection of this market with TSO market, etc. This is also a regulatory barrier that need to be considered in this business model.

- Lack of a regulatory framework for storage devices

Battery storage systems are essential for the provision of the ancillary services outlined in this business model (i.e., phase balancing, congestion management, voltage support, etc) through the FSPs. The installation and control of a battery ensures that the FSPs will be able to provide ancillary services to the distribution grid in the whole day, and not only in the PV generation time horizon. In Cyprus, there is not yet a solid framework that is related to the installation and operation of the battery storage systems. This is a considerable barrier to the implementation of the business model as FSPs will need storage devices to provide frequency support to the grid.

- No licensing and certification procedures are established for the flexibility resources in Cyprus

The participation of flexible resources to a future DSO ancillary service market should be licensed and certified by a responsible body in Cyprus. Nowadays, according to the policies of the DSO in Cyprus, any new FSPs connections are currently accepted only if the new system will not cause any problem to the grid. Therefore, network congestions and voltage violations are always avoided. This is a conservative approach since it reduces significantly the total RES penetration and hence limits the applicability of this business models. The licensing and certification procedures should be established and approved by relevant entities in Cyprus. Such procedures are not yet decided and established; therefore, this might delay flexible resources to participate in the DSO ancillary service market. In this context, a framework for the technical specifications (including the minimum flexibility resource capacity that can participate in the market) that a flexibility resource should have for the provision of grid ancillary services is not yet established and this might delay the implementation of this business model.

- Lack of an established framework for TSO-DSO coordination

Another regulatory barrier that might limit the applicability of this BM is related to the weak TSO–DSO coordination. A regulatory framework for the TSO-DSO coordination should be established to enable the effective coordination of the SOs (TSO and DSO) in Cyprus. This regulatory framework should ensure that no problems at the transmission system will be caused due to the provision of flexibility services by the flexibility resources to the distribution grid. The absence of standardized regulatory procedures for the coordination between the two operators is something important for the high adaptability of this BM.

- Baseline methodologies for the remuneration of FSPs

In order to assess the FSP response for the provision of ancillary services a baseline methodology should be agreed between the buyers and the sellers. The response of the FSPs during the provision of ancillary services should be evaluated by comparing the operation of the FSP before the provision of ancillary services and during the provision of ancillary services. A concrete baseline method should be agreed between the involved parties, which in Cyprus regulations there is not any framework for baseline methods yet.



## 5 Description and analysis of the BMs associated with the BUCS defined for the Northern Cluster

In this section, we provide the representation made and qualitative analysis conducted the BM in the cluster.

### 5.1 Representation and analysis made of the BM for the Northern Flexibility Market

#### 5.1.1.1 Representation made of the BM for the Northern Flexibility Market

Before describing the structure of the BM, the main relationships established, the value created, and revenues and costs for the stakeholder that the BM focuses on resulting from its implementation, we remind the reader about some basic features of the BUC that the BM is associated with.

#### **Description of the Northern Flexibility Market BUC that this BM is associated with**

This section provides the description and analysis for the OneNet's BUC NOCL-01 (Northern Flexibility Market) as described in OneNet Deliverable 2.3 [14].

#### Objectives

The Northern Demonstration Cluster BUC aims to:

- develop a seamless end-to-end process for market-based flexibility utilization of grid services (network congestion management and/or balancing);
- lower entry barriers for flexibility by simplifying the process for the FSPs (FSPs); and
- ensure availability of short-term flexibility from multiple sources.

To accomplish these objectives, the core developments of the Northern Demonstration Cluster are the FR, the T&D CP [14], and the MCOM [30]. These developments will have a role in the management of flexibility resources, in the coordination of TSOs and DSOs, in their joint procurement of flexibility (using grid impact assessment methodology), and in the management of the related data.

To describe the business model related to the Northern demo, the three developments are considered as part of an integrated FP, and the central actor, in this case, is then assumed to be the FPO.

#### Actors

We find 5 main roles in this BUC [14]:

- FPO: a party that: 1) stores information about flexibility assets, results of qualification (both product and grid), market results, and grid information; 2) performs flexibility verification and settlement; 3)

aggregates flexibility information; 4) allocates access rights to the various actors; 5) controls the level of access; and 6) finds the best value-stacking solution among the available flexibilities, using grid impact assessment optimization. Notice that the role of OO, which is described by point 6, is included in the role of FPO.

- SO: a party responsible for operating, ensuring the maintenance of and, if necessary, developing the system in a given area and, where applicable, its interconnections with other systems. It is also responsible for ensuring the long-term ability of the system to meet reasonable demands for the distribution or transmission of electricity. It includes TSOs and DSOs.
- MO: a party that provides a service whereby the offers to sell electricity are matched with the bids to buy electricity. In the Northern BUC, the MO role doesn't include the process of selecting the bids itself (as this is done by the FPO), but all other related activities (e.g. opening the Market for SO Services and informing FSPs, forwarding flexibility bids, publishing selected bids, making contracts of flexibility provision, providing counter-action bids). Moreover, in the Northern demonstration, the MO role can be played by MOs (e.g. NordPool and Piclo) as well as by the TSO or DSO, depending on the product being traded.
- FSP: a party which offers flexibility services to the SOs by using resources of Resource Owners (ROs). The FSP connects the RO, e.g. an individual large resource or through aggregation, to the Market for SO Services, e.g. making flexibility bids. When an FSP acts as aggregator, it contracts individual smaller resources, providing aggregation services (or other related services) to the ROs.
- RO: a party who owns the resource and can provide flexibility. The RO can be a consumer, a prosumer or a generator, as long as the actor possesses flexibility assets (e.g. from controllable demand, generation or storage technologies).

### Procedure

The procedure applied in the Northern demonstrator was structured in six steps (scenarios), that are described next:

- RO on-boarding: deals with the processes related to onboarding ROs willing to provide flexibility. The FSP creates products, contracts resources from ROs, and aggregates ROs' flexibility. Afterwards, the FSP registers its resource portfolio in the FR, providing the information of resources for prequalification.
- Prequalification: focuses on the prequalification of FSPs. Two types of prequalification are performed: 1) resources of the FSP are technically verified, to identify if they respect the flexibility product specifications and can, thus, provide the flexibility product; 2) checking if the activation of FSP's resources cause any violation of grid's restrictions. The first prequalification is an integral part of the FR, while the second is performed by the T&D CP.

- Flexibility procurement: deals with the trading of flexibility products, which are previously defined by the SOs and are standardized within the regional cluster. SOs provide flexibility call for tender (normally applies to long-term capacity products) and flexibility need (this is optional and normally may apply to near-real-time and short-term products) information to the FPO. FPO forwards call for tender information to MOs, which can open the Market for SO Services and inform the FSPs about it. Regarding flexibility need information, this is available to FSPs directly from FPO. As a response, FSPs make bids in the market, and the FPO selects the most optimum set of bids to fulfil SOs' need (taking into account the socio-economic value of the bids and the network limits). Then, the MO notifies the market participants about the clearing result and closes the Market for SO Services.
- Activation: This scenario describes the process of activation of the flexibility, considering any grid limitations, and the needed data exchange. Notification of the activation requests to the FSPs must happen in a reliable and timely manner according to the relevant terms and conditions applicable to FSPs.
- Verification and settlement: focus on verification, balance and financial settlement. The verification is performed by the FPO and takes place by comparing the actual delivered flexibility and flexibility traded on the markets, whereas actual delivered flexibility is the difference of baseline and measured data (i.e. settlement of quantities). Optionally, FPO could also calculate centrally the remuneration and penalties' information. This quantity settlement information is shared from FPO to SOs, BRP, ISR and MOs. It should be also visible to FSPs directly from FPO. Depending on the chosen billing model, SOs as buyers or MOs as intermediaries use the information for billing with the FSPs. The FSP is asked for a penalty if actual delivered flexibility is less than requested flexibility. Quantity settlement information is sent to BRPs/ISR for the balance settlement.

As can be seen, the FP is present in all the steps but step 4 of the Northern demonstrator, being a key resource for the demo success. In the next section, the FPO business model is thus analysed.

### **Description of the BM for the Northern Flexibility Market: the Business Model Canvas**

The BM associated with this BUC is focused on the FPO.

#### Assumptions

As not all the information needed to elaborate the business model has been specified in the BUC, we make the following assumptions:

- We assume that the FP is composed by the FR, the T&D CP and the MCOM.
- Although these three modules can be owned by different companies, we assume they are part of the FP, thus their building blocks are combined and presented together.

Canvas

Next, the canvas of this BM is provided.



Table 5.1: BM canvas for the Northern Flexibility Market

Key partnerships	Key activities	Value proposition	Customer relationships	Customer
<ul style="list-style-type: none"> <li>- Research companies and universities (e.g. development of optimization and baseline methodologies).</li> <li>- IT development companies (e.g. code the different activities)</li> <li>- neighboring FPOs in the region</li> <li>- policy makers</li> <li>- regulators</li> </ul>	<ul style="list-style-type: none"> <li>- Manage flexibility contracts.</li> <li>- Register FSPs and their resources (including resource groups).</li> <li>- Conduct product and grid prequalification (of FSPs' resources and resources groups).</li> <li>- Facilitate required information exchange with SOs, MOs, and FSPs (e.g. resource data for procurement, metering point ID and measurement for verification, concluded trade for settlement).</li> <li>- Calculate the baseline and quantify the delivered flexibility.</li> <li>- Manage grid topology of multiple SOs.</li> <li>- Manage Flexibility Needs, Flexibility Call for Tenders, and Purchase Offers.</li> <li>- Optimize bids considering the flexibility needs, grid impact assessment, and resources' technological constraints.</li> <li>- Communicate verification results.</li> </ul>	<ul style="list-style-type: none"> <li>- Provision of a technology-agnostic and product-agnostic integrated platform enabling single Market for SO Services for MOs (trading places), SOs (buyers) and FSPs (sellers). This should result in the increase in the number of offers, the level of competition, and the efficiency of the resulting market clearing and cost of provision of the service.</li> </ul>	<ul style="list-style-type: none"> <li>- Direct personal relationship (acquisition and retention / trust).</li> <li>- Joint development of FP (FPO, customers, and partners), so that the platform reflects customers' needs.</li> </ul>	<ul style="list-style-type: none"> <li>- MO responsible for the trading in the Markets for SO Services.</li> <li>- DSO with congestion needs to be managed.</li> <li>- TSO with congestion and/or balance needs to be managed.</li> <li>- FSP with flexibility resources in the TSO/DSO area of management.</li> </ul>

	<p>Key resources</p> <ul style="list-style-type: none"> <li>- MCOM and its API connection (software)</li> <li>- Computer servers (physical)</li> <li>- Database (software)</li> <li>- API connections to customers for data exchange (software)</li> <li>- OneNet middleware (software)</li> <li>- Grid models to consider in clearing</li> </ul>		<p>Channel</p> <ul style="list-style-type: none"> <li>- Personal meetings (awareness &amp; evaluation).</li> <li>- APIs to connect the FP to: FSPs, SOs, MOs and partners</li> <li>- User interfaces, public dashboards</li> </ul>	
<p>Cost structure</p> <ul style="list-style-type: none"> <li>- From MCOM <ul style="list-style-type: none"> <li>- IT infrastructure (computer servers, software licenses, and other IT services)</li> <li>- Human resources to design, implement, operate, and maintain the optimization module</li> </ul> </li> <li>- From FR <ul style="list-style-type: none"> <li>- Cost of software maintenance</li> <li>- Potential customization development tasks</li> <li>- Usage fee of priced components</li> </ul> </li> <li>- From T&amp;D CP <ul style="list-style-type: none"> <li>- Cost of software maintenance</li> <li>- Potential customization development tasks</li> <li>- Usage fee of priced components</li> </ul> </li> </ul>		<p>Revenue streams (theoretical)</p> <p>Option 1 (fixed payment by MO):</p> <ul style="list-style-type: none"> <li>- MO is the primary customer contracting the platform and pays a fixed amount to use it (subscription monthly fee / fixed pricing)</li> </ul> <p>Option 2 (fixed + variable payments by multiple actors)</p> <ul style="list-style-type: none"> <li>- MO pays a fixed fee to maintain the Markets for SO Services' operation</li> <li>- SOs and FSPs pay a brokerage fee each time they open or participate in a call for tenders.</li> </ul> <p>Option 3 (paid through electricity tariffs):</p> <ul style="list-style-type: none"> <li>- FPO costs are recovered through regulated tariffs paid by all electricity consumers (tax / fixed pricing).</li> </ul> <p>Option 4 (polluter-pays-principle):</p> <ul style="list-style-type: none"> <li>- Actors (e.g. SO, BRP, generators, suppliers) responsible for the balancing and/or congestion need pays for the platform</li> </ul>		

### 5.1.1.2 Analysis made of the BM for the Northern Flexibility Market

Next, the analysis made of this BM is provided concerning both the classification of stakeholders and the definition of strategies for the engagement of critical stakeholders and the analysis of the compatibility of this BM with local regulation.

#### Stakeholders' engagement analysis

In this section, the main stakeholders involved in the implementation of this BM are identified and classified according to their ability to affect the implementation of the BM and their interest in facilitating this implementation. Then, relevant strategies for the engagement of critical stakeholders, who have large power to affect the successful implementation of the BM but low interest in favouring it, are provided.

#### Power-interest Matrix

The power interest matrix for this BM is provided next, classifying in it the relevant stakeholders according to their power to affect the implementation of the BUC and their incentives to facilitate this implementation. For each stakeholder, its power to affect the implementation of this BUC and interest in facilitating it is discussed within the matrix.

Table 5.2: Classification of the stakeholders for the BM associated with the Northern Flexibility Market:

#### Power-interest matrix

Stakeholder influence/power	High	<ul style="list-style-type: none"> <li>SOs (TSOs and DSOs): as the main customers of the system services which can be procured through Markets for SO Services, SOs have a big influence on the success of such platforms. In general, they are also interested in Markets for SO Services (as shown on the right). However, in some cases their interest can be low. More specifically, some DSOs are prevented from purchasing flexibility due to regulatory barriers (i.e., the local regulation in their area of control does not allow DSOs to create and/or participate in Markets for SO Services ), which then limits their interest on such solutions for system services. Moreover, some DSOs are not unbundled (e.g., they can own other assets than the network, such as generation and storage, given that the unbundling requirement doesn't apply to SOs with less than 100,000 customers) which means that they don't need to procure flexibility to resolve their network needs outside of their company (the flexibility is available in-house).</li> </ul>	<ul style="list-style-type: none"> <li>SOs (TSOs and DSOs): as the main customers of the system services which can be procured through Markets for SO Services, SOs have a big influence on the success of such platforms. Moreover, most of the SOs are interested in the Markets for SO Services: they have been part of the multiple research projects on the topic and recognize those markets potential. Nevertheless, their full interest depends on: the benefits (profits, increased efficiency and/or cost reduction) market-based flexibility procurement can bring to them (if compared to traditional solutions for operation and management of their systems); and on the change of current regulations, to allow those benefits to take place (especially on the side of DSOs).</li> <li>MOs: they are interested in expanding their business, by proposing and operating new markets as the flexibility one. This becomes evident when they join research projects and integrate their existing markets with the demonstrators. As experts in the energy markets domain, they have the necessary</li> </ul>
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		<ul style="list-style-type: none"> <li>• BRPs: the Markets for SO Services can negatively impact BRPs' balancing position, potentially increasing their cost. More specifically, the FSPs and independent aggregators will change the forecasted generation/load profiles, creating a difference between the planned and realized profiles, thus impacting BRPs' balancing position. Although the created imbalances can be compensated by the multiple resources in the BRPs' portfolio or can result in a positive imbalance revenue for the BRPs, the risk of incurring an extra imbalance cost reduces the interest of such stakeholders in Markets for SO Services.</li> <li>• Retailers: existing/potential consumers of the retailers can join independent aggregators or FSPs to provide system services through Markets for SO Services. These consumers have a revenue opportunity when joining aggregators or FSPs, instead of having just an electricity bill from retailers. This aspect can reduce the retailers' market, thus, their revenue, impacting their willingness to collaborate with Markets for SO Services.</li> <li>• ROs (grouped households, some industries): some ROs, such as households that can be grouped and not energy-intensive industries, can be interested in Markets for SO Services, but this is limited. For the households, they do not have enough knowledge or/and technology (e.g., controllable appliances) to join aggregators and provide flexibility. For some industries, their resources are already used in other contexts (e.g., industrial processes, day-ahead trading, etc.) and they might not identify a lot of benefits in providing flexibility. On the other hand, as they have a large potential to provide the needed flexibility, their influence is high, i.e., if they do not join the market, not enough flexibility might be available in the market.</li> </ul>	<p>knowledge and influence to implement Markets for SO Services and related platforms.</p> <ul style="list-style-type: none"> <li>• FSPs and Aggregators: possible FSPs are interested in the creation of flexibility services and in the new revenue streams they can get from flexibility provision. Although they do not have the power to change the regulation and/or to push the development of these services, their participation in the Markets for SO Services is of high importance: if FSPs do not join, market liquidity is low, undermining the success of the market.</li> <li>• European Union: the development of flexibility services has been included in the last electricity market directive and is being favored politically, as it may provide both environmental and economic benefits to society, businesses, and final consumers.</li> <li>• National Governments: sharing the European view on this subject, they may perceive the implementation of Markets for SO Services as an opportunity for society, businesses, and consumers.</li> <li>• National Regulators: similar to the national governments.</li> <li>• ROs (energy-intensive industries, commercial buildings, storage): those stakeholders are already part of Markets for SO Services (e.g., they provide balancing services such as aFRR or mFRR). Moreover, they have high provision capacity, the needed technology to respond to the flexibility need, and the interest in increasing their revenue streams.</li> </ul>
	Low	<ul style="list-style-type: none"> <li>• Developers, Engineers, and Contractors: they might perceive that their profit will shrink because the investment in power infrastructures will lessen. Therefore, they might oppose this change, but they do not have enough decision power to stop the implementation of Markets for SO Services or define how system services should be procured (their influence is low).</li> </ul>	<ul style="list-style-type: none"> <li>• Environmental Organizations: they might be in favor of Markets for SO Services as those can have a positive impact on the environment (e.g. increase energy efficiency through flexibility, enhance the use of local resources with aggregators, expand renewable generation and reduce its curtailment with the use of flexibility). On the other hand, their direct power to change regulation and implement those markets is limited.</li> <li>• Technology Companies: as providers of the necessary technology to support the implementation of the Markets for SO Services, their interest in the Markets for SO</li> </ul>



		<p>Services is high (and they see opportunities in developing modules, API, algorithms to support all the key activities of such business models).</p> <ul style="list-style-type: none"> <li>Universities and Research Companies: the new Markets for SO Services, thus its related aspects (such as market design, business models, market framework, products, roles and responsibilities, etc.) are innovative topics of interest of universities and research groups.</li> </ul>
	Low	High
Stakeholder interest/support		

### Strategies for the engagement of critical stakeholders

Effective strategies must be implemented to achieve the involvement of relevant stakeholders. These are discussed next, placing the focus on critical stakeholders.

After the stakeholder identification and the stakeholder analysis, an engagement plan is drafted, taking into consideration each of the aforementioned stakeholder types and influence level. Different engagement strategies are adopted for each of the types of actors (quadrants in the stakeholder matrix). Priority is given to measures aimed at the engagement of high influence challengers, because they tend to impose barriers to the creation of the business model.

- High influence challengers (high influence but low interest)

These actors have high influence but low interest, so their interest/support shall be increased:

- SOs (TSOs and DSOs)  
Change in the regulation in the control area of some DSOs to allow them to procure flexibility for system services. Enforce the unbundling of the DSOs.
- BRPs  
Clear methodologies to correctly allocate the cost of adjusting their balancing position. Clarity on the remuneration model between BRPs and FSPs. Establishment of incentives: BRPs do not “see the money” (thus the advantages) of the Markets for SO Services.
- Retailers:  
Clarity on the remuneration model between FSPs and retailers. Clear definition of the role of aggregators and their relation to retailers. Clear methodologies on the allocation of the imbalances on the side of the retailers’ consumers. Allowing consumers to have multiple service providers, e.g., one for the provision of flexibility, one for billing their consumption, etc., avoiding some retailers to lose market share. Application of smart-meter based settlement (it is present

in/coming to the Nordic and Baltic countries). Facilitate the competition on flexibility provision, which can increase the interest of retailers in becoming aggregators.

- ROs (grouped households, some industries)

Clear methodologies to remunerate flexibility provision and incentivize the value stack potential of the ROs. Clear methodologies and regulation related to resources' aggregation. Installation of smart meters in all households, and sub-meters where requested. Spread information to households on "how, how much, what, and benefits" of providing flexibility.

- High influence champions (high influence and high interest)

These actors are already interested by the BUC, but they must not be taken for granted:

- SOs (TSOs and DSOs)

Clear methodologies to calculate the benefit of joining Markets for SO Services for system services procurement (if compared to traditional methodologies) must be developed. Specific regulation must be implemented to allow SOs to correctly recover costs of market-based flexibility procurement. Actions to engage FSPs (especially consumers) must be taken in order to guarantee market liquidity.

- MOs

Clear regulation about Markets for SO Services implementation must be created in order to guarantee a trusted legal environment for the business development.

- FSPs and Aggregators

Fair remuneration mechanisms must be implemented to stimulate FSPs to enter the Markets for SO Services. Engagement plans must be developed for FSPs to participate. Actions to engage consumers to join FSPs must be taken to increase the resources available to FSPs to provide flexibility.

- European Union

Is proposing the development of these business models, thus has to see that its development will be aligned with its objectives.

- National governments

As for the European Union, national governments have to perceive that these business models will provide benefits to the population.

- National regulators

Similar to the national governments.

- ROs (energy-intensive industries, commercial buildings, storage)

Clear methodologies to remunerate flexibility provision and incentivize the value stack potential of the ROs. Clear methodologies and regulation related to resources' aggregation.

- Low influence challengers (low influence and low interest)

They have no interest and limited power in these business model. Nevertheless, they should be identified.

- Developers, Engineers, and Contractors

Keep those agents informed about the potential new markets and business that can arise with the development and implementation of Markets for SO Services.

- Low influence champions (low influence and high interest)

The ideas of both the technological companies that may provide the necessary assets to the management of flexibility and those of the environmental organizations must be heard to maintain their interest in the project.

- Environmental Organizations

Keep their support in the development and implementation of Markets for SO Services due to the benefits to the environment.

- Technology Companies

Gather their services for the development and implementation of Markets for SO Services.

- Universities and Research Companies

Collaborate with them to develop theoretical and applied research related to the Markets for SO Services.

### **Analysis of the compatibility of the BM for the Northern Flexibility Market with local regulation**

This section provides the identification of the regulatory barriers to the implementation and success of the local Market for SO Services business model defined here. The information discussed here has been obtained based on the WP3/WP11 Regulatory Questionnaire carried out for all the demonstrators. The regulatory barriers and possible measures to tackle them are presented below.

The regulatory barriers are split into five main groups: Definition of Roles and Responsibilities, Economic Incentives, Technology Related, Market Entry Requirements, and Market Integration and Coordination.

#### Definition of Roles and Responsibilities

- Definition of Independent Aggregators and their link to Balancing Responsible Parties

In most of the Northern demo countries (i.e. Estonia, Finland, and Lithuania) a definition of independent aggregators is in place. In those three countries, they are allowed, they exist in the power systems (specially in Finland), and their role is to provide different system services (e.g. balancing services such as mFRR and congestion management services). Only in Latvia, independent aggregators do not exist, but regulation on their role is being developed.

Although independent aggregators' role is defined (or the definition is on the way), the relationship between aggregators and balancing responsible parties (BRPs)/retail companies is not regulated (i.e. in Estonia) or a bilateral agreement between the aggregator and retailer is needed (i.e. in ongoing regulation of Latvia). This lack of clear definition on how aggregators (and FSPs in general) relate to BRPs can impact the Northern Flexibility Market business model in two ways: a) BRPs can oppose to the creation of Markets for SO Services, or can create barriers to their implementation, given that flexibility provision from their portfolio might harm their balancing position (one of the reasons why BRPs are high influence challengers); b) if aggregators are obliged to establish bilateral agreements with BRPs or retailers (as in Latvia), the transaction costs of creating an aggregator company is increased, which can, in the extreme, limit the number of aggregators in the Markets for SO Services.

- Definition of FMO

A clear definition of the Flexibility Market Operator (FMO) role is lacking in most of the Northern demo countries. For instance, in Estonia, only mFRR is provided as flexibility service, which means that only mFRR market is established. In this case, the TSO assumes the role of MO, and IMOs do not exist. Very recently, the Estonian DSO (being in the role of MO itself) has run a pilot auction to procure flexibility availability for congestion management. A similar situation is present in Lithuania, where only mFRR market exists, and the TSO takes up the role of MO. For local Markets for SO Services, the role of MO should be taken by a separate entity, but this is not allowed by current Lithuanian regulation, which means that DSOs would need to procure such flexibility through public procurement procedures. In Latvia, Markets for SO Services are not developed yet, thus there is no definition on whether the FMO will be independent or not. For that, one should take into account that balancing and congestion management are SO's responsibilities in this country. Only in Finland the role of the FMO is clearly defined: it is responsible for the Market for SO Services clearing and settlement.

The lack of definition of the FMO role, together with some constraints on the IMO existence (as in Lithuania) can prevent the establishment of the Northern Flexibility Market business model, because MOs are important players in this business model. They are the most natural customers of the FP, as MOs role includes making the bridge between FSPs and SOs, and the FP enables such activities. Moreover, many of the information and expertise needed for the success of the Markets for SO Services, thus FPs, is located in IMOs.

- Definition of the Governance of FRO and OO

In the Northern Demo countries, the role of the Flexibility Register Operator (FRO) and Optimization Operator (OO) is either not defined or not yet assigned. The non-existence and/or non-assignment of those roles can imply a regulatory risk for the entity taking them up, thus being a barrier to the Northern Flexibility Market business model, given that the FP performs FRO and OO related activities.

## Economic Incentives

- Lack of Regulation/Guidelines on Financial Compensation Mechanisms for the Flexibility Provision

In none of the four Northern demo countries, a financial compensation is applied and/or foreseen for the FSPs within the demo. However, they all recognize that a financial mechanism is necessary, and they identify that the compensation could take place in both directions (depending on whether the provision is upward or downward, the payment can be from the FSP to the SO or the other way around).

The lack of regulation and or guidelines on financial compensation mechanisms for the flexibility provision is a barrier to the Northern Flexibility Market business model, as the customers of the FP are not certain about the benefits/costs they might perceive/incur when joining Markets for SO Services, rendering this endeavour too risky for almost all actors. For FSPs, not knowing their remuneration implies not being able to calculate possible profits. For SOs, not knowing their possible flexibility procurement costs implies not being able to estimate if this methodology is better for system services than business as usual. For MOs, not knowing both possible profits of FSPs and costs of SOs implies not being able to create and operate a Market for SO Services. Moreover, for specific MOs such as Nord Pool, the volume of trading provides trading fees. The more there is trading the more the MO has revenues. If SOs make the Market for SO Services too difficult (multiple products, strict requirements etc.) for the FSP, then there will be less trading and less MO revenues.

- Policy/Regulatory Incentives and Cost Allocation Rules

It is important to establish policies and regulatory incentives, as well as correct cost allocation rules, on the pricing and assessment of contributions in the several coexisting markets for system services. In Estonia, separate pricing is applied for separate products (thus markets), and, currently, separate bids are considered for each of them. But, in the future, bids may be the same for the several services. This implies the need of establishing a cost allocation rule to correctly divide the costs between the different entities demanding the services. In Finland and Lithuania, the products for separate markets are separately priced, and no combined allocation rule is foreseen for products providing multiple system services (or for bids being used in multiple system services markets). In Latvia, the cost allocation rule is not a question, because Markets for SO Services do not exist.

In addition to the question of cost allocation rules when several coexisting markets for system services exist, and a value stacking potential is sought, there is also the question of cost allocation rule when multiple SOs jointly procure flexibility for their needs (in order to also increase the value stacking). The latter is especially important for the Northern demo context, given that a regional TSO-DSO flexibility market will be implemented. No specific policy or regulation is in place to define how costs should be allocated when multiple SOs jointly procure flexibility. In the demo, an initial settlement methodology

was proposed and tested, but further analysis is still needed to determine its benefits (when compared to other methodologies) and applicability (in real TSO-DSO Markets for SO Services). This is a barrier to the FP of Northern Flexibility Market business model because, again, SOs are uncertain about the costs they may incur when procuring system services through Markets for SO Services, as well as fairness issues might be raised depending on how those costs are divided (e.g. one SO with a congestion management need might question its cost share when another SO has both congestion management and balancing needs).

- **Additional Costs for Market Participants and/or High Costs for Small Ones**

Creating additional cost for Market for SO Services participants or unlimiting the flexibility provision costs for small participants can increase the entry barriers to participants, especially end-consumers, willing to provide flexibility. This jeopardizes the establishment of Markets for SO Services, and the success of FP business models as a result. In the following, some additional costs per Northern demo country are presented. In Estonia, independent aggregators tend to perceive unfavourable treatment (which can result in additional cost) compared with aggregators which are part of vertically integrated utilities. Moreover, there is a lack of regulation limiting or reducing the cost for small market participants. In Finland, e.g., for mFRR provision, metering and data exchange requirements related to the participation in Markets for SO Services are creating additional costs to the new market entrants. In addition, there is a minimum size for participants (1MW) and resources can be aggregated to participate indirectly (which can result in an even higher metering cost). In Latvia, the question is not applicable, as no Market for SO Services at DSO level is possible, and there is no Market for SO Services nor regulation in place at TSO level. In Lithuania, the regulation on Markets for SO Services should not create additional costs other than an increase in administrative costs, and minimum size constraints apply to small units possibly limiting their costs.

#### Technology Related

- **On the Operation of Assets by SOs**

In the Northern Demo countries, SOs might or might not be able to own and operate assets for solving system needs (e.g. congestion management and balancing). For storage, Estonian and Finnish SOs cannot operate storage. In Latvia and Lithuania, only DSOs are prevented to operate storage assets, while TSOs can for balancing service provision or for grid stability. For generation, Estonian TSO can operate power plants with the only purpose of ensuring the security of the system. Similarly, Finnish TSOs can own and operate power plants for the provision of mFRR, but these cannot participate in energy markets. Latvian DSOs cannot operate generation assets, while their TSOs can for the provision of balancing service. In Lithuania, TSOs cannot operate generation assets, while DSOs can operate their own devices to provide grid services.

The possibility of some SOs to operate assets can reduce their interest in procuring system services through Markets for SO Services, which is a barrier to the business model under analysis, unless if regulation is in place requiring to exhaust market-based flexibility procurement prior to the use of SOs' own resources. In that case, the amount of generation capacity owned or leased by SOs may be capped to bring open competition in flexibility procurement, since SOs are regulated entities. Also, SOs operate assets for balance management only. These aspects can reduce the impact of this barrier on the business model. Finally, the lack of harmonization between the regulation of the countries can be a barrier to the application of a common methodology for system services procurement.

- On the Quality of Metering Data

The success of Markets for SO Services, and of the business model of the FP under analysis here, is highly dependent on the access to and quality of the data from multiple agents: resolving the system services needs involves collecting and estimating the need of the SOs, gathering FSPs information and bids, and connecting the multiple stakeholders (including the MO). A first challenge is, then, the availability and reliability of such information, including having harmonized data standards for different countries. For instance, having access to accurate metering/submetering data to correctly calculate the baseline consumption/generation and estimate the actual amount of flexibility delivered can be a barrier, especially if different entities are responsible for the measurement in the same market. In the four Northern demo countries, no submetering rules are in place and/or no submetering processes/standards exist, which can jeopardize the access to the needed data for the settlement.

Moreover, different actors are responsible for collecting and monitoring the multiple data needed for the operation of Markets for SO Services. For instance, the DSOs are responsible for collecting end-customer metering data, which is used for billing, imbalance settlement, etc. This is different from the more granular asset-specific metering data, which would be required to participate in balancing markets, such as the mFRR, and is provided by the FSP to the TSO. Therefore, non-harmonized data standards, such as for metering, can be a barrier. In the four countries, different actors are responsible for collecting the metering data (e.g. the relevant SO or the provider of service to SOs), which means a coordination process between the multiple entities is necessary. Finally, also different actors are responsible for the process of data management, verification, and settlement: in Estonia and in Finland, the main meters' data is managed by the TSO, while in Latvia and Lithuania, the relevant SO is the one responsible.

Two final, but minor, data quality barriers (not necessarily linked to metering data) are: 1) the regulation that mandates the use of European data servers for such data management activities, making it impossible to use other countries repositories (as U.S. ones), reducing the possibilities of data

management services of the FP; and 2) the new product requirements, e.g., locational intraday (ST-P-E in the Northern demo), which implicate new data to be collected.

- On the Confidentiality of Data

The confidentiality of data from multiple agents in a Market for SO Services poses many challenges to the success of the FP, and they can become barriers to its business model, depending on how difficult it is to deal with such constraints. As mentioned before, the platform uses sensitive data from different stakeholders (e.g. topology from SOs, resources specifications and location and bids from FSPs, personal data like measurements from RPs), which must be communicated and used according to the security and privacy-preserving regulations. The FP must be able to implement the correct methodologies to comply with such regulations, and to communicate this ability to the different stakeholders so they can trust the platform. Moreover, consumer consent agreements must be clearly designed so platform customers are aware of and agree with the data usage terms.

In short, data confidentiality concerns all stakeholders including RPs, FSPs, MOs, SOs, etc. Appropriate consent mechanisms authorizing the limited usage of confidential data by the platform is then key to its success.

### Market Entry Requirements

Entry requirements to the FSPs willing to participate in Markets for SO Services can be a barrier to their participation, reducing the markets' liquidity and hindering their success. As a consequence, the business model under analysis here can be negatively impacted by such market entry requirements. Three types of entry requirements are presented here (minimum bid size, level of controllability, metering constraints), with examples from the Northern demo countries, and all have the same impact on the business model mentioned above. It is important to notice that the lack of specific regulation for Markets for SO Services and the procurement of other system service products (e.g. not only well-established balancing products, but also new locational congestion management products) can also imply a barrier, because it results in a regulatory uncertainty, thus risk, for these new markets.

- FSPs Size

In Estonia, Latvia and Finland, FSP bids smaller than 1 MW cannot participate in the mFRR market, while there is no regulation for other types of markets. Similarly, in Lithuania, the 1 MW minimum size applies for the mFRR product. On the other hand, no constraints are applied for congestion management in this country.

It is worth mentioning that FSPs can form resource groups with similar technical characteristics to achieve the defined minimum threshold to enter the target market. This action also ensures readiness during flexibility calls, and trading to produce optimal bids and increase likelihood of bid acceptance.



This could lower the impact of the minimum size barrier, as long as the markets are able to provide a framework for the resources' aggregation, FSPs are interested in participating, and a plan for engaging consumers and/or prosumers is in place.

- FSPs Level of Controllability

In Estonia, agents participating in Markets for SO Services should have appropriate individual (e.g. smart) meters installed. In Latvia, a mandatory granularity of 1 MW is applied to mFRR market, which means that participants should be able to adjust their output to a multiple of 1 MW. In Lithuania, agents participating must ensure their full availability to provide the procured service. In Finland, for balancing products such as the mFRR, a granularity of 1 MW is also applied. Offering flexibility with the accuracy of 1MW at the FSP level may be challenging due to aggregation of several ROs.

- Other Market Barriers to Market Participants

Generally, to guarantee consumers' engagement and the availability of resources to participate in Markets for SO Services, some points should be taken into account in the design of the entry requirements: 1) in a case with many consumers behind the connection point, aggregation rules have to guarantee access to those consumers to the market separately; 2) end-consumers should have the right to their own meter; 3) end-consumers should have the right to choose the aggregator and even have more than one aggregator if they deemed interesting. Moreover, an effective steering logic needs to be defined by the FSP as well, in order to engage the consumers/prosumers.

### Market Integration and Coordination

- Integration with Existent European Level Markets

The Markets for SO Services have been created for the procurement of system services from SOs to fulfil their needs (e.g. congestion management and balancing), and they are operated with existing energy and capacity markets as the day-ahead, the intra-day, and other Markets for SO Services for reserves (e.g. mFRR/MARI, aFRR/PICASSO). Therefore, there is a need to coordinate/integrate such new Markets for SO Services with the existent European level markets, which imposes limitations to the services the FP can provide (e.g. balancing) and the type of bids it can deal with (e.g. when, for certain products, bid forwarding is needed, the platform must be able to select and qualify the bids). For instance, a congestion management market has the potential to activate a lot smaller increments of bids, e.g., 100 kW, while the balancing market might need 1 MW volumes, making it difficult to forward bids from the first to the second (or the other way around). Also, the bid types (in terms of divisibility, complexity relationship, granularity, etc.) allowed by both markets can be different, potentially excluding some bids that could be forwarded and requiring a process between the markets for bid qualification. Moreover, with the goal of market integration, bids can be forwarded from the flexibility

platform to other markets, but they can also come from different markets. The lack of harmonization between the different markets' products makes the development and application of the FP challenging: if products are too specific, not many SOs would be interested in the use of the platform, and no forwarding would be possible; but if products are too general, some SOs needs would not be covered.

It is worth mentioning that the Northern demo has focused on solving this issue by harmonizing the products within different countries and by implementing bid qualification for bid forwarding (e.g. congestion management market to MARI), which resolves some of the issues discussed above. However, not all European-level markets were considered in this effort.

- TSO-DSO Coordination

One of the applications of the Market for SO Services that can be modelled is the coordination between TSOs and DSOs to render the procurement of flexibility for system services more efficient and increase the value stacking potential of FSPs resources. This, naturally, involves many barriers and some were already mentioned in this document, like cost allocation, and the management of data from different agents.

