The PARITY project has received funding from the EU's Horizon 2020 research and innovation programme under grant agreement No 864319

PARITY

Project Acronym:	**PARITY**
Project Full Title:	**Pro-sumer AwaRe, Transactive Markets for Valorization of Distributed flexibilITY enabled by Smart Energy Contracts**
Grant Agreement:	**846319**
Project Duration:	**42 months (01/10/2019 – 31/03/2023)**

DELIVERABLE D4.4
LFM Actors Business Models

Work Package:	**WP4 – Local Flexibility Business & Market Models**
Task:	**T4.4 – Definition of business models for LFM actors**
Document Status:	**Final v1**
File Name:	**PARITY_D4.4_LFM Actors Business Models_R1_V1.0_e7**
Due Date:	**November 2020**
Submission Date:	**January 2021**
Lead Beneficiary:	**e7**

Dissemination Level	
Public	X
Confidential, only for members of the Consortium (including the Commission Services)	

The PARITY project has received funding from the EU's Horizon 2020 research and innovation programme under grant agreement No 864319

Authors List

Leading Author			
First Name	Last Name	Beneficiary	Contact e-mail
Guntram	Pressmair	e7	guntram.pressmair@e-sieben.at

Co-Authors/Contributors				
#	First Name	Last Name	Beneficiary	Contact e-mail
1	Christof	Amann	e7	christof.amann@e-sieben.at
2	Christos	Kapsalas	HYPERTECH	c.kapsalas@hypertech.gr
3	Evgenia	Kapassa	UNIC	kapassa.e@unic.ac.cy
4	Simon	Stukelj	E.ON	simon.stukelj@eon.se
5	Samuel	Wingstedt	CWATT	samuel.wingstedt@checkwatt.se
6	Jorge	Rueda Quintanilla	CUERVA	jruedaq@grupocuerva.com
7	Ana	Villar	URBENER	avillar@urbener.com
8	Paolo	Rossi	AEM	prossi@aemsa.ch
9	Eleni	Daridou	HEDNO	e.daridou@deddie.gr
10	Fotis	Manesis	BFS	fmanesis@konkat.gr

Reviewers List

Reviewers			
First Name	Last Name	Beneficiary	Contact e-mail
Jorge	Rueda	CUERVA	jruedaq@grupocuerva.com
Marilena	Stathopoulou	MERITCH	m.stathopoulou@meritconsultinghouse.eu

Version History

Version	Author	Date	Status
0.1	Guntram Pressmair, e7	June 17th, 2020	Initial draft (TOC)
0.2	Guntram Pressmair, e7	December 22nd, 2020	Final draft for internal review
1.0	Guntram Pressmair, e7	January 12th, 2021	Final version including comments from partners, ready for submission

Legal Disclaimer

The PARITY project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 864319. The sole responsibility for the content of this publication lies with the authors. It does not necessarily reflect the opinion of the Innovation and Networks Executive Agency (INEA) or the European Commission (EC). INEA or the EC are not responsible for any use that may be made of the information contained therein.

Copyright

Executive Summary

The **PARITY project** aims to enable the set-up and operation of local flexibility markets at the distribution network level. Based on a smart contract enabled and blockchain based market platform, internet of things enabled flexibility management tools as well as innovative smart grid management tools, a local market framework will be defined and established. This creates value for a range of stakeholders including prosumers, DSOs, energy retailers and aggregators. The business opportunities arising in this field will be identified and the resulting business models will be formulated and validated.

The overall aim of this report, is to **introduce a set of business models** for the different stakeholders in the local market of PARITY. A list of potential business models has been derived from a literature review and an in-depth brainstorming process has been conducted with the PARITY consortium members with their different backgrounds and perspectives. On the one hand, special attention is given to the flexibility needs of the DSO for congestion management and voltage control. On the other hand, the business models are designed to give new opportunities and benefits for active prosumers deploying flexible assets and distributed generation units.

The overall methodology of this task follows a **lean business modelling approach**. For this report, each iterative step in this process is documented in a dedicated chapter. The starting point for the PARITY BMs is the description of the initial business cases in the project proposal. As a first iteration, the stakeholder interactions and potential business opportunities have been analysed. In the second step, these business opportunities have been further considered through a brainstorming process and literature review, resulting in a mapping of potential business models for PARITY. Then, the most promising ones have been selected and a full description of these business models has been provided. As the last iteration loop, a business model canvas analysis has been performed considering also regulatory aspects. For this analysis, feedback has been received from actual market participants (DSOs, suppliers, aggregators) that are part of the PARITY consortium.

The first group of BMs focusses on the **role of the aggregator**. In PARITY, BMs for a high-level aggregator (integrating an aggregated community of prosumers into a larger flexibility portfolio for trading on the ancillary services and wholesale markets) and a low-level aggregator (supporting local prosumers to participate in a local energy market) are considered. The aggregator BMs can also be distinguished by their approach on how to address balance responsibility issues.

A second group of BMs comprise the **ESCo business models**, where the services of a pure FLESCo (shifting loads to optimise the benefit from a dynamic pricing scheme) and a flexibility-enhanced ESCo (as a provider of energy efficiency contracting services) are considered.

The BMs, more specific and exclusive to the PARITY market framework are the business models of the **Local Flexibility Market Operator (LFMO)** and the **Local Energy Market Operator (LEMO)**.

The **LFMO** BMs are only applicable in case an explicit LFM is implemented. They strongly lean on the idea of previous projects such as GOPACS or Piclo Flex, which are platforms where DSOs can purchase flexibility for congestion management. In PARITY we consider the options that such a platform can be run by each DSO itself or by an external LFMO. For both options, advantages and disadvantages have been discussed. An external LFMO (e.g., existing spot market operators) might have more experience in market operations and can serve several DSOs with one platform. However, this would require an additional interface between DSO and LFMO and, more importantly, confidential information of the DSO might need to be shared with the LFMO, which is a critical aspect.

The **LEMO** BMs basically facilitate peer-to-peer trading, either from the perspective of a supplier or an energy community. Generally, in order to enable peer-to-peer trading, three different approaches for managing balance responsibility can be implemented. These include trading (i) between actors associated with the same Balance Responsible Party (BRP), (ii) by making use of multiple supplier contracts and (iii) by applying the independent aggregator concept.

From the **supplier** perspective, the LEMO BM can be implemented as a simple peer-to-peer facilitator without providing any services for load shifting. This is similar to already existing BMs on the market. In case the supplier assumes the LEMO role, the prosumers interested to participate in the LEM need to

have a supply contract with the specific supplier. In a more comprehensive BM, the supplier as a LEMO and FLESCo also facilitates load shifting and enables the prosumers to optimally exploit the flexibility potential of their flexible DERs and to indirectly participate in AS and WS markets as well as provide flexibility services to the DSO.

From the perspective of **energy communities**, also the community could apply a simple peer-to-peer trading scheme without any automated load shifting. A more comprehensive BM for energy communities includes the automated provision of flexibility (towards DSO or the AS and WS markets). In such a BM, members of an energy community can trade electricity among each other, but are not obliged to have a supply contract with the same supplier and also could eventually benefit from reduced grid tariffs for the energy traded locally. Note, that legislation on energy communities is in a very initial state and currently peer-to-peer schemes for energy communities are not feasible in most European member states.

Table of Contents

List of Figures

List of Tables

List of Acronyms and Abbreviations

Term	Description
AS	Ancillary Service
BC	Business Case
BEMS	Building Energy Management System
BG	Balance Group
BM	Business Model
BRP	Balance Responsible Party
CBA	Cost Benefit Analysis
CEC	Citizen Energy Community
DER	Distributed Energy Resource
DG	Distributed Generation
DR	Demand Response
DSF	Demand Side Flexibility
DSO	Distribution System Operator
EC	Energy Community
ESCo	Energy Service Company
EV	Electric Vehicle
FLESCo	Flexibility Service Company
FRP	Flexibility Requesting Party
GDPR	General Data Protection Regulation
HV	High Voltage
Hz	Hertz
IoT	Internet of Things
ISR	Imbalance Settlement Responsible
LEM	Local Energy Market
LEMO	Local Energy Market Operator
LFM	Local Flexibility Market
LFMO	Local Flexibility Market Operator
MO	Market Operator
MV	Medium Voltage
M&V	Measurement and Verification
PV	Photovoltaics
REC	Renewable Energy Community
SLA	Service Level Agreement
T	Task
TLC	Traffic Light Concept
TSO	Transmission System Operator
USP	Unique Selling Proposition
WP	Work Package
WS	Wholesale

1. Introduction

The PARITY project aims to enable the set-up and operation of local flexibility markets at the distribution network level. The tools that will be developed in the project include:

- A smart contract enabled, blockchain based market platform which will facilitate both **peer-to-peer (P2P)** energy transactions as well as the **sell/purchase of flexibility to smart grid actors**.
- **Internet of things (IoT) flexibility management tools** for Distributed Energy Resources (DER).
- **Smart grid monitoring and management tools** to enable the Distribution System Operator (DSO) to optimally manage the low voltage distribution network.

Facilitated by these tools, a well-functioning **local market framework** will be defined and established, creating value for a range of stakeholders including prosumers, DSOs and energy retailers. The business opportunities arising in this field will be identified and the resulting **business models** will be formulated and validated.

PARITY will demonstrate all its results in four **demonstration sites** with varying characteristics in terms of climatic zones, proliferation of RES and demand device types, regulatory frameworks and market codes as well as culture and environmental consciousness. The sites are located in Spain, Greece, Sweden and Switzerland.

1.1 Scope and objectives of the deliverable

The overall aim of this report, is to introduce a set of business models (BMs) for the different stakeholders in the local market of PARITY. Starting from the market design in T4.3 and the initial business cases, the interactions between the market actors are analysed. A list of potential business models is derived from a literature review and an in-depth brainstorming process with the PARITY consortium members with their different backgrounds and perspectives. On the one hand, special attention is given to the flexibility needs of the DSO for congestion management and voltage control. On the other hand, the business models are designed to give new opportunities and benefits for active prosumers deploying flexible DERs and distributed generation (DG) units. An iterative and lean business modelling approach has been followed, culminating in an extended Business Model Canvas (BMC) analysis, considering aspects such as regulation, cost, revenues, key technologies, and customers. In this context, also possible pricing strategies are described, highlighting the actual options for prosumers.

1.2 Structure of the deliverable

After introducing the methodology applied in this task in chapter 2, chapter 3 gives a brief summary of the market design developed in T4.3. The next chapters describe the different stages of the process towards the development of the PARITY BMs:

- Chapter 4 describes the **initial business cases** derived from the project proposal and further clarified in T3.1.
- Chapter 5 analyses the **interactions between the stakeholders** in the PARITY market framework and gives a first idea of the **potential business opportunities**.
- Chapter 6 shows the results of the **literature review** as well as the **brainstorming** process among the PARITY partners and maps out certain clusters of potential business models.
- Chapter 7 **fully describes the selected business models** that are applicable in the PARITY market framework.
- Chapter 8 refines the most relevant of these BMs by conducting a **business model canvas analysis**
- Finally, chapter 9 gives conclusions about the PARITY BMs and highlights the next steps.

1.3 Relation to other tasks and deliverables

As shown in the PERT (Program Evaluation and Review Technique) diagram in Figure 1, the work of this task and this deliverable heavily builds on the PARITY market design developed in T4.3. The outcomes are relevant for the further work of the project as a whole, but in the next steps the results will be used in WP5. Specifically, T5.2 builds on selected BMs to further develop the PARITY market platform and in T5.4 the stakeholder interactions are further specified by developing smart contracts and service level agreements (SLAs).

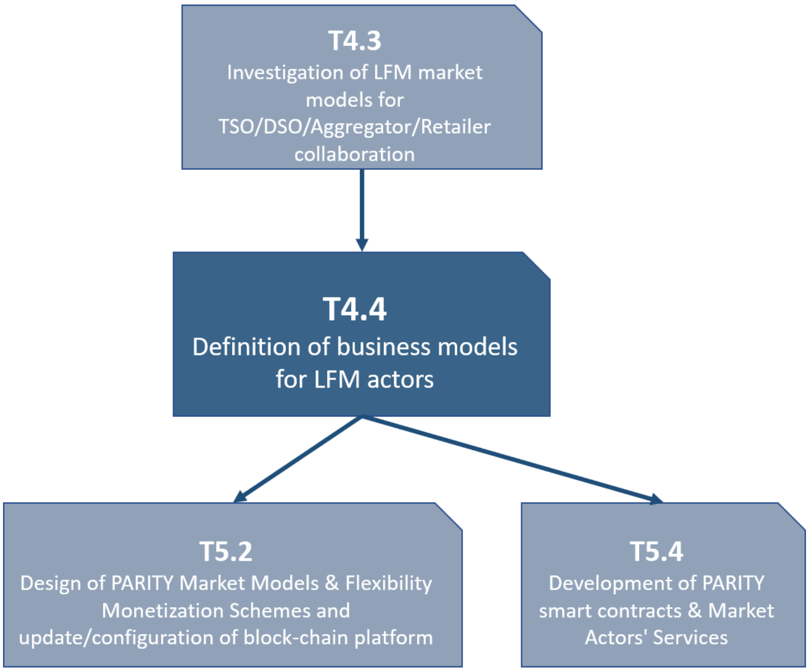

Figure 1. PERT diagram of T4.4.

2. Methodology

The overall methodology of this task follows a lean business modelling approach. For this report, each iterative loop in this process is documented in a dedicated chapter. Hence, the specificity and level of comprehensiveness of the BMs increases with each chapter.

Figure 2 shows the iteration loops (0-4) documented in this report.

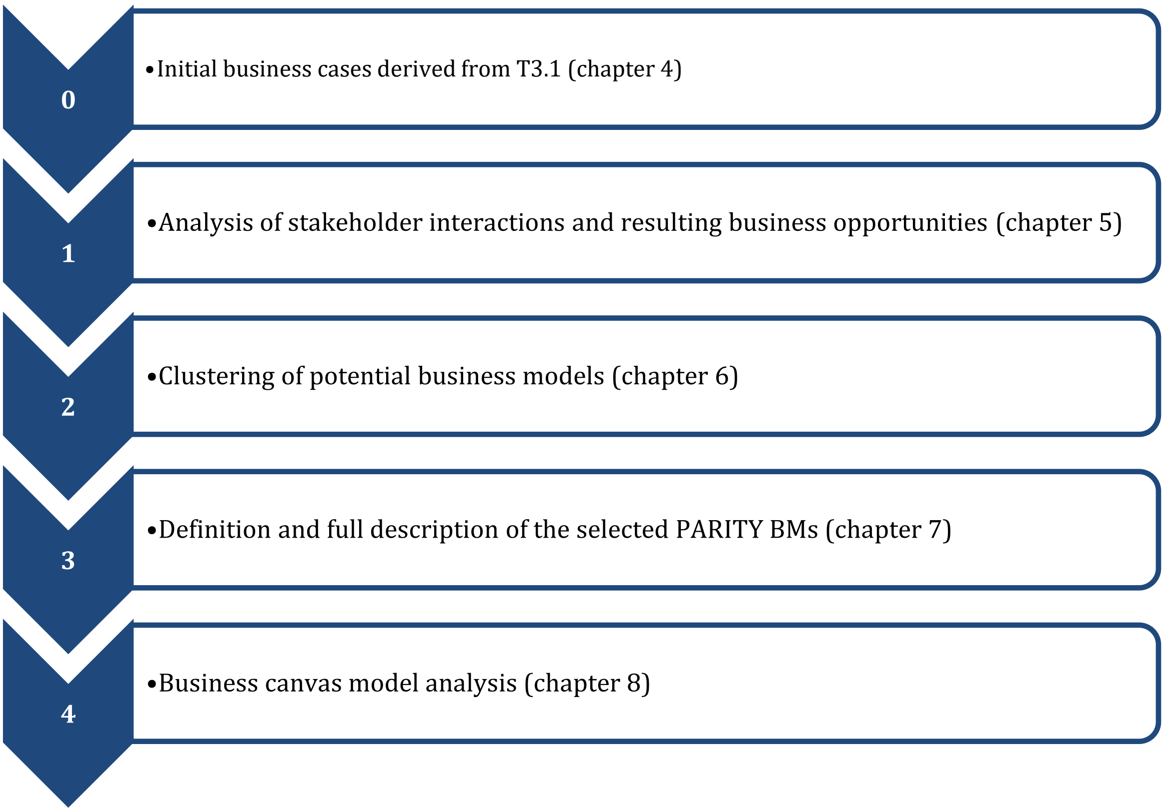

Figure 2. Overall methodology depicting the iteration loops.

The starting point (iteration 0) for the PARITY BMs is the description of the initial business cases in the project proposal, which have been further explained in T3.1. As a first iteration, the stakeholder interactions and potential business opportunities have been analysed, also with regard to the market design developed in T4.3. In the second step, these business opportunities have been further elaborated on through a brainstorming process and literature review, resulting in a mapping of potential business models for PARITY. Then, the most promising ones have been selected and a full description of these business models has been provided. As the last iteration loop in this task, a business model canvas analysis has been performed by receiving feedback from actual market participants (DSOs, suppliers, aggregators) that are part of the PARITY consortium.

3. PARITY Market Design

As introduced in D4.3 (Pressmair et al. 2020), the PARITY market framework consists of two novel markets: The Local Electricity Market (LEM) and the Local Flexibility Market (LFM).

The **LEM** is facilitating P2P trading among prosumers and the platform is operated by the Local Electricity Market Operator (LEMO), a private competitive entity.

The **LFM** has the purpose to activate flexibility for the DSO's needs. As a first option, it can be implemented as an explicit market with a dedicated market platform, that is operated by the Local Flexibility Market Operator (LFMO), a regulated entity. On this platform aggregators can offer flexibility services to the DSO only.

As a second option, the LFM can also be implicitly integrated in the LEM. This means, that there is no market platform for the LFM and hence no LFMO. However, for activating this implicit LFM, the DSO imposes locationally varying grid prices to the prosumers. Those can react to these price signals by adapting their load and/or generation profile and their trades on the LEM accordingly and as a result avoid grid constraint violations.

The PARITY market framework is governed by a Traffic Light Concept (TLC). This is a coordination mechanism, in which the DSO determines the current grid operation regime taking into account grid constraint violations. In the GREEN regime, no violations are forecasted and the DSO does not need any flexibility. Hence, the LEM is active as well as participation of the prosumers in ancillary services (AS) and wholesale (WS) markets through aggregators. In the YELLOW regime, constraint violations are identified in the forecast and the LFM is activated. In case of an explicit LFM, the dedicated market platform is opened and all other market activities (LEM, AS/WS participation) are paused. In an implicit LFM, those market activities continue, but the DSO imposes the locationally varying grid prices. In case an implicit LFM is implemented, a smooth transition between the GREEN and YELLOW regime can be facilitated by already imposing price signals from the DSO in the GREEN regime Finally, in RED (highly critical violations are detected) and BLACK (partial or full outage) grid operation regime, the DSO takes over control and all market activities are stopped.

Figure 3 shows the PARITY market role model, mapping all the roles involved and their interactions.

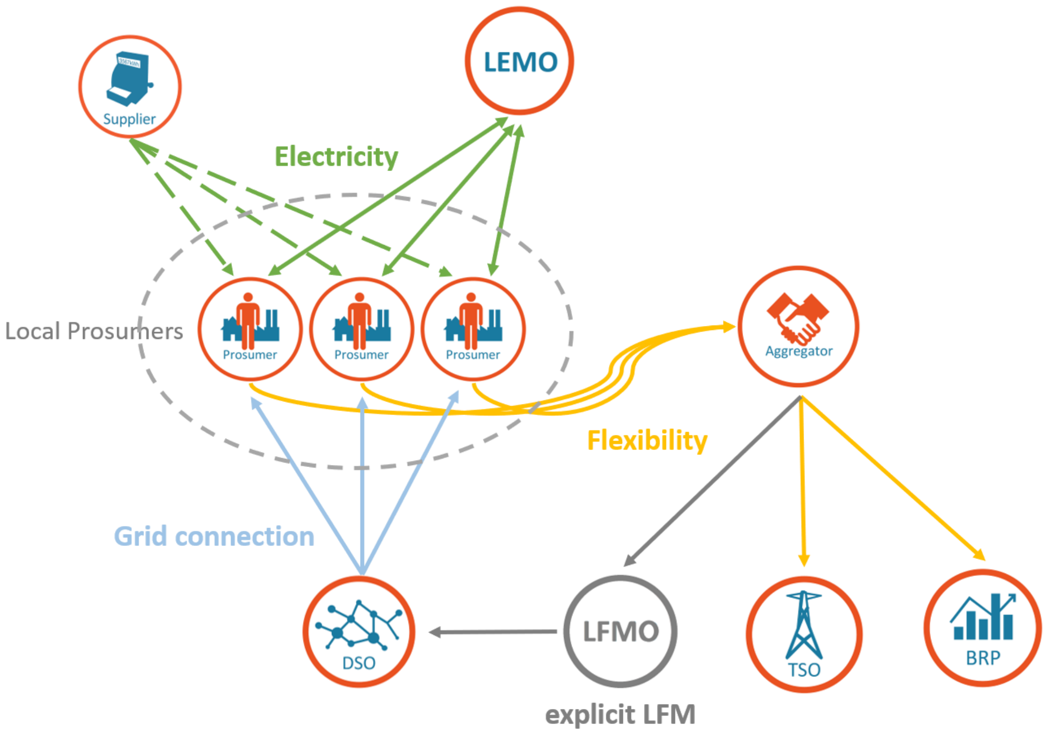

Figure 3. PARITY market role model.

4. Initial PARITY Business Cases

In this chapter, the initial PARITY Business Cases (BC) are retrieved from D3.1 (Fernández Aznar et al. 2020) and slightly adapted in order to bring it in line with the PARITY market design developed in D4.3 (Pressmair et al. 2020).