One other aspect, which is particularly related to the Northern demo cluster, is the regional interoperability. While the demo defines common processes, products, information model (CIM) and tools (e.g., FR), the real-life practical implementation needs further actions beyond the projects' lifetime. Important questions impacting the application of the FP, thus the success of its business model, are: how can one push to a regional platform? What are the government requirements for the regional level market?

It is worth mentioning that the EU-wide implementation of the OneNet solution requires further evaluation of different aspects (scalability, inter-operability, replicability) concerning standardized market products.

## 6 Description and analysis of the BMs associated with the BUCs defined for the Eastern Cluster

In this section, we provide the representation made and qualitative analysis conducted of each of the BMs within each of the Demos in the cluster: Polish, Czech, Hungarian, and Slovenian Demonstrators. We address separately the description and analysis of the BMs for each of them.

### 6.1 Description and analysis of the BMs for the Polish Demo

Here we provide a representation and analysis of the BMs within the Polish Demonstrator. Within the Polish Demonstrator, there are 4 BUCs defined:

- EACL-PL-01 - Prequalification of resources provided by FSPs to support flexibility services in the Polish demo;
- EACL-PL-02 - Managing flexibility delivered by DER to provide balancing services to TSO;
- EACL-PL-03 - Event-driven Active Power Management for Congestion Management and voltage control by the DSO; and
- EACL-PL-04 - Balancing Service Provider on the Flexibility Platform.

In this case, the description and the stakeholder engagement analysis are provided separately for each BM, while the analysis of the regulatory barriers to the implementation of BMs is carried out jointly for all the BMs in the Demonstrator.

#### 6.1.1 Representation and stakeholder analysis made of the BM for BUC EACL-PL-01

##### 6.1.1.1 Representation of the BM focused on MDC for BUC EACL-PL-01

This section provides the description and analysis for the OneNet's BUC "EACL-PL-01 - Prequalification of resources provided by FSPs to support flexibility services in the Polish demo", as described in OneNet D2.3 [14]. There, the objectives, stakeholders and roles, including their responsibilities, and the procedure of this BM are described.

##### Description of this BM: the Business Model Canvas

This BM is focused on the MDC, as its Central Actor. Next, the canvas of this BM is provided.

Table 6.1: BM canvas for BUC EACL-PL-01

<p>Key partnerships</p> <ul style="list-style-type: none"> <li>Management of meter data by the TSO's central data hub.</li> </ul> <p>(In this BUC the DSO also plays the role of MDC).</p>	<p>Key activities</p> <ul style="list-style-type: none"> <li>Meter data reading and quality control.</li> <li>Provides metering data to the TSO's central data hub.</li> </ul>	<p>Value proposition</p> <ul style="list-style-type: none"> <li>Meter data reading and quality control that allows the prequalification and registration of DERs in the FR, enabling them to submit bids on the FP and participate in the Market for SO Services.</li> <li>Meter data of high enough quality is central to implementing a fair, efficient, settlement process.</li> </ul>	<p>Customer relationships</p> <ul style="list-style-type: none"> <li>Direct personal relationship (acquisition and retention / trust).</li> </ul>	<p>Customer</p> <ul style="list-style-type: none"> <li>FSP (Unit/Flexibility provider is included in FSP's description in the BUC), who must need meter data management for their flexibility resources.</li> </ul>
<p>Cost structure</p> <ul style="list-style-type: none"> <li>Computer servers and other IT services.</li> <li>Human resources to carry out the daily operations.</li> <li>Other.</li> </ul>	<p>Key resources</p> <ul style="list-style-type: none"> <li>Meters that can measure DERs relevant characteristics (physical).</li> <li>Computer servers (physical).</li> </ul>		<p>Channel</p> <ul style="list-style-type: none"> <li>Personal meetings &amp; (awareness evaluation).</li> </ul>	
		<p>Revenue streams</p> <ul style="list-style-type: none"> <li>No direct revenues, cost is shared by the TSO and DSO through the TSO and DSO tariff respectively.</li> </ul>		

### 6.1.1.2 Analysis made of this BM

Next, the analysis made of this BM is provided concerning the classification of stakeholder and the definition of strategies for the engagement of critical stakeholders. The analysis of the compatibility of BMs with local regulation is provided jointly for all the BMs associated with BUCs in the Demonstrator.

#### Stakeholders' engagement analysis

In this section, the main stakeholders involved in the implementation of this BM are identified and classified according to their ability to affect the implementation of the BM and their interest in facilitating this implementation. Then, relevant strategies for the engagement of critical stakeholders, who have large power to affect the successful implementation of the BM but low interest in favouring it, are provided.

#### Power-interest Matrix

The power interest matrix for this BM is provided next, classifying in it the relevant stakeholders according to their power to affect the implementation of the BUC and their incentives to facilitate this implementation. For each stakeholder, its power to affect the implementation of this BUC and interest in facilitating it is discussed within the matrix.

Table 6.2: Classification of the stakeholders for the BM associated with the BUC EACL-PL-01: Power-interest matrix.

Stakeholder influence/power	High	<ul style="list-style-type: none"> <li>• Large-Scale Generators: As their interest may not be aligned with the goals of this BM, they might actively engage in discussions, or even regulatory processes that could impact the implementation of the MDC's value proposition. Companies operating large-scale power generation facilities, such as coal or gas-fired power plants, may see DERs as competitors. DER participation in the Market for SO Services could potentially reduce the need for energy from these sources, impacting their revenues.</li> <li>• Grid Operators: Grid operators that currently have ample capacity to meet demand without relying on DERs for flexibility may have limited interest in supporting DER participation. They may perceive DERs as unnecessary for grid stability. As their interest may not be aligned with the goals of this BM, they might actively engage in discussions, or even regulatory processes that could impact the implementation of the BM. Nevertheless, DSOs can have benefits from flexibility and it is important to explain to them how this can happen. In the case of TSOs, they could already use the flexibility resources connected to the DSO grid.</li> <li>• Utilities: In regions where utility companies hold monopolies over energy generation and retail, they</li> </ul>	<ul style="list-style-type: none"> <li>• European Union: The development of flexibility services has been included in the last electricity market directive and is being favoured politically, as it may provide both environmental and economic benefits to society, businesses and final consumers.</li> <li>• National governments: Sharing the European view on this subject, they may perceive this as an opportunity for society, businesses and final consumers.</li> <li>• International organizations representing particular stakeholder groups: E.g. SmartEn, Eurelectric, WindEurope among others.</li> <li>• ACER: who developed the Framework Guideline on DR which in fact is about flexibility. The now Network Code on DR will be the basic platform for the implementation of flexibility on the European electricity markets.</li> </ul>
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		<p>might resist DER integration as it could challenge their dominant position in the market. Again, as their interest may not align with the goals of this BM, they might actively engage in discussions, or even regulatory processes that could impact the implementation of the BM.</p> <ul style="list-style-type: none"> <li>• National regulators: They hold significant power in shaping the regulatory framework. They must allow DERs, aggregators and FSPs to provide flexibility to the DSO. Moreover, the DSO must be allowed to buy this kind of service and must receive a certain incentive.</li> <li>• Local and regional governments: They have influence over local policies, permitting processes, and community engagement. They might perceive that the DSO is not constructing a necessary power line.</li> <li>• Local interest groups: They can have influence over local sentiment and opinion. In line with the local governments, they might perceive that the DSO is choosing to give a poorer service.</li> </ul>	
	Low	<ul style="list-style-type: none"> <li>• Developers, engineers, and contractors: They might perceive that their profit will shrink because the investment in power infrastructures will lessen. Therefore, they might oppose this change, but they are not essential to the power system, so they have no influence.</li> </ul>	<ul style="list-style-type: none"> <li>• Environmental organizations: They might favour this approach as there will be fewer effects on the environment.</li> <li>• Technology companies: As they develop the products needed to measure the energy, manage these new systems, etc., they are interested in these types of business models.</li> <li>• FSPs and aggregators: The possible FSPs are interested in the creation of flexibility services. Nevertheless, they do not have any power, as they can't change the regulation and currently have no power to push for the development of these services.</li> </ul>
		Low	High
		Stakeholder interest/support	

### Strategies for the engagement of critical stakeholders

After the stakeholder identification and the stakeholder analysis, an engagement plan is being drafted, taking into consideration each of the aforementioned stakeholder types and influence level. Different engagement strategies are adopted for each of the types of actors (quadrants in the stakeholder matrix). Priority is given to measures aimed at the engagement of high influence challengers, because engaging them is necessary to create a favourable context for the implementation of this business model.

- High influence challengers (high influence but low interest)

These actors have high influence but low interest, so their interest/support shall be increased:

- Large-Scale Generators

Emphasize how DERs can reduce infrastructure upgrade costs. Offer participation in pilot projects to understand benefits. Advocate for regulatory frameworks that ensure fair compensation. Share real-world examples of successful DER integration. Explore incentive mechanisms and fair compensation models.

- Grid Operators

Highlight mutual benefits, showcasing how DERs can enhance grid stability. Propose collaborative pilot projects to assess impacts and build trust. Engage in regulatory discussions to create a supportive framework. Share data and research findings on DER benefits. Consider compensation mechanisms for grid operators. Analyse these strategies by discriminating the type of operator, TSO or DSO.

- Utilities

Demonstrate how DERs can support grid reliability and reduce costs. Propose collaborative pilot projects to address concerns. Engage in regulatory discussions to create supportive policies. Share data and case studies on DER integration benefits. Consider incentive structures for utilities supporting DERs.

- National regulators

The benefits and the increase in social welfare of this business model have to be clearly explained to the regulator so the corresponding regulation can be developed in a timely manner. The change in the methodology and regulations may have some problems to be adapted to the needs of the new solutions. Defining specific points to be addressed clearly and meetings can help in this regard.

- Local and regional governments

They must perceive that citizens' satisfaction is going to be at least as good as it would have been if the infrastructure has been built. This aspect has to be clearly explained to them as to how it will give benefits for fair participation in energy markets. The long and short-term benefits of the solution must be clearly explained, and very explicit comparisons must be given as to why the solution is better than simply building new infrastructure.

- Local interest groups

While the service does not become widely used, it also has to be explained to local interest groups. Communication is a key factor for them to understand why the service may not even be optimal at the beginning.

- High influence champions (high influence and high interest)

These actors are already interested by the BUC, but they must not be taken for granted, instead they can be used as supporters for other actors that might need more involvement:

- European Union

Is proposing the development of these business models, thus has to see that its development should be aligned with its objectives by following best practices.

- National governments

As for the European Union, national governments have to perceive that these business models will provide benefits to the population. These benefits could be in the form of economic growth, diversifying energy sources to reduce dependence on imports, and addressing climate change.

- International organisations representing particular stakeholder groups

Maintain them informed and involved in the development of the proposed solution.

- ACER

Maintain them informed and involved in the development of the proposed solution. Especially in the framework they have developed.

- Low influence challengers (low influence and low interest)

They have no interest as also low influence in these business model. Nevertheless, they are identified. For these group (developers, engineers, and contractors) communication can be a key factor to provide insights into how their roles can adapt or benefit from the changes.

- Low influence champions (low influence and high interest)

The ideas of both the technological companies that may provide que necessary assets to the management of flexibility and those of the environmental organizations must be heard to maintain their interest in the project. The flexibility providers' and aggregators' influence can go up if they can organize and conform groups, such as energy communities. Because of their high interest, these groups can support in providing with organized and clear key points that need to be addressed by the other groups of stakeholders as for example regulators.



## 6.1.2 Representation and stakeholder analysis made of the BM for BUC EACL-PL-02

### 6.1.2.1 Representation of the BM focused on the TSO for BUC EACL-PL-02

This section provides the description and analysis of the BM for the OneNet's BUC "EACL-PL-02 - Managing flexibility delivered by DER to provide balancing services to TSO", as described in OneNet D2.3. There, the objectives, stakeholders and roles, including their responsibilities, and the procedure of this BM are described.

#### **Description of this BM: the Business Model Canvas**

This BM is focused on the TSO, as its Central Actor. Next, the canvas of this BM is provided.

Table 6.3: BM canvas for BUC EACL-PL-02

<p>Key partnerships</p> <ul style="list-style-type: none"> <li>• Provision of information regarding constraints in the TSO network to the FP, by the FPO.</li> <li>• Pre-verification of submitted offers, taking into account TSO network constraints, by the FP.</li> <li>• Elimination of pre-verified offers that, if activated by the TSO, may cause problems in the DSO network, by the FP and the DSO.</li> <li>• Transfer of offers to the Balancing Market by the TMO, through the TSO's IT system.</li> <li>• Submission of offers for balancing energy by the BSPs that have been selected by the TSO, every morning.</li> </ul>	<p>Key activities</p> <ul style="list-style-type: none"> <li>• Announces, every morning, information on the constraints in the network.</li> <li>• Selects offers for balancing capacity products on the Balancing Market.</li> <li>• Provides information on the selection of offers for balancing products to the TMO in accordance with the rules set out in the Terms and Conditions related to Balancing.</li> <li>• Provides activation signals for delivery of balancing capacity products and/or balancing energy to the BSPs in accordance with the rules set out in the Terms and Conditions related to Balancing.</li> </ul>	<p>Value proposition</p> <ul style="list-style-type: none"> <li>• Managing active power flexibility delivered by DERs to acquire balancing services.</li> </ul>	<p>Customer relationships</p> <ul style="list-style-type: none"> <li>• Direct personal relationship (acquisition and retention / trust).</li> <li>• Interaction via balancing markets</li> </ul>	<p>Customer</p> <ul style="list-style-type: none"> <li>• BSP, that needs to have a valid contract with the TSO.</li> </ul>
<p>Cost structure</p> <ul style="list-style-type: none"> <li>• Computer servers and other IT services.</li> <li>• Human resources to carry out the daily operations.</li> <li>• Other.</li> </ul>	<p>Key resources</p> <ul style="list-style-type: none"> <li>• Meters that can measure whether the flexibility has been provided (physical).</li> <li>• Computer servers (physical).</li> </ul>	<p>Revenue streams</p> <ul style="list-style-type: none"> <li>• Avoiding penalties paid by the SOs, that are associated with outages caused by grid limits violations.</li> </ul>	<p>Channel</p> <ul style="list-style-type: none"> <li>• .</li> <li>• Online platforms for balancing markets</li> </ul>	

### 6.1.2.2 Analysis made of this BM

Next, the analysis made of this BM is provided concerning the classification of stakeholder and the definition of strategies for the engagement of critical stakeholders. The analysis of the compatibility of BMs with local regulation is provided jointly for all the BMs associated with BUCs in the Demonstrator.

#### Stakeholders’ engagement analysis

In this section, the main stakeholders involved in the implementation of this BM are identified and classified according to their ability to affect the implementation of the BM and their interest in facilitating this implementation. Then, relevant strategies for the engagement of critical stakeholders, who have large power to affect the successful implementation of the BM but low interest in favouring it, are provided.

#### Power-interest Matrix

The power interest matrix for this BM is provided next, classifying in it the relevant stakeholders according to their power to affect the implementation of the BUC and their incentives to facilitate this implementation. For each stakeholder, its power to affect the implementation of this BUC and interest in facilitating it is discussed within the matrix.

Table 6.4: Classification of the stakeholders for the BM associated with the BUC EACL-PL-01: Power-interest matrix.

Stakeholder influence/power	High	<ul style="list-style-type: none"> <li>Incumbent Balancing Service Providers (BSPs): They are very important to the implementation of the BM because BSP are proposed as customers in the BM. Existing BSPs may see DERs as newcomers disrupting their established role in providing balancing services. They may resist the entry of DERs into this market, perceiving them as competitors.</li> <li>Grid Operators: DSOs can have benefits from flexibility. TSOs could already use the flexibility resources connected to the DSO grid via the balancing market. It is important to explain to both TSO and DSO how this can happen with good coordination. Their expertise and experience in managing grid operations can provide valuable insights and potentially influence the implementation of active power flexibility services. Traditional grid operators that have not yet adapted to integrating DERs into their operations may face challenges in accommodating DERs' active power flexibility. They might have to invest in new technologies and systems, which could be viewed as a disadvantage.</li> </ul>	<ul style="list-style-type: none"> <li>TSO: As a central actor, their interest is dependent on the benefits/incentives from these solutions, from the existence of the necessary regulatory framework to support it, and from limitations that may exist regarding the confidentiality of data to be exchanged. The TSOs need also to implement adequate tools for flexibility needs assessment.</li> <li>European Union: The development of flexibility services has been included in the last electricity market directive and is being favored politically, as it may provide both environmental and economic benefits to society, businesses and final consumers.</li> <li>National governments: Sharing the European view on this subject, they may perceive this as an opportunity for society, businesses and final consumers.</li> </ul>
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		<ul style="list-style-type: none"> <li>National regulators: They hold significant power in shaping the regulatory framework. Regulatory bodies that are inclined toward conventional energy market models may not fully embrace the idea of DERs playing a significant role in balancing services. They might need convincing regarding the benefits and reliability of DER participation.</li> </ul>	
	LOW	<ul style="list-style-type: none"> <li>Developers, engineers, and contractors: They might perceive that their profit will shrink because the investment in power infrastructures will lessen. Therefore, they might oppose this change, but they are not essential to the power system, so they have no influence.</li> </ul>	<ul style="list-style-type: none"> <li>Environmental organizations: They might favor this approach as there will be fewer effects on the environment.</li> <li>Technology companies: As they develop the products needed to measure the energy, manage these new systems, etc., they are interested in these types of business models.</li> <li>Units/Flexibility providers/BSP: They are interested in providing their flexibility for economic/environmental reasons, but possibly don't have a big enough influence to push for regulation/policy changes towards the direction of the development of these services.</li> </ul>
		Low	High
		Stakeholder interest/support	

### Strategies for the engagement of critical stakeholders

After the stakeholder identification and the stakeholder analysis, an engagement plan is being drafted, taking into consideration each of the aforementioned stakeholder types and influence level. Different engagement strategies are adopted for each of the types of actors (quadrants in the stakeholder matrix). Priority is given to measures aimed at the engagement of high influence challengers, because engaging them is necessary to create a favourable context for the implementation of this business model.

- High influence challengers (high influence but low interest)

These actors have high influence but low interest, so their interest/support shall be increased:

- Incumbent Balancing Service Providers (BSPs)
  - Explore partnerships with existing BSPs to transition into a DER-friendly role or collaborate on DER integration projects. Organize workshops and forums where BSPs can learn about the benefits of DER integration and share their concerns.
- Grid Operators
  - Provide training programs and resources to help traditional grid operators understand DER technologies and their potential impact. Look for government or industry support to help traditional grid operators invest in the necessary infrastructure and technology upgrades.
- National regulators

Present robust data and case studies showcasing the benefits of DER integration in balancing services, such as cost savings and improved grid stability. The benefits and the increase in social welfare of this business model have to be clearly explained to the regulator so the corresponding regulation can be developed in a timely manner. The change in the methodology and regulations may have some problems to be adapted to the needs of the new solutions. Defining specific points to be addressed clearly and meetings can help in this regard. Collaborate with regulators on pilot programs and regulatory sandboxes to demonstrate the feasibility of DER integration.

- High influence champions (high influence and high interest)

These actors are already interested by the BUC, but they must not be taken for granted, instead they can be used as supporters for other actors that might need more involvement:

- TSO

Understanding TSO objectives and challenges, offering technical solutions that enhance grid reliability, and demonstrating proven results from similar projects. It's essential to engage in regulatory discussions, collaborate with industry partners, and promote data sharing while maintaining an open dialogue with TSO representatives. All of these, following a collaborative approach.

- European Union

is proposing the development of these business models, thus has to see that its development should be aligned with its objectives by following best practices.

- National governments

As for the European Union, national governments have to perceive that these business models will provide benefits to the population. These benefits could be in the form of economic growth, diversifying energy sources to reduce dependence on imports, and addressing climate change.

- Low influence challengers (low influence and low interest)

They have no interest as also low influence in these business model. Nevertheless, they are identified. For these group (developers, engineers, and contractors) communication can be a key factor to provide insights into how their roles can adapt or benefit from the changes.

- Low influence champions (low influence and high interest)

The ideas of both the technological companies that may provide que necessary assets to the management of flexibility and those of the environmental organizations must be heard to maintain their interest in the project. The flexibility providers' and BSP influence can go up if they can organize and conform groups, such as energy communities. Because of their high interest, these groups can

support in providing with organized and clear key points that need to be addressed by the other groups of stakeholders as for example regulators.

### **6.1.3 Representation and stakeholder analysis made of the BM for BUC EACL-PL-03**

#### **6.1.3.1 Representation of the BM focused on FPO for EACL-PL-03**

This section provides the description and analysis for the OneNet's BUC "EACL-PL-03 - Event-driven Active Power Management for Congestion Management and voltage control by the DSO", as described in the OneNet D2.3 [14]. There, the objectives, stakeholders and roles, including their responsibilities, and the procedure of this BM are described.

##### **Description of this BM: the Business Model Canvas**

This BM is focused on the FPO, as its Central Actor. Next, the canvas of this BM is provided.

Table 6.5: BM canvas for BUC EACL-PL-03

Key partnerships	Key activities	Value proposition	Customer relationships	Customer
<ul style="list-style-type: none"> <li>• Auction calling for flexibility services by the DSO.</li> <li>• Bidding from FSPs who wish to participate in the auction and have passed the prequalification process.</li> <li>• Sending of updated MOLs that give the expected technical result by the DSO.</li> <li>• Sending of information with a request to start the resource activation procedure by the DSO.</li> <li>• Sending of confirmation about receiving the activation signal and information about the activation and termination processes by the FSPs.</li> <li>• Sending of baselines needed for the billing of services by the FSPs.</li> </ul>	<ul style="list-style-type: none"> <li>• Sends notifications about new auctions for the active power management service, based on the request from the DSO.</li> <li>• Closes the auctions at the appointed time and collects all the bids.</li> <li>• Creates MOL based on the collected offers and sends it to the DSO for verification.</li> <li>• Updates the stack of offers, based on DSO recommendations and analyzes the MOL taking into account the economic and technical conditions.</li> <li>• Selects the optimal offer that meets technical and economic expectations.</li> <li>• Terminates the auction if divergent prices are expected by DSOs and submitted by FSPs, otherwise informs the FSPs who participated in the auction about the results.</li> <li>• Informs the DSO about the auction result and possibly about the optimal offer.</li> </ul>	<ul style="list-style-type: none"> <li>• Provision of market-based event-driven flexibility services based on active power, that allow congestion management and voltage control in the distribution network.</li> </ul>	<ul style="list-style-type: none"> <li>• Direct personal relationship (acquisition and retention / trust).</li> </ul>	<ul style="list-style-type: none"> <li>• FSP (Unit/Flexibility provider is included in the FSP description in the BUC), SO.</li> <li>• DSO must have congestion/voltage violation problems.</li> <li>• FSP must have resources that may solve DSO's congestion and/or voltage violation problems.</li> </ul>

<ul style="list-style-type: none"> <li>• Collection and provision of requested meter data for each of the indicated FSPs by the DSO.</li> <li>• Sending of confirmation regarding the receipt of the invoice by the DSO.</li> </ul>	<ul style="list-style-type: none"> <li>• Informs the DSO about the planned use of the selected offer on a strictly defined date.</li> <li>• Enters the selected offer for a given day in the activation plan to include it in the day-ahead planning (in case of medium-term auctions).</li> <li>• Sends a signal with information about the need to activate the FSP's resource under the contracted service.</li> <li>• Collects information about all contracted services in a given period and requests baselines needed for the billing of services from the FSPs.</li> <li>• Requests (from the DSO) meter data from meters on the indicated clients' resources for a specified period when the service was provided.</li> <li>• Verifies the correctness of the delivery of each of the contracted offers based on the received metered data and baseline data and creates a list of offers that have not been properly delivered, identifying deviations from the corresponding contracted offers.</li> <li>• Calculates the payment for each offer (including any fines charged</li> </ul>			
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	<p>for failure to perform the service) and informs FSPs who have not kept their contracts.</p> <ul style="list-style-type: none"> <li>• Prepares relevant documents and invoices and sends them to the DSO.</li> <li>• Sends a confirmation to the FSPs that the invoice has been issued and received by the DSO.</li> </ul>			
	<p>Key resources</p> <ul style="list-style-type: none"> <li>• Financial guarantees, both for the DSO and the FSP/FSPA (financial).</li> <li>• Market matching system (platform).</li> <li>• Computer servers (physical).</li> </ul>		<p>Channel</p> <ul style="list-style-type: none"> <li>• Communication through the FP.</li> </ul>	
<p>Cost structure</p> <ul style="list-style-type: none"> <li>• Computer servers and other IT services.</li> <li>• Human resources to carry out the daily operations.</li> <li>• Other.</li> </ul>	<p>Revenue streams</p> <ul style="list-style-type: none"> <li>• Option 1 (fixed payment): <ul style="list-style-type: none"> <li>○ Regulated tariff where both the DSO and the FSP pay a fixed amount, whether they use this service or not (subscription fee / fixed pricing).</li> </ul> </li> <li>• Option 2 (fixed + variable payments): <ul style="list-style-type: none"> <li>○ Payment of a brokerage fee both by the SO and the FSP each time the service is requested (brokerage fees / fixed pricing).</li> <li>○ Payment of a subscription fee both by the SO and the FSP to be able to access the market (subscription fee / fixed pricing).</li> </ul> </li> <li>• Option 3 (paid through electricity tariffs): <ul style="list-style-type: none"> <li>○ IMO costs are recovered through regulated tariffs paid by all electricity consumers (tax / fixed pricing).</li> </ul> </li> </ul>			

### 6.1.3.2 Analysis made of this BM

Next, the analysis made of this BM is provided concerning the classification of stakeholder and the definition of strategies for the engagement of critical stakeholders. The analysis of the compatibility of BMs with local regulation is provided jointly for all the BMs associated with BUCs in the Demonstrator.

#### Stakeholders' engagement analysis

In this section, the main stakeholders involved in the implementation of this BM are identified and classified according to their ability to affect the implementation of the BM and their interest in facilitating this implementation. Then, relevant strategies for the engagement of critical stakeholders, who have large power to affect the successful implementation of the BM but low interest in favouring it, are provided.

#### Power-interest Matrix

The power interest matrix for this BM is provided next, classifying in it the relevant stakeholders according to their power to affect the implementation of the BUC and their incentives to facilitate this implementation. For each stakeholder, its power to affect the implementation of this BUC and interest in facilitating it is discussed within the matrix.

Table 6.6: Classification of the stakeholders for the BM associated with the BUC EACL-PL-03: Power-interest matrix.

Stakeholder influence/power	High	<ul style="list-style-type: none"> <li>Traditional Energy Suppliers: They are familiar with market dynamics, often have a diverse portfolio of resources including generation and storage, and they also have significant presence in energy markets. If the FPO enables the integration of more DERs (DERs), it could potentially reduce the reliance on traditional centralized energy suppliers. This might lead to a decreased market share or competitiveness for traditional suppliers.</li> <li>DSOs: They are very important to the implementation of the BM because they are the proposed customers. As the main customers of Markets for SO Services and as entities responsible for the management and efficient operation of the networks, they may have an interest in this use case. Nonetheless, their interest is dependent on the benefits/incentives from these solutions and from the existence of necessary regulatory framework to support it. The SOs need also to have implemented adequate tools for flexibility needs assessment,</li> <li>National regulators: They hold significant power in shaping the regulatory framework. They must allow DERs, aggregators and FSPs to provide flexibility to the DSO. Moreover, the DSO must be</li> </ul>	<ul style="list-style-type: none"> <li>MOs: They have influence and power as they are the experts in the energy market, furthermore, they are interested in expanding their business, by operating in new markets as the flexibility one.</li> <li>European Union: The development of flexibility services has been included in the last electricity market directive and is being favored politically, as it may provide both environmental and economic benefits to society, businesses and final consumers.</li> <li>National governments: Sharing the European view on this subject, they may perceive this as an opportunity for society, businesses and final consumers.</li> </ul>
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		<p>allowed to buy this kind of service and must receive a certain incentive.</p> <ul style="list-style-type: none"> <li>Local and regional governments: They have influence over local policies, permitting processes, and community engagement. They might perceive that the DSO is not constructing a necessary power line.</li> <li>Local interest groups: They can have influence over local sentiment and opinion. In line with the local governments, they might perceive that the DSO is choosing to give a poorer service.</li> </ul>	
	Low	<ul style="list-style-type: none"> <li>Developers, engineers, and contractors: They might perceive that their profit will shrink because the investment in power infrastructures will lessen. Therefore, they might oppose this change, but they are not essential to the power system, so they have no influence.</li> </ul>	<ul style="list-style-type: none"> <li>Environmental organizations: They might favor this approach as there will be fewer effects on the environment.</li> <li>Technology companies: As they develop the products needed to measure the energy, manage these new systems, etc., they are interested in these types of business models.</li> <li>Units/Flexibility providers: They are interested in providing their flexibility for economic/environmental reasons, but possibly don't have a big enough influence to push for regulation/policy changes towards the direction of the development of these services.</li> </ul>
		Low	High
Stakeholder interest/support			

### Strategies for the engagement of critical stakeholders

After the stakeholder identification and the stakeholder analysis, an engagement plan is being drafted, taking into consideration each of the aforementioned stakeholder types and influence level. Different engagement strategies are adopted for each of the types of actors (quadrants in the stakeholder matrix). Priority is given to measures aimed at the engagement of high influence challengers, because engaging them is necessary to create a favourable context for the implementation of this business model.

- High influence challengers (high influence but low interest)

These actors have high influence but low interest, so their interest/support shall be increased:

- Traditional Energy Suppliers

They can be engaged by working with regulatory bodies to create a regulatory environment that encourages the participation of traditional energy suppliers in emerging markets. By encouraging collaboration between them and new market entrants. Joint projects and partnerships as also education and awareness about the changing landscape of the energy industry and the possibilities to be part of new solutions.

- DSO

The regulation has to provide a fair retribution for delaying investments in the grid so that the DSO does not prioritize any of the investments just because of its profits. To get their attention, it must be clear that coordination with flexibility services works well and is more cost-effective than building new infrastructure. For this, the DSO needs to be able to get the flexibility service on time and should be able to measure the impacts of procuring these services. The SOs need also to have implemented adequate tools to implement the solution in an optimal manner.

- National regulators

The benefits and the increase in social welfare of this business model have to be clearly explained to the regulator so the corresponding regulation can be developed in a timely manner. The change in the methodology and regulations may have some problems to be adapted to the needs of the new solutions. Defining specific points to be addressed clearly and meetings can help in this regard.

- Local and regional governments

They must perceive that citizens' satisfaction is going to be at least as good as it would have been if the infrastructure has been built. This aspect has to be clearly explained to them. The long and short-term benefits of the solution must be clearly explained, and very explicit comparisons must be given as to why the solution is better than simply building new infrastructure.

- Local interest groups

While the service does not become widely used, it also has to be explained to local interest groups. Communication is a key factor for them to understand why the service may not even be optimal at the beginning.

- High influence champions (high influence and high interest)

These actors are already interested by the BUC, but they must not be taken for granted, instead they can be used as supporters for other actors that might need more involvement:

- MOs

A well-defined set of regulations is necessary to establish a reliable legal framework that ensures a secure environment for the growth of their business around Markets for SO Services.

- European Union

It is proposing the development of these business models, thus has to see that its development should be aligned with its objectives by following best practices.

- National governments

As for the European Union, national governments have to perceive that these business models will provide benefits to the population. These benefits could be in the form of economic growth, diversifying energy sources to reduce dependence on imports, and addressing climate change.

- MOs

Regulation about Markets for SO Services implementation should be clear and must be created in order to guarantee a trusted legal environment for the development of the BM.

- Low influence challengers (low influence and low interest)

They have no interest and also low influence in these business model. Nevertheless, they are identified. For these group (developers, engineers, and contractors) communication can be a key factor to provide insights into how their roles can adapt or benefit from the changes.

- Low influence champions (low influence and high interest)

The ideas of both the technological companies that may provide que necessary assets to the management of flexibility and those of the environmental organizations must be heard to maintain their interest in the project. The flexibility providers' influence can go up if they can organize and conform groups, such as energy communities. Because of their high interest, these groups can support in providing with organized and clear key points that need to be addressed by the other groups of stakeholders as for example regulators.

## 6.1.4 Representation and stakeholder analysis made of the BM for BUC EACL-PL-04

### 6.1.4.1 Representation of the BM focused on TSO for EACL-PL-04

This section provides the description and analysis for the OneNet's BUC "EACL-PL-04- Balancing Service Provider on the Flexibility Platform", as described in the OneNet D2.3. There, the objectives, stakeholders' and roles, including their responsibilities, and the procedure of this BM are described.

#### **Description of this BM: the Business Model Canvas**

This BM is focused on the Transmission System Operator, as its Central Actor. Next, the canvas of this BM is provided.

Table 6.7: BM canvas for BUC EACL-PL-04

<p>Key partnerships</p> <ul style="list-style-type: none"> <li>The existing BSP applies for confirmation of his relationship status with the TSO.</li> <li>FPO informs TSO about the readiness to test new SUs.</li> </ul>	<p>Key activities</p> <ul style="list-style-type: none"> <li>Confirms his relationship status with existing BSPs.</li> <li>Sets the date and procedure for testing new SUs and confirms or rejects the SUs based on the results.</li> <li>Confirms readiness of SUs and corresponding BSPs to provide balancing services (in case of positive test results) and repeats (recertification) when changes take place within the SUs or when new information emerges by additional tests conducted.</li> </ul>	<p>Value proposition</p> <ul style="list-style-type: none"> <li>Increase in the efficiency of the procurement of market-based balancing services provided by BSP linked with FSPs through a FP, allowing the latter to indirectly take part in the balancing markets. This increase would result from the increase in the number of BSPs being allowed to participate in the market through the improvements achieved in the prequalification process.</li> <li>Increase in the efficiency of the pre-qualification process through the certification of additional BSPs.</li> </ul>	<p>Customer relationships</p> <ul style="list-style-type: none"> <li>Should involve the exchange of the required information through standard means.</li> </ul>	<p>Customer</p> <ul style="list-style-type: none"> <li>BSP.</li> </ul>
	<p>Key resources</p> <ul style="list-style-type: none"> <li>Financial guarantees, both for the DSO and the FSP (financial).</li> <li>Market matching system (platform).</li> <li>Meters that can measure whether the flexibility has been provided (physical).</li> <li>Computer servers (physical).</li> </ul>		<p>Channel</p> <ul style="list-style-type: none"> <li>Standard means, like platforms developed for this (FP).</li> </ul>	
<p>Cost structure</p> <ul style="list-style-type: none"> <li>Computer servers and other IT services.</li> <li>Human resources to carry out the daily operations.</li> </ul>		<p>Revenue streams</p> <ul style="list-style-type: none"> <li>Decrease in procurement costs could, potentially, be partly retained by the TSO if incentive schemes of this type are in place.</li> </ul>		

	<ul style="list-style-type: none"><li>• Potential increase in the amount of flexibility available to be mobilized, which could result in an increase in the system security.</li></ul>
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### 6.1.4.2 Analysis made of this BM

Next, the analysis made of this BM is provided concerning the classification of stakeholder and the definition of strategies for the engagement of critical stakeholders. The analysis of the compatibility of BMs with local regulation is provided jointly for all the BMs associated with BUCs in the Demonstrator.

#### Stakeholders' engagement analysis

In this section, the main stakeholders involved in the implementation of this BM are identified and classified according to their ability to affect the implementation of the BM and their interest in facilitating this implementation. Then, relevant strategies for the engagement of critical stakeholders, who have large power to affect the successful implementation of the BM but low interest in favouring it, are provided.

#### Power-interest Matrix

The power interest matrix for this BM is provided next, classifying in it the relevant stakeholders according to their power to affect the implementation of the BUC and their incentives to facilitate this implementation. For each stakeholder, its power to affect the implementation of this BUC and interest in facilitating it is discussed within the matrix.

Table 6.8: Classification of the stakeholders for the BM associated with the BUC EACL-PL-04: Power-interest matrix.

Stakeholder influence/power	High	<ul style="list-style-type: none"> <li>National regulators: They hold significant power in shaping the regulatory framework. They must allow DERs, aggregators and FSPs to provide flexibility to the DSO. Moreover, the DSO must be allowed to buy this kind of service and must receive a certain incentive.</li> </ul>	<ul style="list-style-type: none"> <li>European Union: The development of flexibility services has been included in the last electricity market directive and is being favored politically, as it may provide both environmental and economic benefits to society, businesses and final consumers.</li> <li>National governments: Sharing the European view on this subject, they may perceive this as an opportunity for society, businesses and final consumers.</li> <li>TSO: As main beneficiary, they might have high interest in the BM and can have a high influence if the solution is well explained and executed.</li> </ul>
	Low	<ul style="list-style-type: none"> <li>Developers, engineers, and contractors: They might perceive that their profit will shrink because the investment in power infrastructures will lessen. Therefore, they might oppose this change, but they are not essential to the power system, so they have no influence.</li> <li>Local and regional governments: The influence that they may have over local policies, permitting processes, and community engagement needs to be analysed.</li> </ul>	<ul style="list-style-type: none"> <li>Environmental organizations: They might favor this approach as there will be fewer effects on the environment.</li> <li>Technology companies: As they develop the products needed to measure the energy, manage these new systems, etc., they are interested in these types of business models.</li> <li>BSP: They are interested in providing their services, but possibly don't have a big enough influence to push for regulation/policy changes in that direction.</li> <li>Units/Flexibility providers: They may be interested in providing their flexibility for economic/environmental reasons but may face some problems. They are very important for the</li> </ul>



	<p>They might perceive that the DSO is not constructing a necessary power line.</p> <ul style="list-style-type: none"> <li>Local interest groups: Their influence over local sentiment and opinion need to be analyzed. In line with the local governments, they might perceive that the DSO is choosing to give a poorer service.</li> </ul>	<p>development of this BM, so maybe have enough influence to push for regulation/policy changes towards the direction of the development of these services.</p>
	Low	High
Stakeholder interest/support		

### Strategies for the engagement of critical stakeholders

After the stakeholder identification and the stakeholder analysis, an engagement plan is being drafted, taking into consideration each of the aforementioned stakeholder types and influence level. Different engagement strategies are adopted for each of the types of actors (quadrants in the stakeholder matrix). Priority is given to measures aimed at the engagement of high influence challengers, because engaging them is necessary to create a favourable context for the implementation of this business model.

- High influence challengers (high influence but low interest)

These actors have high influence but low interest, so their interest/support shall be increased:

- National regulators

The benefits and the increase in social welfare of this business model have to be clearly explained to the regulator so the corresponding regulation can be developed in a timely manner. The change in the methodology and regulations may have some problems to be adapted to the needs of the new solutions. Defining specific points to be addressed clearly and meetings can help in this regard.

- High influence champions (high influence and high interest)

These actors are already interested by the BUC, but they must not be taken for granted, instead they can be used as supporters for other actors that might need more involvement:

- European Union

It is proposing the development of these business models, thus has to see that its development should be aligned with its objectives by following best practices.

- National governments

As for the European Union, national governments have to perceive that these business models will provide benefits to the population. These benefits could be in the form of economic growth, diversifying energy sources to reduce dependence on imports, and addressing climate change.

- TSO

They need to have the adequate tools to implement the solutions in an optimal manner.

- Low influence challengers (low influence and low interest)

They have no interest and also low influence in these business model. Nevertheless, they are identified. For developers, engineers, and contractors, communication can be a key factor to provide insights into how their roles can adapt or benefit from the changes.

- Local and regional governments

They must perceive that citizens' satisfaction is going to be at least as good as it would have been if the infrastructure has been built. This aspect has to be clearly explained to them. The long and short-term benefits of the solution must be clearly explained, and very explicit comparisons must be given as to why the solution is better than simply building new infrastructure.

- Local interest groups

While the service does not become widely used, it also has to be explained to local interest groups. Communication is a key factor for them to understand why the service may not even be optimal at the beginning.

- Low influence champions (low influence and high interest)

The ideas of both the technological companies that may provide the necessary assets to the management of flexibility and those of the environmental organizations must be heard to maintain their interest in the project. The flexibility providers' and BSP influence can go up if they can organize and conform groups, such as energy communities. Because of their high interest, these groups can support in providing with organized and clear key points that need to be addressed by the other groups of stakeholders as for example regulators. The influence of the units/flexibility providers can go up if they can organize and conform groups, such as energy communities. Their interest is dependent on their engagement from the beginning by analysing their needs and concerns through surveys. These groups can support in providing organized and clear key points that need to be addressed by the other groups of stakeholders as for example regulators. There must be no discrimination and therefore the regulatory framework must be well thought out, there must also be facilities for their participation, in this sense some components can help, such as security and automation.

## 6.1.5 Analysis of the compatibility of the Polish BMs with local regulation

This section provides the identification of the regulatory barriers to the implementation and success of the local Market for SO Services business models for Poland. The information discussed here has been obtained based on the WP3/WP11 Regulatory Questionnaire carried out for all the demonstrators. The regulatory barriers and possible measures to tackle them are presented below. Whenever a barrier is specific to a certain BM, this is mentioned.

The regulatory barriers are split into three main groups: lack of definition of roles and responsibilities, economic incentives provided, and lack of additional enabling regulation. The barriers of each of these types are discussed in a separate subsection.

### 6.1.5.1 Barriers related to the lack of definition of roles and responsibilities

#### Further specification of the TSO and DSO model

In Poland, the TSO acts as a balancing MO, procuring both balancing and congestion management services in an integrated scheduling process. No other Market for SO Services exists. By law there is only one balancing market in the country, so this needs to be checked if it could limit the participation of DERs and BSPs. Participation in the balancing market as a BRP imposes additional costs, while rules applying to BSP are to be modified soon. As BSPs are customers of BMs BM EACL-PL-02 and BM EACL-PL-04, this modification should be considered. These further affect BM EACL-PL-02, in which the TSO must rely heavily on the FP for accurate data on available flexibility resources since no alternative markets exist. This lack of an alternative market can also affect BM EACL-PL-04.

In addition, the DSOs cannot buy congestion management and voltage control products in the market because there is no market for this, affecting in this case the BM EACL-PL-03.

### 6.1.5.2 Barriers related to the economic incentives provided

#### Lack of suitable regulation guiding the implementation of alternative flexibility procurement mechanisms

Flexibility can be procured through different mechanisms rewarding the provision of flexibility. The acquisition of flexibility may not rely only on one specific mechanism, but will rather involve applying a combination of them, depending on the characteristics of the needs and the resources that can provide this flexibility. These mechanisms, which can span various timeframes ranging from long-term planning to real-time operation, include the following: connection and access agreements, bilateral contracts, auctions, dynamic tariffs, and others. The design of these mechanisms needs to be carefully considered in order for them to effectively complement each other, produce consistent signals, and optimize the utilization of all the resources.

Procurement mechanisms are essential for the development of local markets and DERs flexibility provision, which affect all BMs.

### 6.1.5.3 Lack of additional enabling regulation

#### **Lack of regulation protecting agents from market power abuse by access to information**

There is a lack of regulation protecting agents from market power abuse by incumbents on access to information. This can impact in all the BMs in different ways. In EACL-PL-01 this can impact the quality of meter data reading and quality control that is central to implementing a fair and efficient settlement process. In EACL-PL-02 and EACL-PL-04 this could hinder the participation in the balancing market effectively.

#### **Constraints on the participation of agents in Markets for SO Services**

According to the answers provided by partners in the Polish Demonstrator, there may be some constraints related to the agents' size for their participation in Markets for SO Services. If this kind of constraints were in place, they could limit the availability of DERs and FSPs to participate in the Market for SO Services, which would affect all BMs in different ways. For EACL-PL-01 and EACL-PL-03 these are possible customers, and for EACL-PL-02 and EACL-PL-04 this could limit the amount of active power flexibility that can be delivered. Nevertheless, if in the future the participation of small flexibility providers is possible, then the portfolio managed by aggregators can grow (now there is a small size of the portfolio). Due to this small size of the portfolio managed by the aggregators, they don't need to pay compensations for the imbalances they create when providing flexibility services. The regulation could be reviewed in this regard.

In addition, there is no regulation limiting the costs of small market agents related to their participation in Markets for SO Services, therefore this needs to be verified to have fair competition with larger market players, as this affects all the BMs.

## 6.2 Description and analysis of the BMs for the Czech Demo

Here we provide a representation and analysis of the BMs within the Czech Demonstrator. Within the Czech Demonstrator, there are 2 BUCs defined:

- EACL-CZ-01 - Nodal area congestion management, and
- EACL-CZ-02 - Reactive power overflow management.

In this case, the description and the stakeholder engagement analysis are provided separately for each BM, while the analysis of the regulatory barriers to the implementation of BMs is carried out jointly for all the BMs in the Demonstrator.

## 6.2.1 Representation and stakeholder analysis made of the BM for BUC EACL-CZ-01

### 6.2.1.1 Representation of the BM focused on Aggregator for EACL-CZ-01

This section provides the description and analysis for the OneNet's BUC "EACL-CZ-01 - Nodal area congestion management", as described in [14]. There, the objectives, stakeholders' roles, including their responsibilities, and the procedure of this BM are described.

#### **Description of this BM: the Business Model Canvas**

This BM is focused on the Aggregator, as its Central Actor. Next, the canvas of this BM is provided.

Table 6.9: BM canvas for BUC EACL-CZ-01

<p><b>Key partnerships</b></p> <ul style="list-style-type: none"> <li>• Provision of flexibility demand by the DSO, through the platform.</li> <li>• Demand/supply matching and market parties informing by the platform.</li> <li>• Grid availability assessment by the DSO, through TLS (TLS).</li> <li>• Provision of flexible resources by the Unit/Flexibility provider to be added to the aggregator’s portfolio.</li> </ul>	<p><b>Key activities</b></p> <ul style="list-style-type: none"> <li>• Informs the platform about available flexibility capacity and grid availability (primary activity).</li> <li>• Posts flexibility offers on the market platform.</li> <li>• Bids into DSO flexibility auctions on the platform.</li> <li>• Receives information about grid availability for his flexibility providers portfolio through the TLS.</li> <li>• Receives notifications for auctions.</li> <li>• Registers flexibility providers into his portfolio.</li> <li>• Submits information about services contracted to the TSO.</li> </ul>	<p><b>Value proposition</b></p> <ul style="list-style-type: none"> <li>• Provision of market-based non-frequency flexibility services that allow the DSO to manage congestion/voltage management in the long-term by utilizing active/reactive power provided through units at the LV network.</li> <li>• TFS as a single source of information for the aggregator about grid availability of flexibility providers in their portfolio (across all DSO networks).</li> </ul>	<p><b>Customer relationships</b></p> <ul style="list-style-type: none"> <li>• Direct personal relationship (acquisition and retention / trust).</li> </ul>	<p><b>Customer</b></p> <ul style="list-style-type: none"> <li>• DSO (through platform), TSO (via a request to the DSO), Unit/Flexibility provider.</li> <li>• DSO must have a congestion or voltage problem to manage.</li> <li>• TSO/aggregators receive information about network restrictions to the ability of distribution network connected FSPs to provide services to the TSO.</li> <li>• Unit/Flexibility provider must have a resource that may help solve the DSO’s congestion problem.</li> </ul>
	<p><b>Key resources</b></p> <ul style="list-style-type: none"> <li>• System that allows direct control of the flexibility resources by the aggregator (physical / related to a platform or a network).</li> </ul>		<p><b>Channel</b></p> <ul style="list-style-type: none"> <li>• Direct personal relationship (acquisition and retention / trust).</li> </ul>	

	<ul style="list-style-type: none"> <li>• Computer servers for market platform (physical).</li> </ul>			
<p>Cost structure</p> <ul style="list-style-type: none"> <li>• Computer servers and other IT services.</li> <li>• Human resources to carry out the daily operations.</li> <li>• Other.</li> </ul>		<p>Revenue streams</p> <ul style="list-style-type: none"> <li>• Revenue streams are not tested in the demo, however, should the platform be implemented in real-life, it would enable aggregators to sell non-frequency services to DSOs and thus earn brokerage fees.</li> </ul>		



### 6.2.1.2 Analysis made of this BM

Next, the analysis made of this BM is provided concerning the classification of stakeholder and the definition of strategies for the engagement of critical stakeholders. The analysis of the compatibility of BMs with local regulation is provided jointly for all the BMs associated with BUCs in the Demonstrator.

#### Stakeholders' engagement analysis

In this section, the main stakeholders involved in the implementation of this BM are identified and classified according to their ability to affect the implementation of the BM and their interest in facilitating this implementation. Then, relevant strategies for the engagement of critical stakeholders, who have large power to affect the successful implementation of the BM but low interest in favouring it, are provided.

#### Power-interest Matrix

The power interest matrix for this BM is provided next, classifying in it the relevant stakeholders according to their power to affect the implementation of the BUC and their incentives to facilitate this implementation. For each stakeholder, its power to affect the implementation of this BUC and interest in facilitating it is discussed within the matrix.

Table 6.10: Classification of the stakeholders for the BM associated with the BUC EACL-CZ-01: Power-interest matrix.

Stakeholder influence/power	High	<ul style="list-style-type: none"> <li>Traditional Energy Suppliers: They are powerful players in the energy market and can provide resources, expertise, and market knowledge to support the Aggregator in offering non-frequency flexibility services. These suppliers may perceive the rise of aggregators and DERs as competition, potentially disrupting their existing business models. Traditional energy suppliers who rely on conventional centralized power generation may have limited interest in the value proposition of this BM.</li> <li>Large Industrial Consumers: They are influential consumers of energy and can directly benefit from more efficient congestion management. Some large industrial consumers of electricity may not have a significant interest in this value proposition if they have stable and predictable energy needs. Their primary focus may be on cost efficiency rather than participating in Markets for SO Services.</li> <li>DSOs: They are very important to the BM because they are the proposed customers. They might be interested in this service, as long as it solves their problems in cost efficient way. Nevertheless, current regulations might not provide any benefits to the DSO if he chooses</li> </ul>	<ul style="list-style-type: none"> <li>European Union: The development of flexibility services has been included in the last electricity market directive and is being favored politically, as it may provide both environmental and economic benefits to society, businesses and final consumers.</li> <li>National governments: Sharing the European view on this subject, they may perceive this as an opportunity for society, businesses and final consumers.</li> </ul>
	Low		



Low	<p>flexibility over the construction of new infrastructure or the use of other non-market solutions. Furthermore, the DSO must set up a system to measure whether the flexibility has been, indeed, provided.</p> <ul style="list-style-type: none"> <li>• National regulators: They hold significant power in shaping the regulatory framework. They must allow DERs, aggregators and FSPs to provide flexibility to the DSO. Moreover, the DSO must be allowed to buy this kind of service and must receive a certain incentive.</li> <li>• Local and regional governments: They have influence over local policies, permitting processes, and community engagement. They might perceive that the DSO is not constructing a necessary power line.</li> <li>• Local interest groups: They can have influence over local sentiment and opinion. In line with the local governments, they might perceive that the DSO is not improving its service.</li> </ul>	
	<ul style="list-style-type: none"> <li>• Developers, engineers, and contractors: They might perceive that their profit will shrink because the investment in power infrastructures will lessen. Therefore, they might oppose this change, but they are not essential to the power system, so they have no influence.</li> </ul>	<ul style="list-style-type: none"> <li>• Environmental organizations: They might favor this approach as there will be fewer effects on the environment.</li> <li>• Academic and Research Institutions: These groups can provide real and impartial evaluation of the solutions and possibly contribute to their improvement.</li> <li>• Technology companies: As they develop the products needed to measure the energy, manage these new systems, etc., they are interested in these types of business models.</li> <li>• Units/Flexibility providers: They are interested in providing their flexibility for economic/environmental reasons, but possibly don't have a big enough influence to push for regulation/policy changes towards that direction.</li> </ul>
	Low	High
Stakeholder interest/support		

### Strategies for the engagement of critical stakeholders

After the stakeholder identification and the stakeholder analysis, an engagement plan is being drafted, taking into consideration each of the aforementioned stakeholder types and influence level. Different engagement strategies are adopted for each of the types of actors (quadrants in the stakeholder matrix). Priority is given to measures aimed at the engagement of high influence challengers, because engaging them is necessary to create a favourable context for the implementation of this business model.

- High influence challengers (high influence but low interest)

These actors have high influence but low interest, so their interest/support shall be increased:

- Traditional Energy Suppliers

Start by educating traditional energy suppliers about the benefits of non-frequency flexibility services. Explore opportunities for partnerships between aggregators and traditional energy suppliers. These partnerships can involve joint companies or products, collaborations, or shared projects focused on delivering flexibility services.

- Large Industrial Consumers

Show how participating in Markets for SO Services can lead to reduced energy costs, improved reliability, and enhanced sustainability. Understand the specific energy needs and challenges of large industrial consumers in order to develop tailored flexibility solutions that align with their operational requirements.

- DSO

The regulation has to provide a fair retribution for using flexibility as an alternative to the grid reinforcement. To get their attention, it must be clear that coordination with flexibility services works well and is more cost-effective than building new infrastructure. For this to occur, they need to measure the benefits of this value proposition.

- National regulators

The benefits and the increase in social welfare of this business model have to be clearly explained to the regulator. The change in the methodology and regulations may have some problems to be adapted to the needs of the new solutions. Defining specific points to be addressed clearly and meetings can help in this regard.

- Local and regional governments

They must perceive that citizens' satisfaction is going to be at least as good as it would have been if the infrastructure has been built. This aspect has to be clearly explained to them.

- Local interest groups

While the service does not become widely used, it also has to be explained to local interest groups.

- High influence champions (high influence and high interest)

These actors are already interested by the BUC, but they must not be taken for granted, instead they can be used as supporters for other actors that might need more involvement:

- European Union

It is proposing the development of these business models, thus has to see that its development will be aligned with its objectives.

- National governments

As for the European Union, national governments have to perceive that these business models will provide benefits to the population.

- Low influence challengers (low influence and low interest)

They have no interest as also low influence in these business model. Nevertheless, they are identified. For these group (developers, engineers, and contractors) communication can be a key factor to provide insights into how their roles can adapt or benefit from the changes.

- Low influence champions (low influence and high interest)

The ideas of both the technology companies that may provide the necessary assets to the management of flexibility and those of the environmental organizations must be heard to maintain their interest in the project. The flexibility providers' influence can go up if they can organize and conform groups, such as energy communities.

## 6.2.2 Representation and stakeholder analysis made of the BM for BUC EACL-CZ-02

### 6.2.2.1 Representation made of the BM focused on DSO for EACL-CZ-02

This section provides the description and analysis for the OneNet's BUC "EACL-CZ-02- Reactive power overflow management", as described in [14]. There, the objectives, stakeholders' roles, including their responsibilities, and the procedure of this BM are described.

#### **Description of this BM: the Business Model Canvas**

This BM is focused on the DSO, as its Central Actor. Next, the canvas of this BM is provided.

Table 6.11: BM canvas for BUC EACL-CZ-02

<p><b>Key partnerships</b></p> <ul style="list-style-type: none"> <li>• Provision of available flexibility capacity by the aggregator, through the platform.</li> <li>• Demand/supply matching and market parties informing by the platform.</li> <li>• Provision of flexible resources by the FSP or Unit/Flexibility provider.</li> </ul>	<p><b>Key activities</b></p> <ul style="list-style-type: none"> <li>• Evaluates the exchange of active/reactive power between DSO and TSO.</li> <li>• Identifies relevant flexibility needs to address voltage problems.</li> <li>• Sends flexibility demand to the platform (by creating an auction).</li> <li>• Posts information about availability of the grid to flexibility providers and aggregators through TLS.</li> </ul>	<p><b>Value proposition</b></p> <ul style="list-style-type: none"> <li>• Procurement of market-based non-frequency services that allow control over the reactive power overflows from DSO to TSO by utilizing the reactive power provided through units at the MV/HV network.</li> <li>• Ability to provide information to flexibility providers and aggregators about network availability through the TFS and therefore also indicate their ability to provide flexibility services (to the DSO, TSO as well as other parties).</li> </ul>	<p><b>Customer relationships</b></p> <ul style="list-style-type: none"> <li>• Direct personal relationship (acquisition and retention / trust).</li> </ul>	<p><b>Customer</b></p> <ul style="list-style-type: none"> <li>• FSP or Unit/Flexibility provider. Both must have a resource that may solve the DSO's reactive power overflow problem or voltage issues.</li> <li>• FSP/aggregator receives information about network restrictions to their units.</li> </ul>
	<p><b>Key resources</b></p> <ul style="list-style-type: none"> <li>• System in the dispatch control center of the DSO that enables direct control of the relevant flexible resources (physical / related to a platform or a network).</li> <li>• Systems that allow the DSO to determine flexibility needs.</li> <li>• Computer servers (physical).</li> </ul>		<p><b>Channel</b></p> <ul style="list-style-type: none"> <li>• Direct personal relationship (acquisition and retention / trust).</li> </ul>	
<p><b>Cost structure</b></p> <ul style="list-style-type: none"> <li>• Computer servers and other IT services.</li> </ul>		<p><b>Revenue streams</b></p>		

<ul style="list-style-type: none"><li>• Human resources to carry out the daily operations.</li></ul>	<ul style="list-style-type: none"><li>• Increased revenues by avoiding building new infrastructure and penalties for grid limits violation.</li></ul>
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### 6.2.2.2 Analysis made of this BM

Next, the analysis made of this BM is provided concerning the classification of stakeholder and the definition of strategies for the engagement of critical stakeholders. The analysis of the compatibility of BMs with local regulation is provided jointly for all the BMs associated with BUCs in the Demonstrator.

#### Stakeholders' engagement analysis

In this section, the main stakeholders involved in the implementation of this BM are identified and classified according to their ability to affect the implementation of the BM and their interest in facilitating this implementation. Then, relevant strategies for the engagement of critical stakeholders, who have large power to affect the successful implementation of the BM but low interest in favouring it, are provided.

#### Power-interest Matrix

The power interest matrix for this BM is provided next, classifying in it the relevant stakeholders according to their power to affect the implementation of the BUC and their incentives to facilitate this implementation. For each stakeholder, its power to affect the implementation of this BUC and interest in facilitating it is discussed within the matrix.

Table 6.12: Classification of the stakeholders for the BM associated with the BUC EACL-CZ-02: Power-interest matrix.

Stakeholder influence/power	High	<ul style="list-style-type: none"> <li>National regulators: They hold significant power in shaping the regulatory framework. Regulators may face challenges in developing and implementing regulations that accommodate the DSO's procurement of non-frequency services. Balancing the interests of various stakeholders, including traditional generators, consumers, and new entrants, could be complex.</li> <li>Local and regional governments: They have influence over local policies, permitting processes, and community engagement. They might perceive that the DSO is not constructing a necessary power line.</li> <li>Local interest groups: They can have influence over local sentiment and opinion. In line with the local governments, they might perceive that the DSO is choosing to give a poorer service.</li> </ul>	<ul style="list-style-type: none"> <li>European Union: The development of flexibility services has been included in the last electricity market directive and is being favored politically, as it may provide both environmental and economic benefits to society, businesses and final consumers.</li> <li>National governments: Sharing the European view on this subject, they may perceive this as an opportunity for society, businesses and final consumers.</li> <li>Power Generators: The traditional power generators can participate in this market. Large power utilities can for example provide reactive power.</li> </ul>
	Low	<ul style="list-style-type: none"> <li>Developers, engineers, and contractors: They might perceive that their profit will shrink because the investment in power infrastructures will lessen. Therefore, they</li> </ul>	<ul style="list-style-type: none"> <li>Environmental organizations: They might favor this approach as there will be fewer effects on the environment.</li> </ul>

		might oppose this change, but they are not essential to the power system, so they have no influence.	<ul style="list-style-type: none"> <li>• Technology companies: As they develop the products needed to measure the energy, manage these new systems, etc., they are interested in these types of business models.</li> <li>• Units/FSPs and aggregators: The possible FSPs are interested in the creation of flexibility services. Nevertheless, they don't have a big enough influence to push for regulation/policy changes and currently have no power to push for the development of these services.</li> </ul>
		Low	High
Stakeholder interest/support			

### Strategies for the engagement of critical stakeholders

After the stakeholder identification and the stakeholder analysis, an engagement plan is being drafted, taking into consideration each of the aforementioned stakeholder types and influence level. Different engagement strategies are adopted for each of the types of actors (quadrants in the stakeholder matrix). Priority is given to measures aimed at the engagement of high influence challengers, because engaging them is necessary to create a favourable context for the implementation of this business model.

- High influence challengers (high influence but low interest)

These actors have high influence but low interest, so their interest/support shall be increased:

- National regulators

The benefits and the increase in social welfare of this business model have to be clearly explained to the regulator. The change in the methodology and regulations may have some problems to be adapted to the needs of the new solutions. Defining specific points to be addressed clearly and meetings can help in this regard. Support demonstration projects and pilots that showcase the effectiveness of innovative technologies and market structures. These projects can provide regulators with tangible evidence of the benefits of modernization. Provide them with data-driven insights and case studies.

- Local and regional governments

They must perceive that citizens' satisfaction is going to be at least as good as it would have been if the infrastructure has been built. This aspect has to be clearly explained to them. The long and short-term benefits of the solution must be clearly explained, and very explicit comparisons must be given as to why the solution is better than simply building new infrastructure.

- Local interest groups

While the service does not become widely used, it also has to be explained to local interest groups. Communication is a key factor for them to understand why the service may not even be optimal at the beginning.

- High influence champions (high influence and high interest)

These actors are already interested by the BUC, but they must not be taken for granted, instead they can be used as supporters for other actors that might need more involvement:

- European Union

Is proposing the development of these business models, thus has to see that its development will be aligned with its objectives.

- National governments

As for the European Union, national governments have to perceive that these business models will provide benefits to the population. These benefits could be in the form of economic growth, diversifying energy sources to reduce dependence on imports, and addressing climate change.

- Power generators

Invite them to participate in workshops, seminars, and industry events where the future of the energy sector is being discussed. Encourage them to voice their concerns and ideas. Consider offering transition assistance programs that help them repurpose existing assets, invest in cleaner technologies, or diversify their operations.

- Low influence challengers (low influence and low interest)

They have no interest as also low influence in these business model. Nevertheless, they are identified. For these group (developers, engineers, and contractors) communication can be a key factor to provide insights into how their roles can adapt or benefit from the changes.

- Low influence champions (low influence and high interest)

The ideas of both the technological companies that may provide the necessary assets to the management of flexibility and those of the environmental organizations must be heard to maintain their interest in the project. The flexibility providers' and aggregators' influence can go up if they can organize and conform groups, such as energy communities.

### 6.2.3 Analysis of the compatibility of the Czech BMs with local regulation

This section provides the identification of the regulatory barriers to the implementation and success of the local Market for SO Services business models for the Czech Republic. The information discussed here has been obtained based on the WP3/WP11 Regulatory Questionnaire carried out for all the demonstrators. The



regulatory barriers and possible measures to tackle them are presented below. Whenever a barrier is specific to a certain BM, this is mentioned.

The regulatory barriers are split into three main groups: lack of definition of roles and responsibilities, economic incentives provided, and lack of additional enabling regulation. The barriers of each of these types are discussed in a separate subsection.

### **6.2.3.1 Barriers related to the lack of definition of roles and responsibilities**

#### **Missing MO role**

MO is not defined as an agent, so the SO is contracting the flexibility directly from suppliers through bilateral contracts, as no centralized market is defined. This affects both BMs, and specifically for EACL-CZ-01 this lack of centralized market could affect the ability of aggregators to efficiently manage congestion as it may limit the availability of flexibility services from suppliers across different DSO networks. Moreover, it could make it difficult for the aggregators to provide accurate and up-to-date information through TSF about the grid availability of the flexibility providers.

#### **Further specification of the aggregator model**

Independent aggregators need to be defined in the regulation to have fair participation in the flexibility provision, otherwise, this could limit their participation in the market-based non-frequency flexibility services, for EACL-CZ-01 in terms of effectively provide this, meanwhile for EACL-CZ-02 the procurement of it.

Since the minimum size and bid for flexibility services is 1MW, aggregators will be able to make it possible for small flexibility providers to participate in the market as one player. It is also important to keep in mind that agents can only participate in bilateral contracts if they are fully controllable. For both BMs the controllability of resources providing flexibility is a key for any units providing the service (aggregated or not). There also exist technical barriers, in which the SO cannot operate either storage or generation, which may limit the availability of flexibility services that aggregators can offer. DSO is able to contract voltage control and congestion management products through bilateral contracts.

### **6.2.3.2 Barriers related to the economic incentives provided**

#### **Lack of suitable regulation guiding the implementation of alternative flexibility procurement mechanisms**

Flexibility can be procured through different mechanisms rewarding the provision of flexibility. The acquisition of flexibility may not rely only on one specific mechanism, but will rather involve applying a combination of them, depending on the characteristics of the needs and the resources that can provide this flexibility. The design of these mechanisms needs to be carefully considered in order for them to effectively

complement each other, produce consistent signals, and optimize the utilization of all the resources. There is a need to bring more clarity concerning market/non-market based/rule-based flexibility, non-firm connection, etc. In this respect, all market parties would have a more certain understanding of how they can procure flexibility as a market product and what kind of bilateral agreement is tolerated.

Procurement mechanisms are essential for the development of local markets and flexibility provision, which is related to both BMs.

### **6.2.3.3 Barriers related to the lack of additional enabling regulation**

#### **Lack of regulation protecting agents from market power abuse exerted by limiting access to information**

Once the agents and the market have been defined, there also should be a regulation to protect these agents from possible market power abuse by incumbent on access to information. To enable the development of local Markets for SO Services, the availability of data on the individual customers' profiles is required to assess the flexibility potential and develop new business models that can be offered to such customers. Marketplace enabling data exchange could remove this obstacle and bring data transparency into the process. However, when regulating data access, privacy, cybersecurity considerations, and third-party access rules need to be established to protect the customers' rights.

## **6.3 Description and analysis of the BMs for the Hungarian Demo**

Here we provide a representation and analysis of the BMs within the Hungarian Demonstrator. Within the Czech Demonstrator, there are 2 BUCs defined:

- EACL-HU-01 - MV feeder voltage control, and
- EACL-HU-02 - HV/MV transformer overload.

However, we focus on the description and analysis of the BM associated with the BUC EACL-HU-02, since the BUC EACL-HU-01 is not suitable for the definition of a BKM associated with it, due to the fact that the type of service addressed in this BUC is of a very local nature.

### **6.3.1 Representation and stakeholder analysis made of the BM for BUC EACL-HU-02**

#### **6.3.1.1 Representation of the BM focused on FSP for EACL-HU-02**

This section provides the description and analysis for the OneNet's BUC "EACL-HU-02- HV/MV transformer overload", as described in the OneNet D2.3 [14]. There, the objectives, stakeholders' roles, including their responsibilities, and the procedure of this BM are described.



### **Description of this BM: the Business Model Canvas**

This BM is focused on the FSP, as its Central Actor. Next, the canvas of this BM is provided.



Table 6.13: BM canvas for BUC EACL-HU-02

<p><b>Key partnerships</b></p> <ul style="list-style-type: none"> <li>Announcement of flexibility needs by the DSO.</li> <li>Provision of flexible resources by individual units to be added to the FSP's portfolio<sup>8</sup>.</li> </ul>	<p><b>Key activities</b></p> <ul style="list-style-type: none"> <li>Requests prequalification by the DSO.</li> <li>Submits bids to W-1 &amp; D-1 order book.</li> <li>Provides flexible resources according to the qualified bids.</li> </ul> <p><b>Key resources</b></p> <ul style="list-style-type: none"> <li>Financial guarantees for the Units/Flexibility providers included in the FSP's portfolio (financial).</li> <li>System that allows indirect control of the flexibility resources by the FSP (physical / related to a platform or a network).</li> <li>Computer servers (physical).</li> <li>FP (related to a platform or a network).</li> </ul>	<p><b>Value proposition</b></p> <ul style="list-style-type: none"> <li>Provision of flexibility services (capacity and energy activation) that allow the DSO to mitigate overloading of HV/MV transformers.</li> </ul>	<p><b>Customer relationships</b></p> <ul style="list-style-type: none"> <li>Direct personal relationship (acquisition and retention / trust).</li> </ul> <p><b>Channel</b></p> <ul style="list-style-type: none"> <li>Direct personal relationship (acquisition and retention / trust).</li> <li>MO's online platforms for FSPs.</li> </ul>	<p><b>Customer</b></p> <ul style="list-style-type: none"> <li>DSO, who must have overloading problems on HV/MV transformers.</li> </ul>
<p><b>Cost structure</b></p> <ul style="list-style-type: none"> <li>Computer servers and other IT services.</li> <li>Human resources to carry out the daily operations.</li> <li>Other.</li> </ul>		<p><b>Revenue streams</b></p> <ul style="list-style-type: none"> <li>The difference between revenues gained through selling the flexibility services to the DSO and costs stemming from the compensation to be paid to the Flexible resources.</li> </ul>		

<sup>8</sup> In this BUC, the FSP can also act as an aggregator.

### 6.3.1.2 Analysis made of this BM

Next, the analysis made of this BM is provided concerning the classification of stakeholders and the definition of strategies for the engagement of critical stakeholders. The analysis of the compatibility of BMs with local regulation is provided afterwards.

#### Stakeholders' engagement analysis

In this section, the main stakeholders involved in the implementation of this BM are identified and classified according to their ability to affect the implementation of the BM and their interest in facilitating this implementation. Then, relevant strategies for the engagement of critical stakeholders, who have large power to affect the successful implementation of the BM but low interest in favouring it, are provided.

#### Power-interest Matrix

The power interest matrix for this BM is provided next, classifying in it the relevant stakeholders according to their power to affect the implementation of the BUC and their incentives to facilitate this implementation. For each stakeholder, its power to affect the implementation of this BUC and interest in facilitating it is discussed within the matrix.

Table 6.14: Classification of the stakeholders for the BM associated with the BUC EACL-HU-02: Power-interest matrix.

Stakeholder influence/power	High	<ul style="list-style-type: none"> <li>• Incumbent Generators: Incumbent generators are likely to have substantial experience and infrastructure in place to provide these types of services and may also hold influence over regulatory and policy decisions. Especially those operating conventional power plants might have lower interest in this value proposition. They may see DERs (DERs) and flexibility services as competition that can reduce the demand for their electricity generation, particularly during peak periods. This could potentially impact their revenue and profitability.</li> <li>• SOs: They are very important to the implementation of the BM because they are the proposed customers. DSO might be interested in this service, provided that it can reduce or postpone the necessary investment costs. Nevertheless, current regulations might not provide any benefits to the DSO if he chooses flexibility over the construction of new infrastructure or the use of other</li> </ul>	<ul style="list-style-type: none"> <li>• European Union: The development of flexibility services has been included in the last electricity market directive and is being favored politically, as it may provide both environmental and economic benefits to society, businesses and final consumers.</li> <li>• National governments: Sharing the European view on this subject, they may perceive this as an opportunity for society, businesses and final consumers.</li> </ul>
	Low		

	<p>non-market solutions. In some cases, incumbent transmission and distribution operators might see FSPs as competitors or entities introducing complexity into their established networks. They may need to adapt their operations and business models to accommodate the integration of DERs and flexibility services.</p> <ul style="list-style-type: none"> <li>• National regulators: They hold significant power in shaping the regulatory framework. They must allow DERs, aggregators and FSPs to provide flexibility to the DSO. Moreover, the DSO must be allowed to buy this kind of service and must receive a certain incentive.</li> <li>• Local and regional governments: They have influence over local policies, permitting processes, and community engagement. They might perceive that the DSO is not constructing a necessary power line.</li> <li>• Local interest groups: They can have influence over local sentiment and opinion. In line with the local governments, they might perceive that the DSO is choosing to give a poorer service.</li> </ul>	
Low	<ul style="list-style-type: none"> <li>• Developers, engineers, and contractors: They might perceive that their profit will shrink because the investment in power infrastructures will lessen. Therefore, they might oppose this change, but they are not essential to the power system, so they have no influence.</li> </ul>	<ul style="list-style-type: none"> <li>• Environmental organizations: They might favor this approach as there will be fewer effects on the environment.</li> <li>• Technology companies: As they develop the products needed to measure the energy, manage these new systems, etc., they are interested in these types of business models.</li> <li>• Units/Flexibility providers: They are interested in providing their flexibility for economic/environmental reasons, but possibly do not have a big enough influence to push for regulation/policy changes towards that direction.</li> </ul>
	Low	High
Stakeholder interest/support		

### Strategies for the engagement of critical stakeholders

After the stakeholder identification and the stakeholder analysis, an engagement plan is being drafted, taking into consideration each of the aforementioned stakeholder types and influence level. Different engagement strategies are adopted for each of the types of actors (quadrants in the stakeholder matrix). Priority is given to measures aimed at the engagement of high influence challengers, because engaging them is necessary to create a favourable context for the implementation of this business model.

- High influence challengers (high influence but low interest)

These actors have high influence but low interest, so their interest/support shall be increased:

- Incumbent Generators

Offer incentives or revenue-sharing models that can make it financially attractive for power generators to participate in Markets for SO Services. Show them how they can profit from these services without negatively impacting their business. Provide concrete data and case studies showing the benefits of flexibility services.

- SO

Assist them in assessing the technical requirements and capabilities of flexibility resources, ensuring a smooth integration process. Advocate for standardized protocols and interfaces that simplify the interaction between FSPs and SOs. For this, the DSO needs to be able to get the flexibility service on time and should be able to measure the impacts of procuring these services. The SOs need also to have implemented adequate tools to implement the solution in an optimal manner. Work together to assess grid constraints, identify areas where flexibility services can alleviate overloading issues, and develop integrated grid management strategies. Pilot projects can demonstrate the feasibility and benefits of flexibility services in addressing overloading challenges. Furthermore, in theory a model could be developed where DSOs compete for scarce capacity on a network of DSOs. This would be analogous to the models that exist today for capacity on cross-border lines. Here, system users would be able to acquire additional capacity over and above their guaranteed entitlement, e.g., through auctions, with the proceeds going to the DSOs (which could then use the capacity to upgrade their network). This would of course require a much larger proportion of consumers with conditional access contracts.

- National regulators

Highlight case studies and successful implementations from other regions to demonstrate the positive impact of such regulations. In this regard, the benefits and the increase in social welfare of this business model have to be clearly explained to the regulator so the corresponding

regulation can be developed in a timely manner. The change in the methodology and regulations may have some problems to be adapted to the needs of the new solutions. Defining specific points to be addressed clearly and meetings can help in this regard.

- Local and regional governments

They must perceive that citizens' satisfaction is going to be at least as good as it would have been if the infrastructure has been built. This aspect has to be clearly explained to them. The long and short-term benefits of the solution must be clearly explained, and very explicit comparisons must be given as to why the solution is better than simply building new infrastructure.

- Local interest groups

While the service does not become widely used, it also has to be explained to local interest groups. Communication is a key factor for them to understand why the service may not even be optimal at the beginning.

- High influence champions (high influence and high interest)

These actors are already interested by the BUC, but they must not be taken for granted, instead they can be used as supporters for other actors that might need more involvement:

- European Union

Is proposing the development of these business models, thus, it has to see that its development should be aligned with its objectives by following best practices.

- National governments

As for the European Union, national governments have to perceive that these business models will provide benefits to the population. These benefits could be in the form of economic growth, diversifying energy sources to reduce dependence on imports, and addressing climate change.

- Low influence challengers (low influence and low interest)

They have no interest as also low influence in these business model. Nevertheless, they are identified. For these group (developers, engineers, and contractors) communication can be a key factor to provide insights into how their roles can adapt or benefit from the changes.

- Low influence champions (low influence and high interest)

The ideas of both the technological companies that may provide the necessary assets to the management of flexibility and those of the environmental organizations must be heard to maintain their interest in the project. The flexibility providers' and aggregators' influence can go up if they can organize and conform groups, such as energy communities.