Latter introduces a Traffic Light Concept (TLC) specifically for PARITY that determines which market operations are active in which grid operation regime. The active grid operation regime is determined by the DSO. According to that the four initial BCs are also applicable only in specific grid regimes as stated in Table 1.

Table 1. Initial PARITY Business Cases and their applicability in the different grid operation regimes of the TLC.

Business Case #	Main role	Applicable in grid operation regime	
		LFM explicit	LFM implicit
1	Aggregator	GREEN	GREEN & YELLOW
2	Supplier	GREEN	GREEN & YELLOW
3	DSO	YELLOW	YELLOW
4	DSO	RED	RED

In the following sections each of the Initial Business Cases are described in detail.

4.1 Business Case 1: Aggregator

Initial description: Aggregator as an active player in the LFM and national energy/ancillary services markets (including optimal trading of flexibility under control across available markets for revenue maximization and adequate liquidity safeguard)

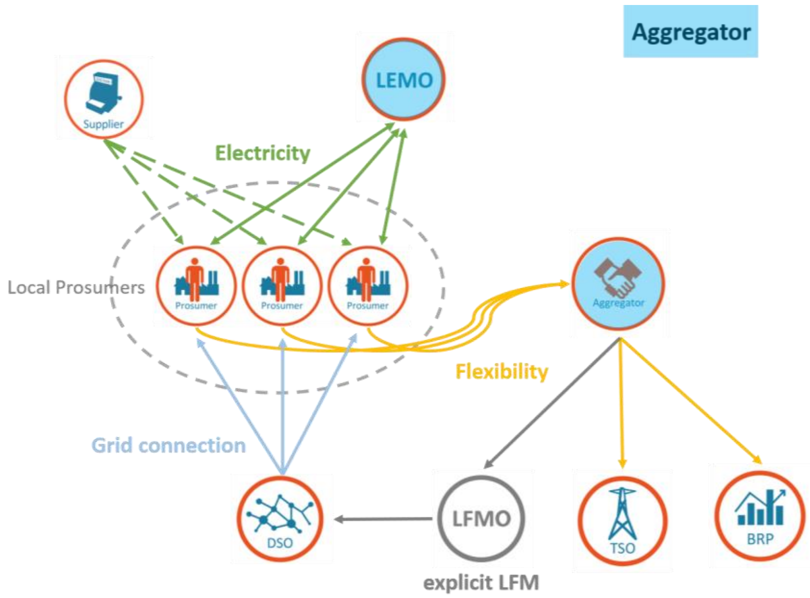

Figure 4. Schematic of BC1.

Applicable in grid regime:

LFM explicit:

- GREEN

LFM implicit:

- GREEN
- YELLOW

Roles assumed by the aggregator:

- Aggregator
- (LEMO)

The first element of this BC is the **typical business model of a DR aggregator**. Here, the aggregator controls devices at the prosumers' premises that have a relevant potential for load shifting. The aggregator then offers the aggregated loads at various flexibility markets to flexibility requesting parties (in this case towards TSO on the balancing market or towards BRPs on the wholesale market). In return the prosumers will get a financial remuneration from the aggregator for providing their flexibility. By applying this explicit DR model, the aggregator is linking the local prosumers to wholesale and ancillary services markets.

The second element is **the aggregator assuming the role of the LEMO, facilitating peer-to-peer trading** among prosumers. In this case, the aggregator would provide the necessary peer-to-peer trading platform and therefore clear and settle the LEM. Depending on the specific pricing model, the aggregator is incurring a fee for this service. However, this element can be considered as optional in this BC as it may not be feasible under the current regulatory framework.

Generally, these **two elements may compete with each other**. The aggregator's mission is to maximise its profit and therefore the profit for the prosumers. This means that the aggregator will either prefer to offer bids of bundled flexibility on the ancillary services (AS) and wholesale (WS) markets or try to self-balance the local community via peer-to-peer trading. However, the electricity supplied from local peers may be subject to a reduced grid tariff where only charges for the local grid apply. If this results in a significant reduction of the grid costs for the prosumers, **it is expected, that the first priority will be self-balancing of the local community**. In this case only the residual flexibility will be offered at the balancing/wholesale market.

This BC deals with the LEM and participation in the balancing and wholesale markets. As a result, if the LFM is designed as an **explicit** market this BC is applicable only in the **green grid regime**, whereas if the LFM is **implicitly** included in the LEM, it is applicable in **green and yellow grid regime**.

4.2 Business Case 2: Supplier

Initial description: Energy Retailer as a P2P flexibility trading facilitator (including flexibility, day-ahead, intraday, balancing & ancillary market trading optimisation)

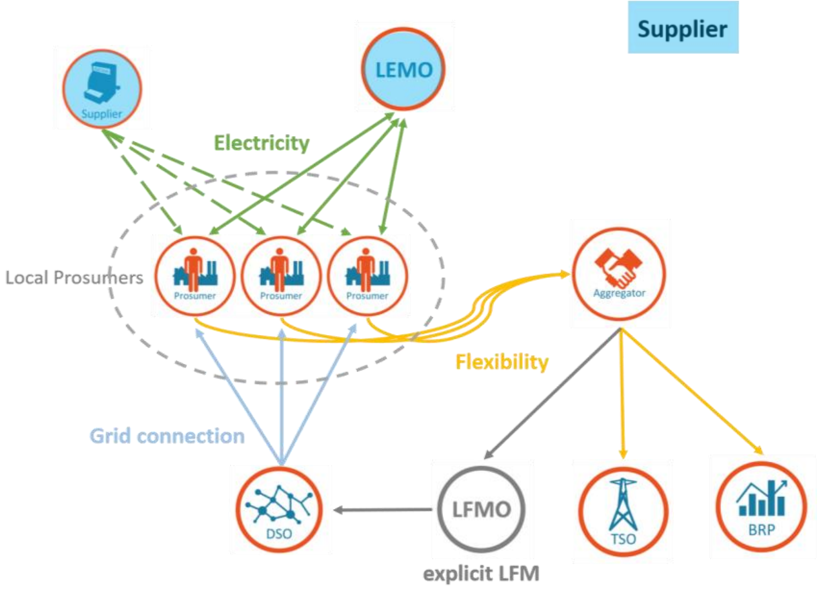

Figure 5. Schematic of BC2.

Applicable in grid regime:		**Roles assumed by the supplier:**
LFM explicit:	*LFM implicit:*	❖ LEMO ❖ Supplier
❖ GREEN	❖ GREEN ❖ YELLOW	

In the second BC, an **energy supplier assumes the role of the Local Electricity Market Operator (LEMO)**, providing the peer-to-peer trading platform. Here, the core business of a supplier – electricity supply to the prosumers – is combined with facilitating peer-to-peer trade between local prosumers. In this context, it needs to be considered, that prosumers have the right to choose their electricity supplier independently. This means prosumers do not necessarily need to have a supply contract with the supplier operating the LEM.

Taking this into account, there **are two possible business strategies for a supplier** in this BC:

1) The supplier taking the role of the LEMO requires LEM members to subscribe to one of its supply tariffs as a condition for LEM participation.
2) Prosumers may switch their supplier at any time and still participate in the LEM. In this case a specific fee towards the LEMO applies. By offering attractive tariffs specifically for LEM members, the supplier assuming the role of the LEMO tries to retain the prosumers. Note, that this option is not feasible under the current regulatory framework.

If the LFM is designed as an **explicit** market this BC is applicable only in the **green grid regime**, whereas if the LFM is **implicitly** included in the LEM, it is applicable in **green and yellow grid regime**.

4.3 Business Case 3: DSO as LFM operator

Initial description: DSO as a market coordinator (the trusted party capable to operate an LFM to ensure independence and fairness to all involved market actors)

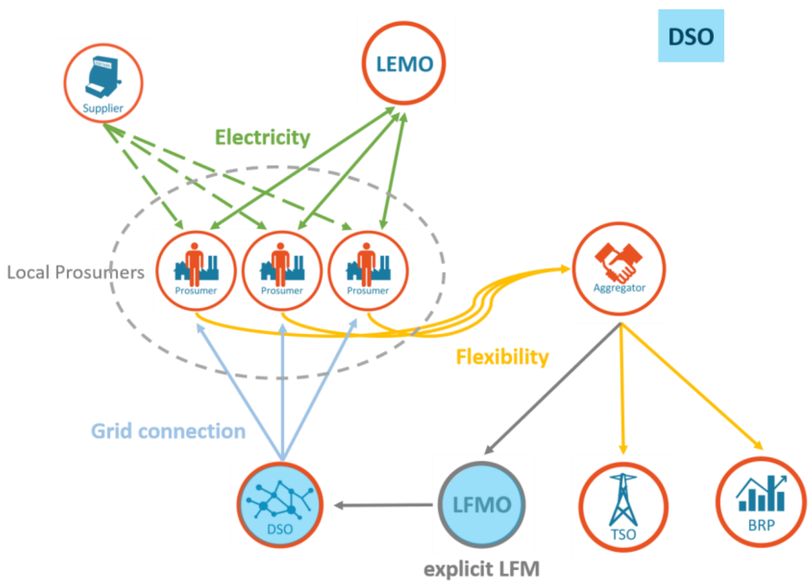

Figure 6. Schematic of BC3.

Applicable in grid regime:		**Roles assumed by the DSO:**
LFM explicit:	*LFM implicit:*	❖ LFMO ❖ DSO
❖ YELLOW	❖ YELLOW	

This BC deals with the operation of the LFM and therefore it is only applicable in **yellow grid regime**. The activities in this BC depend on the design of the **LFM either as an explicit or implicit market**.

In case the LFM is an **explicit** market, the **DSO assumes the role of the Local Flexibility Market Operator (LFMO)**. The DSO provides the market platform for the LFM and in this way **procures flexibility for performing voltage control and congestion management**. By doing so, the DSO needs to ensure fairness among all market participants. Regulation has to make sure, that in this role, the DSO is not using its monopsony position (as a single buyer on the LFM) to keep prices down.

In case the LFM is **implicitly** included in the LEM, there is **no such role of an LFMO**. However, the DSO is in charge of **determining and incurring the locally varying grid prices** in yellow grid regime. By doing so, the DSO is forecasting potential constraints in the distribution grid (by applying smart grid monitoring tools) and calculating the grid prices according to the constraints detected (by applying an optimization algorithm).

4.4 Business Case 4: DSO as DER enhanced network operator

Initial description: DSO as a DER enhanced network operator (including the use of novel smart grid management tools and infrastructure that enable more cost-efficient ways to ensure power quality and grid stability in the distribution grid and consideration of flexibility as an alternative to network upgrades).

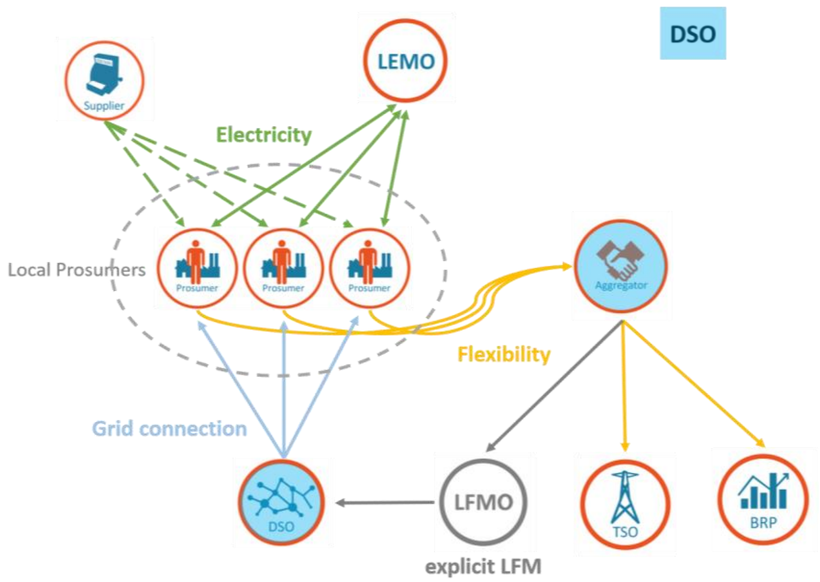

Figure 7. Schematic of BC4.

Applicable in grid regime:		Roles assumed by the DSO:
LFM explicit:	*LFM implicit:*	❖ DSO ❖ Aggregator (for enforcing direct load control)
❖ RED	❖ RED	

In this BC, the **DSO is actively controlling the loads** at prosumers' premises in order to gain flexibility for the distribution grid and **solve critical grid constraints** severely endangering grid stability. This means, in order to fulfil the DSO's core competency (operating the distribution grid and guaranteeing grid stability), it is acting as an aggregator solely for meeting the flexibility needs of the distribution grid. By doing so the DSO can override existing contracts of the free market. This direct load control can be executed via the aggregators' or the DSO's own infrastructure. A remuneration for the affected prosumers (and also the aggregators if their infrastructure is used) needs to be agreed on prior to establishing the bilateral agreement.

As this BC overrules all market-based contracts, it is only applicable in **red grid regime**.

5. Market Integration and Stakeholder Interactions

This chapter describes in an analytical way the possible business opportunities emerging for the different actors in the local market described in PARITY. The aim is to show how the LEM activities and the LFM activities can be interconnected and also linked to the existing wholesale markets and ancillary services markets. In this context, the idea is to **convert all flexibility needs into price signals** that can be communicated to the agent[1] of each prosumer. The agents then can react to these price signals and adapt the prosumer's load/generation profile accordingly by using flexible DERs.

5.1 Linking LFM and LEM

As introduced in D4.3 (Pressmair et al. 2020), the PARITY local market framework consists of an LEM, facilitating P2P trade among prosumers and also an LFM for activating flexibility for the DSO. Latter can be either designed as an **explicit market place**, where the DSO can buy flexibility, or it can be **implicitly integrated into the LEM**, where the DSO activates flexibility by introducing price signals reflecting its flexibility needs. As a result, the design of the LFM heavily affects the business opportunities for the LEMO, who is operating the LEM (facilitating P2P trading) and all the other roles.

Implicit LFM

In case an implicit LFM is implemented, the price signals reflecting the grid regime are calculated by the DSO on a regulated basis. The DSO also imposes these price signals directly on the prosumers as a part of the grid tariff. From a regulatory perspective, the regulator needs to grant the DSO the right to impose spatio-temporally varying grid tariffs. In this scenario, the LEMO is not aiming at activating flexibility for the DSO. The LEMO just facilitates P2P trading and the prices on the LEM platform reflect demand and supply between local prosumers. However, the prices on the LEM are also indirectly affected by the price signals coming from the DSO, because they need to be added to each P2P trade and paid by the prosumers to the DSO as a grid tariff.

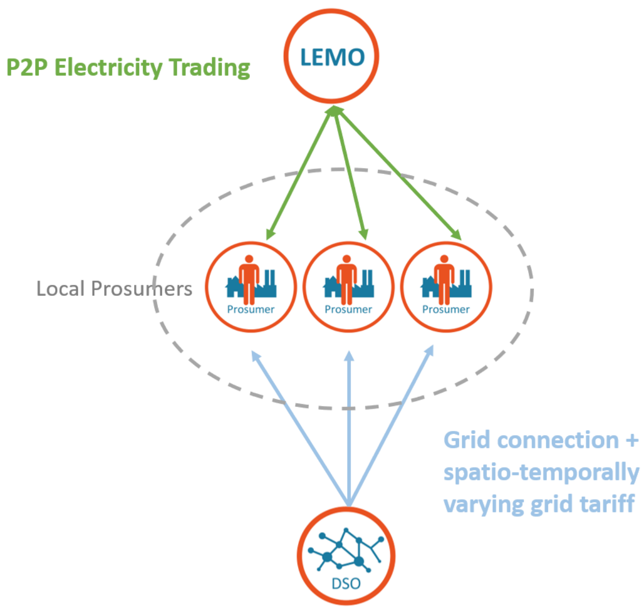

Figure 8. Schematic of the implicit LFM.

[1] In the PARITY architecture, „agents" are the blockchain actors that communicate with and control flexible DERs at prosumers' premises.

Explicit LFM

If the LFM is designed as an explicit marketplace (e.g., operated by the DSO or another regulated third party), the LEMO establishes a **pseudo-implicit LFM** within its LEM. This means, that the LEMO sells flexibility via a BRP to the DSO on the LFM, just like an aggregator. But for activating this flexibility, the LEMO additionally charges a varying fee for each LEM trade, introducing a price signal on the LEM so prosumers react by deploying their flexible assets according to the DSO needs. In contrast to the implicit LFM described above (where the DSO creates the price signal), in the pseudo-implicit LFM the LEMO creates the price signal and is then remunerated by the DSO through a transaction on the explicit LFM. Other than the DSO, the LEMO is not a regulated entity and therefore can freely design its pricing scheme[2]. This could be beneficial in order to achieve high local granularity for solving grid constraint violations.

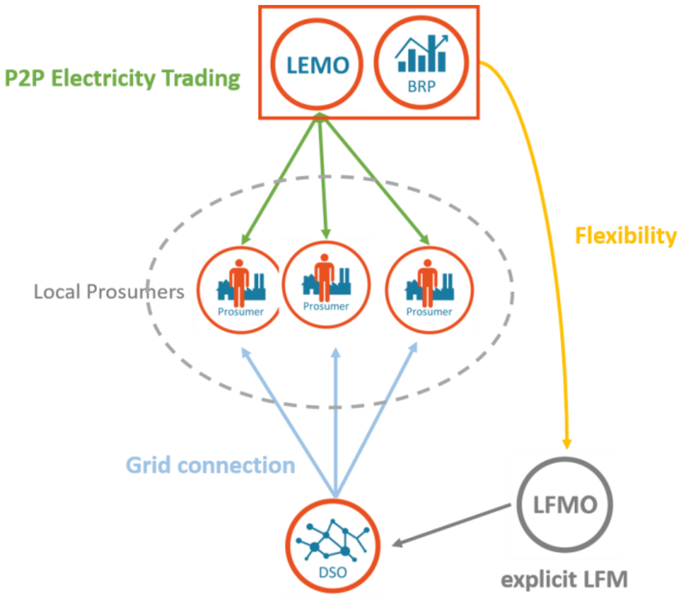

Figure 9. Schematic of the pseudo-implicit LFM.

5.2 Linking LEM/LFM with existing markets

5.2.1 Linking with the wholesale market via the supplier

The first and most obvious link between a prosumer and the wholesale market is established through the prosumer's supplier. The prices on the LEM are influenced by the pricing scheme of each prosumer's supplier and therefore by the prices on the wholesale market. That's because suppliers can source electricity via their BRP from the wholesale market. The price signals coming from the supplier need to be processed by the agents and taken into account for the load shifting strategy of the prosumer's DERs.

Note, that depending on the business model, the role of the supplier for all prosumers in the LEM can also be assumed by the LEMO itself.

[2] cf. Article 5 of the Directive (EU) 2019/944 of the European Parliament and of the Council of 5 June 2019 on common rules for the internal market for electricity

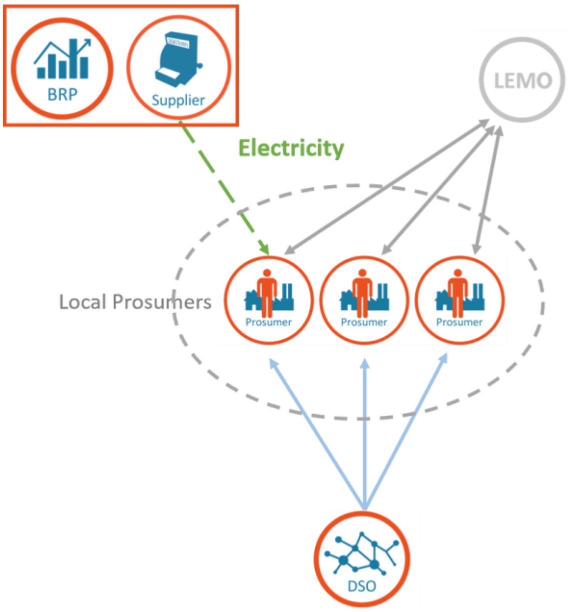

Figure 10. Schematic of linking LEM with wholesale market via supplier.

5.2.2 Linking with the wholesale market via the aggregator

In PARITY, the aggregator is the party that can sell flexibility to all BRPs on the wholesale market (via spot market or over-the-counter). These trades are conducted by a BRP associated with the aggregator. The aggregator aggregates flexibility directly from the LEMO amongst other sources of DSF. As described above, the LEMO activates flexibility at the prosumers not through direct DR dispatches but in a transactive way through P2P trading. In order to facilitate that, the flexibility requests from the aggregator will be translated in price signals by the LEMO. The LEMO then includes these signals in the LEM prices, incentivising load shifting. The prosumers' flexibility managers optimise the load profile accordingly (by controlling DERs) in order to minimise costs.

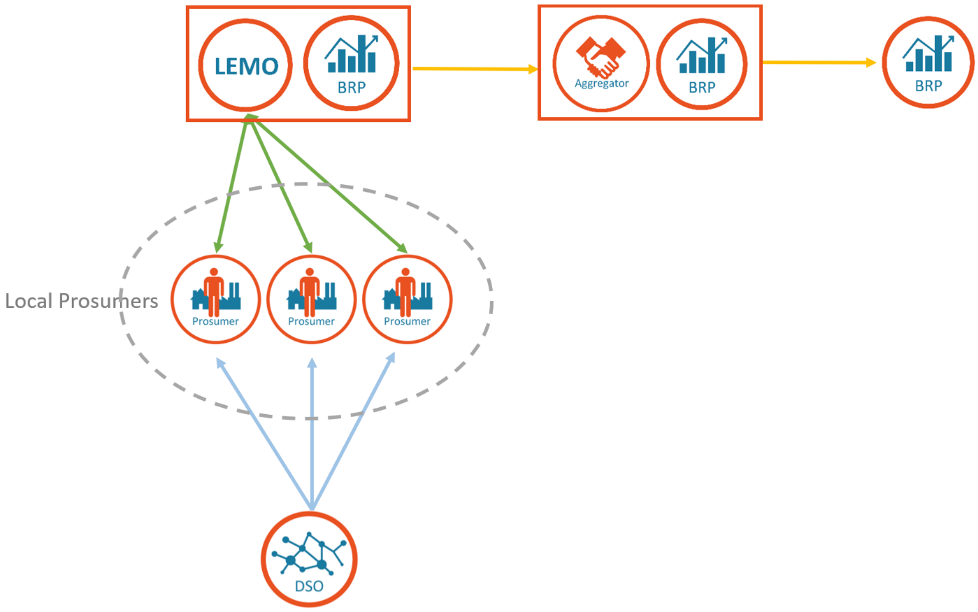

Figure 11. Schematic of linking LEM with wholesale market via aggregator.