## **Analysis of the compatibility of this BM with local regulation**

This section provides the identification of the regulatory barriers to the implementation and success of the local Market for SO Services business model EACL-HU-02. The information discussed here has been obtained based on the WP3/WP11 Regulatory Questionnaire carried out for all the demonstrators. The regulatory barriers and possible measures to tackle them are presented below.

The regulatory barriers are split into three main groups: lack of definition of roles and responsibilities, economic incentives provided, and lack of additional enabling regulation. The barriers of each of these types are discussed in a separate subsection.

### Barriers related to the lack of definition of roles and responsibilities

- Missing MO role

TSO purchases services on a market basis, so there has been no justification for a third, independent FMO. In this country, this role is taken by, the corresponding DSO and TSO for Grid Related Services such as Congestion Management and Voltage Control on their own grids, while only the TSO is responsible for balancing. DSO and TSO can operate and own integrated network storage facilities but aren't allowed to operate or own generation. DSO and TOS can buy congestion management products and voltage control products. There is no regulation on setting a lower limit on the size of participants in the market or limiting the costs of small ones (the development of standards could be of help with this), and the controllability level is not regulated either, so it needs to be checked if needed. In the case of TSOs, there is a minimum quantity requirement for each product in terms of orders, but markets are available for any size of unit through an aggregator.

- Further specification of the aggregator model

In Hungary, aggregators can be completely independent of the supplier, but can also be integrated with the supplier. Independent aggregators already exist providing balancing services. Rules for aggregators are being developed and products for separate markets are separately priced. The necessary information such as tenders, historical prices, and condition is publicly available to everyone on the TSO's website. As of now, due to the high and growing penetration of PV generation in Hungary and insecure gas prices, the situation is in favour of aggregators that can handle more complex portfolios other than gas-based balancing assets. Currently, all products and services purchased by TSOs are technology independent, they can and are provided by PVs, specifically through aggregators. A verification of the model may be considered, due to the rapidly changing circumstances.

#### Barriers related to the economic incentives provided

- Lack of regulation or framework to guide the implementation of alternative flexibility procurement mechanisms

Flexibility can be procured through different mechanisms rewarding the provision of flexibility. The acquisition of flexibility may not rely only on one specific mechanism, but will rather involve applying a combination of them, depending on the characteristics of the needs and the resources that can provide this flexibility. Procurement mechanisms are essential for the development of local markets and DERs flexibility provision. The attitude of the government and regulation regarding the PV and storage penetration and PV power plant permit granting procedures are in continuous change, thus the nature of distribution grid issues and resolving strategies. An exact take cannot be provided on this topic due to the rapidly changing circumstances. The design of these mechanisms needs to be carefully considered in order for them to effectively complement each other, produce consistent signals, and optimize the utilization of all the resources.

#### Barriers related to the lack of additional enabling regulation

- About the regulation protecting agents from market power abuse exerted by limiting access to information

The LXXXVI. Act of 2007 on Electricity defines the possibilities and obligations regarding data access for aggregators which may protect these agents from market power abuse by incumbents on access to information. To enable the development of local Markets for SO Services, the availability of data on the individual customers' profiles is required to assess the flexibility potential and develop new business models which can be offered to such customers. However, when regulating data access, privacy, cybersecurity considerations, and third-party access rules need to be established to protect the customers' rights. In this regard, the current legal framework and grid codes are still missing these rules, but industry-wide discussions are going on about this topic.

## 6.4 Description and analysis of the BMs for the Slovenian Demo

Here we provide a representation and analysis of the BMs within the Slovenian Demonstrator. Within the Slovenian Demonstrator, there are 2 BUCs defined:

- EACL-SL-01 - Congestion management in distribution grids under market conditions, and
- EACL-SL-02 - Voltage control in distribution grids under market conditions.

In this case, the description and the stakeholder engagement analysis are provided separately for each BM, while the analysis of the regulatory barriers to the implementation of BMs is carried out jointly for all the BMs in the Demonstrator.

## **6.4.1 Representation and stakeholder analysis made of the BM for BUC EACL-SL-01**

### **6.4.1.1 Representation made of this BM**

This section provides the description and analysis for the OneNet's BUC "EACL-SL-01- Congestion management in distribution grids under market conditions", as described in the OneNet D2.3 [14]. There, the objectives, stakeholders' roles, including their responsibilities, and the procedure of this BM are described.

#### **Description of this BM: the Business Model Canvas**

This BM is focused on the FSP, as its Central Actor. Next, the canvas of this BM is provided.

Table 6.15: BM canvas for BUC EACL-SL-01

<p><b>Key partnerships</b></p> <ul style="list-style-type: none"> <li>• Provision of grid prequalification by the DSO.</li> <li>• Provision of product prequalification and registration to the FR by the FMO.</li> <li>• Calculation of provided flexibility volume and settlement by the DSO or the FMO.</li> <li>• Provision of flexible resources to be added to the FSP's portfolio by Units/Flexibility providers.</li> </ul>	<p><b>Key activities</b></p> <ul style="list-style-type: none"> <li>• Requests grid/product prequalification by the DSO/FMO respectively.</li> <li>• Offers bids to the local Market for SO Services or makes long-term (e.g., 6 months) contracts with the DSO regarding offered flexibility services.</li> <li>• Provides flexibility services according to the contracts signed and the requests from the DSO, as well as real-time measurements of those.</li> <li>• Confirmation of provided flexibility volume and settlement calculations.</li> </ul>	<p><b>Value proposition</b></p> <ul style="list-style-type: none"> <li>• Provision of flexibility services under market conditions that will help the DSO avoid grid equipment overloading and secondary substation replacement/grid upgrades.</li> </ul>	<p><b>Customer relationships</b></p> <ul style="list-style-type: none"> <li>• Direct personal relationship (acquisition and retention / trust).</li> </ul>	<p><b>Customer</b></p> <ul style="list-style-type: none"> <li>• Unit/Flexibility provider, DSO.</li> <li>• DSO needs to have congestion/overloading problems to manage.</li> <li>• Unit/Flexibility provider needs to have flexibility resources that might solve DSO's congestion/overloading problems.</li> </ul>
<p><b>Key resources</b></p> <ul style="list-style-type: none"> <li>• VPP (including a technical and a business channel) for units' activation, internal baseline calculations and monitoring of available locations (related to a platform or a network).</li> <li>• Unit controller for the transmission of activation demands to technical units (physical / related to a platform or a network).</li> </ul>			<p><b>Channel</b></p> <ul style="list-style-type: none"> <li>• Personal meetings (awareness &amp; evaluation).</li> </ul>	
<p><b>Cost structure</b></p> <ul style="list-style-type: none"> <li>• Computer servers and other IT services.</li> </ul>		<p><b>Revenue streams</b></p>		



- Human resources to carry out the daily operations.
- Other.

- The difference between revenues gained through selling the flexibility services to the DSO/market and costs stemming from the compensation to be paid to the Flexible resources.



### 6.4.1.2 Analysis made of this BM

Next, the analysis made of this BM is provided concerning the classification of stakeholder and the definition of strategies for the engagement of critical stakeholders. The analysis of the compatibility of BMs with local regulation is provided jointly for all the BMs associated with BUCs in the Demonstrator.

#### Stakeholders' engagement analysis

In this section, the main stakeholders involved in the implementation of this BM are identified and classified according to their ability to affect the implementation of the BM and their interest in facilitating this implementation. Then, relevant strategies for the engagement of critical stakeholders, who have large power to affect the successful implementation of the BM but low interest in favouring it, are provided.

#### Power-interest Matrix

The power interest matrix for this BM is provided next, classifying in it the relevant stakeholders according to their power to affect the implementation of the BUC and their incentives to facilitate this implementation. For each stakeholder, its power to affect the implementation of this BUC and interest in facilitating it is discussed within the matrix.

Table 6.16: Classification of the stakeholders for the BM associated with the BUC EACL-SL-01: Power-interest matrix.

Stakeholder influence/power	High	<ul style="list-style-type: none"> <li>• DSOs: They are very important to the implementation of the BM because they are the proposed customers. As the main customers of this BM and as entities responsible for the management and efficient operation of the networks, they have full interest in this use case. Nonetheless, their interest is dependent on the benefits/incentives from these solutions and from the existent of necessary regulatory framework to support it. The SOs need also to have implemented adequate tools for flexibility needs assessment.</li> <li>• National regulators: They hold significant power in shaping the regulatory framework. They must allow DERs, aggregators and FSPs to provide flexibility to the DSO. Moreover, the DSO must be allowed to buy this kind of service and must receive a certain incentive.</li> <li>• Local and regional governments: They have influence over local policies, permitting processes, and community engagement. They might perceive that the DSO is not constructing a necessary power line.</li> <li>• Local interest groups: They can have influence over local sentiment and opinion. In line with the</li> </ul>	<ul style="list-style-type: none"> <li>• European Union: The development of flexibility services has been included in the last electricity market directive and is being favored politically, as it may provide both environmental and economic benefits to society, businesses and final consumers.</li> <li>• National governments: Sharing the European view on this subject, they may perceive this as an opportunity for society, businesses and final consumers.</li> </ul>
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		local governments, they might perceive that the DSO is choosing to give a poorer service.	
	Low	<ul style="list-style-type: none"> <li>Developers, engineers, and contractors: They might perceive that their profit will shrink because the investment in power infrastructures will lessen. Therefore, they might oppose this change, but they are not essential to the power system, so they have no influence.</li> </ul>	<ul style="list-style-type: none"> <li>Environmental organizations: They might favor this approach as there will be fewer effects on the environment.</li> <li>Technology companies: As they develop the products needed to measure the energy, manage these new systems, etc., they are interested in these types of business models.</li> <li>Units/Flexibility providers: They are interested in providing their flexibility for economic/environmental reasons, but possibly do not have a big enough influence to push for regulation/policy changes towards that direction.</li> </ul>
		Low	High
		Stakeholder interest/support	

### Strategies for the engagement of critical stakeholders

After the stakeholder identification and the stakeholder analysis, an engagement plan is being drafted, taking into consideration each of the aforementioned stakeholder types and influence level. Different engagement strategies are adopted for each of the types of actors (quadrants in the stakeholder matrix). Priority is given to measures aimed at the engagement of high influence challengers, because engaging them is necessary to create a favourable context for the implementation of this business model.

- High influence challengers (high influence but low interest)

These actors have high influence but low interest, so their interest/support shall be increased:

- DSO

The regulation has to provide a fair retribution for delaying investments in the grid so that the DSO does not prioritize any of the investments just because of its profits. To get their attention, it must be clear that coordination with flexibility services works well and is more cost-effective than building new infrastructure. For this, the DSO needs to be able to get the flexibility service on time and should be able to measure the impacts of procuring these services. The SOs need also to have adequate tools to implement the solution in an optimal manner. Plans showing the benefits of the proposed solution in the short and long term can help to unlock the full potential of the BM.

- National regulators

The benefits and the increase in social welfare of this business model have to be clearly explained to the regulator so the corresponding regulation can be developed in a timely manner. The change in the methodology and regulations may have some problems to be adapted to the needs of the new solutions. Defining specific points to be addressed clearly, and organizing meetings can help in this regard, furthermore an incremental but planned approach can bring benefits. Conclusion from demonstrators can help to get the results in order to create a roadmap that will allow a wide participation of FSPs.

- Local and regional governments

They must perceive that citizens' satisfaction is going to be at least as good as it would have been if the infrastructure has been built. This aspect has to be clearly explained to them. The long and short-term benefits of the solution must be clearly explained, and very explicit comparisons must be given as to why the solution is better than simply building new infrastructure.

- Local interest groups

While the service does not become widely used, it also has to be explained to local interest groups. Communication is a key factor for them to understand why the service may not even be optimal at the beginning. Align visions and objectives with associations and try to seek partnerships and do workshops to educate on the solutions are being implemented. Joint industry events and seminars can help build trust, and these groups can help push the necessary changes from the bottom up.

- High influence champions (high influence and high interest)

These actors are already interested by the BUC, but they must not be taken for granted, instead they can be used as supporters for other actors that might need more involvement:

- European Union

It is proposing the development of these business models, thus has to see that its development should be aligned with its objectives by following best practices.

- National governments

As for the European Union, national governments have to perceive that these business models will provide benefits to the population. These benefits could be in the form of economic growth, diversifying energy sources to reduce dependence on imports, and addressing climate change.

- Low influence challengers (low influence and low interest)



They have no interest as also low influence in these business model. Nevertheless, they are identified. For these group (developers, engineers, and contractors) communication can be a key factor to provide insights into how their roles can adapt or benefit from the changes.

- Low influence champions (low influence and high interest)

The ideas of both the technological companies that may provide que necessary assets to the management of flexibility and those of the environmental organizations must be heard to maintain their interest in the project. The flexibility providers' and aggregators' influence can go up if they can organize and conform groups, such as energy communities.

## 6.4.2 Representation and stakeholder analysis made of the BM for BUC EACL-SL-02

### 6.4.2.1 Representation of the BM focused on MO for EACL-SL-02

This section provides the description and analysis for the OneNet's BUC "EACL-SL-02- Voltage control in distribution grids under market conditions", as described in the OneNet D2.3 [14]. There, the objectives, stakeholders' roles, including their responsibilities, and the procedure of this BM are described.

#### **Description of this BM: the Business Model Canvas**

This BM is focused on the MO, as its Central Actor. Next, the canvas of this BM is provided.

Table 6.17: BM canvas for BUC EACL-SL-02

<p><b>Key partnerships</b></p> <ul style="list-style-type: none"> <li>• Pre-qualification of the grid product by the DSO.</li> <li>• Provision of flexible services by the FSP.</li> </ul> <p>(In this BM the DSO plays the role of the MO as well)</p>	<p><b>Key activities</b></p> <ul style="list-style-type: none"> <li>• Matches the request for flexibility of the DSO with the most cost-efficient offer (primary activity / value network). To accomplish that task, the constraints given by the DSO must be taken into consideration.</li> <li>• Pre-qualifies the market product (support activity / value shop)</li> <li>• Publishes the market results (support activity / value shop).</li> <li>• Manages the economic compensation/retribution of the different actors.</li> </ul>	<p><b>Value proposition</b></p> <ul style="list-style-type: none"> <li>• Provision of flexibility services under market conditions that will help the DSO avoid voltage control problems and secondary substation replacement/grid upgrades.</li> </ul>	<p><b>Customer relationships</b></p> <ul style="list-style-type: none"> <li>• Direct personal relationship (acquisition and retention / trust).</li> </ul>	<p><b>Customer</b></p> <ul style="list-style-type: none"> <li>• DSO, FSP.</li> <li>• DSO must have voltage control needs.</li> <li>• FSP must have resources that may solve DSO's voltage control needs.</li> </ul>
	<p><b>Key resources</b></p> <ul style="list-style-type: none"> <li>• Financial guarantees, both for the DSO and the FSP (financial).</li> <li>• Market matching system (platform).</li> <li>• Settlement system collecting DSO activations and FSP measurements, evaluating activation success and energy to be paid (physical/related to a platform or a network).</li> <li>• Computer servers (physical).</li> </ul>		<p><b>Channel</b></p> <ul style="list-style-type: none"> <li>• Personal meetings (awareness &amp; evaluation).</li> </ul>	
<p><b>Cost structure</b></p> <ul style="list-style-type: none"> <li>• Computer servers and other IT services.</li> <li>• Human resources to carry out the daily operations and code the market platform.</li> <li>• Other.</li> </ul>		<p><b>Revenue streams</b></p> <ul style="list-style-type: none"> <li>• Payment of a brokerage fee both by the DSO and the FSP each time the service is requested (brokerage fees / fixed pricing).</li> </ul>		

### 6.4.2.2 Analysis made of this BM

Next, the analysis made of this BM is provided concerning the classification of stakeholder and the definition of strategies for the engagement of critical stakeholders. The analysis of the compatibility of BMs with local regulation is provided jointly for all the BMs associated with BUCs in the Demonstrator.

#### Stakeholders’ engagement analysis

In this section, the main stakeholders involved in the implementation of this BM are identified and classified according to their ability to affect the implementation of the BM and their interest in facilitating this implementation. Then, relevant strategies for the engagement of critical stakeholders, who have large power to affect the successful implementation of the BM but low interest in favouring it, are provided.

#### Power-interest Matrix

The power interest matrix for this BM is provided next, classifying in it the relevant stakeholders according to their power to affect the implementation of the BUC and their incentives to facilitate this implementation. For each stakeholder, its power to affect the implementation of this BUC and interest in facilitating it is discussed within the matrix.

Table 6.18: Classification of the stakeholders for the BM associated with the BUC EACL-SL-02: Power-interest matrix.

Stakeholder influence/power	High	<ul style="list-style-type: none"> <li>• DSOs: They are very important to the implementation of the BM because they are the proposed customers. As the main customers of this BM and as entities responsible for the management and efficient operation of the networks, as well as playing the role of MO in this BM, they have full interest in this use case. Nonetheless, their interest is dependent on the benefits/incentives from these solutions and from the existence of the necessary regulatory framework to support them. The SOs need also to have implemented adequate tools for flexibility needs assessment.</li> <li>• Existing Voltage Control Solution Providers: Companies providing voltage control solutions might see reduced demand for their products and services if flexibility services can effectively address these issues.</li> <li>• National regulators: They hold significant power in shaping the regulatory framework. They must allow DERs, aggregators and FSPs to provide flexibility to the DSO. Moreover, the DSO must be allowed to buy this kind of service and must receive a certain incentive.</li> <li>• Local and regional governments: They have influence over local policies, permitting</li> </ul>	<ul style="list-style-type: none"> <li>• European Union: The development of flexibility services has been included in the last electricity market directive and is being favored politically, as it may provide both environmental and economic benefits to society, businesses and final consumers.</li> <li>• National governments: Sharing the European view on this subject, they may perceive this as an opportunity for society, businesses and final consumers.</li> </ul>
	Low		

		<p>processes, and community engagement. They might perceive that the DSO is not constructing a necessary power line.</p> <ul style="list-style-type: none"> <li>Local interest groups: They can have influence over local sentiment and opinion. In line with the local governments, they might perceive that the DSO is choosing to give a poorer service.</li> </ul>	
	LOW	<ul style="list-style-type: none"> <li>Developers, engineers, and contractors: They might perceive that their profit will shrink because the investment in power infrastructures will lessen. Therefore, they might oppose this change, but they are not essential to the power system, so they have no influence.</li> </ul>	<ul style="list-style-type: none"> <li>Environmental organizations: They might favor this approach as there will be fewer effects on the environment.</li> <li>Technology companies: As they develop the products needed to measure the energy, manage these new systems, etc., they are interested in these types of business models.</li> <li>Units/Flexibility providers: They are interested in providing their flexibility for economic/environmental reasons, but possibly do not have a big enough influence to push for regulation/policy changes towards that direction.</li> </ul>
		Low	High
Stakeholder interest/support			

### Strategies for the engagement of critical stakeholders

After the stakeholder identification and the stakeholder analysis, an engagement plan is being drafted, taking into consideration each of the aforementioned stakeholder types and influence level. Different engagement strategies are adopted for each of the types of actors (quadrants in the stakeholder matrix). Priority is given to measures aimed at the engagement of high influence challengers, because engaging them is necessary to create a favourable context for the implementation of this business model.

- High influence challengers (high influence but low interest)

These actors have high influence but low interest, so their interest/support shall be increased:

- o DSO

In this BM, the DSO can also play the role of the MO, and is also the customer, so there may be an interest but it depends on the regulations and possible barriers. The regulation has to provide a fair retribution for delaying investments in the grid so that the DSO does not prioritize any of the investments just because of its profits. To get their attention, it must be clear that coordination with flexibility services works well and is more cost-effective than building new infrastructure. For this, the DSO needs to be able to get the flexibility service on time and should

be able to measure the impacts of procuring these services. The SOs need also to have implemented adequate tools to implement the solution in an optimal manner.

- o Existing Voltage Control Solution Providers

Educate these providers about the benefits and potential of flexibility services in addressing voltage control and grid upgrade issues by explaining how these services can complement or enhance existing solutions. Highlight that flexibility services can work alongside traditional voltage control solutions. Allow voltage control solution providers to tailor their offerings to work seamlessly with flexibility services.

- o National regulators

The benefits and the increase in social welfare of this business model have to be clearly explained to the regulator so the corresponding regulation can be developed in a timely manner. The change in the methodology and regulations may have some problems to be adapted to the needs of the new solutions. A good plan, by defining specific points to be addressed clearly and meetings can help in this regard.

- o Local and regional governments

They must perceive that citizens' satisfaction is going to be at least as good as it would have been if the infrastructure has been built. This aspect has to be clearly explained to them. The long and short-term benefits of the solution must be clearly explained, and very explicit comparisons must be given as to why the solution is better than simply building new infrastructure.

- o Local interest groups

While the service does not become widely used, it also has to be explained to local interest groups. Communication is a key factor for them to understand why the service may not even be optimal at the beginning.

- High influence champions (high influence and high interest)

These actors are already interested by the BUC, but they must not be taken for granted, instead they can be used as supporters for other actors that might need more involvement:

- o European Union

Is proposing the development of these business models, thus has to see that its development should be aligned with its objectives by following best practices.

- National governments

As for the European Union, national governments have to perceive that these business models will provide benefits to the population. These benefits could be in the form of economic growth, diversifying energy sources to reduce dependence on imports, and addressing climate change.

- Low influence challengers (low influence and low interest)

They have no interest as also low influence in these business model. Nevertheless, they are identified.

- Low influence champions (low influence and high interest)

The ideas of both the technological companies that may provide the necessary assets to the management of flexibility and those of the environmental organizations must be heard to maintain their interest in the project. The flexibility providers' and aggregators' influence can go up if they can organize and conform groups, such as energy communities.

### 6.4.3 Analysis of the compatibility of the Slovenian BMs with local regulation

This section provides the identification of the regulatory barriers to the implementation and success of the local Market for SO Services business models for Slovenia. The information discussed here has been obtained based on the WP3/WP11 Regulatory Questionnaire carried out for all the demonstrators. The regulatory barriers and possible measures to tackle them are presented below. Whenever a barrier is specific to a certain BM, this is mentioned.

The regulatory barriers are split into three main groups: lack of definition of roles and responsibilities, economic incentives provided, and lack of additional enabling regulation. The barriers of each of these types are discussed in a separate subsection.

#### 6.4.3.1 Barriers related to the lack of definition of roles and responsibilities

##### Further specification of the FSP model

The products for separate markets are separately priced, so this needs to be analysed to see if it can be a barrier or not for small participants. The Markets for SO Services do not exist yet, because the volumes for flexibility services are still too small, but this is not a regulatory issue, but rather a market issue that will likely be addressed as more DERs are integrated into the grid. The minimal bid for TSO in Slovenia is 5 MW of power. It has additional prequalification tests, availability has to be 24/7, has big penalties for non-delivery and the provider has to have a bank guarantee. High frequency of measurements is requested from the provider. Bids for DSO are not so strict, minimal bid power is in kW, for now, there are no prequalification tests to prove the flexibility power of FSP. Availability only in part of the day when overloaded is expected. There are no penalties

for non-delivery, the frequency of measurements is 15 min, so there is no need to install additional meters/RTUs on flexible providers.

#### **Further specification of the MO model**

There may not be significant regulatory problems in implementing BM EACL-SL-02. However, the Markets for SO Services do not exist yet, because the volumes for flexibility services are still too small, but this is not a regulatory issue, but rather a market issue that will likely be addressed as more DERs are integrated into the grid. It also needs to be verified if the lack of a centralized market may limit the full exploitation of this BM. Furthermore, it is specified that in this BM the DSO plays the role of the MO also, which is the central role that provides the value proposition, so this needs to be carefully checked as the DSO is part of the customers and gets benefits of the provided flexibility.

#### **Operation rules of storage operation, including those by TSO/DSO**

SOs cannot operate generation and storage in Slovenia. Storage and generation can provide services to both TSOs and DSOs, and therefore the rules under which they are operated need to be defined.

This barrier is relevant as these are important aspects to provide flexibility and can impact both BMs.

### **6.4.3.2 Barriers related to the economic incentives provided**

#### **Lack of suitable regulation guiding the implementation of alternative flexibility procurement mechanisms**

Flexibility can be procured through different mechanisms rewarding the provision of flexibility. The acquisition of flexibility may not rely only on one specific mechanism, but will rather involve applying a combination of them, depending on the characteristics of the needs and the resources that can provide this flexibility. These mechanisms, which can span various timeframes ranging from long-term planning to real-time operation, include connection and access agreements, bilateral contracts, auctions, dynamic tariffs, and others. The design of these mechanisms needs to be carefully considered in order for them to effectively complement each other, produce consistent signals, and optimize the utilization of all the resources.

Procurement mechanisms are essential for the development of local markets and DERs flexibility provision, which need to be considered in both BMs.

### **6.4.3.3 Barriers related to the lack of additional enabling regulation**

#### **About the regulation protecting agents from market power abuse exerted by limiting access to information**

There is a regulation that defines the possibilities and obligations regarding data access for aggregators which may protect these agents from market power abuse by incumbents on access to information. To enable the development of local Markets for SO Services, the availability of data on the individual customers' profiles is



required to assess the flexibility potential and develop new business models that can be offered to such customers. However, when regulating data access, privacy, cybersecurity considerations, and third-party access rules need to be established to protect the customers' rights. The regulation needs to be checked accordingly in this regard.





## 7 Synthesis of the results of the analysis of BMs

Based on the information collected on the main regulatory barriers of different types faced by those stakeholders pushing the implementation of markets for SO services, we provide here a synthesis of this information properly structured. Afterwards, considering also the information collected through questionnaires from Demos, we identify the critical stakeholders for the implementation of these markets in the systems of the several Demonstrators in the project, and discuss the strategies proposed to engage them. Lastly, we provide a comparison of those BMs focused on the same stakeholder, according to the representation made of these BMs through their Canvas. The purpose of this is identifying the impact that the context where the business of a stakeholder is implemented may have on the focus and main features of this business.

### 7.1 Synthesis of the main regulatory barriers to the implementation of BMs

Next, we identify the most relevant regulatory barriers to the implementation of many of the business models related to the deployment of local markets for SO services and the stakeholders to address to overcome these barriers. This is provided in Table 7.1. Within this table, the regulatory barriers are properly classified by type. For each of the different main barriers identified, the national systems where these have been found to be relevant are identified (among brackets). Given that these are regulatory barriers, the stakeholders to address to overcome them should be, in the first place, European regulatory authorities, which should develop appropriate regulation at regional level, together with national regulatory authorities and governments, who should be involved in the implementation of the corresponding European legislation at country level.

Table 7.1: Main regulatory barriers to the implementation of BMs and stakeholders to address to overcome them

Type of Barrier	Subtype of Barrier	Description
<b>Lack of relevant regulation</b>	Non-existence of Local FM	Not possible to implement most BMs if markets for SO services do not exist (SP, PT (for other than balancing), LV(NO), GR, CY, PL (only integrated sched. process for CM and Balancing), CZ, SL)
	Main roles in markets for SO services not defined	<ul style="list-style-type: none"> <li>- Independent Aggregator (SP, LV(NO), CZ, HU(exist but regulation for them is being further defined))</li> <li>- IMO (SP, NO, GR, CZ, SL, HU)</li> <li>- FRO (NO)</li> <li>- OO (NO)</li> </ul>

	Lack of regulation on key aspects of market functioning	<ul style="list-style-type: none"> <li>- Relationship among Aggregator, BRP, and Supplier: compensations (NO, GR, PL)</li> <li>- CBA for non-investment options (flexibility) (PT)</li> <li>- Financial compensations for flexibility provision (between FSPs and SO) (NO, GR, CY)</li> <li>- Appropriate flexibility pricing schemes: joint vs. separate (NO, SL (separate pricing), HU(separate))</li> <li>- Measurement of flexibility available and provided: baselining, observability (SP, PT, GR, CY)</li> <li>- Cost allocation rules across services and SOs (NO)</li> <li>- TSO/DSO coordination (prequalification, registration, product definition, data exchange between markets) (SP, NO, GR)</li> </ul> <ul style="list-style-type: none"> <li>- Integration into European markets: product harmonization to the extent that is reasonable (NO) vs. product differentiation to cover the system needs for each service</li> <li>- Submetering and other metering constraints, and harmonization (SP, PT, NO, GR)</li> <li>- Access to data on consumers and other stakeholders (privacy, cybersecurity, third party access) (NO, CZ, SL)</li> <li>- Data management harmonization across stakeholders responsible for this and markets (NO, GR)</li> <li>- Mixed (load and generation) flexibility portfolios (SP)</li> <li>- Balancing Responsibility aggregation (at portfolio level) (GR)</li> <li>- Demand participation in markets for SO services (GR (other than balancing))</li> </ul>
<b>Lack of economic incentives to procure flexibility</b>	Lack of appropriate remuneration schemes	<ul style="list-style-type: none"> <li>- Capex vs. Totex (SP) [31]</li> <li>- Specific schemes for risky investments in immature/innovative technologies (PT)</li> </ul>
<b>Lack of additional schemes for mobilization of flexibility</b>	Lack of appropriate pricing schemes	<ul style="list-style-type: none"> <li>- Appropriate network pricing schemes (SP, GR, PL, CZ, SL)</li> <li>- Energy pricing: Time varying, Dynamic... (GR, PL, CZ, SL)</li> <li>- Coordination between these and markets for SO services is needed (SP, GR, PL, CZ, SL)</li> </ul>

<b>Ownership and/or operation of DERs by the SOs</b>	Reduced market liquidity or flexibility portfolio	<ul style="list-style-type: none"> <li>- Allowing ownership/operation of DERs could discourage participation in markets (NO (some countries), HU (for storage))</li> <li>- Not allowing it could limit flexibility options to address system needs (SP, NO (some countries), GR, PL, CZ, SL, HU(for generation))</li> </ul>
<b>Barriers to the participation of (small) agents</b>	Reduced market liquidity and agent discrimination	<ul style="list-style-type: none"> <li>- Constraints on small agent participation (NO, CY, PL, CZ, SL (TSO services))</li> <li>- Additional costs (like transaction ones) for agents in local markets for SO services (NO, PL (for BRPs))</li> <li>- Disproportionate costs for small agents (NO, PL)</li> <li>- Controllability requirements (NO, CZ, SL (TSO services))</li> </ul>
<b>Access to data</b>	Market power in access to metering data	Incumbent restricts access of newcomers to data required for flexibility provision (SP, GR, PL, CZ, SL)

## 7.2 Main critical stakeholders for BM implementation and main strategies to apply to engage them. Relationship with regulatory barriers

We first identify the most relevant stakeholders that have been defined as critical for the implementation of many of the business models related to the deployment of local markets for SO services and the most relevant measures that have been derived to achieve their engagement. Together with these, for those engagement measures that are relevant from a regulatory point of view, we mention how these could overcome some main regulatory barriers previously identified. This is provided in Table 7.2. Within this table, for each stakeholder, the most promising engagement measures are listed, and the discussion of how these measures could overcome some regulatory barriers is underscored.

Table 7.2: Main critical stakeholders for the implementation of BMs and measures to engage them

Type of Critical Stakeholder	Engagement Measures to implement and relationship to the regulatory barriers that the former should overcome (highlighted by being underscored)
<b>National regulatory authorities and governments</b>	<ul style="list-style-type: none"> <li>• Providing comprehensive information on costs and benefits of implementation of the solution concerned for the system, the citizen, and society as a whole (also in dedicated meetings)</li> <li>• Support the implementation of Regulatory Sandboxes [32] to gather evidence of these benefits and costs in a controlled environment</li> </ul>

	<ul style="list-style-type: none"> <li>Provide them with advice on regulation conducive to the wide use of markets for SO services → <u>Should address the existing regulatory barriers in general</u></li> </ul>
<b>Local associations of consumers, authorities, or interest groups</b>	<ul style="list-style-type: none"> <li>Providing comprehensive information, through various well functioning communication channels, on local benefits of flexibility provision and its advantages over undertaking alternative, traditional, investments</li> <li>Advocating the implementation of regulation conducive to the wide use of flexibility solutions in the BM → <u>Encouraging consumers to provide flexibility through appropriate pricing schemes; as well as enabling Demand participation in markets for SO services</u></li> </ul>
<b>BRPs, Retailers</b>	<ul style="list-style-type: none"> <li>Appropriate compensation mechanisms for imbalances → <u>Compensation mechanisms between these stakeholders and aggregators/BSPs should be implemented</u></li> <li>Defining clear regulation on the relationship among them and aggregators → <u>The relationship among Aggregator, BRP, and Supplier should be clearly specified including the rights and responsibilities of each party</u></li> <li>Foster competition in retailing and flexibility provision to encourage their participation in the solution → <u>This includes implementing appropriate baselining approaches; and flexibility pricing schemes; Advancing the integration into European markets; and having free access of potential flexibility providers to data on consumers relevant to provide these services</u></li> <li>Deployment of Smart meters and settlement based on measures from them</li> </ul>
<b>TSOs/DSOs</b>	<ul style="list-style-type: none"> <li>Remuneration schemes considering also operation costs and not only investment ones → <u>Changing from Capex based to Totex based schemes to consider all the of costs incurred in implementing the most efficient option from a social point of view</u></li> <li>Providing information on all types of benefits they would get from solutions, also involving increase in security</li> <li>Consider the application of compensation schemes, if needed → <u>For example, certain types of investments that are especially risky, or costly, but relevant for the implementation of markets for SO services, should be subject to higher remuneration rates</u></li> </ul>
<b>Small FSPs</b>	<ul style="list-style-type: none"> <li>Decreasing their costs and burden of participating in markets for SO services → <u>addressing regulatory barriers increasing the costs incurred by small FSPs when participating in markets for SO services</u></li> <li>Limiting entry barriers and providing measures to overcome them (aggregation) → <u>addressing those regulatory barriers preventing the participation of small FSPs in the relevant markets</u></li> <li>Make them aware of the benefits they will get from these solutions (all FSPs)</li> <li>Deploying Smart Meters</li> <li>Implementing clear regulation on the remuneration of flexibility provision → <u>this should amend the lack of appropriate flexibility pricing schemes.</u></li> </ul>

	<u>Flexibility should, in principle, be priced according to the marginal cost of delivering it</u>
<b>Sectorial Associations</b>	Showing the benefits to them of the solutions proposed
<b>Conventional and large generation / utilities</b>	<ul style="list-style-type: none"> <li>• Showing them the benefits they would get out of their participation in markets for SO services</li> <li>• Mandating the provision of flexibility by RES based generators as well</li> <li>• Advocate implementation of compensation or incentive mechanisms</li> </ul>
<b>Large Industrial Consumers</b>	<ul style="list-style-type: none"> <li>• Provide comprehensive information on the benefits they could get</li> <li>• Promote the implementation of flexibility solutions tailored to their needs</li> </ul>

### 7.3 Comparison of those BMs focused on each of the main stakeholders in markets for SO services

Finally, within this section, we provide a comparison of those BMs focused on the same stakeholder, according to the representation made of these BMs through their Canvas. The purpose of this is identifying the impact that the context where the business of a stakeholder is implemented may have on the focus and main features of this business. The context considered here includes the regulation and conditions in place in the country and region where this stakeholder is located.

For each of the main stakeholders involved in the implementation of markets for SO services, we compare the features of its business along the dimension, or aspects, of it considered in the BM Osterwalder’s Canvas.

#### 7.3.1 Comparison of those BMs focused on the MO

The comparison of the BMs for the BUCs WECL-ES-01 and EACL-SL-02, focused on Long-term congestion management, and Voltage control in distribution grids under market conditions, respectively, is separately carried out for each of the main building blocks considered in the description of these BMs. For each building block, first we describe the features of each BM in this regard and then we compare them. The objective is determining how the role played by this stakeholder may be affected by the context where it operates.

##### 7.3.1.1 Key partnerships

###### EACL-SL-02

- Pre-qualification of the grid product by the DSO.
- Provision of flexible services by the FSP.
- (In this BM the DSO plays the role of the MO as well)

#### **WECL-ES-01**

- DSO:
  - Management of metering information
  - Pre-qualification of the grid product
- Customers:
  - Provision of flexible resources by the FSP to the IMO
  - Possible Settlement by the IMO of the provision of flexibility by the FSPs.

#### **Comparison**

The key partnerships of EACL-SL-02 and WECL-ES-01 differ in terms of their stakeholders and the specific activities involved. EACL-SL-02 involves the DSO and FSP as key partners. The DSO's role includes pre-qualifying the grid product and the provision of flexible services. For EACL-SL-02, the DSO also acts as the MO. On the other hand, WECL-ES-01 encompasses partnerships with the DSO and customers. The DSO's involvement consists of managing metering information and pre-qualifying the grid product. These activities are deemed strategically important with high integration but have no competition or substitutability. In terms of customer partnerships, WECL-ES-01 focuses on the provision of flexible resources by the FSP, considering their acquisition, strategic importance, competition, integration, and substitutability factors. Additionally, there is a possibility of settling the provision of flexibility by the FSPs, optimizing economies at scale. Overall, EACL-SL-02 involves partnerships with the DSO and FSP, while WECL-PT-01 encompasses partnerships with the DSO and customers, highlighting different activities and stakeholders involved in each proposition.

### **7.3.1.2 Key activities**

#### **EACL-SL-02**

- Matches the request for flexibility of the DSO with the most cost-efficient offer (primary activity / value network). To accomplish that task, the constraints given by the DSO must be taken into consideration.
- Pre-qualifies the market product (support activity / value shop)
- Publishes the market results (support activity / value shop).
- Manages the economic compensation/ retribution of the different actors.

#### **WECL-ES-01**

- Matches the request for flexibility of the DSO with the most cost-efficient offer (primary activity/value network). To accomplish that task, the constraints given by the DSO must be taken into consideration.
- Pre-qualifies the market product (support activity/value shop)
- Publishes the market results (support activity/value shop).
- The IMO manages the economic retribution of the different actors.