5.2.3 Linking with the ancillary services market

Similarly, the aggregator could sell flexibility to the TSO for the provision of ancillary services.

The most important ancillary service market is the balancing market. However, as offers on the balancing market (e.g., aFRR or mFRR) are characterised by reservation of the flexibility potential and actual dispatch of flexibility, the agents additionally need to be able to process not only price signals, but command signals in parallel. Another option for the aggregator is to participate in congestion management at TSO level ("redispatch"). This could be facilitated by adapting the price signals in the whole LEM during a congestion management-related flexibility request.

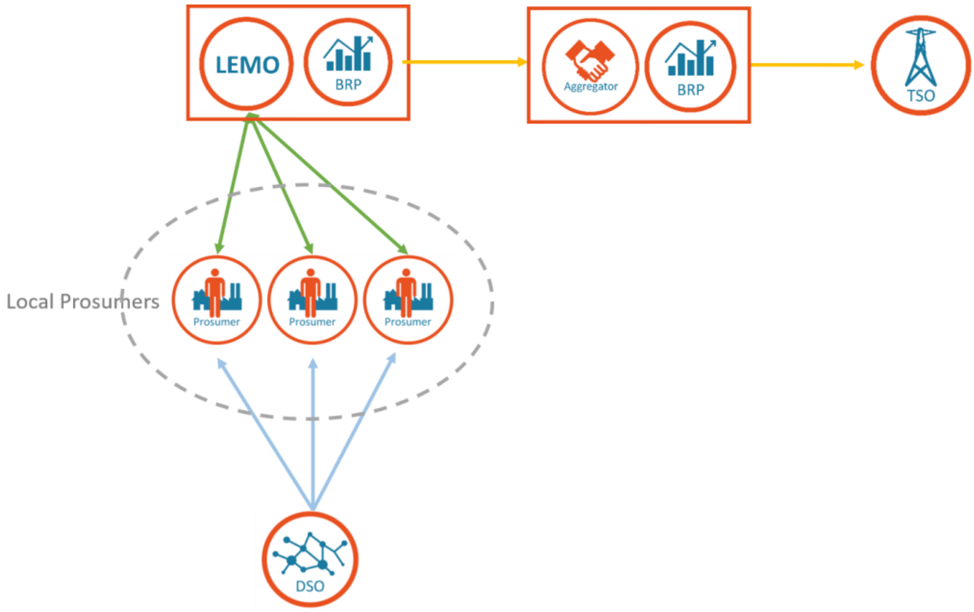

Figure 12. Schematic of linking LEM with ancillary services market at TSO level.

6. Clustering Potential Business Models

Starting from the initial PARITY Business Cases (chapter 4) and the business opportunities in the integrated market design (chapter 5), a brainstorming process was started to identify potential business models that could be applicable and promising in the market framework of PARITY. This chapter gives an overview of the results of this process, by clustering the ideas in generic BMs. Ideas have been collected through the following approaches:

- Review of scientific literature in the field of LFMs and LEMs.
- Review of proposed BMs from related research and pilot projects.
- Review of already existing BMs applied by innovative enterprises.
- Collecting BM ideas from PARITY consortium partners that are active players in the energy system. The BM templates with their original ideas are attached in Annex B.

The initial BC1 describes the potential role of an aggregator in the PARITY local market. The **typical independent aggregator BM**, not necessarily linked to any local market, is widely proposed in the literature and guidelines in the field of Demand Response (DR). ENTSO-E (2015) introduces business models for independent aggregators, meaning that the provision of DR is dissociated with the service of energy supply and provided by a different entity. Also, in USEF (De Heer and Van der Laan 2017), such models are elaborated with an in-depth consideration of the contractual relationship between the aggregator and the supplier and its associated BRP. Moreover, this BM is referenced to in many DR related research projects, for instance in the DELTA project (Leutgöb et al. 2019). In the consortium brainstorming process on BM ideas in PARITY, the independent aggregator model was raised several times, as a model for an *(3) Aggregator enabling participation of prosumers in balancing/wholesale market*, similarly for *(2) Participation in Ancillary services market for frequency support* and more specific as *(4) Electric Vehicle (EV) participation in flexibility mechanisms*.

This **aggregator** model can also be **integrated with the service of electricity supply**, meaning that a supplier offers the aggregation service to its prosumers. This option comprises less complexity as there is no need for compensation between BRPs. This is also considered by ENTSO-E (2015) and in several DR research projects, e.g., in DELTA (Leutgöb et al. 2019). PARITY partners conceptualised this idea as a model for an *(1) Aggregator enabling participation of prosumers (not locally attached) in balancing market through retailer and BRP*, where the aggregator is subcontracted by the supplier to provide its aggregation services to supplier's prosumers.

The so-called "**dual service**" combines the aggregator model with the services of an ESCo providing energy efficiency contracting. This BM is closely examined in the NOVICE project, which is dedicated to the dual service (Energati 2018). PARITY consortium partners raised the idea of *(6) Heating/Cooling as a service for providing grid management services* which is closely related to this BM and proposes an aggregator in charge of flexibility exploitation and obliged to energy efficient operation of the prosumer's assets (Annex B). Specht and Madlener (2019) sketched the BM of an "Energy Supplier 2.0" that integrates this dual service into a traditional supplier BM.

An aggregator BM more specific to the PARITY local market approach is the notion of a **Local Aggregator**. Lynch et al. (2016) propose the role of a Local Flexibility Aggregator that ensures that flexibility is firstly used for in-home optimisation, secondly for local level trading and thirdly sold to a Wholesale Market Aggregator. The INVADE project similarly follows an ecosystem approach for their BMs (Wåge, Bremdal and Crawford 2018; Wåge et al. 2018). They introduce a Local Flexibility Operator providing a channel to the prosumers and creating synergies with a Global Flexibility Operator by sharing resources and expertise.

Another branch of business models is focussing on creating value through the exploitation of **implicit DR**, meaning the shifting of loads to enable prosumers to react to price signals from the supply or grid price. In this context, USEF (2015) finds business opportunities for Energy Service Companies (ESCos). USEF defines an ESCo as a provider of auxiliary energy-related services for prosumers, including energy optimisation for increasing the benefit of prosumers from dynamic energy tariffs. However, in the domain of energy efficiency contracting "ESCo" is already well defined as a provider of contracting projects and therefore the term might be ambiguous (section 7.2). The DELTA project (Leutgöb et al.

2019) therefore proposes the term Flexibility Service Company (**FLESCo**) for this kind of service provider. Similar ideas for BMs specifically making use of the dynamic grid prices in PARITY, the consortium partners have proposed an *(5) ESCO providing building-level energy optimization services to minimize costs induced through an indirect LFM/highly dynamic price model* as well as (*4) Electric Vehicle (EV) participation in flexibility mechanisms* (in this case through implicit DR).

An alternative of this BM would be the actual combination of a **FLESCo and an ESCo** (in the sense of energy efficiency contracting). In such a BM a service provider is responsible for both optimisation of energy efficiency and flexibility with the aim to find an optimal trade-off in order to maximise profit for the prosumer. This notion has been considered by the PARITY partners who propose a BM for *(6) Heating/Cooling as a service for providing grid management services*, which includes a trade of between optimisation of a time-of-use tariff and energy efficiency and a BM for *(7) Self-optimization for electricity cost reduction, sharing and self-consumption*, where the service provider also provides the equipment just like in contracting projects.

The initial BC3 of PARITY describes a **DSO assuming the role of the LFMO,** operating an own marketplace for procuring its flexibility needs. This concept has been further specified by the consortium partners towards a *(10) DSO acting as LFMO cooperating with the Aggregator*.

In contrast, the role of the **LFMO could also be assumed by an external party** that is not a market participant at the LFM, but regulated and supervised by a regulatory body. In Europe, there are already some initiatives in place testing an integration of the LFM into existing markets operated by external market operators. An example is “Enera”, where EPEX Spot, one of the two largest power exchanges in Europe is operating a platform for DSOs to procure flexibility. Similarly, “NODES” cooperates with the power exchange operator NordPool and “GOPACS” is backed by ETPA an independent power exchange based in Amsterdam. A third-party market operator is also established in “Piclo Flex” (cf. Schitekatte and Meeus 2020).

In initial BC4, the DSO acts as a DER enhanced network operator with the ability to **actively control loads at prosumers’ sites in emergency states (in RED grid operation regime)**. Olivella-Rosell et al. (2018), mention the idea that the DSO could use an aggregators infrastructure in order to enforce this load control. The PARITY partners put this together in the BM *(11) Aggregator in RED operation regime*, where an aggregator is contracted by the DSO to enforce load control on DSO’s requests in RED grid regime.

For setting up and operating the LEM, BC2 proposes a **supplier as P2P trading facilitator**. Considering the current regulatory framework in the EU, this is the only feasible model to implement an LEM. Assuming the role of a LEMO, a fully licenced supplier (attached to a BRP) provides a platform for P2P trading among its clients. This means, by sourcing electricity from prosumers and selling it to other prosumers, the supplier enables P2P trade. Trading could be carried out automatically in order to source the required electricity in a cost-efficient way, but the decisions for trading ultimately would be under control of the end-user. There are already some novel suppliers on the market applying such a BM, where prosumers can trade with each other but also obtain the residual electricity through the supplier (who sources it on the wholesale market). Examples are e-friends (e-friends 2020) in Austria or Powerpeers (Powerpeers 2020) in the Netherlands.

Merging BC1 and BC2, the aforementioned BM can be extended by **adding the service of optimal load shifting**. This means, the supplier not only acts as LEMO but also offers the service of an aggregator or FLESCo. Rocha, Villar and Bessa (2019) propose the BM of a supplier acting as aP2P market facilitator and also as an aggregator at the same time. The PARITY partners also raised the idea of a *(9) Supplier supplying energy and providing LEM platform contracted with aggregator*, meaning that the supplier cooperates with an aggregator for explicit flexibility provision.

Another related BM has been proposed by the PARITY partners for a *(8) Supplier leasing local battery storage capacity to prosumers*. In this BM a supplier additionally installs a local battery storage that can be used by the prosumers in order to increase their benefit from P2P trading. Such a BM is currently applied and tested in the research project “Blockchain Grid” in Austria (Energienetze Steiermark 2020).

Other than a LEM facilitating P2P transactions via an intermediary, also approaches with **direct P2P trade** can be considered. As mentioned by Rocha, Villar and Bessa (2019), the current regulatory framework makes such direct transactions between prosumers unfeasible. However, in the context of renewable **energy communities** this could be possible in the future, especially against the backdrop of the recast of the EU Renewable Energy Directive (2018). Article 2 (18) defines peer-to-peer trading as "the sale of renewable energy between market participants by means of a contract with pre-determined conditions governing the automated execution and settlement of the transaction, either directly between market participants or indirectly through a certified third-party market participant, such as an aggregator." It also states that "the right to conduct peer-to-peer trading shall be without prejudice to the rights and obligations of the parties involved as final customers, producers, suppliers or aggregator." Direct P2P trade would raise the discussion of coordination between Local and "Back-up" supply, as highlighted by CEER (2019). When engaging in P2P trade, a single prosumer could be supplied by various sources of supply: On the one hand a licensed supplier and on the other hand the community of peers. CEER points out that there are different possibilities of determining the balance responsibility in such a concept, but the exact options are still open for discussion.

If direct P2P trade is feasible, we need to consider also BMs particularly for an LEM in an energy community. In this case, the **energy community administration could act as a LEMO** facilitating direct P2P trade. Considering the initial BC1 in this context, we can also **add the aggregator** functionality to the role of the LEMO, similar to the aforementioned BMs.

Concluding this assessment of potential BMs in the PARITY market framework, Table 2 summarises the possible BMs discussed in this chapter by indicating the roles of the service provider in each BM.

For the further developing a set of PARITY BMs and the process of validating them, a first selection of the most relevant and most promising generic models has to be made. The **BM related to the RED grid operating regime will not be further examined**, as it is applicable only in a very specific and infrequent emergency situation in the grid that PARITY aims to prevent from happening. Based on the other models resulting from this brainstorming exercise, the actual PARITY BMs are developed and described in the next chapter.

Table 2. Summary of potential PARITY Business Models.

Generic BM	Specific BM	AGG	SUP	DSO	LEMO	LFMO	ESCo[3]	FLESCo	References
		Roles of the service provider							
Aggregator	Independent Aggregator	x							ENTSO-E (2015), USEF (De Heer and Van der Laan 2017), DELTA (Leutgöb et al. 2019), PARITY partner proposals (2), (3), (4), Initial BC1
	Supplier as Aggregator	x	x						ENTSO-E (2015), DELTA (Leutgöb et al. 2019), PARITY partner proposal (1), Initial BC1
	Aggregator dual service	x					x		NOVICE (Energati 2018), DELTA (Leutgöb et al. 2019), Specht and Madlener (2019) PARITY partner proposal (6), Initial BC1
	Local Aggregator	x							Lynch et al. (2016), INVADE (Wåge, Bremdal and Crawford 2018; Wåge et al. 2018), Initial BC1
ESCo	FLESCo							x	USEF (2015), DELTA (Leutgöb et al. 2019), partner proposals (5), (4)
	Contracting and FLESCo						x	x	Partner proposals (6)
LFMO	External LFMO					x			Enera, NODES, GOPACS, Piclo Flex (Schittekatte and Meeus 2020)
	DSO as LFMO			x		x			PARITY partner proposal (10), Initial BC3
RED regime	Aggregator in RED regime	x							Olivella-Rosell et al. (2018), initial BC3, partner proposal (11)
Supplier LEM	Supplier as LEMO		x		x				Initial BC2, e-friends, Powerpeers
	Supplier as LEMO + DR	x	x		x			x	Rocha, Villar and Bessa (2019), partner proposals (9), (8), Blockchain Grid (Energienetze Steiermark 2020)
Energy Community LEM	Energy Community as LEMO				x				Renewable Energy Directive (2018)
	Energy Community as LEMO + DR				x			x	Renewable Energy Directive (2018), initial BC1

[3] As a provider of energy contracting services (cf. section 7.2)

7. Definition of PARITY Business Models

Based on the business opportunities in the integrated PARITY market framework described above and the review of potential BMs, here a set of generic and more specified BMs for the actors involved in the PARITY local market framework will be identified.

Generic BMs can be understood as meta-models or ontologies for actual BMs. They represent an aggregation of possible BMs and consider the main components that constitute the business (Nielsen and Bukh 2011). This means, that they address the core concept of what value the business creates and at the same time gives room for adapting it to the specific strengths and weaknesses of the one implementing it as well as to its specific environment.

At first, generic BMs are discussed that are often proposed in the context of exploiting demand side flexibility (DSF). Those include Aggregator (section 7.1) and ESCo (section 7.2) BMs and are also applicable within the PARITY framework. Then, generic BMs for the market operator roles are described, which are particularly designed for their implementation in the local market structure of PARITY. Those include the BM of operating an LFM (section 7.3) and the BM of operating an LEM (section 7.4). Each of these generic PARITY BMs is detailed by several more specific sub-models and described using a BM template (cf. Annex A).

7.1 Aggregator Business Model

In PARITY, a general distinction between the business models of a high-level and a low-level aggregator is made. However, in both models, the aspect of balance responsibility needs to be considered and procedures for the imbalance settlement need to be defined accordingly.

7.1.1 Balance responsibility in aggregator business models

In electricity systems, generation and consumption need to be balanced at all times in order to maintain a stable frequency in the grid, which in Europe is 50 Hz. In theory, every party connected to the power grid is responsible for their individual balance position and hence must ensure that the exact amount of energy consumed/produced is sourced/supplied in the electricity system (USEF 2015). In order to guarantee this, each party connected to the grid has to be a member of a balance group (BG), which is represented by the Balance Responsible Party (BRP). The BG tries to minimise its internal imbalances. For the remaining imbalances either flexibility can be purchased or otherwise imbalance costs are incurred by the Imbalance Settlement Responsible (ISR). The ISR is a regulated authority that is in charge of settling the differences between contracted quantities and the actual delivered quantities of energy among the BRPs (ENTSO-E 2019). For distributing costs resulting from imbalances within the BG, there are individual agreements between BG members. Usually, the balance responsibility of prosumer’s is transferred to its supplier, which is contracting a BRP. Therefore, the BRP holds the imbalance risk for each prosumer in its portfolio (USEF 2015). For more details on the standard model of balance responsibility in Europe, one can refer to D4.3 of the PARITY project (Pressmair et al. 2020).

Considering this balance responsibility, there are three options how an aggregator business model can implement the imbalance settlement procedure. These options are described in the following paragraphs.

a) Integrated supplier and aggregator

In this option, energy supply and flexibility aggregation are facilitated by the same actor. This means, that the balance responsibility for both (supply and flexibility) remains with the same BRP. In this case, all prosumers that want to make use of their flexibility need to switch to a supplier offering such a service. USEF (2015) refers to this as the “USEF standard Aggregator model”, as it is the most straightforward and least complex model in terms of imbalance settlement.

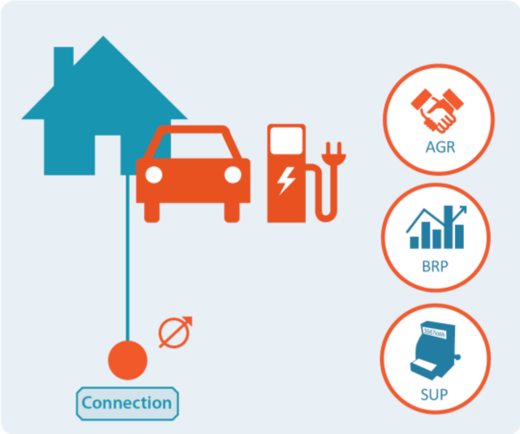

Figure 13. USEF standard aggregator model (USEF 2015).

b) Split supply

This model takes into account, that an aggregator might prefer to include only a single type of flexible device into its portfolio. For example, a manufacturer of wallboxes for EV charging might want to extract flexibility only from the EVs at the prosumers charging station and do not be responsible also for the other (uncontrollable) loads. USEF (2015) refers to this approach as the "USEF Virtual Transfer Points (VTP) model" (Figure 14).

In this model, separate metering (e.g., additional register in the electricity meter or separate reliable sub metering) is needed. The prosumer makes separate contracts with a "normal" supplier for the loads connected to VTP1 and an integrated supplier and aggregator (e.g., the wallbox manufacturer) at VTP2. In this way, nothing changes regarding the traditional BRP principle and the imbalance settlement, because the balance responsibility can be assigned according to the sub-meters to the different BRPs.

However, the aggregator also needs to take care of the energy supply for the loads of VTP2 (the charging station), not only the flexibility extraction. Also note, that in this model an additional grid connection point would need to be registered at the DSO.

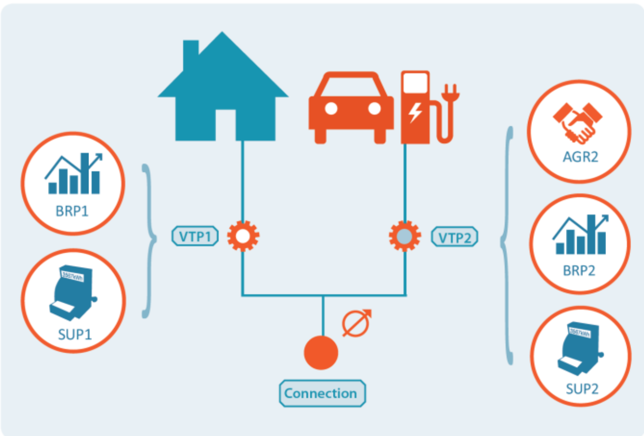

Figure 14. USEF virtual transfer point model (USEF 2015).

c) Independent aggregator

Finally, in this model flexibility extraction is fully separated from energy supply. USEF (2015) refers to this as the flex-only balance responsibility model ("Flex-BR model"). Here, an independent aggregator that is not associated with the "normal" supplier/BRP of the prosumer is shifting loads at the prosumer's assets to activate flexibility for its flexibility pool (Figure 15).

However, this means that the BRP associated with the aggregator needs to compensate the BRP of the supplier for any imbalances caused. To separate the activated flexibility from the remaining load, a baseline needs to be defined that evaluates what would have been the consumption/generation without load shifting intervention. In this way, the impact on the balance position of both BRPs is determined. In order to avoid conflicts, USEF proposes an independent third party to set this baseline.

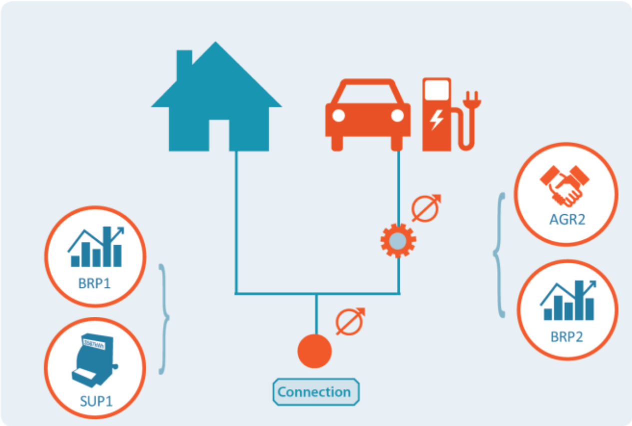

Figure 15. USEF flex-only balance responsibility model (USEF 2015).