### Comparison

The key activities of EACL-SL-02 and WECL-ES-01 exhibit remarkable similarities. Both propositions involve the primary activity of matching the request for flexibility of the DSO with the most cost-efficient offer, taking into consideration the constraints set by the DSO. This activity forms the core of their value network. Additionally, both EACL-SL-02 and WECL-ES-01 share support activities as they engage in pre-qualifying the market product and publishing the market results. These activities contribute to the smooth functioning of their respective value shops. Another common aspect is the management of economic compensation or retribution for the different actors involved. However, there is a slight difference in terminology, with EACL-SL-02 mentioning economic compensation, while WECL-ES-01 refers to economic retribution in the markets managed by the IMO. Overall, the key activities of EACL-SL-02 and WECL-ES-01 align closely, encompassing request matching, pre-qualification, market result publication, and economic compensation/retribution management, highlighting their similar operational frameworks.

#### 7.3.1.3 Value proposition

##### EACL-SL-02

- Provision of flexibility services under market conditions that will help the DSO avoid voltage control problems and secondary substation replacement/grid upgrades.

##### WECL-ES-01

- Provision of a platform for DSOs to procure competitive long-term flexibility products (both for availability and activation) that allow the DSOs to manage long-term congestion in the most efficient way (effort/pricing / market / purchase) from years to weeks ahead.
- To facilitate the participation of distributed resources in local markets.

### Comparison

The value propositions of EACL-SL-02 and WECL-ES-01 showcase distinct focuses and objectives. EACL-SL-02 aims to provide flexibility services under market conditions to assist the DSO in avoiding voltage control problems and the need for secondary substation replacement or grid upgrades. This proposition emphasizes the importance of addressing operational challenges and optimizing the existing infrastructure. On the other hand, WECL-ES-01 offers a different value proposition. It provides a platform for DSOs to procure competitive long-term flexibility products, both for availability and activation, enabling efficient management of long-term congestion from years to weeks ahead. This proposition focuses on offering tools and mechanisms for proactive congestion management potentially affecting the planning. Additionally, WECL-ES-01 aims to facilitate the participation of distributed resources in local markets, emphasizing the integration and engagement of decentralized energy sources. Overall, while EACL-SL-02 focuses on resolving voltage control issues and

infrastructure optimization, WECL-ES-01 prioritizes long-term congestion management, flexibility procurement, and the inclusion of distributed resources in local markets.

#### 7.3.1.4 Customer relationships

##### EACL-SL-02

- Direct personal relationship (acquisition and retention / trust).

##### WECL-ES-01

- Direct relationships (acquisition and retention / trust).

##### Comparison

The customer relationship strategies of EACL-SL-02 and WECL-ES-01 differ slightly in terms of their approach and channels. EACL-SL-02 emphasizes a direct personal relationship with customers, focusing on both acquisition and retention while fostering trust. This suggests a more hands-on and personalized approach to engaging and maintaining customer relationships. In contrast, WECL-ES-01 also values direct relationships with customers, emphasizing acquisition, retention, and trust. This indicates a more diverse and multi-channel approach to customer engagement and interaction, utilizing online platforms to reach and communicate with customers. In summary, EACL-SL-02 emphasizes direct personal relationships for acquisition and retention, with a focus on trust, while WECL-ES-01 adopts a similar approach but supplements it with online channels like the web and social media for customer engagement.

#### 7.3.1.5 Key resources

##### EACL-SL-02

- Financial guarantees, both for the DSO and the FSP (financial).
- Market matching system (platform).
- Settlement system collecting DSO activations and FSP measurements, evaluating activation success and energy to be paid (physical/related to a platform or a network).
- Computer servers (physical).

##### WECL-ES-01

- Financial guarantees, both for the DSO and the FSP (financial), supporting the transactions that all of them engage in.
- Market matching system (platform).
- Meters that can measure whether the flexibility has been provided (physical).
- Computer servers (physical).



## Comparison

The key resources of EACL-SL-02 and WECL-ES-01 exhibit similarities with a few nuanced differences. Both propositions emphasize the importance of financial guarantees for both the DSO and the FSP, highlighting the need for financial stability and security in their operations. Additionally, both EACL-SL-02 and WECL-ES-01 rely on a market matching system, which serves as a platform for facilitating the matching of flexibility requests and offers. This system enables efficient coordination and optimization of resources. In terms of physical resources, both propositions require computer servers for data storage, processing, and communication. However, there are slight differences between the two propositions. EACL-SL-02 highlights the importance of a settlement system that collects DSO activations and FSP measurements, evaluates activation success, and calculates energy to be paid. This highlights the need for a comprehensive system for transaction settlement and performance evaluation. On the other hand, WECL-ES-01 emphasizes the use of meters capable of measuring the provision of flexibility, indicating the importance of accurate measurement and verification of flexibility services. Overall, while EACL-SL-02 and WECL-ES-01 share key resources such as financial guarantees and market matching systems, they differ in terms of the type of resources they place focus on, either settlement systems, or meters, reflecting the specific innovation addressed by each.

### 7.3.1.6 Customer

#### EACL-SL-02

- DSO, FSP.
- DSO must have voltage control needs.
- FSP must have resources that may solve DSO's voltage control needs.

#### WECL-ES-01

- DSOs must have congestion to manage, which could be solved by using resource flexibility.
- FSP must have resources (from consumers) that may solve the congestions of the DSO and could get savings by offering their flexibility through the local market platform.

## Comparison

The customer profiles of EACL-SL-02 and WECL-ES-01 differ in terms of their specific needs and requirements. EACL-SL-02 primarily focuses on two main customers: the DSO and the FSP. For EACL-SL-02, the DSO must have voltage control needs, and the FSP must possess resources that can potentially address these voltage control requirements. This indicates a specific target audience that revolves around voltage control challenges and the availability of suitable resources to meet those needs. On the other hand, WECL-ES-01 targets DSOs that have congestion management requirements. The proposition identifies congestion as a problem that can be alleviated by utilizing resource flexibility. Therefore, DSOs with congestion issues become the primary customers

for WECL-ES-01. Furthermore, FSPs with resources, typically in the form of consumers, are sought after, as they can potentially provide solutions to DSO congestion and benefit from cost savings by offering their flexibility through the local market platform. Overall, while EACL-SL-02 focuses on DSOs with voltage control needs and FSPs with compatible resources, WECL-ES-01 targets DSOs with congestion management requirements and FSPs with flexibility resources to address those congestion challenges.

### 7.3.1.7 Channel

#### EACL-SL-02

- Personal meetings (awareness & evaluation).

#### WECL-ES-01

- Meetings (awareness & evaluation).
- Conferences.
- Online platforms for small DSO (purchase & after sales (settlement)).

#### Comparison

The channel strategies of EACL-SL-02 and WECL-ES-01 differ in terms of their approach and the platforms they utilize. EACL-SL-02 relies primarily on personal meetings as a channel for both awareness and evaluation. This indicates a direct and personalized approach to engage with potential customers. On the other hand, WECL-ES-01 also emphasizes the importance of meetings for awareness and evaluation, suggesting a similar approach to EACL-SL-02 in terms of direct engagement. However, WECL-ES-01 expands its channel strategy by incorporating conferences as an additional platform for creating awareness and facilitating evaluation. This suggests a broader reach and the opportunity to engage with a larger audience within the industry. Additionally, WECL-ES-01 utilizes an online platform whose capabilities are augmented to also address the needs of small DSOs, enabling them to make purchases and engage in after-sales activities, including settlement processes. This indicates the utilization of digital platforms to provide convenience and accessibility to small DSOs. In summary, while EACL-SL-02 relies on personal meetings, WECL-ES-01 combines meetings for awareness and evaluation, with an online platform covering the needs of small DSOs to facilitate purchase and after-sales processes.

### 7.3.1.8 Revenue streams

#### EACL-SL-02

- Payment of a brokerage fee both by the DSO and the FSP each time the service is requested (brokerage fees / fixed pricing).

#### WECL-ES-01

- Option 1 (fixed payment):
  - Regulated tariff where both the DSO and the FSP pay a fixed amount, whether they use this service or not (subscription fee / fixed pricing).
- Option 2 (fixed + variable payments):
  - Payment of a brokerage fee both by the DSO and the FSP each time the service is requested (brokerage fees / fixed pricing).
  - Payment of a subscription fee both by the DSO and the FSP to be able to access the market (subscription fee / fixed pricing).
- Option 3 (paid through electricity tariffs):
  - IMO, costs are recovered through regulated tariffs paid by all electricity consumers (tax / fixed pricing).

### Comparison

The revenue streams of EACL-SL-02 and WECL-ES-01 differ in their approaches and payment structures. EACL-SL-02 generates revenue through the payment of a brokerage fee by both the DSO and the FSP each time the service is requested. This indicates a transaction-based revenue model where the brokerage fee serves as the primary source of income. In contrast, the BM for WECL-ES-01 offers multiple revenue options. Option 1 involves a fixed payment in the form of a regulated tariff where both the DSO and the FSP pay a fixed amount, regardless of whether they use the service or not. This subscription fee offers a predictable and consistent revenue stream. Option 2 combines fixed and variable payments, including a brokerage fee charged each time the service is requested, as well as a subscription fee for accessing the market. This hybrid payment structure allows for both transaction-based revenue and recurring subscription revenue. Lastly, Option 3 involves recovering costs through regulated tariffs paid by all electricity consumers, suggesting a tax-like revenue model where costs are distributed across the broader consumer base. Overall, EACL-SL-02 relies on brokerage fees, while the BM for WECL-ES-01 offers multiple revenue options, including fixed payments, transaction-based fees, subscription fees, and cost recovery through electricity tariffs.

### 7.3.1.9 Cost structure

#### EACL-SL-02

- Computer servers and other IT services.
- Human resources to carry out the daily operations and code the market platform.
- Other.

#### WECL-ES-01

- Computer servers and other IT services (25%).
- Human resources to carry on the daily operations and code the market platform (50%).-
- Other (25%).

### Comparison

The cost structures of EACL-SL-02 and WECL-ES-01 share some similarities but also exhibit slight differences. Both propositions require computer servers and other IT services to support their operations, indicating the significance of technological infrastructure in their cost structure. Additionally, both EACL-SL-02 and WECL-ES-01 rely on human resources to carry out daily operations and code the market platform, highlighting the importance of skilled personnel for efficient functioning. However, there are differences in the distribution of costs. EACL-SL-02 does not provide specific percentages, but it includes other costs beyond computer servers and human resources. In contrast, WECL-ES-01 provides a breakdown, allocating 25% of the cost to computer servers and other IT services, 50% to human resources, and the remaining 25% to other costs. This suggests that WECL-ES-01 places a greater emphasis on human resources as a significant component of its cost structure. It also allocates a specific portion to cover additional miscellaneous expenses. Overall, while both propositions require computer servers, IT services, and human resources, WECL-ES-01 highlights a higher proportion of costs attributed to human resources and provides a more detailed breakdown of cost distribution.

### 7.3.2 Comparison of BMs focused on the TSO

The comparison of the BMs for the BUCs WECL-FR-02, WECL-PT-02 and EACL.PL-04, which are focused on the 'Improved TSO-DSO information exchange for DER activation', the 'Exchange of Information for Congestion Management – Long Term', and the 'Balancing Service Provider on the Flexibility Platform', respectively, is separately carried out for each of the main building blocks considered in the description of these BMs. For each building block, first we describe the features of each BM in this regard and then we compare them. The objective is determining how the role played by this stakeholder may be affected by the context where it operates.

#### 7.3.2.1 Key partnerships

##### WECL-FR-02

- TSO/DSO workshops.

##### WECL-PT-02

Interactions through the data exchange platform with the DSO in case of forecasted congestions in transmission and distribution systems for the following process phases of the ASM report [28]: i) pre-qualification ii) forecast iii) market phase iv) monitoring and activation.

##### EACL.PL-04

- The existing BSP applies for confirmation of his relationship status with the TSO.
- FPO informs TSO about the readiness to test new SUs.

### Comparison

The key partnership approaches of WECL-FR-02, WECL-PT-02, and EACL.PL-04 highlight their unique engagement strategies. WECL-FR-02 centres on workshops involving collaboration between the TSO and DSO, which indicates an interactive and knowledge-sharing approach to partnership. On the other hand, since the core activity foreseen in the WECL-PT-02 is the interaction between the SOs (SOs) through data exchange platforms during various phases of the ASM report [28] to address congestions, the key partnership relies on this exact interaction, emphasizing proactive engagement for congestion management. This approach aligns with a strategic and integrated partnership focused on addressing forecasted congestions. EACL.PL-04's partnerships involve the existing BSP's application for confirming their relationship status with the TSO and the FPO's communication to the TSO about the readiness to test new SUs, highlighting procedural interactions within the operational context. In summary, while WECL-FR-02 focuses on collaborative workshops, WECL-PT-02 emphasizes SO interactions for congestion management, and EACL.PL-04's partnerships revolve around procedural communication with the TSO and FPO. Each approach reflects distinct strategies tailored to their respective operational contexts.

### 7.3.2.2 Key activities

#### WECL-FR-02

- Defining and listing the main flexibility usages of both SOs.
- Illustrating what coordination issues, it could entail now or in the future.
- Highlighting leads of further cooperation between TSO and DSO to tackle them.

#### WECL-PT-02

Provides information to the connected SO to fill in the following process phases of the ASM report [28]: (i) pre-qualification ii) forecast iii) market phase iv) monitoring and activation.

- Offers flexibility products to respond to SOs needs.

#### EACL-PL-04

- Confirms his relationship status with existing BSPs.
- Sets the date and procedure for testing new SUs and confirms or rejects the SUs based on the results.
- Confirms readiness of SUs and corresponding BSPs to provide balancing services (in case of positive test results) and repeats (recertification) when changes take place within the SUs or when new information emerges by additional tests conducted.

### Comparison

The key activities of WECL-FR-02, WECL-PT-02, and EACL-PL-04 demonstrate distinct operational functions. WECL-FR-02 engages in defining flexibility usages of SOs, addressing coordination challenges that might arise presently or in the future, and suggesting potential collaborative measures between the TSO and DSO. This approach emphasizes strategic planning and cooperation. In contrast, WECL-PT-02 involves providing connected SOs with information needed for ASM report [28] phases, not only to allow offering flexibility products aligned with SO needs but also to avoid additional congestions created by service activation, showcasing a responsive approach to addressing SO requirements within the ASM framework [28]. EACL-PL-04's activities centre on communication with BSPs, encompassing confirmation of relationship status, scheduling and overseeing testing of new SUs, and certifying the readiness of SUs and corresponding BSPs for balancing services, reflecting a procedural approach within the balancing services context. In summary, WECL-FR-02 emphasizes strategic definition and coordination, WECL-PT-02 aligns products with SO needs, and EACL-PL-04 focuses on relationship confirmation, testing, and certifying readiness within the context of balancing services. Each proposition exhibits a targeted approach tailored to their specific operational objectives.

### 7.3.2.3 Value proposition

#### WECL-FR-02

- Highlights of possible leads of future cooperation between TSO and DSO.

#### WECL-PT-02

- Enable market-based procurement of flexibility products.
- Allows FSPs to offer flexibility services to non-connected SOs.

#### EACL-PL-04

- Increase in the efficiency of the procurement of market-based balancing services provided by BSP linked with FSPs through a FP, allowing the latter to indirectly take part in the balancing markets. This increase would result from the increase in the number of BSPs being allowed to participate in the market through the improvements achieved in the prequalification process.
- Increase in the efficiency of the pre-qualification process through the certification of additional BSPs.

### Comparison

The value propositions of WECL-FR-02, WECL-PT-02, and EACL-PL-04 encompass distinct benefits and objectives. WECL-FR-02 emphasizes the identification of potential avenues for future cooperation between TSO and DSO, underscoring their collaborative potential. In contrast, WECL-PT-02's value proposition lies in enabling market-based procurement of flexibility products and facilitating FSPs' provision of flexibility services to non-

connected SOs, showcasing a broader market reach and facilitation of services beyond connected SOs. EACL-PL-04's proposition is multifaceted, aiming to enhance the efficiency of market-based balancing services procurement by linking BSPs with FSPs through a FP, thereby indirectly involving FSPs in balancing markets. This increase in efficiency results from improvements in the prequalification process, further supported by an efficiency boost through the certification of additional BSPs. In summary, while WECL-FR-02 emphasizes future cooperation identification, WECL-PT-02 targets market-based flexibility procurement and broader service provisions, and EACL-PL-04 focuses on enhancing efficiency in market participation through FPs and improving the prequalification process. Each proposition aligns with specific objectives tailored to their respective operational contexts.

#### 7.3.2.4 Customer relationships

##### **WECL-FR-02**

- Direct interaction via communication infrastructure.

##### **WECL-PT-02**

- As the FSPs will be simulated, the interactions with the SOs are not defined. Can be via MP, FR or direct interaction.

##### **EACL-PL-04**

- Direct personal relationship (acquisition and retention / trust).

##### **Comparison**

The customer relationship strategies of WECL-FR-02, WECL-PT-02, and EACL-PL-04 exhibit variations based on their operational contexts. WECL-FR-02 emphasizes direct interactions facilitated through communication infrastructure, highlighting an interactive and communicative approach to engage with customers. In contrast, WECL-PT-02's approach to interactions with FSPs is not explicitly defined due to simulation, but possibilities include engagement via market platforms, FPOs, or direct interaction. This indicates flexibility in communication methods to adapt to the simulation context. EACL-PL-04, however, focuses on direct personal relationships, emphasizing acquisition, retention, and trust-building. This approach signifies a strong emphasis on building and maintaining trust-based relationships with customers. In summary, WECL-FR-02 highlights direct communication infrastructure interactions, WECL-PT-02 offers flexible interaction possibilities within a simulation context, and EACL-PL-04 places a significant emphasis on direct personal relationships and trust. Each approach is tailored to the specific customer engagement requirements of the respective propositions.

#### 7.3.2.5 Key resources

#### **WECL-FR-02**

- Flexibilities usage analysis for both SOs.
- Literature recommendations

#### **WECL-PT-02**

- TDEP
- DDEP
- DSO and TSO databases
- Computer servers (physical)

#### **EACL-PL-04**

- Financial guarantees, both for the DSO and the FSP (financial), or alternative resources received for the management of the Platform and provision of this service.
- Market matching system (platform).
- Meters that can measure whether the flexibility has been provided (physical).
- Computer servers (physical).

#### **Comparison**

The key resources of WECL-FR-02, WECL-PT-02, and EACL-PL-04 encompass diverse elements catering to their specific operational needs. WECL-FR-02's resources include flexibilities usage analysis for both SOs, indicating the importance of data analysis in their operations, along with literature recommendations for informed decision-making. WECL-PT-02 relies on several digital resources, such as TSO and DDEP, databases of both operators, and physical computer servers. These resources underscore the significance of information exchange and technological infrastructure. EACL-PL-04's resources comprise financial guarantees for both DSO and FSP, a market matching system in the form of a platform, meters for measuring flexibility provision, and physical computer servers. This mix of resources reflects financial stability, technological infrastructure, and measurement tools vital for their operations. In summary, while WECL-FR-02 focuses on data analysis and literature recommendations, WECL-PT-02 highlights digital platforms and databases, and EACL-PL-04 emphasizes financial guarantees, technological infrastructure, and measurement tools. Each proposition's resources are tailored to its specific operational context.

### **7.3.2.6 Customer**

#### **WECL-FR-02**

- DSO or TSO.

#### **WECL-PT-02**



- TSO
- DSO

#### **EACL-PL-04**

- BSP.

#### **Comparison**

The customer profiles of WECL-FR-02, WECL-PT-02, and EACL-PL-04 vary in their targeted stakeholders. WECL-FR-02 primarily engages with either a DSO or TSO, indicating flexibility in its customer base. In contrast, WECL-PT-02's proposition extends to both TSOs and DSOs, aiming to cater to both SOs within its operations. EACL-PL-04 focuses its customer relationship on BSPs (Balancing Service Providers), signalling a specialized engagement strategy. In summary, while WECL-FR-02 caters to DSOs or TSOs, WECL-PT-02 encompasses TSOs and DSOs, and EACL-PL-04's customer focus centres on BSPs. Each proposition's customer profile aligns with its specific operational context and objectives.

### **7.3.2.7 Channel**

#### **WECL-FR-02**

- TSO/DSO communication infrastructure.

#### **WECL-PT-02**

- As the FSPs will be simulated, the channel for the interactions with the SOs is not defined. Can be via market platform, FPO or direct interaction.

#### **EACL-PL-04**

- Personal meetings (awareness & evaluation).

#### **Comparison**

The channel strategies of WECL-FR-02, WECL-PT-02, and EACL-PL-04 exhibit diverse approaches in engaging with their stakeholders. WECL-FR-02 relies on TSO/DSO communication infrastructure, indicating a direct communication approach through established channels. In contrast, WECL-PT-02's approach to interacting with simulated FSPs is open-ended, allowing for possible engagement via market platforms, FPOs, or direct interactions. This approach highlights the adaptability of communication methods within a simulation context. EACL-PL-04's channel strategy focuses on personal meetings for awareness and evaluation, reflecting a hands-on and personalized approach to stakeholder engagement. In summary, while WECL-FR-02 emphasizes TSO/DSO communication infrastructure, WECL-PT-02 offers flexibility within a simulation context, and EACL-PL-04 relies

on personal meetings. Each proposition's channel strategy aligns with its unique operational context and objectives.

### 7.3.2.8 Revenue streams

#### WECL-FR-02

- None.

#### WECL-PT-02

- Value being paid: network tariff.
- Revenue source: flexibility services payment.

#### EACL-PL-04

- Reduction in penalties from increase in system security.
- Potential share of reduction in procurement costs (as an incentive)

#### Comparison

The revenue models of WECL-FR-02, WECL-PT-02, and EACL-PL-04 demonstrate distinct approaches to generating income. WECL-FR-02 does not explicitly mention a revenue model. WECL-PT-02's revenue model involves the value being paid in the form of network tariff, with the revenue source stemming from payments for flexibility services. Note, however, that this revenue stream is only applicable in a context of roll-out of the solution, with its consideration as a regulated cost, not actually applicable within the demonstration environment. This signifies a connection between network utilization and revenue generation. EACL-PL-04's revenue model focuses on certification fees paid by BSPs, suggesting a direct revenue stream tied to certification processes. In summary, while WECL-FR-02's revenue model is unspecified, WECL-PT-02's model revolves around network tariff and flexibility services payments, and EACL-PL-04's model centres on certification fees. Each proposition's revenue model reflects its unique operational context and financial structure.

### 7.3.2.9 Cost structure

#### WECL-FR-02

- Human resources to carry on the operations (study).

#### WECL-PT-02

- Not applicable as the demo doesn't involve actual FSPs, so no costs for FSPs are considered.

#### EACL-PL-04

- Computer servers and other IT services.
- Human resources to carry out the daily operations.
- Other.

### Comparison

The cost structures of WECL-FR-02, WECL-PT-02, and EACL-PL-04 highlight their distinct operational requirements. WECL-FR-02 relies on human resources for operational execution, specifically for study-related activities. WECL-PT-02's cost structure is marked as not applicable since the demo does not involve actual FSPs, implying that costs related to FSPs are not considered in this context. EACL-PL-04's resources encompass computer servers and IT services, signifying the importance of technological infrastructure, along with human resources for daily operations. Additionally, EACL-PL-04 mentions "other" costs, reflecting a comprehensive approach to cost considerations. In summary, while WECL-FR-02 relies on human resources for study operations, WECL-PT-02's context leads to no FSP-related costs, and EACL-PL-04 emphasizes computer servers, IT services, human resources, and other associated costs. Each proposition's cost structure aligns with its specific operational context and requirements.

### 7.3.3 Comparison of BMs focused on the FSP

The comparison of the BMs for the BUCs EACL-SL-01, EACL-HU-02 and WECL-PT-01, focused on the 'Congestion management in distribution grids under market conditions', the 'V/MV transformer overload', and the 'Exchange of Information for Congestion Management – Short Term', respectively, all of them focused on the FSP, is separately carried out for each of the main building blocks considered in the description of these BMs. For each building block, first we describe the features of each BM in this regard and then we compare them. The objective is determining how the role played by this stakeholder may be affected by the context where it operates.

#### 7.3.3.1 Key partnerships

##### EACL-SL-01

- Provision of grid prequalification by the DSO.
- Provision of product prequalification and registration to the FR by the FMO.
- Calculation of provided flexibility volume and settlement by the DSO or the FMO.
- Provision of flexible resources to be added to the FSP's portfolio by Units/Flexibility providers.

##### EACL-HU-02

- Announcement of flexibility needs by the DSO.
- Provision of flexible resources by individual units to be added to the FSP's portfolio1.

#### **WECL-PT-01**

Interactions with the SOs in case of forecasted congestions in transmission and distribution systems for the following process phases of the ASM report [28]: i) pre-qualification ii) forecast iii) market phase iv) monitoring and activation

#### **Comparison**

In the EACL-SL-01, the DSO prequalifies the grid, while the FMO handles product prequalification and registration for the FR. Settlements and flexibility volume calculation are managed by either the DSO or FMO. Flexible resources are acquired for the FSP's portfolio from Units/Flexibility providers.

In the EACL-HU-02, the DSO communicates flexibility needs, and individual units provide flexible resources. Moreover, in the WECL-PT-01, the FSP engages with the SOs when congestion is forecasted in transmission and distribution systems, spanning the phases of pre-qualification, forecast, market participation, monitoring, and activation in the ASM report [28].

### **7.3.3.2 Key activities**

#### **EACL-SL-01**

- Requests grid/product prequalification by the DSO/FMO respectively.
- Offers bids to the local market for SO services or makes long-term (e.g., 6 months) contracts with the DSO regarding offered flexibility services.
- Provides flexibility services according to the contracts signed and the requests from the DSO, as well as real-time measurements of those.
- Confirmation of provided flexibility volume and settlement calculations.

#### **EACL-HU-02**

- Requests prequalification by the DSO.
- Submits bids to W-1 & D-1 order book.
- Provides flexible resources according to the qualified bids.

#### **WECL-PT-01**

Provides information to the connected SO to fill in the following process phases of the ASM report [28] (i) pre-qualification ii) forecast iii) market phase iv) monitoring and activation.

- Offers flexibility products to respond to SOs needs.

#### **Comparison**

From the perspective of the FSP, these BMs involve distinct activities. In the EACL-SL-01, the FSP initiates prequalification requests from the DSO or FMO, subsequently offering bids in the local market for SO services or establishing long-term contracts with the DSO. The FSP then provides flexibility services as per agreements and DSO requests, accompanied by real-time measurements. Settlement calculations and confirmation of provided flexibility volume follow.

In the EACL-HU-02, the FSP seeks prequalification from the DSO, places bids in order books, and delivers flexible resources based on qualified bids. Lastly, in the WECL-PT-01, the FSP provides information to the connected SO, supporting the ASM report's [28] pre-qualification, forecast, market participation, monitoring, and activation phases, while also delivering flexibility products that cater to the needs of the SOs.

### 7.3.3.3 Value proposition

#### EACL-SL-01

- Provision of flexibility services under market conditions that will help the DSO avoid grid equipment overloading and secondary substation replacement/grid upgrades.

#### EACL-HU-02

- Provision of flexibility services (capacity and energy activation) that allow the DSO to mitigate overloading of HV/MV transformers.

#### WECL-PT-01

- Enable market-based procurement of flexibility products
- Allows FSPs to offer flexibility services to non-connected SOs

#### Comparison

From the FSP's standpoint, these BMs offer varying value propositions. In the EACL-SL-01, the FSP's value comes from providing flexibility services to the DSO in a market-driven context, preventing grid equipment overloading and avoiding the need for costly secondary substation replacements or grid upgrades.

In the EACL-HU-02, the FSP offers flexibility services that specifically address the overloading of HV/MV transformers. By delivering both capacity and energy activation services, the FSP enables the DSO to effectively manage transformer loads, avoiding potential outages and optimizing transformer operations. The WECL-PT-01 introduces market-based procurement of flexibility products, enabling FSPs to extend their flexibility services to non-connected SOs, thereby broadening their market reach and potential impact.

### 7.3.3.4 Customer relationships

#### **EACL-SL-01**

- Direct personal relationship (acquisition and retention / trust).

#### **EACL-HU-02**

- Direct personal relationship (acquisition and retention / trust).

#### **WECL-PT-01**

- As the FSPs will be simulated, the interactions with the SOs are not defined. Can be via market platform, FPO or direct interaction.

#### **Comparison**

In these perspectives of the FSP, there is a recurring emphasis on direct personal relationships for acquisition, retention, and fostering trust. Both EACL-SL-01 and EACL-HU-02 stress the importance of such relationships for the FSPs.

However, WECL-PT-01 introduces a different dimension by acknowledging that since FSPs are simulated in that demo, their interactions with the SOs might involve various channels such as the market platform, a FPO, or even direct interaction, reflecting a more diverse and adaptable approach to customer engagement.

### **7.3.3.5 Key resources**

#### **EACL-SL-01**

- VPP (including a technical and a business channel) for units' activation, internal baseline calculations and monitoring of available locations (related to a platform or a network).
- Unit controller for the transmission of activation demands to technical units (physical / related to a platform or a network).

#### **EACL-HU-02**

- Financial guarantees for the Units/Flexibility providers included in the FSP's portfolio (financial).
- System that allows indirect control of the flexibility resources by the FSP (physical / related to a platform or a network).
- Computer servers (physical).
- FP (related to a platform or a network).

#### **WECL-PT-01**

- TDEP
- DDEP
- DSO and TSO databases

- Computer servers (physical)

#### **Comparison**

EACL-SL-01 involves a mix of technical and business channels through a VPP that facilitates activation, baseline calculations, and location monitoring. It also employs unit controllers to transmit activation demands, incorporating both physical and platform-related elements.

In contrast, EACL-HU-02 encompasses financial guarantees for Units/Flexibility providers within the FSP's portfolio, alongside a system for indirect control of flexibility resources, computer servers, and a FP. WECL-PT-01 mainly revolves around data exchange platforms and databases maintained by both the TSO and DSO, as well as computer servers. The differences lie in the varying degrees of technical and financial focus, resource management, and platform integration.

### **7.3.3.6 Customer**

#### **EACL-SL-01**

- Unit/Flexibility provider, DSO.
- DSO needs to have congestion/overloading problems to manage.
- Unit/Flexibility provider needs to have flexibility resources that might solve DSO's congestion/overloading problems.

#### **EACL-HU-02**

- DSO, who must have overloading problems on HV/MV transformers.

#### **WECL-PT-01**

- TSO
- DSO

#### **Comparison**

In these FSP perspectives, EACL-SL-01 involves engaging with Unit/Flexibility providers and DSOs, where the DSO requires congestion or overloading issues to address, while the Unit/Flexibility provider needs suitable resources to alleviate these concerns.

In contrast, EACL-HU-02 centres around collaborating with DSOs who must grapple with overloading problems specifically related to HV/MV transformers. WECL-PT-01, however, focuses on interactions with both TSOs and DSOs, reflecting a broader scope of engagement across these two entities. The distinctions lie in the specific challenges each BM addresses and the variety of entities with which the FSP interacts.

### 7.3.3.7 Channel

#### EACL-SL-01

- Personal meetings (awareness & evaluation).

#### EACL-HU-02

- Direct personal relationship (acquisition and retention / trust).
- MO's online platforms for FSPs.

#### WECL-PT-01

- As the FSPs will be simulated, the channel for the interactions with the SOs is not defined. Can be via market platform, FPO or direct interaction

#### Comparison

In these FSP perspectives, EACL-SL-01 involves direct personal engagement through personal meetings, mainly focused on creating awareness and evaluating options. In EACL-HU-02, a direct personal relationship is emphasized, encompassing acquisition, retention, and trust-building. Additionally, the MO's online platforms serve as a channel for FSP interactions.

In WECL-PT-01, the exact channel for FSP interactions with the simulated SOs remains open, potentially encompassing various options like the market platform, FPO, or direct interaction. The distinctions arise in the nature of the interactions and the platforms facilitating them, ranging from personal meetings to online platforms and adaptable interaction methods.

### 7.3.3.8 Revenue streams

#### EACL-SL-01

- The difference between revenues gained through selling the flexibility services to the DSO/market and costs stemming from the compensation to be paid to the Flexible resources.

#### EACL-HU-02

- The difference between revenues gained through selling the flexibility services to the DSO and costs stemming from the compensation to be paid to the Flexible resources.

#### WECL-PT-01

- Value being paid: network tariff
- Revenue source: flexibility services payment



### Comparison

In these FSP viewpoints, EACL-SL-01 centres on the net gain from selling flexibility services to the DSO or the market while deducting compensation paid to flexible resources.

EACL-HU-02 also focuses on the net gain from selling services to the DSO, but without specifying the involvement of the market. WECL-PT-01 involves the value exchange, with the FSP receiving network tariff payment and generating revenue from flexibility services. Note, however, that this revenue stream is only applicable in a context of roll-out of the solution, with its consideration as a regulated cost, not actually applicable within the demonstration environment. While the first two BMs revolve around the net revenue balance, the third BM highlights the revenue sources including network tariff and payment for flexibility services.

#### 7.3.3.9 Cost structure

##### EACL-SL-01

- Computer servers and other IT services.
- Human resources to carry out the daily operations.
- Other.

##### EACL-HU-02

- Computer servers and other IT services.
- Human resources to carry out the daily operations.
- Other.

##### WECL-PT-01

- Not applicable as the demo doesn't involve actual FSPs, so no costs for FSPs are considered.

### Comparison

In these FSP perspectives, Both EACL-SL-01 and EACL-HU-02 emphasize similar cost components: computer servers and IT services, along with human resources required for daily operations. Both the first and second BMs repeat these elements without differentiation. However, the WECL-PT-01 takes a distinct stance by stating that no costs for FSPs are considered in the demo, due to the absence of actual FSPs in the demo.

#### 7.3.4 Comparison of BMs focused on the DSO

The comparison of the BMs for the BUCs EACL-CZ-02, SOCL-GR-01, and SOCL-CY-02, focused on the 'Reactive power overflow management', the 'Enhanced Active/Reactive Power Management for TSO-DSO coordination', and the 'Reactive power flexibility and power quality', respectively, is separately carried out for each of the main building blocks considered in the description of these BMs. For each building block, first we describe the features

of each BM in this regard and then we compare them. The objective is determining how the role played by this stakeholder may be affected by the context where it operates.

#### 7.3.4.1 Key partnerships

##### EACL-CZ-02

- Provision of available flexibility capacity by the AGG, through the platform.
- Demand/supply matching and market parties informing by the platform.
- Provision of flexible resources by the FSP or Unit/Flexibility provider.

##### SOCL-GR-01

- WFP delivers the forecasts of the weather parameters to the TSO and DSO (.
- TSO and DSO use forecast to check the needs and the availability of the flexibility in the grid.
- FSPs offer the needed services to TSO and DSO.
- TSO and DSO use the data from the weather forecasts and FSPs to ensure proper grid operation.

##### COCL-CY-02

- Procure services/products to the Local DSO Ancillary Service Market
- Provision of flexibility services by Flexible Resources

##### Comparison

EACL-CZ-02 highlights key partnerships between the DSO, Aggregator (AGG), and FSPs (FSPs) or Unit/Flexibility providers. The AGG, through the platform, facilitates the provision of available flexibility capacity. The platform serves for matching the demand and supply of flexibility services and to inform market parties. The FSPs or Unit/Flexibility providers play a crucial role in offering flexible resources to meet the needs of the DSO.

On the other hand, SOCL-GR-01 focuses on a different set of key partnerships for the DSO. It involves a partnership with a WFP who delivers weather forecasts to both the TSO and DSO. These forecasts are utilized by the TSO and DSO to assess the needs and availability of flexibility in the grid. Additionally, FSPs partner with the TSO and DSO to offer the required flexibility services. The DSO and TSO relies on the data from weather forecasts and the services provided by FSPs to ensure proper grid operation, taking into account weather conditions and the availability of flexibility resources.

Lastly, SOCL-CY-02 focuses on partnerships between the DSO and flexible resources. Therefore, the type of partnerships highlighted here are analogous to those discussed in the BM for the BUC EACL-CZ-02.

#### 7.3.4.2 Key activities

#### **EACL-CZ-02**

- Evaluates the exchange of reactive power between DSO and TSO.
- Identifies relevant flexibility needs to address voltage problems.
- Sends flexibility demand to the platform (by creating an auction).
- Posts information about availability of the grid to flexibility providers and aggregators through TLS.

#### **SOCL-GR-01**

- Obtaining the weather data forecast;
- Modelling perspective grid;
- Determining the needs for flexibility;
- Communicating with MO to consider bids;
- Choosing the FSPs;
- TSO – DSO coordination.

#### **SOCL-CY-02**

- Defines the amount of flexibility to be procured and communicates the corresponding requests to the FMO.
- The DSO monitors the real-time operation of the grid and coordinates the provision of ancillary services by sending coordination signal to the flexible resources to manage congestion in the distribution grid (primary activity / value shop).

#### **Comparison**

In comparing EACL-CZ-02 and SOCL-GR-01, which are focused on key activities from the perspective of the DSO, we can observe both similarities and differences. EACL-CZ-02 emphasizes the DSO's role in evaluating the exchange of reactive power with the TSO, identifying flexibility needs to address voltage problems, sending flexibility demand to the platform through auctions, and providing grid availability information to flexibility providers and aggregators via TLS.

On the other hand, SOCL-GR-01 highlights activities such as obtaining weather data forecasts, modelling the perspective grid, determining flexibility needs, communicating with the MO to consider bids, selecting FSPs, and coordinating with the TSO. While both BMs share the common goals of understanding flexibility needs and coordinating with stakeholders, they differ in specific activities related to reactive power exchange, voltage problems, and grid availability information in EACL-CZ-02, and weather data, modelling, and bid consideration in SOCL-GR-01.

Lastly, analogously to EACL-CZ-02, the main activities of the DSO in SOCL-CY-02 concern the procurement of flexibility from aggregators and DERs. However, in this case, flexibility is procured to manage congestion in the distribution grid.

### 7.3.4.3 Value proposition

#### EACL-CZ-02

- Procurement of market-based non-frequency services that allow control over the reactive power overflows from DSO to TSO by utilizing the reactive power provided through units at the MV/HV network.
- Ability to provide information to flexibility providers and aggregators about network availability through the TFS and therefore also indicate their ability to provide flexibility services (to the DSO, TSO as well as other parties).

#### SOCL-GR-01

- The weather data forecasts made with the precision and the resolution higher than the ones offered by the available tools for this task, which will aid the TSO and DSO with:
  - Detecting and mitigating the congestions in the system;
  - Identifying and solving the potential problems related to voltages out of bounds;
  - Improving power regulation through mFRR and RR;
  - Providing the benchmark approach for the future implementation within the existing market.
  - Since this enhances security of supply and grid reliability value of solution is verified.

#### SOCL-CY-02

- Enabling the DSO to manage short-term congestion in the most efficient way (effort / innovative innovation / market / purchase) from minutes to hours ahead in order to reduce investments for upgrading the infrastructure by coordinating the available flexibility services.

#### Comparison

EACL-CZ-02 emphasizes the DSO's ability to procure market-based non-frequency services that allow control over reactive power overflows, utilizing units at the MV/HV network. Additionally, it highlights the value of providing information to flexibility providers and aggregators about network availability, enabling them to offer their flexibility services effectively to the DSO, TSO, and other parties.

On the other hand, SOCL-GR-01 expresses the value proposition of weather data forecasts with enhanced precision and resolution, enabling the TSO and DSO to detect and mitigate system congestions, address voltage-related issues, improve power regulation through mFRR and RR, and provide a benchmark approach for future

market implementations. The emphasis is on enhancing the security of supply and grid reliability. These distinct value propositions highlight the specific benefits that each BM brings to the DSO, addressing different aspects of grid management, flexibility utilization, and system reliability.

SOCL-CY-02 focuses on the value of the procurement of flexibility services, in this case, the management of congestion in the grid. Therefore, the type of value delivered here is similar to that in the BM for EACL-CZ-02, though focusing on a different type of flexibility service (congestion management instead of voltage control).

#### 7.3.4.4 Customer relationships

##### EACL-CZ-02

- Direct personal relationship (acquisition and retention / trust).

##### SOCL-GR-01

- Direct communication is set to improve the relations and develop the trust among the participants in the process;
- Additional calls and the web meetings will make the flow of the process smooth.

##### SOCL-CY-02

- The relationship with the customer is established through license agreements (acquisition and retention / trust).

##### Comparison

In comparing these customer relationships from the perspective of the DSO, we can observe their common objective of improving communication and trust among participants. EACL-CZ-02 emphasizes the importance of direct personal relationships for customer acquisition and retention, highlighting the value of building trust with customers. On the other hand, SOCL-GR-01 outlines the specific measures taken to enhance relations and trust, such as direct communication, additional calls, and web meetings to ensure a smooth flow of the process. Both BMs recognize the significance of establishing strong relationships and fostering trust among participants in the electricity market. While EACL-CZ-02 emphasizes the overall importance of personal relationships, SOCL-GR-01 provides specific strategies to facilitate effective communication and strengthen the customer relationships.

In SOCL-CY-02, contrary to what occurs in EACL-CZ-02 and SOCL-GR-01, the relationship with customers is established through formal means, in this case, according to license agreements. Based on these agreements, communication according to predefined protocols should take place.

#### 7.3.4.5 Key resources

#### **EACL-CZ-02**

- System in the dispatch control centre of the DSO that enables direct control of the relevant flexible resources (physical / related to a platform or a network).
- Systems that allow the DSO to determine flexibility needs.
- Computer servers (physical).

#### **SOCL-GR-01**

- Financial and other support needed for implementation of the developed solution;
- Weather measurements of the high enough quality;
- DSO and TSO voltage level forecasted grid models.

#### **SOCL-CY-02**

- Financial guarantees to be provided to flexible resources (financial) by the DSO.
- Market clearing system (platform).
- Meters (physical) to real-time measure the distribution grid operation (at the substation level) and store the measurements in the SCADA system (platform).
- Computer servers (physical).

#### **Comparison**

In this comparison, we can observe distinct resource requirements. EACL-CZ-02 highlights the key resources needed by the DSO, including a system in the dispatch control centre that enables direct control of flexible resources, systems for determining flexibility needs, and physical infrastructure such as computer servers. These resources are essential for the DSO to effectively manage and control the relevant flexibility within the grid.

On the other hand, SOCL-GR-01 emphasizes the specific resources required for the implementation of the developed solution, including financial and other forms of support, weather measurements of high quality, and forecasted grid models for voltage levels provided by both the DSO and TSO. These resources are crucial for the successful implementation and operation of the developed solution, ensuring accurate forecasts and reliable grid management. While EACL-CZ-02 focuses on the technological resources necessary for flexibility control, SOCL-GR-01 emphasizes the support and data-related resources needed for the implementation process.

Again, in this case, the resources employed in by the DSO for SOCL-CY-02 are similar to those it employs in EACL-CZ-02. In the former, financial guarantees are also included, but these would be also relevant in EACL-CZ-02.

#### **7.3.4.6 Customer**

#### **EACL-CZ-02**

- FSP or Unit/Flexibility provider. Both must have a resource that may solve the DSO's reactive power overflow problem or voltage issues.
- FSP/aggregator receives information about network restrictions to their units.

#### **SOCL-GR-01**

- Demand that gets electrical energy from the distribution system, since it will see the improvement in the security of supply once the solution is fully implemented.
- Generation connected to the distribution grid, as the more reliable operation of the system will also make the evacuation of produced energy into the grid easier.
- FSPs (with or without aggregator) that will have much simpler and more efficient methods of communicating with the SO after all of described steps are done.

#### **SOCL-CY-02**

- Must be the flexible resources (i.e., aggregators, flexibility services providers, DERs, producers) able to provide ancillary services
- Must be all the consumers that are utilizing the grid (grid usage fee) to have access to electricity.
- Must be all the generators producing electricity to inject this electricity to a grid operating in a stable manner.

#### **Comparison**

We can identify different customer groups and their respective benefits. EACL-CZ-02 highlights the involvement of FSPs or Unit/Flexibility providers, who possess resources that can address the DSO's reactive power overflow or voltage issues. This implies that these customers have the opportunity to contribute to the solution and play a role in improving the grid's stability. Additionally, FSPs/aggregators receive important information about network restrictions that affect their units, allowing them to make informed decisions and optimize their operations.

On the other hand, SOCL-GR-01 emphasizes different types of customers that will benefit from the solution. First, there are the demand customers who rely on the distribution system for their electrical energy needs. The solution aims to enhance the security of their energy supply, ensuring a more reliable and stable distribution system. Second, there are generation customers connected to the distribution grid. With an improved system operation, these customers will find it easier to evacuate the energy they produce into the grid, increasing the efficiency of their operations. Lastly, FSPs, whether they operate independently or through aggregators, will benefit from simplified and more efficient methods of communication with the SO, streamlining their interactions and enabling better coordination.

SOCL-CY-02 basically considers the same type of customers of the DSO that are relevant in EACL-CZ-02 and SOCL-GR-01. Even when EACL-CZ-02 does not mention generators and consumers, these can also be considered customers of the DSO in the BM for this BUC.

Overall, while EACL-CZ-02 focuses on customers who can contribute resources to address specific grid issues, SOCL-GR-01 and SOCL-CY-02 highlights a broader customer base that expects to experience enhanced security, reliability, and improved communication with the DSO as a result of the implemented solution. But, as mentioned, the customer set in EACL-CZ-02 could be considered larger to include also these.

### 7.3.4.7 Channel

#### EACL-CZ-02

- Direct personal relationship (acquisition and retention / trust).

#### SOCL-GR-01

- Presentation of the benefits to the DSO customers;
- Personal meetings with the customers to clarify some of the troublesome points;
- Public promotion of the new solution to gain attention;
- F-channel platform.

#### SOCL-CY-02

- Personal meetings (awareness & evaluation).
- Online platforms managed by the MO for participating to the market (purchase & after sales)

#### Comparison

EACL-CZ-02 emphasizes the importance of a direct personal relationship, which includes activities related to customer acquisition, retention, and building trust. This suggests that the DSO values direct interactions with customers, establishing a strong and personalized connection to address their needs and concerns.

On the other hand, SOCL-GR-01 highlights a variety of channels employed by the DSO to engage with customers. Firstly, the presentation of benefits to DSO customers indicates a proactive approach to communicate the advantages and value proposition of the new solution. Secondly, personal meetings are utilized to address specific issues or queries, demonstrating a commitment to addressing customer concerns. Thirdly, public promotion is employed to gain attention around the new solution, potentially reaching a wider audience and attracting interest from various stakeholders. Lastly, the mention of an "F-channel platform" suggests the utilization of digital platforms or online channels for communication and engagement.

The kind of channels considered in SOCL-CY-02 are similar to those in SOCL-GR-01 and comprise those in EACL-CZ-02. Overall, while EACL-CZ-02 focuses on establishing direct personal relationships with customers,



SOCL-GR-01 shows a multi-faceted approach that combines personal interactions, public promotion, and digital channels to effectively communicate with and engage DSO customers. This highlights the DSO's commitment to providing tailored communication and ensuring that customers are informed, engaged, and involved throughout the process.

#### 7.3.4.8 Revenue streams

##### EACL-CZ-02

- Increased revenues by avoiding building new infrastructure and penalties for grid limits violation.

##### SOCL-GR-01

- Based on the conducted analyses, the possible revenue streams have been identified:
  - Better utilization of the flexibility resources allows the optimal selection of the offers, thus avoiding unnecessary costs for the same purposes.
  - The easier resolution of the potential congestions in the grid will enable either the delay or shelving of the construction of the new infrastructure.
  - The increased security of supply will prevent possible fees that would need to be paid to customers left without the power due to sub-optimal operation of the grid.

##### SOCL-CY-02

- Grid usage fee:
  - The DSO is paid according to the grid usage fee (€/kWh) by the consumers that is serving.
- Alternative revenue streams:
  - Through the specific BUC, the DSO can reduce its operational cost (energy losses cost) and to potentially reduce the cost for grid expansion.

However, it should be stated that the DSO could not expect all of these revenues to come directly to it, since the DSO service is a regulated one and the costs are covered primarily by the network users. Hence, the network users would see the benefits from listed revenue streams. Nonetheless, DSO could expect at least a part of these revenues to come to it from the potential efficiency incentive schemes in which this solution could be included.

#### Comparison

EACL-CZ-02 stresses the benefits of avoiding the construction of new infrastructure and penalties for exceeding grid limits, which can lead to cost savings and increased revenue for the DSO. It emphasizes the financial advantages that come from optimizing the existing grid infrastructure and effectively managing grid constraints.

SOCL-GR-01 also talks about the investment in the infrastructure in terms of delaying or even eliminating it by solving potential grid congestion, which can result in further cost savings, but this BM provides a more comprehensive analysis of potential revenue streams. These include better utilization of flexibility resources, which can lead to cost optimization and avoidance of unnecessary expenses. Additionally, the increased security of supply also plays a role in revenue generation by preventing fees that would need to be paid to customers affected by grid operation issues. However, it acknowledges that not all of these revenues would directly come to the DSO, as the DSO service is regulated and costs are primarily covered by network users. The benefits from the identified revenue streams would primarily be realized by network users. Nevertheless, the DSO could expect to receive a portion of these revenues through potential efficiency incentive schemes in which the proposed solution could be included.

The revenues for the DSO in SOCL-CY-02 can be deemed similar to those discussed for EACL-CZ-02 and SOCL-GR-01. In all cases, the DSO, earning the tariffs applied in the system, could increase its profit margin by being allowed to appropriate part of the system benefits resulting from an increase in the economic efficiency and the quality of service.

#### 7.3.4.9 Cost structure

##### EACL-CZ-02

- Computer servers and other IT services.
- Human resources to carry on the daily operations.
- Other.

##### SOCL-GR-01

- From the experience on some of the other solutions of the comparable scale, the following estimations regarding the costs needed for implementing the solution were made:
  - 25% - computer and other IT services;
  - 25% - needed hardware (servers and equipment);
  - 40% - necessary human resources;
  - 10% - other costs.

##### SOCL-CY-02

- Computer servers and other IT services (15%).
- Human resources to carry on the daily operations for managing the distribution grid (5%).
- Software development and maintenance for automatically manage the distribution grid (10%).
- Payment to the flexible resources to provide the ancillary services for congestion management and power quality improvement (70%)

## Comparison

Both EACL-CZ-02 and SOCL-GR-01 address the cost structure related to the provision of system services but provide slightly different perspectives, being the second BM more specific on measuring the percentage of each defined cost structure.

As stated previously EACL-CZ-02 provides a general overview of the DSO cost structure, mentioning computer servers and other IT services, human resources for daily operations, and other unspecified costs. On the other hand, SOCL-GR-01 offers a more detailed breakdown, allocating 25% of the costs to computer and IT services, 25% to the needed hardware like servers or other necessary equipment, 40% to human resources, and 10% to other costs that may occur, giving insights into the proportional distribution of costs for the BM.

In both, the cost structure includes the involvement of human resources necessary for carrying out the provision of daily operations. This indicates that they recognize the need for personnel and associated costs to ensure the smooth functioning of the system services. Furthermore, both mention computer servers and other IT services as one cost component, highlighting the expenses related to the technological infrastructure required for the BM operation.

The costs in the case of SOCL-CY-02 should be the same as those in the two other cases. BM drafters have included, in this case, payments to the FSPs, but these are expenses to be recovered from their regulated revenues. These should probably not be included.

### 7.3.5 Comparison of BMs focused on the Aggregator

The comparison of the BMs for the BUCs EACL-CZ-01, and SOCL-CY-01, focused on the 'Nodal area congestion management', and the 'Active power flexibility', respectively, is separately carried out for each of the main building blocks considered in the description of these BMs. For each building block, first we describe the features of each BM in this regard and then we compare them. The objective is determining how the role played by this stakeholder may be affected by the context where it operates.

#### 7.3.5.1 Key partnerships

##### EACL-CZ-01

- Provision of flexibility demand by the DSO, through the platform.
- Demand/supply matching and market parties informed by the platform.
- Grid availability assessment by the DSO, through TLS.
- Provision of flexible resources by the Unit/Flexibility provider to be added to the AGG's portfolio.

##### SOCL-CY-01

- TSO market (acquisition of particular resources and activities).

- Pre-qualification of the grid product by the DSO.
- Provision of frequency support by the FSPs.

### Comparison

In terms of key partnerships, the descriptions in EACL-CZ-01 and SOCL-CY-01 have different aspects. EACL-CZ-01 focuses on partnerships involving the DSO in providing flexibility demand and grid availability assessment. The platform is used to inform market parties about demand/supply matching, and finally, the Unit/Flexibility provider adds their flexible resources to the aggregator's portfolio.

In contrast, SOCL-CY-01 focuses on partnerships involving the TSO market for the acquisition of particular resources and activities, grid product pre-qualification by the DSO in order to reduce risk and uncertainty, and FSPs as frequency support providers.

Overall, while EACL-CZ-01 primarily focuses on partnerships involving the DSO, platform, and flexibility providers, SOCL-CY-01 highlights partnerships involving the TSO market, DSO, and FSPs. The nature and emphasis of these partnerships differ in the specific roles and goals on flexibility provision.

### 7.3.5.2 Key activities

#### EACL-CZ-01

- Monitor the offers in the TSO market.
- Provide bids in the TSO market.
- Send the requested offers to the FSPs under the aggregator's jurisdiction.

#### SOCL-CY-01

- Informs the platform about available flexibility capacity and grid availability (primary activity).
- Posts flexibility offers on the market platform.
- Bids into DSO flexibility auctions on the platform.
- Receives information about grid availability for his flexibility providers portfolio through the TLS.
- Receives notifications for auctions.
- Registers flexibility providers into his portfolio.
- Submits information about services contracted to the TSO.

### Comparison

In EACL-CZ-01, the key activities revolve around the aggregator's participation in the TSO market. The aggregator monitors the offers in the TSO market, provides bids on behalf of flexibility providers, and ensures the requested offers are sent to the providers under its jurisdiction. This involvement enables the aggregator to actively engage in the market and secure the necessary flexibility services.

In contrast, SOCL-CY-01 focuses on the activities of using the platform to facilitate flexibility service exchange. The aggregator will inform the platform about the available flexibility capacity and grid availability, post offers on the market platform and bid in DSO flexibility auctions. In addition, the aggregator receives information on grid availability and notifications for auctions, registers flexibility providers into its portfolio, and submits information about services contracted to TSO.

In summary, the activities in EACL-CZ-01 highlight the aggregator's role in the TSO market, while SOCL-CY-01 emphasizes the platform's role in managing the market for SO services. In the first one, the aggregator's activities involve direct engagement with the TSO market, while the second one highlights the aggregator's engagement with the platform, involving information sharing, posting offers, bidding, receiving grid availability information, registering providers, and submitting service-related data. Both approaches contribute to efficient coordination and utilization of flexibility services, although through different mechanisms.

### 7.3.5.3 Value proposition

#### EACL-CZ-01

- Provision of market-based non-frequency flexibility services that allow the DSO to manage congestion in the long-term by utilizing active power provided through units at the LV network.
- TFS as a single source of information for the aggregator about grid availability of flexibility providers in their portfolio (across all DSO networks).

#### SOCL-CY-01

- Provision of competitive frequency support products (both for availability and activation) that allow the TSO to stabilize the frequency after a frequency event in the primary control framework.

#### Comparison

The Czech Business Model EACL-CZ-01 offers value on non-frequency flexibility services for managing congestion in the long-term at the distribution system level. Additionally, it presents the TFS as a centralized data source that provides the aggregator with information about grid availability insights across multiple DSO networks. In contrast, the Cypriot SOCL-CY-01 focuses on the provision of competitive frequency support products to the TSO. These products encompass both availability and activation, enabling the TSO to stabilize frequency post a frequency event within the primary control framework.

### 7.3.5.4 Customer relationships

#### EACL-CZ-01

- Direct personal relationship (acquisition and retention / trust).

#### **SOCL-CY-01**

- License agreement between the aggregator and the MO to participate in the market (acquisition and retention / trust).

#### **Comparison**

EACL-CZ-01 stresses the significance of establishing a direct personal relationship between the Aggregator and its customers. This involves actively engaging with customers, building trust, and creating long-term relationships. By directly interacting with customers, the Aggregator can better understand their specific needs, preferences, and challenges. This gives trust and reliability, which is vital for customer acquisition and retention.

In contrast, SOCL-CY-01 shifts the focus to the importance of a license agreement between the Aggregator and the MO. This agreement serves as a formal authorization for the Aggregator to participate in the market, demonstrating its compliance with regulatory requirements and guidelines. While customer relations are essential for acquisition and retention, the license agreement is expected to enhance trust and confidence among customers.

### **7.3.5.5 Key resources**

#### **EACL-CZ-01**

- System that allows direct control of the flexibility resources by the AGG (physical / related to a platform or a network).
- Computer servers for market platform (physical).

#### **SOCL-CY-01**

- Financial guarantees to be provided to the aggregator by the TSO (financial), as well as to the FSPs by the aggregator.
- Market clearing system (platform).
- Meters that can measure whether the flexibility has been provided (physical).
- Computer servers (physical).

#### **Comparison**

EACL-CZ-01 highlights the key resources related to the Aggregator's system and infrastructure. It mentions a system that enables the Aggregator to have direct control over the flexibility resources. This system, whether it is related to a platform or a network, provides the necessary framework for the Aggregator to monitor and manage the flexibility resources efficiently. Additionally, computer servers are mentioned, which likely serve for

the market platform operated. These physical resources are essential for the Aggregator's operations, to offer flexibility services to market participants.

In contrast, SOCL-CY-01 mentions a range of resources that are relevant to the financial and operational aspects of the Aggregator's activities. The financial guarantees are provided to the Aggregator by the TSO, and are also provided to the FSPs by the Aggregator. The market clearing system, likely a platform, is another important resource mentioned and additionally, meters are referenced as physical resources that measure and verify the provision of flexibility. Computer servers, similar to EACL-CZ-01, play a role in supporting the operational infrastructure required for the Aggregator's activities.

### 7.3.5.6 Customer

#### EACL-CZ-01

- DSO (through platform), TSO (via a request to the DSO), Unit/Flexibility provider.
- DSO must have a congestion to manage.
- TSO/aggregators receive information about network restrictions to the ability of distribution network connected FSPs to provide services to the TSO.
- Unit/Flexibility provider must have a resource that may help solve the DSO's congestion problem.

#### SOCL-CY-01

- Must be a TSO who must have a frequency instability to solve (frequency event where the frequency is increased or decreased more than the predefined limits).

#### Comparison

EACL-CZ-01 involve various customers, specifically the DSO, TSO, and Unit/Flexibility provider as key entities with whom the Aggregator interacts. The DSO, through a platform, must have a congestion to manage within the distribution network. The Aggregator receives information from the DSO regarding network restrictions that may impact the ability of distribution network-connected FSPs to offer services to the TSO. The Unit/Flexibility provider plays a crucial role as a customer of the Aggregator, as they possess resources that can help alleviate congestion issues faced by the DSO.

In contrast, SOCL-CY-01 focuses on a different customer scenario for the Aggregator. In this case, the Aggregator must respond to a frequency instability issue faced by the TSO. The Aggregator's role here is to provide solutions or resources that can help stabilize the frequency and address the instability issue faced by the TSO.

To summarize, EACL-CZ-01 highlights the Aggregator's interaction with various customers, such as the DSO, TSO, and Unit/Flexibility provider, to address congestion issues within the distribution network. On the other

hand, SOCL-CY-01 focuses on the Aggregator's role in responding to frequency instability challenges faced by the TSO.

### 7.3.5.7 Channel

#### EACL-CZ-01

- Direct personal relationship (acquisition and retention / trust).

#### SOCL-CY-01

- Personal meetings (awareness & evaluation).
- Online platforms for application in participation to the market (purchase & after sales)

#### Comparison

EACL -CZ-01 emphasizes the direct personal relationship channel. In this case, the interactions are taken place through a platform seeking for the establishment of trust through personalized communication. This channel involves direct interaction and engagement with customers, allowing for personalized communication and building trust.

On the other hand, SOCL-CY-01 highlights the utilization of personal meetings for awareness and evaluation, as well as online platforms for market participation, purchase, and after-sales processes. These meetings allow the Aggregators to introduce themselves, display their offerings, and discuss the benefits of their services in person. The platforms enable customers to access information, submit applications, and engage in the purchasing and after-sales processes conveniently and efficiently.

Both BMs channels contribute to customer acquisition, retention, and effective communication, with EACL-CZ-01 focusing on personalized interactions and SOCL-CY-01 addressing a combination of personal meetings and online platforms to engage with customers.

### 7.3.5.8 Revenue streams

#### EACL-CZ-01

- Revenue streams are not tested in the demo, however, should the platform be implemented in real-life, it would enable aggregators to sell non-frequency services to DSOs and thus earn brokerage fees.

#### SOCL-CY-01

- Market clearing remuneration: Aggregator remuneration through the market for the provision of flexibility services

#### Comparison



EACL-CZ-01 explains that revenue streams have not been tested in the demo, but in a real-life implementation of the platform, aggregators would have the opportunity to sell non-frequency services to DSOs and earn brokerage fees. This suggests that the Aggregator's revenue stream would be based on facilitating transactions between FSPs and DSOs, earning fees as intermediaries. The implementation of the platform would provide aggregators with a marketplace to monetize their services and generate revenue from the sale of non-frequency services.

On the other hand, SOCL-CY-01 presents one option, which focuses on the Aggregator's remuneration through the market for the provision of flexibility services. This implies that the Aggregator would receive direct compensation for offering flexibility services, possibly through a market clearing mechanism where the Aggregator's participation and service provision are rewarded with a share of the market clearing cost. Both approaches offer potential revenue streams for the Aggregator, with EACL-CZ-01 emphasizing brokerage fees for facilitating transactions, while SOCL-CY-01 highlights remuneration through the market for direct provision of flexibility services.

### 7.3.5.9 Cost structure

#### EACL-CZ-01

- Computer servers and other IT services.
- Human resources to carry on the daily operations.
- Other.

#### SOCL-CY-01

- Computer servers and other IT services (10%).
- Human resources to carry on the daily operations of the aggregator platform, communication with the TSO and MO, as well as communication with the FSPs (10%).
- Subscription fee paid to the MO for the participation to the market (10%)
- Payment to the FSPs for their provisioned services (70%).

#### Comparison

Both EACL-CZ-01 and SOCL-CY-01 address the cost structure related to the provision of system services but provide slightly different perspectives, being the second BM more specific on measuring the percentage of each defined cost structure.

As stated previously EACL-CZ-01 provides a general overview of the Aggregator's cost structure, mentioning computer servers and other IT services, human resources for daily operations, and other unspecified costs. On the other hand, SOCL-CY-01 offers a more detailed breakdown, allocating 10% of the costs to computer servers and IT services, 10% to human resources for platform operations and communication with stakeholders, 10% as

a subscription fee to the MO, and 70% as payment to FSPs. This breakdown provides a clearer understanding of the cost components, including technology infrastructure, personnel expenses, market participation fees, and payments to service providers, giving insights into the proportional distribution of costs for the BM.

In both, the cost structure includes the involvement of human resources necessary for carrying out the provision of daily operations. This indicates that they recognize the need for personnel and associated costs to ensure the smooth functioning of the system services. Furthermore, both mention computer servers and other IT services as one cost component, highlighting the expenses related to the technological infrastructure required for the BM operation.

### 7.3.6 Comparison of BMs focused on the FPO

The comparison of the BMs for the BUCs EACL-PL-03, and NOCL-01, focused on the ‘Event-driven Active Power Management for Congestion Management and voltage control by the DSO’, and the ‘Northern flexibility market’ and the coordination of the SOs within it, respectively, is separately carried out for each of the main building blocks considered in the description of these BMs. For each building block, first we describe the features of each BM in this regard and then we compare them. The objective is determining how the role played by this stakeholder may be affected by the context where it operates.

#### 7.3.6.1 Key partnerships

##### EACL-PL-03

- Auction calling for flexibility services by the SO.
- Bidding from FSPs who wish to participate in the auction and have passed the prequalification process.
- Sending of updated MOLs that give the expected technical result by the SO.
- Sending of information with a request to start the resource activation procedure by the SO.
- Sending of confirmation about receiving the activation signal and information about the activation and termination processes by the FSPs.
- Sending of baselines needed for the billing of services by the FSPs.
- Collection and provision of requested meter data for each of the indicated FSPs by the SO.
- Sending of confirmation regarding the receipt of the invoice by the SO.

##### NOCL-01

- Research companies and universities (e.g. development of optimization and baseline methodologies).
- IT development companies (e.g. code the different activities)
- Neighbouring FPOs in the region
- Policy makers
- Regulators

## Comparison

EACL-PL-03 revolves around the operational interactions between the FPO and key market participants. It encompasses the mechanics of flexibility auctions, including auction initiation, bidding processes, technical updates, activation requests, and confirmation exchanges. This BM emphasizes the hands-on coordination required to ensure smooth operation of the market for SO services and the billing processes.

On the other hand, NOCL-01 entails collaboration with diverse entities including research institutions, IT development firms, neighbouring FPOs, policy makers, and regulators. These stakeholders play pivotal roles in shaping the FPO's broader operational environment.

In summary, EACL-PL-03 delves into operational aspects and real-time interactions within the market for SO services, while NOCL-01 highlights strategic engagements and collaborations that shape the FPO's overall functioning and environment.

### 7.3.6.2 Key activities

#### EACL-PL-03

- Sends notifications about new auctions for the active power management service, based on the request from the SO.
- Closes the auctions at the appointed time and collects all the bids.
- Creates MOL based on the collected offers and sends it to the SO for verification.
- Updates the stack of offers, based on SO recommendations and analyses the MOL taking into account the economic and technical conditions.
- Selects the optimal offer that meets technical and economic expectations.
- Terminates the auction if divergent prices are expected by SOs and submitted by FSPs, otherwise informs the FSPs who participated in the auction about the results.
- Informs the SO about the auction result and possibly about the optimal offer.
- Informs the SO about the planned use of the selected offer on a strictly defined date.
- Enters the selected offer for a given day in the activation plan to include it in the day-ahead planning (in case of MT auctions).
- Sends a signal with information about the need to activate the FSP's resource under the contracted service.
- Collects information about all contracted services in a given period and requests baselines needed for the billing of services from the FSPs.
- Requests (from the DSO) meter data from meters on the indicated clients' resources for a specified period when the service was provided.

- Verifies the correctness of the delivery of each of the contracted offers based on the received metered data and baseline data and creates a list of offers that have not been properly delivered, identifying deviations from the corresponding contracted offers.
- Calculates the payment for each offer (including any fines charged for failure to perform the service) and informs FSPs who have not kept their contracts.
- Prepares relevant documents and invoices and sends them to the DSO.
- Sends a confirmation to the FSPs that the invoice has been issued and received by the DSO.

#### **NOCL-01**

- Manage flexibility contracts.
- Register FSPs and their resources (including resource groups).
- Conduct product and grid prequalification (of FSPs' resources and resources groups).
- Facilitate required information exchange with SOs, MOs, and FSPs (e.g. resource data for procurement, metering point ID and measurement for verification, concluded trade for settlement).
- Calculate the baseline and quantify the delivered flexibility.
- Manage grid topology of multiple SOs.
- Manage Flexibility Needs, Flexibility Call for Tenders, and Purchase Offers.
- Optimize bids considering the flexibility needs, grid impact assessment, and resources' technological constraints.
- Communicate verification results.

#### **Comparison**

In terms of key activities, both BM involve critical processes that the FPO manages. In EACL-PL-03, the FPO's activities revolve around the organization and execution of flexibility auctions. This includes initiating auctions upon SO request, collecting bids, creating Market Offering Lists (MOLs), analysing offers, selecting optimal bids, coordinating resource activation, and managing the billing process. The FPO's role extends from the auction setup to the detailed management of bid results, meter data verification, and financial settlements.

In contrast, NOCL-01 highlights the broader scope of the FPO's activities. Beyond managing auctions, the FPO's responsibilities encompass various aspects of flexibility service provision. These include registering FSPs and their resources, conducting prequalification processes, facilitating data exchange with relevant stakeholders, calculating baselines, managing grid topology, optimizing bids based on grid and resource constraints, and communicating verification outcomes. While both BMs emphasize the FPO's critical role in coordinating flexibility services, NOCL-01 provides a more comprehensive overview of the FPO's involvement in managing contracts, resources, and data exchanges to ensure effective and efficient operation of the market for SO services.

### 7.3.6.3 Value proposition

#### EACL-PL-03

- Provision of market-based event-driven flexibility services based on active power, that allow congestion management and voltage control in the transmission and/or distribution network.

#### NOCL-01

- Provision of a technology-agnostic and product-agnostic integrated platform enabling a single market for SO services for MOs (trading places), SOs (buyers) and FSPs (sellers). This should result in the increase in the number of offers, the level of competition, and the efficiency of the resulting market clearing and cost of provision of the service.

#### Comparison

In EACL-PL-03, the FPO's value proposition centres on the provision of specific flexibility services focused on congestion management and voltage control in the transmission and distribution network. These services are event-driven and are aimed at addressing critical grid stability issues. By offering targeted active power flexibility services, the FPO directly contributes to the smooth operation of the network, ensuring optimized power flow and voltage levels.

NOCL-01, on the other hand, highlights an integrated platform that aims to establish a single market for SO services connecting MOs, SOs, and FSPs. The value lies in fostering an ecosystem where multiple stakeholders can engage in efficient trading, increasing the availability of offers, competition, and ultimately streamlining the market clearing process.

### 7.3.6.4 Customer relationships

#### EACL-PL-03

- Direct personal relationship (acquisition and retention / trust).

#### NOCL-01

- Direct personal relationship (acquisition and retention / trust).
- Joint development of FP (FPO, customers, and partners), so that the platform reflects customers' needs.

#### Comparison

In EACL-PL-03, the emphasis is placed on the establishment of a direct personal relationship between the FPO and its customers, with a primary focus on acquisition, retention, and building trust over time.

NOCL-01 expands on this by not only highlighting the importance of direct personal relationships for acquisition, retention, and trust but also stress the collaborative aspect of customer relationships. The FPO, along with its customers and partners, engages in joint development efforts to create a FP that aligns closely with the specific needs and requirements of customers. This collaborative approach aims to ensure that the platform's features, functionalities, and services effectively serve customers, promoting an even stronger bond between the FPO and its user base through active participation in shaping the platform's evolution.

### 7.3.6.5 Key resources

#### EACL-PL-03

- Financial guarantees, both for the SO and the FSP/FSPA (financial).
- Market matching system (platform).
- Computer servers (physical).

#### NOCL-01

- MCOM and its API connection (software)
- Computer servers (physical)
- Database (software)
- API connections to customers for data exchange (software)
- OneNet middleware (software)
- Grid models to consider in clearing

#### Comparison

In EACL-PL-03, the key resources for the FPO revolve around ensuring financial guarantees for both the SO and the FSP/FSPA. Additionally, the presence of a market matching system within the platform is expected to enable efficient connections between market participants. The physical aspect of computer servers is also emphasized, indicating their role in supporting the technological infrastructure of the FPO.

NOCL-01 shows more specific software-related resources. The MCOM and its API connection stand out as a software tools that enable the FPO to optimize market clearing processes. Computer servers, once again, are a fundamental physical component, supporting the computational demands of the platform. The importance of a database for managing data is highlighted, alongside API connections to facilitate data exchange with customers. The OneNet middleware is added as a resource, while grid models are considered for market clearing activities.

### 7.3.6.6 Customer

#### **EACL-PL-03**

- FSP (Unit/Flexibility provider is included in the FSP description in the BUC), SO.
- SO must have congestion/voltage violation problems.
- FSP must have resources that may solve SO's congestion and/or voltage violation problems.

#### **NOCL-01**

- MO responsible for the trading in the markets for SO services.
- DSO with congestion needs to be managed.
- TSO with congestion and/or balance needs to be managed.
- FSP with flexibility resources in the TSO/DSO area of management.

#### **Comparison**

We can identify different customer groups and their respective benefits. EACL-PL-03 revolves around the interaction between the FSPs and the SO. The FSPs, including Unit/Flexibility providers, engage in this dynamic. The SO, facing congestion or voltage violation issues, seeks solutions through flexibility services. FSPs are required to possess resources capable of addressing these congestion and voltage concerns effectively. This highlights the interaction between FSPs and the SO, where the FSPs' capabilities align with the SO's needs for grid management.

NOCL-01 shifts the focus to the MO and its interactions within the markets for SO services. In addition to the MO, both the DSO and TSO play critical roles. The DSO, dealing with congestion issues, engages with flexibility resources to manage them effectively. Similarly, the TSO requires flexibility resources for addressing congestion and maintaining balance. The FSPs, providing flexibility resources within the TSO and DSO area of management.

### **7.3.6.7 Channel**

#### **EACL-PL-03**

- Communication through the FP.

#### **NOCL-01**

- Personal meetings (awareness & evaluation).
- APIs to connect the FP to: FSPs, SOs, MOs and partners
- User interfaces, public dashboards

#### **Comparison**

In EACL-PL-03, communication is channelled primarily through the FP, implying that interactions among stakeholders occur within the platform's digital framework. This approach underscores a centralized and

digitalized means of interaction. On the contrary, NOCL-01 envisions a combination of communication approaches. It involves personal meetings for awareness and evaluation, supplemented by the integration of APIs to establish direct connections between the FP and various entities. Moreover, user interfaces and public dashboards are highlighted, indicating an emphasis on visual tools that can potentially enhance transparency and engagement.

### 7.3.6.8 Revenue streams

#### EACL-PL-03

- Option 1 (fixed payment):
  - Regulated tariff where both the SO and the FSP pay a fixed amount, whether they use this service or not (subscription fee / fixed pricing).
- Option 2 (fixed + variable payments):
  - Payment of a brokerage fee both by the SO and the FSP each time the service is requested (brokerage fees / fixed pricing).
  - Payment of a subscription fee both by the SO and the FSP to be able to access the market (subscription fee / fixed pricing).
- Option 3 (paid through electricity tariffs):
  - IMO costs are recovered through regulated tariffs paid by all electricity consumers (tax / fixed pricing).

#### NOCL-01

- Option 1 (fixed payment by MO):
  - MO is the primary customer contracting the platform and pays a fixed amount to use it (subscription monthly fee / fixed pricing)
- Option 2 (fixed + variable payments by multiple actors)
  - MO pays a fixed fee to maintain the markets for SO services' operation
  - SOs and FSPs pay a brokerage fee each time they open or participate in a call for tenders.
- Option 3 (paid through electricity tariffs):
  - FPO costs are recovered through regulated tariffs paid by all electricity consumers (tax / fixed pricing).
- Option 4 (polluter-pays-principle):
  - Actors (e.g. SO, BRP, generators, suppliers) responsible for the balancing and/or congestion need pays for the platform

#### Comparison



In EACL-PL-03, the revenue streams focus on different payment options within the setup of the market for SO services. Option 1 proposes a fixed payment approach involving regulated tariffs that both SOs and FSPs pay, regardless of service usage. Option 2 introduces a mixed fixed and variable payment scheme where both SOs and FSPs pay a brokerage fee each time the service is requested, alongside a subscription fee for accessing the market. Additionally, Option 3 suggests cost recovery through regulated tariffs from all electricity consumers.