7.1.2 High-level aggregator

In PARITY, the purpose of the high-level aggregator is to provide a link between the LEM and the wholesale market or specific ancillary service markets at TSO level. This means that the high-level aggregator is actively trading on the WS/AS markets and buys flexibility via explicit requests from the LEMO (cf. section 5.2.2 and 5.2.3).

Table 3 structures and further explains this BM according to the business model template introduced earlier.

Table 3. Business model template for the high-level aggregator BM.

#	BM Element	Description
1	Service Provider	Aggregator, actively trading in WS/AS markets
2	Customers	Aggregating flexibility from: LEMOs, (also big prosumers and other aggregators which are not involved in an LEM) Selling flexibility to: Flexibility Requesting Parties at the WS and AS market: BRPs, TSO
3	Problem	Prosumers in the LEM want to maximise the benefit from their flexible assets and therefore want to participate in WS/AS markets. Hence, the LEMO is interested in linking the LEM with WS/AS markets, but cannot do this on its own due to its limited pool of flexibility.
4	Service	The aggregator integrates the LEM into its pool of flexibility providers. The aggregator sends explicit flexibility requests to the LEMO and in return remunerates the LEMO for the flexibility provision.

5	Value Proposition	Additional revenues for the LEMO and as a result more attractive prices for the prosumers in the LEM.
6	USP	This BM enables prosumers in the LEM to indirectly participate in the WS/AS markets.
7	Resources	Market access to all relevant WS/AS markets M&V procedures to verify flexibility activation in the LEMs
8	Revenue Model	Revenues for selling explicit flexibility on WS/AS markets
9	References	ENTSO-E (2015), USEF (De Heer and Van der Laan 2017), DELTA (Leutgöb et al. 2019), PARITY partner proposals (1), (2), (3), Initial BC1 “Wholesale Market Aggregator”: Lynch et al. (2016), INVADE (Wåge, Bremdal and Crawford 2018; Wåge et al. 2018)

7.1.3 Low-level aggregator

The concept of the low-level aggregator follows the idea, that the aggregator is aggregating several local prosumers (which are not participating in the LEM on their own) and participates on in the LEM as a big prosumer agent on their behalf. This BM takes up the idea of the “Local Aggregator” introduced in chapter 6.

Table 4 shows the according BM template for the low-level aggregator business model.

Table 4. Business model template for the low-level aggregator BM.

#	BM Element	Description
1	Service Provider	Aggregator, not actively trading in WS/AS markets This role could be assumed also by equipment manufacturers, facility managers etc.
2	Customers	Aggregating energy from: Individual prosumers Selling energy to: Peers in the LEM
3	Problem	Small individual prosumers want to participate in the LEM with only some specific flexible assets (e.g., EV) Actors like equipment manufacturers want to participate in the LEM with their pool of flexible assets they have access to and therefore act as a low-level aggregator in this BM.
4	Service	The aggregator bundles the selected assets (in terms of technical communication and remote control) and participates on the LEM with this pool.

5	Value Proposition	Individual prosumers gain financial benefit for granting access to the flexibility potential of selected assets.
6	USP	Prosumers can participate in the LEM with individual assets without having any effort for market entrance and participation. Specific assets with a suitable flexibility potential enter the market opening up trading opportunities for the peers in the LEM.
7	Resources	Capability of communication and remote control of selected assets Interface for LEM participation
8	Revenue Model	Cost reduction and additional revenues through optimal trading on the LEM
9	References	ENTSO-E (2015), USEF (De Heer and Van der Laan 2017), DELTA (Leutgöb et al. 2019), PARITY partner proposals (4) "Local Aggregator": Lynch et al. (2016), INVADE (Wåge, Bremdal and Crawford 2018; Wåge et al. 2018)

7.1.4 PARITY aggregator business model options

Summarising the sections above, following options to implement the aggregator business model are identified:

- Low-level aggregator
    1) Low-level integrated supplier and aggregator
    2) Low-level split supply
    3) Low-level independent aggregator
- High-level aggregator
    4) High-level integrated supplier and aggregator
    5) High-level split supply
    6) High-level independent aggregator

However, the matrix in Table 5 indicates, that not all options are equally well suited for practical implementation. For the low-level aggregator, either the integrated supplier and aggregator or the split supply model are preferred. Low level-aggregators could be equipment manufacturers, energy suppliers or charging point operators, for instance. Hence, an independent aggregator model would not be necessary (as there might already be a supply contract) and too complex for managing small loads. The opposite applies for the high-level-aggregator. In order to create very large portfolio of small distributed loads and generators, it might be difficult to unite them under the umbrella of one BRP (which would mean that all prosumers need to have a supply contract with suppliers from the same balance group). Hence, the preferred option is the independent aggregator model.

Table 5. PARITY aggregator business model options.

	Integrated supplier and aggregator	Split supply	Independent aggregator
Low-level aggregator	**Feasible** option	**Feasible** option	**Not suitable**, too complex
High-level aggregator	Practically **not feasible**	**Difficult** to implement	**Preferred** option

7.2 ESCo Business Model

7.2.1 Terminology: ESCo vs. FLESCo

In the literature, there are different definitions for the term "**Energy Service Company (ESCO)**". According to USEF (2015), an ESCo can provide all kind of auxiliary energy-related services to prosumers. USEF highlights energy optimisation behind the meter as an important ESCo service.

In contrast to this **flexibility-centric definition**, a more **energy efficiency-centric definition** has emerged in the domain of Energy Performance and Supply Contracting. In that context, an ESCo always accepts some degree of risk for energy efficiency improvements (JRC 2016). According to Bertoldi et al. (2003), the remuneration of an ESCo is directly tied to the energy savings achieved. Some ESCOs also take care of financing such projects, recovering their investment cost from the resulting savings. Typical characteristics of an ESCO project include for example:

- Identification of possible energy saving and efficiency improving actions;
- Comprehensive engineering and project design and specifications;
- Guarantee of the results by proper contract clauses;
- Procurement and installation of equipment;
- Project management and commissioning;
- Facility and equipment operation & maintenance for the contract period
- Project financing

As this energy efficiency-centric definition is well defined and partly contradicts the flexibility-centric definition of USEF, Leutgöb et al. (2019) introduced the role of a **Flexibility Service Company (FLESCo)**, which is a service provider offering specifically flexibility services (load shifting) behind the meter. Compared to an ESCo, a FLESCo also does not necessarily need to take a risk for achieving any cost savings.

In the following business models, the term FLESCo is used for referring to the service of load shifting behind the meter, whereas the term ESCo indicates that the service provider takes some degree of risk for the cost savings achieved.

7.2.2 FLESCo Business Model

In the FLESCo BM, the service provider offers the service of load shifting behind the meter as a standalone service. This means, that a prosumer hires a FLESCo to shift loads or generation patterns of the prosumer's flexible DERs. By doing so, the FLESCo achieves cost savings for the prosumer who is subject to a dynamic supply pricing scheme (from the energy supplier) and/or a dynamic grid tariff (from the DSO in an implicit LFM).

A FLESCo as a standalone service provider might be a rather theoretical concept. In practice, the FLESCo service could be provided as an add-on service to already existing services, such as:

- Equipment provision (e.g., a heat pump manufacturer shifting loads at the heat pump)
- Facility management (e.g., shifting loads for the whole facility through a BEMS)

In the context of PARITY, the FLESCo service could be also part of the LEMO's value proposition (cf. section 8.2.2 and 8.2.4).

Table 6 describes standalone FLESCo BM by using the BM template.

Table 6. Business model template for the FLESCo BM.

#	BM Element	Description
1	Service Provider	FLESCo This role could be assumed also by equipment manufacturers, facility managers etc.
2	Customers	Prosumers
3	Problem	Prosumers are subject to price signals (dynamic supply pricing scheme, dynamic grid tariffs), but it is difficult for them to optimally react to these signals and maximise their benefit.
4	Service	The FLESCo provides tools for shifting loads automatically from a high-price period to a low-price period (or vice versa for flexible generation assets). Also, the FLESCo considers the value of self-consumption optimisation.
5	Value Proposition	The prosumer benefits from cost savings by optimally adapting their load profile to price signals. Their comfort parameters (e.g., indoor temperature, state of charge of an EV) will be respected.
6	USP	The prosumers can achieve cost savings when they are subject to dynamic pricing schemes or dynamic grid tariffs.
7	Resources	Communication and remote control of prosumers' DERs Self-learning optimisation algorithms for adapting the load profile while maintaining user comfort
8	Revenue Model	The FLESCo charges a service fee (flat or performance-based)
9	References	USEF (2015), DELTA (Leutgöb et al. 2019), partner proposals (5), (4)

7.2.3 Flexibility-enhanced ESCo business model

In this BM, a typical energy efficiency service of an ESCo (e.g., Energy Supply Contracting) is enhanced by the service of load shifting. The ESCo guarantees certain predefined cost savings for the prosumer and takes the risk for achieving them. In order to achieve that, the ESCo provides energy efficient equipment, increases the efficiency of operation etc., but also makes use of the flexibility potential of the assets. Latter can be done as a FLESCo (by making use of dynamic pricing schemes) or by participating in an aggregator programme (making explicit flexibility offers).

This BM takes up the idea of the "Aggregator dual service" and the "Contracting and FLESCo" BM in chapter 6.

Table 7 shows the BM template for the Flexibility-enhanced ESCo BM.

Table 7. Business model template for the Flexibility-enhanced ESCo BM.

#	BM Element	Description
1	Service Provider	ESCo
2	Customers	Prosumers
3	Problem	Prosumers want to have guaranteed cost savings from energy efficiency and flexibility with minimal internal effort.
4	Service	The ESCo guarantees certain cost savings and achieves them by improving energy efficiency and by making use of flexibility from the prosumer's DERs.
5	Value Proposition	Guaranteed cost savings as defined in the contract with the ESCo
6	USP	The ESCo becomes a one-stop shop for energy efficiency improvement and flexibility exploitation. The prosumer can be sure that the planned costs savings will be achieved.
7	Resources	Communication and remote control of prosumers' DERs Interface with an aggregation or FLESCo platform Optimisation algorithm to find an optimal trade of between flexibility provision and energy efficiency (considering that optimal energy efficient operation of DER hampers its flexibility potential)
8	Revenue Model	The ESCo receives the energy efficiency services fees from the prosumer The ESCo receives revenues for selling flexibility on explicit flexibility markets (in the role of an aggregator) or achieves cost savings when sourcing the energy costs (by acting as a FLESCo).
9	References	NOVICE (Energati 2018), DELTA (Leutgöb et al. 2019), Specht and Madlener (2019), Partner proposals (6)

7.3 LFMO Business Model

In this generic BM, a service provider establishes and operates a local flexibility market platform. This is a platform BM, which creates value for all market participants by providing an organised marketplace for them including the necessary infrastructure.