NOCL-01 revenue streams also offer a variety of models. Option 1 entails the MO as the key customer, paying a fixed monthly subscription fee to utilize the platform. Option 2 involves a combination of fixed and variable payments, where the MO sustains the market's operation with a fixed fee, and SOs and FSPs pay brokerage fees when participating in calls for tenders. Option 3 mirrors the approach in EACL-PL-03, recovering costs through regulated tariffs paid by all electricity consumers. Lastly, Option 4 aligns with the polluter-pays-principle, indicating that actors responsible for balancing and/or congestion needs bear the platform's cost.

### 7.3.6.9 Cost structure

#### EACL-PL-03

- Computer servers and other IT services.
- Human resources to carry out the daily operations.
- Other.

#### NOCL-01

- From MCOM
  - IT infrastructure (computer servers, software licenses, and other IT services)
  - Human resources to design, implement, operate, and maintain the optimization module
- From FR
  - Cost of software maintenance
  - Potential customization development tasks
  - Usage fee of priced components
- From T&D CP
  - Cost of software maintenance
  - Potential customization development tasks
  - Usage fee of priced components

#### Comparison

In EACL-PL-03, the cost elements include computer servers, general IT services, human resources for daily operations, and unspecified "other" costs.

In contrast, NOCL-01 outlines distinct sources of costs. From the MCOM, the FPO incurs expenses for IT infrastructure, encompassing computer servers and software licenses, along with human resources for module design, implementation, operation, and maintenance. The FR results in costs related to software maintenance, potential tasks related to customization developments, and usage fees for priced components. Moreover, the Transmission and Distribution Coordination Platform (T&D CP) have costs of software maintenance, potential customization development tasks, and the usage fee of priced components.

## 8 Quantitative analysis of the implementation of flexibility services

Here we provide the main quantitative estimates of the benefits and costs involved in the implementation of different solutions for system services including those concerning the implementation of local markets for SO services. As explained above in section 2.4, the information collected is incomplete and based on that published in previous works.

### 8.1 Background and assumptions

As discussed in section 2.4, the studies that the most relevant publications report on differ significantly in their features. Both in the aim and the depth of the studies as well as in the quantification methodology applied. Therefore, to be able to draw conclusions based on the quantitative information presented, it is important to understand the context of the respective studies. This section discusses the context of the analyses used to produce the quantitative information found in each of the sources, which is presented in the next section. The assumptions made are categorised as follows.

- Flexibility-related assumptions
- Generation mix capacity
- Demand scenarios
- Comparison of scenarios considered

#### 8.1.1 Flexibility assumptions

In the following, the background and assumptions regarding flexibility provision made in the analyses discussed in each document are discussed.

##### 8.1.1.1 Base case: SmartEn

This study [2] is focused on analysing the impact of demand side flexibility (DSF) on the provisions of different associated services (balancing services, congestion management, and wholesome markets). Additionally, it breaks down the savings in these services into different cost components affected by the provision of each service. The type of flexibility whose impact is assessed in this study is that mobilized by demand, i.e. DSF. The study compares two scenarios to analyse the impact of DSF: one in which DSF is used, and other in which DSF is not used. However, the study makes a disclaimer on the unfeasibility of the no DSF scenario, since DSF is already in use to some extent in EU member states, and removing it from the system is not realistic. The assumptions for each scenario are provided in Table 8.1.

Table 8.1: SmartEn - DSF and no-DSF scenario implementation

	DSF scenario	No-DSF scenario
<b>Industrial DSR</b>	Industrial DSR capacity is price responsive	There is no industrial DSR capacity, all is modelled as fixed traditional load
<b>BESS – behind the meter</b>	BESS capacity provides flexibility	BESS systems behind the meter do not feed-in or off-take electricity.
<b>Smart charging</b>	EV charging is optimised against prices	EV charges following a fixed hourly profile
<b>V2G</b>	V2G capacity provides flexibility	There is no V2G
<b>Residential electric heating</b>	Residential electric heating is optimised against prices	Electric heating demand follows a fixed hourly profile
<b>Industrial electric heating – CHP</b>	CHPs can increase/decrease generation to provide flexibility	CHPs follow a fixed generation profile
<b>District heating – CHP</b>	CHPs can increase/decrease generation to provide flexibility	CHPs follow a fixed generation profile
<b>BESS – front of the meter</b>	BESS capacity provides flexibility	BESS capacity provides flexibility
<b>Electrolysers</b>	Electrolysers are price responsive, i.e. flexible	Electrolysers are price responsive, i.e. flexible

Table extracted from [2]

The assessment of the correlation between DSF power and investment savings is not calculated using grid model simulations. Instead, it is extracted from two different studies that provide the necessary data required to calculate it. The model is an energy only one, as it considers marginal costs to calculate the different savings, in line with the way the market works currently. Capital expenditure in generation assets, batteries, electrolysers, and DSF is overlooked, except when quantifying the security of supply benefits. Additionally, the study takes into account the fact that, in principle, the investments in DSF are significantly lower than those in the rest of technologies. However, there is some uncertainty on the level of DSF costs, which is due to the fact that it is not possible to know how the DSF technologies will develop on their own, or if they will need some regulatory incentives to develop, as it appears to be the case with batteries, electrolysers, and RES.

Savings in TSO redispatch and DSO grid reinforcement costs are not considered, and neither are the efficiency savings obtained from the activation of DSF. Benefits stemming from the provision of each service are discussed separately. The total DSF benefits are lower than the sum of the benefits per segment, due to the close interaction of these segments. Lastly, it is worth considering that the model assumes lower natural gas prices than

the levels registered in 2022, and that the model works under the assumption that regulatory barriers hindering the deployment of DSF are entirely removed.

### 8.1.1.2 Comparison case: METIS 2 S1

This study delves into the use of different sources of flexibility, at the transmission and distribution levels, to analyse the main benefits in terms of reduction in congestion management costs, through energy not served and RES curtailment reductions.

The study considers METIS-EUCO3232.5 [3] as the baseline scenario for which it provides the installed capacity, the baseline demand, and the available flexibility based on the different technologies that are expected to be present by the year 2030. The study covers 34 zones corresponding to the EU27+UK (scope of PRIMES scenario) and is complemented with data for 6 additional countries (referred to as EU27+UK+6), which enables a better representation of power exchanges within Europe.

The identification of the flexibility solutions analysed includes the analysis of the various technologies that are included in the EUCO3232.5 scenario, followed by an assessment of their capability to offer flexibility on different timescales and their characteristics, based on the following assumptions:

- Thermal power plants (CCGT/OCGT/Nuclear/Coal/Biomass/Waste) can provide both upwards and downwards flexibility, by means of ramping down/up production.
- Renewable energy sources (onshore and offshore wind, hydro run-of-the-river (RoR), Tidal) can only provide upwards flexibility by means of curtailing production.
- BESS, PHS and EVs can provide flexibility by means of modifying the charging/discharging times, sometimes imposing the constraint that charging not taking place at a certain time must take place at another point in time later.
- Heat Pumps and DHW can provide flexibility by shifting their load.

Certain technologies can provide flexibility at the transmission level, the distribution level, or at both. In this regard:

- Wind onshore, solar, waste, biomass, and BESS can provide flexibility at both transmission and distribution levels.
- The rest of thermal power plants, wind offshore, and reservoir hydro/PHS can only provide flexibility at transmission level.
- Heat pumps and EVs can only provide flexibility at the distribution level.

The redispatch of interconnections/HVDC/Phase shifting transformers is also contemplated in the study as a source of flexibility at the transmission level.

Lastly, one key difference between SmartEn [2] and this study is that in METIS 2 S1 [3], the hydrogen fleet (electricity generation hydrogen turbines), electrolysis and methanation (production of electrolytic hydrogen and potential subsequent methanation) are not considered, as they are either absent or insignificant in the considered scenario.

### **Methodology for congestion management at distribution level**

The distribution networks within the EU27+UK+6 countries are represented through 288 archetypes, capturing the topology and technical attributes of European distribution networks. These archetypes are tailored to specific countries, climatic zones, and types of loads (rural, urban, semiurban). The study facilitates drawing conclusions about the operation of the European grid within the framework of the EUCO3232.5 scenario, particularly focusing on congestion issues and examining how certain types of flexibilities can effectively address them at the distribution level.

The distribution model encompasses the following generic assets:

- Demand: just one demand assets profile, split in two subcategories:
  - Flexible Demand: This category includes Heat-pumps and Sanitary Hot Water assets. The demand from these sources can be adjusted through load-shifting actions.
  - Non-flexible Demand: This category comprises market assets such as Air Conditioning, Thermosensitive Remainder, Non-thermosensitive Remainder, and Hybrid and Battery immediate-charging Electric Vehicles (EVs). The demand from these assets is considered fixed and cannot be modified by either the market or the distribution model.
- Generation: One unified generation profile that includes Wind Onshore, Solar, Hydro Run-of-River (RoR), Biomass, and Waste market assets. These assets are treated as curtailable.
- Electrical Vehicles: Electrical vehicles that can be charged either in vehicle-to-grid or smart charging mode are considered. Four types are distinguished, based on their technical characteristics and driving patterns: hybrid and pure electric EVs both at home and at work.
- Batteries: distribution-level electrical storage units, which are batteries directly connected at the consumer's location. In the reference situation outlined by the EUCO3232.5 scenario, only a minor storage capacity in Portugal is taken into account. Consequently, this particular asset was excluded from the disaggregation process for all the countries examined.

Table 8.2: Summary of flexibility assets and the flexibility approach for different technologies at distribution level – METIS 2 S1

Market Disaggregated asset	Distribution asset	Flexibility approach
Heat pumps	Flexible demand	Redispatch of the load with mandatory recovery by the end of the day
Sanitary hot water		
Wind onshore fleet	Generation	Generation curtailment
Solar fleet		
Hydro ROR fleet		
Biomass fleet		
waste fleet		
PHEV home charge	EV Hybrid home	Redispatch of charging and discharging with recovery by the end of the day
PHEV work charge	EV Hybrid work	
BEV home charge	EV Battery home	
BEV work charge	EV Battery work	

Table extracted from [3]

Then, three different scenarios depending on the type of flexibility employed are compared to the base scenario where no flexibility is considered. The available solutions for flexibility in distribution consist of:

- Load shifting mechanisms: Redispatch of the flexible load profile with mandatory recovery of the displaced energy during the day. No limitations in terms of maximum/minimum power or energy are considered.
- EV shifting: EVs charging profiles whose redispatch follows the same rules as load shifting.

Table 8.3: Flexibility deployed for each scenario at the distribution level

Flexibility mechanism	Load Shifting flexibility	EV Shifting flexibility	Full flexibility	No flexibility constrained scenario
Load shifting	✓	✗	✓	✗
EV shifting	✗	✓	✓	✗
Load shedding	✓	✓	✓	✓
Generation curtailment	✓	✓	✓	✓

Table extracted from [3]

The resulting scenarios can either be just load shifting, or EV load shifting, or both.

### 8.1.1.3 Comparison case: METIS 1 Mainstreaming RES & Metis 1 S1

Both METIS 1 Mainstreaming RES [1] and METIS 1 S1 [4] consider the same flexibility methodology and assumptions. These studies focus on looking at what the flexibility needs will be in the EU by the year 2030, and on that basis, calculate the optimal flexibility portfolio for different scenarios.

The methodology used to determine the flexibility needs and optimizing the flexibility mix is as follows:

The first step in the methodology involves determining the required level of system flexibility to accommodate the presence of a significant proportion of RES-e. This is necessary to manage fluctuations in both demand and generation. Various factors create the flexibility needs across different timeframes:

- At the hourly and sub-hourly levels, the surge in flexibility needs is primarily driven by the necessity to address imbalances resulting from forecasting errors in RES-e.
- At the daily level, flexibility needs on a daily basis are predominantly influenced by the daily demand pattern and the solar generation cycle.
- At the weekly level, flexibility needs are mainly shaped by wind regimes and the structure of weekday/weekend demand profiles.
- Lastly, at the annual level flexibility needs are primarily determined by a combination of solar, wind, and demand patterns. Solar production peaks during summertime, while wind generation exhibits contrasting behaviour. Another factor impacting annual flexibility needs is the sensitivity of load to temperature, which can vary significantly among Member States based on the mix of heating and cooling technologies.

Subsequently, daily, weekly, and annual flexibility needs are defined by analysing the dynamics of the residual load<sup>9</sup> across various timescales. This approach ensures the consideration of all underlying phenomena driving the demand for flexibility.

Daily, weekly, and annual flexibility needs are calculated using the following procedure:

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<sup>9</sup> Residual load is defined as the load that has to be served by dispatchable technologies (thermal, hydro, storage, demand-response, interconnectors, etc.). It is computed by subtracting the wind, solar and must-run generation from the demand.

Flexibility is defined as the ability of the power system to cope with the variability of the residual load curve at all times. Hence, flexibility needs can be characterised by analysing the residual load curve.



- The residual load is calculated throughout the year by subtracting variable Renewable Energy Sources for electricity (RES-e) generation and must-run generation from the demand, at an hourly/daily/monthly resolution for the daily/weekly/annual levels respectively.
- Then, the daily/weekly/annual average of the residual load is calculated. Afterwards, depending on the level, the procedure varies:
  - For the daily/weekly flexibility needs calculation, the aggregate positive difference between the hourly/daily average load and its daily/weekly average is computed. The result is expressed as a volume of energy per day/week. Then, the sum of the results obtained over the 365 days/52weeks are summed up, and the result is expressed as a volume of energy per year in both cases.
  - For the annual level, the difference between the monthly residual load and its annual average is calculated. The result is presented as an amount of energy per year.

Secondly, after quantifying the flexibility needs, the possible flexibility sources are identified and analysed for each member state, considering that the characteristics of each flexibility solution are different for each member state (investment costs, operating costs, availability...). The flexibility sources identified are the following:

- Flexible generation technologies. Includes traditional thermal units, such as coal, OCGT and CCGT, considering either new power plants or retrofitting existing ones.
- Storage. It includes PHS, battery storage, and compressed air storage.
- DR. It considers industrial peak shaving and load shifting.
- Interconnections. It extracts the interconnection capacity for the year 2030 from ENSTO-E TYNDP 2016.
- System-friendly RES. It mostly considers “system friendly” wind turbines, which are basically new-generation wind turbines, and offshore wind, which has a higher power yield for the majority of the time (For example, VESTAS V110)

When all of the flexibility needs have been quantified and possible sources have been identified, a model is used to optimize the portfolio of flexibility solutions. From this, three different scenarios emerge from the constraints that are chosen:

- Option (I) – In the first option, the model is only allowed to invest in flexible thermal generation (including retrofitting). This option can reflect situations in which the regulatory framework does not allow other technologies such as demand-response, storage or interconnectors to participate in the provision of flexibility.
- Option (II) – In the second option, the model has access to more flexibility options: storage, demand-response and system-friendly RES.

- Option (III) – the same constraints as in Option (II) apply, and additionally interconnectors are considered as a way to increase the flexibility of the European power system. This scenario serves to highlight the role of an increased level of cooperation between Member States.

### METIS 1 Mainstreaming RES & METIS 1 S1

Next, the scenarios METIS 1 Mainstreaming RES [1] & METIS 1 S1 [4] are described.

Table 8.4: Options for flexibility deployment and assumptions considered in the METIS 1 Mainstreaming RES & METIS 1 S1 cases

		Option (I)	Option (II)	Option (III)
Optimised deployment	Available flexibility solutions	Gas-fired generation	Gas-fired generation <b>Demand-response</b> <b>Storage</b>	Gas-fired generation <b>Demand-response</b> <b>Storage</b> <b>Interconnectors</b>
	Available flexibility improvements	Coal retrofits Gas retrofits	Coal retrofits Gas retrofits <b>Advanced onshore wind</b>	Coal retrofits Gas retrofits <b>Advanced onshore wind</b>
Assumptions	Based on METIS EUCO30	Solar, wind, run-of-the-river, large hydro, biomass, waste, nuclear, coal and lignite capacities, fuel and CO <sub>2</sub> prices, annual demand		
	Other assumptions	Interconnectors (current network + currently under construction) Storage technologies (2015 capacities) Demand-response (2015 capacities)	Interconnectors (current network + currently under construction)	

Table extracted from [1]

The expected results for this study are:

- Installed capacities (MW) and associated power generation (MWh) - These indicators show the capacity of the selected flexibility solutions and their annual electricity generation.
- Investment costs – They provide the cost of the optimal flexibility portfolio, expressing it as annuities, and measuring it in M€ (they do not include operational costs)
- Production costs - They correspond to the production and running costs associated with power generation and reserve procurement.
- Social welfare –It indicates the socio-economic welfare achieved. To obtain it, the sum of the producer surplus, consumer surplus and congestion rents is calculated.

- Provision of flexibility - This indicator shows the impact of each technology on the flexibility needs. The provision of flexibility by any given technology is obtained by comparing the flexibility needs based on the residual load to residual flexibility needs. The latter are computed as the residual load less the corresponding technology generation profile.

### 8.1.2 Generation Capacity Mix

In this section, the assumptions made regarding the mix of generation capacity for the various studies are discussed.

#### 8.1.2.1 Generation Capacity mix: METIS 2 S1

Regarding capacity, the EUCO3232.5 scenario encompasses a total installed power production capacity of 1400 GW (Figure 8.1), with Germany, France, Great Britain, Spain, and Italy emerging as the leading countries in terms of installed capacities. The scenario demonstrates a notable level of renewable energy sources (RES) penetration. The primary technologies in place include Solar (304 GW) and Wind onshore (270 GW), collectively constituting 41% of the European energy mix. This is followed by CCGT (Combined Cycle Gas Turbine) at 160 GW, Hydro at 140 GW, and Nuclear at 110 GW.

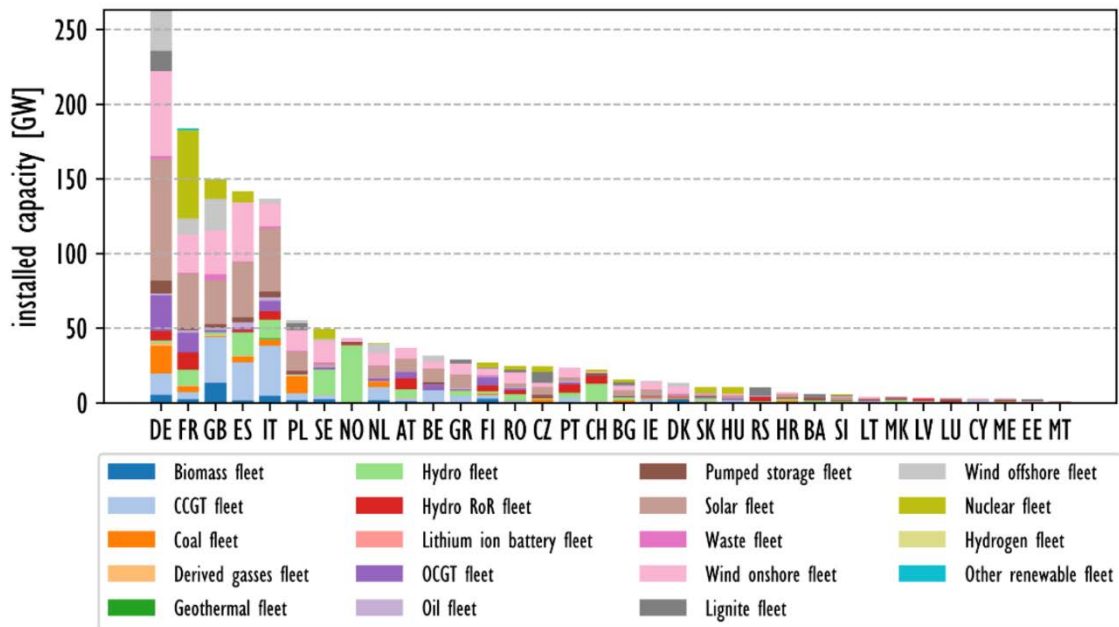


Figure 8.1: Installed capacity in EU27+UK+6 METIS 2 S1

Figure extracted from [3].

The overall capacity installed in the EU27+UK+6 in this study is shown in the table below:

Table 8.5: Overall capacity per technology in the EU27+UK+6 METIS 2 S1 study

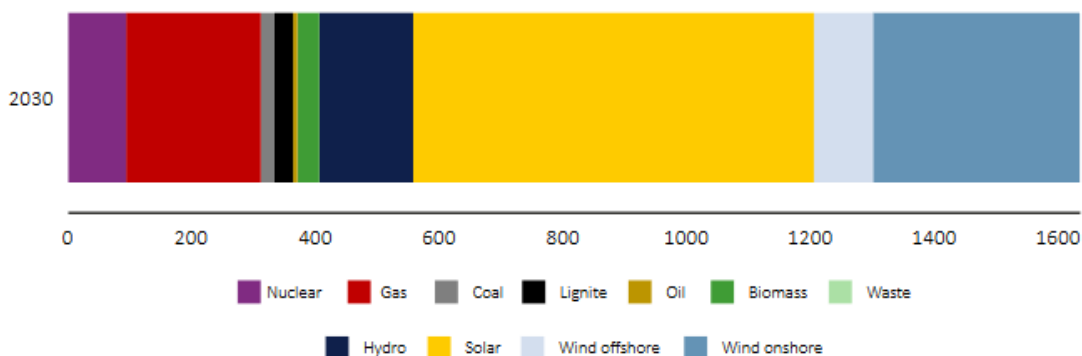
Generation mix			
Conventional generation		RES	
Technology	Installed capacity (GW)	Technology	Installed capacity (GW)
Nuclear	110,00	Hydro	140,00
Gas	160,00	PV	300,00
Others	340,00	Wind offshore	70
		Wind onshore	270,00
		Other RES	2,00
Subtotal	610,00	782,00	
Total	1400		

Data in this table have been extracted from [3].

### 8.1.2.2 Generation Capacity mix: SmartEn

For the EU 27 Member States, the generation capacity mix in 2030 is characterized by a substantial emphasis on renewables, constituting 75% of the total installed capacity. Thermal installed capacity is notably reduced, comprising less than 25% of the overall generation portfolio. Gas-fired generation emerges as the primary thermal source, with significant reductions in coal and lignite generation. Specifically, the installed solar photovoltaic (PV) capacity, encompassing both front and behind-the-meter installations, is projected to reach 600 GW across the EU 27 by 2030 as outlined in the REPowerEU Plan. Furthermore, capacities for offshore wind in the North Sea are expanded in line with the latest targets established by Belgium, Denmark, Germany, and the Netherlands, reaching 65 GW by 2030 according to [33].

Table 8.6: Generation capacity mix in SmartEn



Generation mix in SmartEn

Conventional generation		RES	
Technology	Capacity installed (GW)	Technology	Capacity installed (GW)
Nuclear	92	Hydro	149
Gas	212	PV	634
Coal	21	Wind offshore	97
Lignite	32	Wind onshore	328
Oil	8		
Biomass	36		
Waste	<1%		
Subtotal	402	1208	
Total	1610		

Graphic and data in this table have been extracted from [2].

### 8.1.2.3 Generation Capacity Mix METIS 1 Mainstreaming RES & METIS 1 S1

The generation capacity installed in the year 2030 in both METIS 1 studies [1] is shown in Table 8.7, for the three different scenarios considered and compared: no flexibility, flexibility without additional interconnection capacity, and full flexibility.

Table 8.7: Installed Capacity in the year 2030 for METIS 1: Mainstreaming RES & S1 [1]

Technologies [GW]		Option (I)	Option (II)	Option (III)
Variable RES-e	Solar	238	238	238
	Wind	331	228	228
	Run-of-the-river	50	50	50
Hydro storage	Lake + Mixed PHS	138	138	138
	Pure PHS	31	37	37
Lignite		47	47	47
Waste		12	12	12
Biomass		42	42	42

Coal	Legacy	44	46	46
	Retrofit	2	0	0
	State-of-the-art	16	16	16
Nuclear		110	110	110
CCGT	Legacy	104	110	110
	Retrofit	9	3	4
	State-of-the-art	87	78	77
OCGT	Legacy	27	27	27
	State-of-the-art	34	26	18
Total installed capacities		1322	1208	1200

Table extracted from [1].

### 8.1.2.4 Generation Capacity Mix Eurelectric

Eurelectric [5] considers necessary to install additional 510GW of vRES by the year 2030, totalling at 940GW of cumulative capacity. No information is provided on the mix of conventional generation.

### 8.1.3 Demand & installed flexibility

This section gathers all the available information on the electricity demand contemplated in each study. Additionally, it contains information on the types of flexibility utilized, and the installed flexibility power, whenever stated in the study.

#### 8.1.3.1 Demand: METIS 2 S1

We point out the main features of this scenario [3] related to demand in Table 8.8.

Table 8.8: Annual demand per EU member in the year 2030 in METIS 2 S1

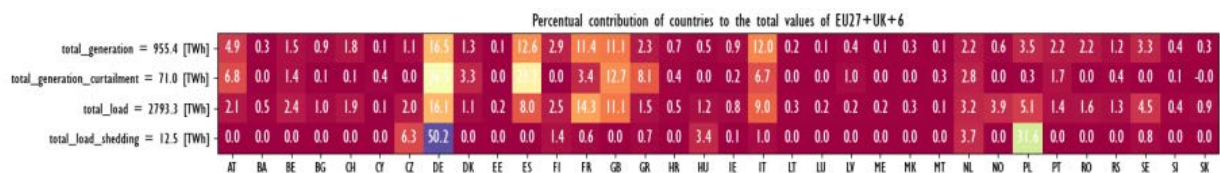


Table extracted from [3].

The total demand in the base case with no flexibility is 2793.3 TWh. Heat pumps do not include large-scale heat pumps for district heating. The study does not provide information on the installed flexibility.

### 8.1.3.2 Demand & flexibility: SmartEn

- Traditional demand is comprised of household, commercial and industrial power demand. This segment of demand reaches 2858 TWh across EU 27 Member States in 2030.
- Electric vehicles. Technological and infrastructure development results in an electricity demand of 151 TWh in 2030.
- Electrification of heating consists of both space heating and industrial heating, that amount to 510 TWh by 2030.

Power-to-hydrogen. The electrolyzers’ demand increases significantly in 2030 to reach the targeted 10 Mt of renewable hydrogen production in Europe, based on the REPowerEU Communication. Therefore, according to European Commission assumptions and according to SmartEn’s [2] calculations, 562 TWh of electricity consumption for hydrogen production is expected in 2030.

The components of electricity demand in SmartEn [2] are provided in Table 8.9.

Table 8.9: Electricity and its composition for the SmartEn study

Electricity demand	
Type of demand	Annual consumption (TWh)
Conventional demand	2858
Electric vehicles	151
Electric heating	510
P2H	562
Total	4081

*Data in this table have been extracted from [2].*

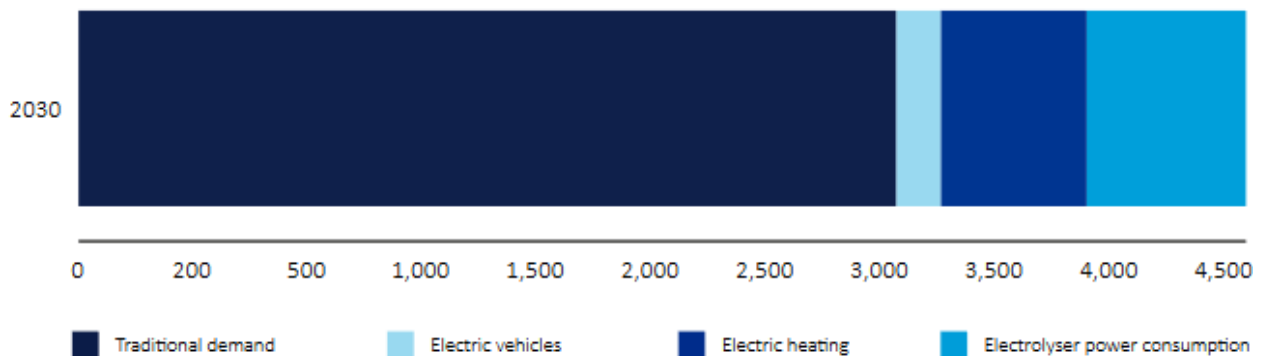


Figure 8.2: Electricity demand in EU27 in 2030 (TWh)

Figure extracted from [2].

The demand in SmartEn [2] is significantly higher than that in METIS 2 S1 [3], which does not consider electrolysers. Furthermore, the total demand in METIS 2 S1 [3] is the same as the traditional demand in SmartEn [2]. If we only consider the common technologies, the demand in SmartEn [2] is  $2858 + 151 + 510 = 3519$ .

The flexibility sources and amounts in distribution networks considered in SmartEn [2] comprise the following:

1. Smart charging – 60 million EVs by 2030 are included for the 27 Member States.
2. Vehicle-to-grid capabilities
3. Behind-the-meter (BTM) batteries – A capacity of 10.9 GW of BTM batteries in the EU 27.
4. Industrial demand-side response (DSR) – A capacity of 21.7 GW
5. Residential space electric heating – An energy capacity of 449 TWh by 2030.
6. Industrial electric heating – A capacity of 7 GW.
7. District heating – A capacity of 56 GW of combined heat and power (CHP).
8. Industrial heating – A capacity of 19 GW (CHP).
9. Grid-connected storage – A capacity of 15.5 GW of front-of-the meter batteries in EU 27
10. Electrolysers – A capacity of 149 GW in total for all Member States by 2030 at cost of 86.2 €/MWh.

Various Distributed Solar Flexibility (DSF) technologies with significant potential were omitted from the flexibility sources portfolio for this study. The exclusion was attributed to insufficient data availability for assessing their presence across the EU 27 by the year 2030. Noteworthy among these technologies are district cooling, residential cooling, Joule effect electric heating, and residential electric boilers. The study authors opted to exclude them from consideration to avoid the risk of overestimating the total DSF capacities accessible to the power system in 2030.

Additionally, the model does take into account behind-the-meter solar PV; however, it is not represented as a controllable asset but rather as non-curtailable PV generation. In the METIS 2: Study S1 [3], biomass, wind and ROR hydro is considered to be curtailable generation in distribution, but no mention is made to PV behind the meter.

### 8.1.3.3 Demand & flexibility: METIS 1 – Mainstreaming RES & METIS 1 S1

In these studies [1], the conventional demand amounts to 2650TWh, as per EUCO30. The installed flexible power capacity is shown in Table 8.10, for the several scenarios considered (No flexibility, flexibility without additional interconnection capacity, and full flexibility).

Table 8.10: installed flexibility in METIS 1: Mainstreaming RES



Technologies [GW]		Option (I)	Option (II)	Option (III)
Batteries	1-hour discharge time	-	2	2
DR	Load shedding	-	4	4
	Load shifting <sup>10</sup>	-	8	8
Interconnectors	Import capacity	181	181	205

Table extracted from [1].

### 8.1.3.4 Demand: Eurelectric

According to the Eurelectric study [5], the demand in EU27+UK in the year 2030 is ~3,530TWh. The flexibility portfolio in this study comprises the following components:

- Heat pumps: 40-50 million units.
- Electric vehicles: 50-70 million
- P2X: additional industrial demand and P2X totalling at 335TWh.

## 8.2 Quantitative flexibility benefits

In order to provide the best possible quantification of the costs and benefits associated with the mobilization of flexibility in the European Union according to the business model solutions identified in OneNet, a large body of relevant publications has been reviewed. The condensed, most relevant publications to be used in this chapter for quantitative analysis are shown in the Table 8.11.

Table 8.11: Names of publications to be reviewed by grouped categories of quantitative information

Publication	Service benefits	Benefits per cost components
-------------	------------------	------------------------------

<sup>10</sup> Includes EVs & Heat pumps

	Redispatch savings	Balancing savings	Elec. market benefits	Investment savings	Variable production cost savings	Curtailment reduction	Carbon emissions	Energy not served
SMARTEN: Demand-side flexibility in the EU: Quantification of benefits in 2030	X	X	X	X	X	X	X	X
EURELECTRIC: Connecting the dots	NONE	NONE	NONE	NONE	NONE	NONE	X	NONE
DG ENER: Assessing the role and magnitude of different flexibility measures and assets in distribution and transmission grids: METIS 2: study S1	X	NONE	NONE	NONE	NONE	X	NONE	X
DG ENER: Mainstreaming RES: flexibility portfolios: design of flexibility portfolios at Member State level to facilitate a cost-efficient integration of high shares of renewables	NONE	NONE	NONE	X	X	NONE	X	NONE
DG ENER: Optimal flexibility portfolios for a high-RES 2050 scenario: METIS Studies: study S1	NONE	NONE	NONE	X	NONE	NONE	NONE	NONE
DG JRC: Flexibility requirements and the role of storage in future European power systems	NONE	NONE	NONE	X	NONE	NONE	NONE	NONE

For each of the categories introduced in the following subsections of this chapter, the quantified benefits are discussed in relation to OneNet business models.

### 8.2.1 Service Benefits

DER-based flexibility business models provide various services that result in savings and benefits. The following subsections will shed light on the prospective benefits to be obtained by mobilizing this flexibility when providing through markets the redispatch (congestion management, and voltage control), balancing and wholesale energy services.

Because each study focuses on different aspects of service provision under different assumptions, and the methodology applied varies from one case to another, the results are not easily comparable. For this reason, a discussion of where the savings for each service and cost component originate from each of the studies consulted is also included in the following.

SmartEn [2] – For the most part, this study provides the total savings achieved when providing each service (redispatch savings, wholesale energy savings, balancing savings). Besides, this study also computes the savings for some selected cost components (CO<sub>2</sub> emissions, investment costs, curtailment costs, costs related to energy not served) without necessarily breaking down these into the specific services that these savings are attributable to.

METIS 2 S1 [3]– This document only analyses congestion management as a service, and it considers that savings obtained from this service can be broken down into reduced load shedding costs and reduced curtailment. Generation costs are considered for the optimal dispatch, but the savings in generation costs are not presented in this study.

METIS 1 Mainstreaming RES [1] – This study analyses the deployment of the potential flexibility portfolio for the year 2030. It does not break down the savings into those attributable to each specific service. It provides the overall operational savings achieved thanks to the use of flexibility. Because the operational savings are not attributable to any service in particular, the results will be presented in the following section.

#### 8.2.1.1 Overall savings comprising all the services delivered

As already mentioned, here we discuss the overall benefits produced by the mobilization of flexibility across all the services that can potentially be delivered. The estimates here provided correspond to a single study, the METIS 1 Mainstreaming RES one [1]. Several scenarios for the mobilization of flexibility are considered in this study.

- For the first flexibility scenario, in which the flexibility solutions considered do not include the flexible use of interconnections, the operational savings achieved amount to €1.2Billion compared to the scenario without flexibility mobilization and no interconnections.
- For the second flexibility scenario, in which all the flexibility solutions, or sources, are considered, including the use of interconnection capacity for this, the overall savings achieved amount to €1.9 Billion.

Furthermore, the METIS 1 Mainstreaming RES [1] study also analyses the savings achieved in investment costs and CO2 emissions for each scenario, when comparing it to the base case, in which no demand side flexibility, nor interconnection capacity is considered. Lastly, it also delves into determining the volume of new flexibility deployed for balancing services.

### 8.2.1.2 Redispatch savings

This section reports on the redispatch savings quantified in the SmartEn [2] and the METIS 2 S1 studies [3], that largely stem from congestion management and voltage control.

#### Redispatch savings: SmartEn

Redispatch is considered from the perspective of achieving savings in generation costs.

Additionally, the scenario for which redispatch savings have been calculated in SmartEn [2] considers that there is enough generation to cover all the demand when DSF is mobilized, and so, energy not served is zero, whereas without DSF NSE would amount to 2.56 TWh. (€9 billion estimated in the paper as savings obtained by avoiding all the lost load. The VLL has been deemed to be 3500 €/MWh in the study).

Savings in generation costs alone make up for €4.6 billion, which represent 5% of production costs in the scenario where no DSF is applied.

Furthermore, renewable energy curtailment is reduced by 61% thanks to the activation of these flexibility mechanisms, which translates into 15.5 TWh.

#### Redispatch savings - DG Ener METIS 2 S1

In METIS 2 S1 [3], redispatch is looked at from a network standpoint, and congestion seems to be alleviated through it, but no quantitative results are provided. Quantitative estimates of redispatch savings are only provided for the reduction of both energy not served and curtailment. Redispatch savings are provided both at transmission and distribution levels, although for transmission, these savings are only estimated for three critical time steps identified. In this section, we will only focus on the distribution redispatch savings, as these are the ones comparable to the estimates produced within SmartEn [2]. In this case, redispatch savings (for congestion

management) at the distribution level comprise those for reduced load shedding, and reduced generation curtailment.

Table 8.12: Summary of the three flexibility configurations and their network problems alleviation outcome, for EU27+UK+6

Flexibility Mechanism	Generation curtailment TWh	Load shedding TWh	Load shifting TWh	EV shifting TWh
No flexibility	71.0	12.5	--	--
Load shifting	69.1 (-3%)	10.5 (-15%)	3.5	--
EV load shifting	69.9 (-2%)	11.8 (-5%)	--	1.7
Full	68.3 (-4%)	10.1 (-19%)	3.0	1.6

Table extracted from [3].

In the scenario where all kinds of load shifting are used at the same time, generation curtailment is reduced in 2.7 TWh and load shedding is reduced in 2.4 TWh, as shown in Table 8.12.

#### Redispatch savings: Conclusions

Load shedding is reduced similarly in both studies consulted (2.56 TWh in SmartEn [2] compared to 2.4 in the METIS 2 S1 study [3]), whereas curtailment reduction is significantly lower in the METIS 2 S1 study [3] compared to those estimated in SmartEn [2] (2.7 TWh in METIS 2 S1 study [3] compared to 15.5 TWh in SmartEn). This can be attributed to the fact that, while generation capacity in SmartEn [2] is assumed to be 1600 GW and in METIS 2 S1 [3] it is 1400 GW, the overall annual demand in SmartEn [2] is significantly higher than in METIS 2 S1 [3] (4800 TWh in SmartEn compared to 2800 TWh in METIS 2 S1 [3]).

#### Relation to OneNet business models

Redispatch savings can be assumed to be achieved in those OneNet business models that are focused on OneNet services congestion management and voltage control. The relevant timeframes of these services are operational as well as short-term. The following BUCs are allowing the stakeholders in the OneNet business models to profit from redispatch savings:

- NOCL-01 Northern flexibility market;
- SOCL-GR-01 Enhanced Active/Reactive Power Management for TSO-DSO coordination;
- SOCL-CY-01 Active power flexibility;
- SOCL-CY-02 Reactive power flexibility and power quality
- WECL-ES-02 Short-term congestion management
- WECL-FR-01 Improved monitoring of flexibility for congestion management
- WECL-FR-02 Improved TSO-DSO information exchange for DER activation
- WECL-PT-01 Exchange of Information for Congestion Management – Short Term
- WECL-PT-03 Exchange of information for operational planning

- EACL-CZ-01 Nodal area congestion management
- EACL-CZ-02 Reactive power overflow management
- EACL-CZ-03 Voltage Control
- EACL-HU-01 MV feeder voltage control
- EACL-HU-02 HV/MV transformer overload
- EACL-PL-01 Prequalification of resources provided by FSPs to support flexibility services
- EACL-PL-03 Event-driven Active Power Management for Congestion Management and voltage control by the DSO
- EACL-SL-01 Congestion management in distribution grids under market conditions
- EACL-SL-02 Voltage control in distribution grids under market conditions

Where some of the BUCs are enabling demand side flexibility to be used and others are directly concerned with the mobilization of this flexibility to address the underlying problems, such as congestion management and voltage control.

### 8.2.1.3 Balancing savings

This section reports on the savings achieved when delivering the balancing service including the mobilization of flexibility. The studies focusing on these savings are also the SmartEn [2] and the METIS 1 Mainstreaming RES [1] ones.

#### Balancing savings - SmartEn

The SmartEn study [2] reveals quantifiable balancing cost savings resulting from the mobilization of demand-side flexibility. It determines that the total potential cost savings from mobilizing flexibility in the provision of balancing services range between €0.3 billion for the pessimistic (low) and €0.7 billion for the more optimistic case (high) as shown in Table 8.13, which may seem relatively low due to the smaller size of the balancing market compared to the wholesale market. In relative terms, these savings amount approximately to between 0.7 € and 1.6 € per consumer in the EU27 area. That represents between 43 % and 66 % savings in the DSF scenario, underlining the substantial economic advantages of implementing DSF.

Under the assumption that the provided DSF technologies meet the technical requirements, a three-step analysis based on the technology's marginal costs is conducted in this study. In a first step, they collect data on the market size in terms of reserve volumes and range for aFRR, mFRR and RR, as well as technology data in terms of marginal cost and balance service eligibility. In a second step, the technology merit order is built both for a DSF and a no-DSF scenario, showing, among other things, that "all aFRR upward capacity can be provided by hydro energy in the no-DSF scenario (at around 6 €/MWh) and by residential DSF in the DSF scenario (at around 3 €/MWh)." [2]. The third step involves calculating the balancing costs for the researched market size in

both scenarios. The difference between both of them represents the benefits broken down by technology and category.

Table 8.13: SmartEn - DSF power system balancing benefits per category in million €

UPWARD	DSF balancing benefits (million €)	
	Low	High
aFRR down	53.1	53.1
aFRR up	23.6	23.6
mFRR down	127.0	127.0
mFRR up	58.4	486.6
RR down	0.0	0.0
RR up	0.0	0.0
<b>TOTAL</b>	<b>262.0</b>	<b>690.2</b>

Table extracted from [2].

### Balancing savings - METIS 1 Mainstreaming RES

The study METIS 1 Mainstreaming RES [1] considers that upwards synchronized reserves (FCR and aFRR) are mainly covered by hourly flexibility solutions, that is, by 7.7 GW of short-term demand-response and 2.1 GW of batteries at the EU28 level. The related cost saving are not provided in the METIS 1 Mainstreaming RES study [1].

### Relation to the OneNet business models

Balancing savings can be assumed to be achieved in those OneNet business models that are based on the OneNet service Frequency Control. The relevant timeframe of this service is operational. The following BUCs are allowing the stakeholders in the OneNet business models to profit from balancing savings:

- NOCL-01 Northern flexibility market;
- SOCL-GR-01 Enhanced Active/Reactive Power Management for TSO-DSO coordination;
- SOCL-CY-01 Active power flexibility;
- WECL-ES-02 Short-term congestion management
- WECL-FR-02 Improved TSO-DSO information exchange for DER activation
- WECL-PT-03 Exchange of information for operational planning
- EACL-PL-01 Prequalification of resources provided by FSPs to support flexibility services
- EACL-PL-02 Managing flexibility delivered by DER to provide balancing services to TSO.
- EACL-PL-04 Balancing Service Provider on the FP

Where some of the BUCs are enabling demand side flexibility to be used and others are directly concerned with its mobilization to address the underlying problems within the balancing timeframe.

#### 8.2.1.4 Electricity wholesale energy market savings

Savings corresponding to the reduction of the cost of the wholesale energy market dispatch are provided here. These have been only drawn from the SmartEn study [2].

##### Wholesale savings- SmartEn

The results from the SmartEn study [2] show that, in the year 2030, the activation of 397 TWh of upward DSF and 340.5 TWh of downward DSF will have the following effects.

It will reduce the aggregated expenditure of all the consumers in the wholesale market by 48%. That is €301.5 billion less than in the no-DSF scenario. Costs to generate energy will be €4.6 billion (5%) lower than in a no-DSF system. It is worth noticing that consumer savings are much higher than savings in energy production, which means that under SmartEn [2] forecasted energy mix, most of the energy produced will be RES based, and thus, its marginal cost will be zero. The system can serve all demand throughout the year when mobilizing DSF, whereas the no-DSF system cannot serve all the 2,054 GWh of load in 2030. Therefore, the DSF system saves €9 billion on value of lost load.

- The savings in what the sum of all market consumers spend on the wholesale market are significantly higher than the rest of identified savings. This highlights the considerable impact that load curtailment and load shifting have on the market price at certain times. DSF avoids the creation of high price spikes where very expensive (and price setting) generators are needed. DSF also absorbs the excess energy in the case of a generation surplus and relatively low prices. Therefore, it can be observed that even if the generator costs are only 5% less, the lower utilization of expensive generators makes a tremendous impact on the final cost to load (nearly 50%).

##### Relation to OneNet business models

Benefits related to electricity wholesale markets can be assumed to be achieved in those OneNet business models that are related to market operation in general. The relevant timeframe of this service is operational, short term as well as long term. The following BUCs are allowing the stakeholders involved in the OneNet business models to profit from the savings achieved in the cost of the electricity wholesale energy markets.

- NOCL-01 Northern flexibility market;
- WECL-FR-02 Improved TSO-DSO information exchange for DER activation
- WECL-PT-01 Exchange of Information for Congestion Management – Short Term
- WECL-PT-03 Exchange of information for operational planning
- EAEL-PL-01 Prequalification of resources provided by FSPs to support flexibility services



These BUCs can be seen as enabling demand side flexibility to improve wholesale market performance.

## 8.2.2 Benefits per Cost Component

Resulting from the provision of services mobilizing flexibility, there are a multitude of types of benefits to be achieved, related to different system cost components. In the following sections, benefits on investment, curtailment, carbon emissions and energy not served cost savings are discussed.

### 8.2.2.1 Investment savings

The following sections quantify results in terms of possible investment savings. The publications quantified investments that can be avoided or minimized due to the use of DER-based flexibility.

#### Investment savings - SmartEn

The SmartEn study [2] provides evidence of the potential economic advantages associated with the adoption of Demand-Side Flexibility (DSF) as a replacement for traditional methods. At this point, it is important to remind the reader about the main limitation of the SmartEn study [2]. This concerns the fact that investment savings are upper bound estimates derived from data from two distinct sources. In their comprehensive cost analysis, the authors of the study make the following findings.

Gas Peaker plants, as a conventional energy source, were estimated to have a significant annual cost of 45,500 €/MW per year. In contrast, DSF was found to be an exceptionally cost-effective alternative, with a remarkably lower cost of only 120 €/MW per year. Therefore, the following savings in generation capacity can be found in Table 8.14.

Table 8.14: SmartEn - capital expenditure for investment in gas peaker plants and DSF capacity

Year 2030 – EU 27	Cost [€/MW/year]	Total cost [million €]
Gas peaker CAPEX (annualised)	45,500 (LAZARD, 2020)	2,730
DSF CAPEX	120 (European Commission DG Energy, 2016)	7.2

Table extracted from [2].

Moreover, the study went further to project the potential annual grid investment savings. It estimated yearly savings ranging between €11.1 billion and €29.1 billion. This range represents a substantial portion of the forecasted grid expenses, accounting for 27 % to 80 % of the total expected costs. When projected over the span of today to 2030, these savings accumulate to make a significant total of €77.6 billion to €203.6 billion. These

figures are contingent upon the assumption that no grid restrictions impede the implementation of DSF, underlining the economic benefits that DSF can bring within the EU27.

### **Investment savings for DG ENER's METIS 1 S1 & METIS 1- Mainstreaming RES**

The METIS 1 S1 study [4] “Optimal flexibility portfolios for a high-RES 2050 scenario”, among other findings, touches on potential investment savings associated with the use of flexibility technologies. Using the METIS-S1-2050 scenario [4] assumptions, with zero net emissions in the power grid in 2050, the model considered in this study is part of the METIS projects [4].

Noteworthy is that 7 GW of investment costs in Combined Cycle Gas Turbine (CCGT) and Open Cycle Gas Turbine (OCGT) power plants could be saved through the mobilization of flexibility, amounting to savings in a range between €3.85 billion to €5.95 billion. Additionally, the study highlights that 4 GW of investment expenses in Pumped Hydro Storage (PHS) can be avoided, resulting in savings of 3.6 billion euros, assuming a cost of 900 euros per kilowatt installed. Furthermore, a significant 14 GW of investments in stationary batteries, valued at 120 €/kW, can be saved, amounting to €1.68 billion. All of these savings claimed in the study are enabled by 100 GW of flexibility provided by the EV fleet with a daily energy storage capacity of up to 400 GWh.

Moreover, the research indicates that the adoption of hybrid heat pump systems, which combine electric and gas heating, can lead to annual savings of €2.4 billion in CCGT/OCGT investment costs while requiring only 300 million euros in yearly investments. This results in a net saving of €2.1 billion annually. The hybrid heat pump system also offers 37 GW of flexible capacity by enabling gas fired heating during peak demand hours.

The METIS 1 S1 scenario study [4] reveals substantial potential cost savings in the energy sector through the integration of EV flexibility and the adoption of innovative solutions like hybrid heat pumps. The investment savings total up to a span between 10.23 billion euros and €12.38 billion.

Both studies find yearly investment savings of slightly above €10 billion for their conservative estimate. In the most optimistic case for Smarten [2] savings achieved are almost the triple of those achieved in the METIS 1 S1 study [4], which can be explained by the fact that, in the latter, savings in a lower number of technologies are being quantified. These annual investment savings do only consider CAPEX. The OPEX is to be considered separately.

### **8.2.2.2 Production costs reduction**

This section presents the reduction in production costs thanks to the activation of flexibility services.

### **Production costs reduction SmartEn**

In SmartEn [2], production costs savings are only presented for the wholesale market, where the activation of DSF allows to cut peak demand, avoiding the dispatch of marginal technologies such as CCGT, and reducing production costs by 5%, which represents €4.6 billion a year.

### **Production costs reduction - METIS 1 Mainstreaming RES**

Two scenarios for the mobilization of flexibility are considered in this study. These savings are not service specific, so they belong to all the services that can be provided by activation of flexibility.

- For the first flexibility scenario, in which the flexibility solutions considered do not include the flexible use of interconnections, the operational savings achieved amount to €1.2Billion compared to the scenario without flexibility activation and no interconnections.
- For the second flexibility scenario, in which all the flexibility solutions, or sources, are considered, including the use of increased interconnection capacity, the overall savings achieved amount to €1.9 Billion.

Production cost savings in this study are less than half in absolute terms than in the SmartEn study [2]. This is most likely due to the fact that demand, generation capacity and flexibility in METIS 1 Mainstreaming RES [1] are smaller than in SmartEn [2].

### **8.2.2.3 RES curtailment reduction**

Within this section, the reductions in the amount of curtailments incurred that are reported in several studies are discussed, though these are not monetized, because RES curtailment, itself, does not represent a cost.

#### **RES curtailment reduction - SmartEn**

Savings in generation thanks to redispatch make up for €4.6 billion, which represent 5% of production costs in the scenario where no DSF is applied.

#### **RES curtailment reduction - METIS 2 study S1**

In the scenario in which all types of load shifting are used at the same time [3], generation curtailment is reduced in 2.7 TWh.

### **8.2.2.4 Carbon emission savings**

Here, savings in the costs of emissions due to the mobilization of flexibility are discussed.

### Carbon emission savings - SmartEn

The Smarten study [2] examines the carbon savings attributed to DSF. In this analysis, the total carbon emissions for the year 2030 were determined as a direct outcome of the model used, considering the carbon emissions generated by the utilization of carbon-based fuels and biomass by dispatched generators. Furthermore, the results consider the impact of carbon capture and storage measures. These emissions were then assessed against the established 2030 power system emissions target, which aligns with the 55% reduction objective. This emission target for the power sector is derived from DNV's energy transition outlook model used in the SmartEn study [2] and is set to 410 million equivalent CO<sub>2</sub> tons. This is shown in Table 8.15.

Table 8.15: Carbon emissions savings for study SmartEn

Year 2030 – EU 27	Potential savings	% Relative to no-DSF	Potential savings per capita <sup>16</sup>
Cost to serve load	€301.5 billion	-48%	€673.5
Adequacy	€2.7 billion	-100%	€6.0
Balancing	€0.3–0.7 billion	[-66%, -43%]	€0.7–1.6
Infrastructure <sup>17</sup>	€11.1–29.1 billion	[-80%, -27%]	€27.8–65
Emissions	37.5 Mt	-8%	83.8 kg

Table extracted from [2].

In comparison to the scenarios that do not incorporate demand-side flexibility, the study reveals a reduction of 37.5 million metric tons of CO<sub>2</sub> equivalent emissions achieved through flexibility mobilization, representing an 8% decrease with respect to the reference scenario. Notably, these emissions savings correspond to approximately 84 kilograms per capita within the European Union's 27 member states. Quantifying these savings monetarily at 30 €/t, as valued in the Eurelectric study [5], the savings here would amount to 1.125 billion euros (Connecting the dots: Distribution grid investment to power the energy transition, 2021).

### Carbon emission savings - Eurelectric

The Eurelectric study [5] cites a range of 6500-8000 million metric tons (MT) of CO<sub>2</sub> savings resulting from all DSO investments made between 2020 and 2030. While it is important to note that these figures encompass a variety of factors and are not exclusively attributable to DSF, the study does emphasize a compelling case for leveraging flexibility in the context of electric vehicle (EV) charging. Specifically, the study considers the scenario in which 75% of the EV fleet is charged during off-peak hours.

At a rate of €30 per ton of CO<sub>2</sub>, these savings correspond to an estimated range of 17-22 billion euros in average annual cost savings associated with reduced CO<sub>2</sub> emissions. This financial estimation is pivotal in facilitating a 50-55% reduction in greenhouse gas (GHG) emissions compared to the 1990 levels.

#### **Carbon emission savings - METIS 1 Mainstreaming RES**

This study [1] makes the assumption that carbon price remains constant regardless of the amount of CO<sub>2</sub> emissions. The result of this is that, even if there is a big increase in RES capacity, the overall CO<sub>2</sub> emissions increase by 0,7% or 0,9% by the year 2030, depending on the scenario (if interconnections are considered or not), because there is an increase in coal/lignite production at the expense of natural gas power plants, as the fuel is cheaper.

#### **8.2.2.5 Savings in energy not served**

Here, savings related to the reduction in energy not served that are achieved through flexibility mobilization are discussed.

##### **Savings energy not served - SmartEn**

The scenario for which redispatch savings have been calculated in SmartEn [2] assumes that there is enough generation to cover all the demand when DSF is mobilized. Then, the energy not served is zero in this case. On the other hand, without DSF, NSE would amount to 2.56 TWh, which amount to €9 billion of costs when considering a VLL of 3500 €/MWh, as in the study.

##### **Savings energy not served - METIS 2: Study S1**

In the scenario where all kinds of load shifting are used at the same time, load shedding is reduced by 2.4 TWh [3]. Assuming the unit value of lost load to be at 3500€/MWh, as in the SmartEn study [2] discussed in the previous paragraph, this would translate into cost savings of €8.4 billion.

#### **Relationship with OneNet business models**

Investment savings, savings in energy not served and savings related to carbon emissions reductions can be assumed to be achieved in those OneNet business models that are based on the OneNet services congestion management, voltage control and Frequency Control. The relevant timeframes of these services are operational, short term as well as long term. The following BUCs are allowing the stakeholders in the following OneNet business models to profit from investment savings, reductions in RES energy curtailment and carbon emission reductions:

- NOCL-01 Northern flexibility market;
- SOCL-GR-01 Enhanced Active/Reactive Power Management for TSO-DSO coordination;
- SOCL-CY-01 Active power flexibility;

- SOCL-CY-02 Reactive power flexibility and power quality
- WECL-ES-01 Long-term congestion management
- WECL-ES-02 Short-term congestion management
- WECL-PT-01 Exchange of Information for Congestion Management – Short Term
- WECL-PT-02 Exchange of Information for Congestion Management – Long Term
- WECL-PT-03 Exchange of information for operational planning
- EACL-CZ-01 Nodal area congestion management
- EACL-CZ-02 Reactive power overflow management
- EACL-CZ-03 Voltage Control
- EACL-HU-01 MV feeder voltage control
- EACL-HU-02 HV/MV transformer overload
- EACL-PL-01 Prequalification of resources provided by FSPs to support flexibility services
- EACL-PL-03 Event-driven Active Power Management for Congestion Management and voltage control by the DSO
- EACL-SL-01 Congestion management in distribution grids under market conditions
- EACL-SL-02 Voltage control in distribution grids under market conditions

Where some of the BUCs are enabling demand side flexibility to be used and others are directly concerned with its mobilization to address the underlying problems in congestion management, voltage and frequency control.

## 9 Conclusions

Conclusions and recommendations are divided into those of a qualitative, or conceptual, nature and the quantitative ones.

### 9.1 Conclusions of qualitative analyses

Achieving the implementation of markets for SO services requires that the stakeholders involved in the implementation of these markets and services are subject to the right conditions allowing and encouraging them to engage in this implementation process. The organization of the businesses made by stakeholders when participating in these services has been here analysed along three dimensions:

- Identification and engagement strategies of critical stakeholders, having large power over the implementation of the BM but low interest in contributing to it.
- Barriers posed by the regulation in a country and region to the successful implementation of this BM.
- Impact of the local regulation and conditions on the characterization of the business of main stakeholders involved in markets for SO services.

The main regulatory barriers to the implementation and smooth functioning of the markets for the SO services, allowing those partners involved in these services to profit from their participation, include the following. First, the existing regulation should enable the development of markets for SO services, defining the main roles in them, and determining the main aspects of the functioning of these markets. Second, the TSO and DSO may be subject to remuneration schemes, traditionally based on the remuneration of investments, which are discouraging them from implementing solutions of the provision of system services involving the mobilization of flexibility. They may also lack other types of incentives, possibly associated with the quality of the service they provide. Third, suppliers and retailers may not receive appropriate compensations associated with the penalties they face due to the imbalances they incur as a result of the mobilization of flexibility by the aggregators and FSPs in general. Fourth, there may not be in place additional schemes for the mobilization of flexibility, like appropriate energy pricing schemes, and, when there are, sometimes, these are not appropriately coordinated with the markets for the provision of SO services. Fifth, the ownership and operation of DERs by the SOs should be properly regulated, trying to achieve a balance between the possible discouraging effect on the development of markets for SO services that the option for the SOs to own and operate flexible DERs may have, and the advisability of enabling additional options for the SOs to meet the system flexibility needs, possibly through the direct operation of DERs by them, if no other market based option is available. Sixth, the access of flexibility providers to markets for SO services may be difficult or excessively expensive, especially for small agents. And, additionally, significant constraints for agents in these markets to access the relevant data required

to provide SO services may exist, possibly due to obstacles created by the incumbent to limit the level of competition this entity faces in the market. Achieving the implementation of a BM requires overcoming those barriers, within the former ones, that are especially relevant for the corresponding business to be successful.

Engaging critical stakeholders in the implementation of socially efficient local flexibility services requires that a solid and attractive enough BM associated with their participation in these services is in place. This BM should produce large enough benefits for the corresponding critical stakeholder to cover the costs it incurs associated with its participation in the corresponding service according to this BM. Besides, critical stakeholders should be provided with enough, clear, information about these benefits and costs. Lastly the role to be played by them in delivering this service, or enjoying it, should be well defined.

Critical stakeholders for the successful implementation of local markets for SO services include the National Regulatory Authorities and governments; the Local associations of consumers, authorities, or interest groups; the Balance Responsible Parties (BRPs) and Retailers; the TSOs and DSOs; the FSPs, especially the small ones; the conventional and large utilities; and the sectoral associations. Engaging National Regulatory Authorities involves, among other things, providing them with advice on the regulation conducive to the wide use of markets for SO services, which they should implement to overcome the existing regulatory barriers to the successful implementation of these markets. The participation of demand in markets for SO services should be allowed and the pricing schemes applied should encourage consumers to provide flexibility.

BRPs and retailers should earn compensations commensurate with the extra costs and penalties they face associated with the mobilization of flexibility by aggregators and FSPs. Their relationship with aggregators should be properly regulated. Additionally, efficient baselining and flexibility pricing schemes should be in place; these stakeholders should have access to relevant data on the actual consumption profile of their consumers; and the integration into European markets should be fostered. The remuneration schemes applied to TSOs and DSOs should consider not only the investment costs but also the operation costs, and therefore the total costs they face in implementing flexibility solutions and markets for SO services. Additionally, they should be compensated when incurring in risky investments in immature technologies is needed to implement these solutions and markets.

The costs incurred by FSPs when they participate in markets for SO services should be reduced. This is especially relevant for small FSPs. Additionally, relevant barriers preventing these small FSPs from participating in local markets should be removed. It is also very relevant that the remuneration schemes applied to the provision of flexibility through markets are clearly defined and result in attractive enough remuneration levels.

Lastly, stakeholders and authorities should be aware that the conditions existing in a region or national system may affect the service that stakeholders engage in, the focus of their activities related to that service, the stakeholders with whom they relate in these activities, and even the main means and resources used to relate to them.



## 9.2 Main results of the quantitative analyses conducted

Regarding the quantitative analyses conducted to make an informed guess of the potential of the BM analysed, our literature review has quantified the multifaceted benefits derived from DERs (DER) based flexibility services. We have classified these benefits according to two dimensions:

- service benefits, i.e. having the benefits classified by service where they are achieved, encompassing re-dispatch, balancing, and electricity wholesale. And
- secondly, benefits classified according to the associated cost component affected, encompassing investment savings, reduction in renewable energy curtailment, carbon emission savings, savings due to the reduction of energy not served, and variable production cost savings.

In summary, the service benefits of DER based flexibility services are undeniably profound, as our comprehensive literature review has revealed. Firstly, the savings related to balancing services alone, added up to a range between €0.3 and €0.7 billion. Supplementarily, the Mainstreaming RES study carried with METIS [1] 7.7 GW of DSF and an additional 2.1 GW of batteries being mobilized for this purpose within the European Union.

Secondly, the findings for re-dispatch savings suggested that load shedding is decreased to a similar extent in both referenced studies due to flexibility mobilization (2.56 TWh in SmartEn [2] compared to 2.4 TWh in the METIS 2 S1 study [3]). However, the reduction in curtailment is notably less in the METIS 2 S1 study [3] when compared to the estimates in SmartEn [2] (2.7 TWh in METIS 2 S1 study [3] compared to 15.5 TWh in SmartEn).

Thirdly, as the SmartEn study [2] states, there are substantial savings to be achieved due to the mobilization of flexibility in the wholesale market. Activating 397 TWh upward and 340.5 TWh downward DSF reduces wholesale market consumer expenditure by 48% (€301.5 billion less than no-DSF). Energy generation costs are €4.6 billion lower (5%) due to the fact that deploying flexibility allows to integrate mostly additional amounts of renewable energy with zero marginal production costs. The DSF system ensures year-round demand fulfilment, saving €9 billion on lost load compared to a no-DSF system. Reducing energy not served through conventional investments in additional capacity, instead of using DSF, is contemplated in some studies from a CAPEX standpoint, but the analysis of the impact of this on generation costs is not carried out. Load curtailment and shifting significantly impact market dynamics, preventing high price spikes from occurring. Thus, while a modest 5% reduction in generation costs is achieved, the final cost of electricity to load nearly halves.

Stemming from these service benefits, the findings on the benefits per cost components, starting with the investment savings, were the following. The examined studies that spoke on this matter, SmartEn [2] and METIS 1 S1 [3], both find yearly investment savings of slightly above 10 billion euros for their conservative estimate. These savings for the best case for SmartEn [2] almost triple those of the METIS 1 S1 study [3]. This can be explained by the fact that the savings related to a lower number of technologies are being quantified in the later study. These annual investment savings only consider CAPEX. OPEX is to be considered separately

Our analysis concerning RES curtailment in SmartEn [2] concluded that DSF results in renewable energy curtailment being reduced by 61%, which amounts to a 15.5 TWh reduction. In the scenario considering all types of load shifting available in the METIS 2 S1 study [3] (traditional load shifting and EV load shifting) simultaneously, generation curtailment is reduced by DSF in 2.7 TWh.

Furthermore, we have discussed the carbon emission savings achieved by DER flexibility implementation. Two studies include quantitative information on these emission savings. However, the Eurelectric study [5] provides a significantly higher estimate of savings of this type than the SmartEn study [2]. This is probably due to the fact that savings in the former result from all types of DSO investments, while those in SmartEn [2] are exclusively attributable to DSF. The total savings estimated in both studies amount to €1.125 billion (37.5 MT) and €17-22 billion (6500-8000 MT), respectively.

Finally, additional savings that can be achieved by reducing the amount of energy not served. In the SmartEn study [2], all the non-served energy is avoided in the DSF scenario, while in the Reference scenario the cost of non-served energy amounts to €9 billion approximately (the cost of VLL in this study is 3500€/MWh). In the METIS 2 S1 study [3], using all types of load shifting simultaneously results in a load shedding reduction of 2.4 TWh. In the METIS 2 S1 report [3], the VLL considered in this study is not provided. If the same cost of non-served energy as in SmartEn [2] is used, the savings in energy not served achieved in METIS 2 S1 [3] would amount to €8.4billion, which is 6% less than in SmartEn [2].

As shown above, the business model potential for OneNet flexibility solutions is enormous. Even though the studies quantitative findings are not directly comparable, and the aggregated benefits related to individual services cannot simply be summed up, the ranges of savings provided give a good indication of the large potential for cost reduction that flexibility from DER has. Future research could provide significant added value by analysing the quantitative flexibility benefits in a more comprehensive way. This involves, for example, studying the value of flexibility mobilized for different services individually as well as overall, considering a range of realistic scenarios that appropriately represent the related uncertainties.

### 9.3 Way forward

The quantitative analyses here conducted are only providing information produced in previous works. No quantitative results have been estimated here. The benefits and costs of the implementation of flexibility solutions through markets for SO services should be properly estimated in the context relevant for this study. Not only this, the allocation of benefits and costs to the main stakeholders involved in the implementation of these solutions should also be investigated to derive a proper reallocation of benefits and costs if needed to engage these stakeholders.

## References

- [1] European Commission. Directorate General for Energy. and Artelys., *Mainstreaming RES: flexibility portfolios : design of flexibility portfolios at Member State level to facilitate a cost efficient integration of high shares of renewables*. LU: Publications Office, 2019. Accessed: Nov. 30, 2023. [Online]. Available: <https://data.europa.eu/doi/10.2833/97595>
- [2] A. Sáez Armenteros, H. de Heer, and L. Fiorini, 'Demand side flexibility: Quantification of benefits in the EU', *SmartEn*, 2022, Accessed: Nov. 30, 2023. [Online]. Available: <https://smarten.eu/wp-content/uploads/2022/09/SmartEN-DSF-benefits-2030-Report DIGITAL.pdf>
- [3] European Commission. Directorate General for Energy., *Assessing the role and magnitude of different flexibility measures and assets in distribution and transmission grids: METIS 2 : study S1*. LU: Publications Office, 2023. Accessed: Nov. 30, 2023. [Online]. Available: <https://data.europa.eu/doi/10.2833/68749>
- [4] European Commission. Directorate General for Energy., *Optimal flexibility portfolios for a high-RES 2050 scenario: METIS Studies : study S1*. LU: Publications Office, 2018. Accessed: Nov. 30, 2023. [Online]. Available: <https://data.europa.eu/doi/10.2833/642476>
- [5] Eurelectric, 'Connecting the dots: Distribution grid investment to power the energy transition'. 2021. Accessed: Nov. 30, 2023. [Online]. Available: <https://www.eurelectric.org/media/5140/eurelectric-connecting-the-dots-full-study.pdf>
- [6] G. Hamel, *Leading the Revolution*, First Edition, 2nd Printing. New York: Harvard Business School Press, 2000.
- [7] L. M. Applegate and M. Collura, *Emerging E Business Models: Lessons from the Field*. Harvard Business School Press, 2000.
- [8] R. Amit and C. Zott, 'Value Creation in E-Business', *Strategic Management Journal*, vol. 22, no. 6/7, pp. 493–520, 2001.
- [9] P. Weill and M. Vitale, *Place to Space: Migrating to eBusiness Models*. 2001.
- [10] J. Gordijn, 'E3-value in a Nutshell', in *International workshop on e-business modeling*, HEC Business School Lausanne, 2002. Accessed: Nov. 25, 2023. [Online]. Available: <https://scholar.google.com/scholar?cluster=2029275829637353174&hl=en&oi=scholar>
- [11] H. Chesbrough and R. S. Rosenbloom, 'The role of the business model in capturing value from innovation: evidence from Xerox Corporation's technology spin-off companies', *Industrial and Corporate Change*, vol. 11, no. 3, pp. 529–555, Jun. 2002, doi: 10.1093/icc/11.3.529.
- [12] Afuah and Tucci, *Internet Business Models and Strategies: Text and Cases*. 2001.
- [13] A. Osterwalder, 'The Business Model Ontology: a proposition in a design science approach', *Institut d Informatique et Organisation. Lausanne, ...*, Jan. 2004, Accessed: Nov. 25, 2023. [Online]. Available: [https://books.google.es/books/about/The Business Model Ontology.html?id=wunyZwEACAAJ&redir\\_esc=y](https://books.google.es/books/about/The Business Model Ontology.html?id=wunyZwEACAAJ&redir_esc=y)
- [14] K. Drivakou *et al.*, 'Business Use Cases for the OneNet D2.3', 2021. [Online]. Available: <https://onenet-project.eu/public-deliverables/>
- [15] A. Osterwalder and Y. Pigneur, *Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers*, vol. 2010. New Jersey: Wiley. Accessed: Jun. 21, 2022. [Online]. Available: <https://www.wiley.com/en-us/Business+Model+Generation%3A+A+Handbook+for+Visionaries%2C+Game+Changers%2C+and+Challengers-p-9780470876411>
- [16] InterGRIDy, 'Energy Business Modelling Tool - inteGRIDy Business Modelling Tool', Energy Business Modelling Tool. Accessed: Nov. 25, 2023. [Online]. Available: <https://energy.venturely.io/>
- [17] F. Oliveira, S. Gandhi, E. Anderson, and C. Augusto, 'Recommendations for the Harmonised Electricity Role Model. OneNet D2.5', 2021. [Online]. Available: <https://onenet-project.eu/wp-content/uploads/2022/10/D25-Recommendations-for-the-Harmonised-Electricity-Role-Model.pdf>
- [18] AXELOS, *Managing Successful Projects with PRINCE2*, 2017th edition. London Norwich: TSO, The Stationery Office, 2017.
- [19] C.-V.-S. CIVITAS, 'Involving stakeholders: toolkit on organising successful consultations', 2000. Accessed: Nov. 25, 2023. [Online]. Available:

- [https://civitas.eu/sites/default/files/Results%20and%20Publications/Brochure\\_STAKEHOLDER\\_CONSULTATION\\_web.pdf](https://civitas.eu/sites/default/files/Results%20and%20Publications/Brochure_STAKEHOLDER_CONSULTATION_web.pdf)
- [20] Integrid, ‘Design of Consumer Engagement Strategies’, 2018.
- [21] I. Ielite, G. Olevsky, and T. Safiulins, ‘Identification and prioritization of stakeholders in the planning process of sustainable development of the smart city’, in *2015 IEEE Seventh International Conference on Intelligent Computing and Information Systems (ICICIS)*, Dec. 2015, pp. 251–257. doi: 10.1109/IntelCIS.2015.7397229.
- [22] P. Smith, ‘Stakeholder Engagement Framework’, *Information & Security: An International Journal*, vol. 38, pp. 35–45, 2017, doi: <http://dx.doi.org/10.11610/isij.3802>.
- [23] R. Sharma, ‘The 6 principles of Stakeholder Engagement’, *Supply Chain Management Review*, 2008, [Online]. Available: <https://www.fwsolutions.net/wp-content/uploads/2015/07/The-role-of-stakeholder-engagement-article.pdf>
- [24] Ministerio de Industria, Energía y Turismo, *Orden IET/2735/2015, de 17 de diciembre, por la que se establecen los peajes de acceso de energía eléctrica para 2016 y se aprueban determinadas instalaciones tipo y parámetros retributivos de instalaciones de producción de energía eléctrica a partir de fuentes de energía renovables, cogeneración y residuos*, vol. BOE-A-2015-13782. 2015, pp. 119084–119135. Accessed: Nov. 25, 2023. [Online]. Available: <https://www.boe.es/eli/es/o/2015/12/17/iet2735>
- [25] Nicolas Stevens *et al.*, ‘Markets for DSO and TSO procurement of innovative grid services: Specification of the architecture, operation and clearing algorithms’, Deliverable D2.1. Accessed: Dec. 10, 2021. [Online]. Available: [https://private.coordinet-project.eu/files/documentos/6033b5fe475cdCoordiNet\\_WP2\\_D2.1\\_Markets%20for%20DSO%20and%20TSO%20procurement%20of%20innovative%20grid%20services\\_V1.0\\_20.02.2021.pdf](https://private.coordinet-project.eu/files/documentos/6033b5fe475cdCoordiNet_WP2_D2.1_Markets%20for%20DSO%20and%20TSO%20procurement%20of%20innovative%20grid%20services_V1.0_20.02.2021.pdf)
- [26] European Parliament, ‘Amending Regulations (EU) 2019/943 and (EU) 2019/942 as well as Directives (EU) 2018/2001 and (EU) 2019/944 to improve the Union’s electricity market design’, 2023/0077(COD). Accessed: Nov. 24, 2023. [Online]. Available: [https://www.europarl.europa.eu/doceo/document/ITRE-AM-749127\\_EN.pdf](https://www.europarl.europa.eu/doceo/document/ITRE-AM-749127_EN.pdf)
- [27] L. Lind, J. P. Chaves Avila, A. Barlier, and J. M. Cruz, ‘Specifications and guidelines for Western Demos. OneNet D9.1’, 2021. Accessed: Jul. 09, 2023. [Online]. Available: <https://onenet-project.eu/public-deliverables/>
- [28] CEDEC, E.DSO, ENTSO-E, EURELECTRIC, and GEODE, ‘An integrated Approach to Active System Management’, 2019. Accessed: Jul. 18, 2020. [Online]. Available: [https://eepublicdownloads.blob.core.windows.net/public-cdn-container/clean-documents/Publications/Position%20papers%20and%20reports/TSO-DSO\\_ASM\\_2019\\_190416.pdf](https://eepublicdownloads.blob.core.windows.net/public-cdn-container/clean-documents/Publications/Position%20papers%20and%20reports/TSO-DSO_ASM_2019_190416.pdf)
- [29] IPTO, ‘Balancing Market Rulebook’, 2020. Accessed: Nov. 25, 2023. [Online]. Available: [https://www.admie.gr/sites/default/files/users/dda/KAE/Balancing\\_Market\\_Rulebook\\_v2.pdf](https://www.admie.gr/sites/default/files/users/dda/KAE/Balancing_Market_Rulebook_v2.pdf)
- [30] K. Kukk, E.-K. Gildemann, A. Sanjab, L. Marques, T. Treumann, and M. Petron, ‘OneNet Deliverable D7.4 - Northern Cluster Demonstrator: TSO-DSO Coordination module description and implementation D7.4’, OneNet H2020 Project, 2022.
- [31] M. A. Ruiz, T. Gómez, J. P. Chaves, and R. Cossent, ‘Regulatory Challenges for Energy Infrastructure—Do Electricity Distribution Remuneration Schemes in Europe Promote the Use of Flexibility from Connected Users?’, *Curr Sustainable Renewable Energy Rep*, Jun. 2023, doi: 10.1007/s40518-023-00214-5.
- [32] ISGAN, ‘ISGAN Regulatory Sandbox 2.0 Project Policy Messages to the Clean Energy Ministerial’, 2021. Accessed: Nov. 25, 2023. [Online]. Available: <https://www.cleanenergyministerial.org/content/uploads/2022/03/policy-messages-from-the-isganregulatory-sandbox-2-0-project-1-min.pdf>
- [33] Tinne Van der Straeten, Dan Jorgensen, Rob Jetten, and Robert Habeck, ‘The declaration of energy ministers on The North Sea as a Green Power Plant of Europe’. 2022. Accessed: Nov. 30, 2023. [Online]. Available: <https://www.bmww.de/Redaktion/DE/Downloads/Energie/20220518-declaration-of-energy-ministers>