The main value activated in this BM lies in the new opportunity for the DSO to procure flexibility in an efficient way. This means, applying this BM makes the YELLOW grid regime more manageable for the DSO and therefore it might be accepted to occur more frequently. As a result, the DSO can delay grid reinforcement which would be required due to increasing penetration with DERs in the distribution grid. At the same time, the BM creates a new business opportunity for aggregators who can place offers on the LFM. Moreover, prosumers can tap into a new revenue stream by exploiting the flexibility potential of their DERs. According to the link between LEM and LFM (as described in section 5.1) the aggregator offering the flexibility can be the LEMO, who translates the explicit flexibility requests into price signals for the prosumers.

Note, that this BM is only applicable in **YELLOW grid regime** and also only if an **explicit LFM** is implemented. This depends on the market design intended by regulation.

7.3.1 DSO as LFMO

In the first model the DSO as a regulated entity is entitled to set up an LFM and assume the role of the LFMO. In this model each DSO is running its own LFM platform for procuring flexibility with locational attributes from aggregators (also in the role of a LEMO) or prosumers of relevant size.

This concept can be seen as an analogue to the balancing market, which is mostly operated by the TSO who is also the only buyer on that market.

Table 8 structures and further explains this BM according to the business model template.

Table 8. Business model template for the BM DSO as LFMO.

#	BM Element	Description
1	Service Provider	DSO
2	Customers	DSO, requesting flexibility All parties offering flexibility to the DSO: aggregators (also in the role of a LEMO) and large prosumers
3	Problem	Aggregators can’t offer flexibility to the DSO in a competitive manner (without making long term contracts with the DSO) DSO can’t procure flexibility in an efficient manner
4	Service	The DSO as LFMO invites aggregators to make offers and then clears the market by accepting the most attractive offers, that can provide the required flexibility service (considering the locational tag of the offer).
5	Value Proposition	Aggregators (and large prosumers) can transparently compete for providing flexibility to the DSO. DSO can select the most attractive offers.

6	USP	DSO can buy the flexibility offered by the aggregators or activate its own flexibility assets, trying to optimise the best solution for the grid performance considering the cost incurred. If the DSO operates the LFM, costs for an independent MO and especially for an additional interface between a third-party MO and the DSO can be avoided (Schittekatte and Meeus 2020).
7	Resources	The grid problem needs to be forecasted by the DSO prior that it occurs to find a solution for preventing the damage. A coordination and clearing mechanism is needed between the offer from the aggregator and the forecasting of the problem from the DSO side.
8	Revenue Model	The DSO can purchase flexibility from the best bidding market participant. Optimal procurement means minimising costs for gaining the required flexibility. In the long term, the need for grid reinforcement can be reduced.
9	References	Initial BC3 Related ideas from partners: *(10) DSO acting as LFMO cooperating with the Aggregator*. See discussion on integration vs. separation of market operator role in Schittekatte and Meeus (2020).

7.3.2 External LFMO

The alternative option is that a third-party entity (that is not trading on the LFM) assumes the role of the LFMO. As the LFM needs to be an organized and regulated market, this external LFMO needs to be regulated and supervised by a regulatory authority. The external LFMO can be a completely novel entity or a market operator of another already existing energy market, such as the wholesale spot market or balancing market. Here, DSOs only act as buyers on the LFM. Note: that such a market platform could also serve several DSOs for procuring their flexibility at the same time. The locational attributes of each offer would make sure that the DSO can select the right offers to solve its local grid constraints.

Table 9 shows the respective template for this BM.

Table 9. Business model template for the External LFMO BM.

#	BM Element	Description
1	Service Provider	Third-party entity that is regulated and supervised by a regulatory authority. This can be a novel entity or a market operator of an existing organised energy market (e.g., wholesale energy exchange or balancing market)
2	Customers	Purchasing flexibility: DSO Offering flexibility: aggregators (also in the role of a LEMO), large prosumers
3	Problem	DSO: doesn’t have a marketplace for procuring flexibility efficiently

		Aggregators, (large consumers): can't offer flexibility to the DSO in a competitive manner (without making long term contracts with the DSO)
4	Service	The service provider offers a marketplace as an intermediary between aggregators and the DSO.
5	Value Proposition	Efficient clearing of a dedicated marketplace for local flexibility. This ensures that all market participants optimise their profits. In theory, an economically optimal resource allocation can be reached.
6	USP	An independent market operator has following USP: (1) ensures transparency and neutrality of the MO, (2) may have experience in running an organised marketplace, (3) can minimise MO costs through bundling of several LFMs in one platform
7	Resources	A coordination and clearing mechanism is needed between the offer from the aggregator and the forecasting of the problem from the DSO side. Moreover, expertise for operating the platform and the concession for market operation by regulatory authority is needed.
8	Revenue Model	Transaction fees
9	References	Enera, NODES, GOPACS, Piclo Flex (cf. Schittekatte and Meeus 2020)

7.4 LEMO Business Model

PARITY basically considers two players as a potential LEMO: suppliers and energy communities. In both options the LEMO can offer a basic service as a P2P facilitator (section 7.4.2 and 7.4.4) or a comprehensive service for P2P trading including optimised use of flexible DERs (section 7.4.3 and 7.4.5).

Before describing the distinct models, the aspect of balance responsibility for P2P trading needs to be considered.

7.4.1 Balance responsibility in P2P trading

Similar as for the aggregator business models (cf. 7.1.1), also for business models enabling local P2P trading among prosumers, balance responsibility and the settlement of imbalances can be tackled mainly in three ways (Repo et al. 2020):

a) Smaller balance responsible parties

In the first option, the actual imbalance settlement mechanism would remain the same with BRPs being fully responsible for the imbalances in their portfolio of prosumers. Therefore, all prosumers engaging in such a P2P trading scheme would need to be part of the same BG. This approach corresponds as an analogue to the standard aggregator model formulated by USEF, where flexibility provision is integrated with energy supply (section 7.1.1, paragraph a). Here, this means P2P trading is integrated with energy supply.

For enabling P2P trade at local level Repo et al. (2020) propose to create a mechanism to enable and foster smaller BRPs. In this way a local energy community could act as its own BRP. However, nowadays the threshold for being a BRP is quite high in terms of responsibilities, financial requirements and information system needs, which makes small BRPs usually not profitable.

As an alternative to manage the energy balances on a more granular level, Repo et al. (2020) also propose a model of "Light Balance Responsibility" (*light* in terms of the amount of regulatory changes that are needed). In this model the traditional system of balance responsibility of BRPs is maintained, but an additional layer of balance settlement is introduced which is only visible for the LEMO (operator of the local electricity/P2P trading market). In this concept the prosumers (as "sub-BRPs") are responsible for their imbalances towards the LEMO, based on a separate contractual agreement.

b) Multiple suppliers

The second option is to assign multiple suppliers to one prosumer. This means, the prosumer has several parallel contracts with different suppliers, for example one for the EV charging station, which could be used for P2P trading, and another one for the rest of the (uncontrollable) loads. This approach works as an analogue to the USEF "Virtual Transfer Points" model (section 7.1.1, paragraph b). In this model, separate metering (e.g., additional register in the electricity meter or separate reliable sub metering) is needed and a separate contract with a supplier role that facilitates P2P trading. As in the first option above, nothing changes regarding the traditional BRP principle. Although, the balancing responsibility is divided among the BRPs associated with the different (sub-)metering points.

c) Independent aggregators

Finally, independent aggregators facilitating P2P trading require an additional imbalance settlement mechanism between the BRPs involved. This approach is an analogue to the flex-only balance responsibility model ("Flex-BR model") described by USEF for independent DSF aggregators (section 7.1.1, paragraph c). In this model an independent aggregator that is not associated with the supplier/BRP of the prosumer is shifting loads at the prosumer's assets and facilitates P2P trading with the activated flexibility. Therefore, the BRP associated with the aggregator needs to compensate the BRP of the supplier for any imbalances caused. To achieve this, also baseline methodologies are required that evaluate what would have been the consumption/generation without load shifting intervention to determine the impact on the balance position of both BRPs.

7.4.2 Supplier as LEMO

In this BM a supplier operates the LEM. It can be a novel or traditional supplier both providing centralised electricity supply and a LEM platform where prosumers can buy and sell electricity. This means, that the supplier sources the electricity that is supplied (mainly) from local prosumers. The balance responsibility for the prosumers under contract remains with the supplier's BRP.

This BM is generally applicable in **GREEN** grid operation regime. In case an **implicit LFM** is implemented, it **also works in YELLOW** regime.

In this first option, the supplier provides the basic service of a P2P facilitator without controlling the prosumer's DERs. The supplier in the role of the LEMO only provides the market platform and the infrastructure to connect prosumers to this platform. The individual transactions are enforced automatically based on predetermined preferences via smart contracts.

Here, the value is created for the prosumers participating in the LEM. They could benefit from a reduced grid tariff which applies to the locally sourced electricity as the transmission system is not used for this share of energy traded on the LEM. On the one hand, prosumers selling their surplus electricity on the LEM could gain a better price than they would get from a feed-in-tariff. On the other hand, buying electricity on the LEM could attractively cheap in times of high supply.

Table 10 shows the respective template for this BM.

Table 10. Business model template for the BM Supplier as LEMO.

#	BM Element	Description
1	Service Provider	Supplier (with associated BRP)
2	Customers	Prosumers
3	Problem	Prosumers want to make optimal use of their surplus energy from DGs. At the same time, they want to consume locally generated renewable energy.
4	Service	A traditional or novel supplier provides a platform where prosumers can virtually exchange electricity with each other. In this BM, each prosumer needs to engage in a supply contract with the supplier. Then, prosumers can sell and purchase electricity on the LEM via the supplier. In times a prosumer doesn't source enough energy on the LEM to meet its demand, the residual electricity is sourced and supplied by the supplier.
5	Value Proposition	The supplier offers its typical supply service and additionally enables the prosumers to source and sell electricity locally.
6	USP	The supplier is a one-stop-shop for the prosumers for electricity supply, only one contractual relationship is required for participating in an LEM.
7	Resources	Smart contract-enabled P2P trading platform. Communication of the platform with the prosumers' smart meters and the DER controlling gateway of a FLESCo, if applicable.
8	Revenue Model	Supply price for energy supplied centrally and a transaction fee on each LEM trade.
9	References	Initial BC2 Existing businesses: Powerpeers, e-friends P2P trading service offered by centralized suppliers (Klaassen and van der Laan 2019) Need for a supplier role in P2P trading frameworks (cf. Zhang et al. 2017, Klein et al. 2019, CEER 2018)

7.4.3 Supplier as LEMO and FLESCo

In addition to the previous BM, here the supplier acts as a LEMO and also as FLESCo. This means, that the supplier is not on only responsible for automatically arranging transactions for optimal electricity sourcing on the LEM, but also for adapting the load profiles of prosumers. As a FLESCo the supplier tries to make use of fluctuating prices on the LEM and change the individual load profiles accordingly.

The added value compared to the previous BM is that the supplier also takes care that loads are actually shifted which enables:

- Actual (not only virtual) local consumption of locally generated electricity
- Community self-balancing which may avoid grid constraints at certain nodes (not necessarily always the case; it can also trigger constraints e.g., at single power lines/connections)
- Portfolio optimization for the supplier (independent from the local balance)
- Provision of explicit DR services through the LEMO (who translates the explicit requests in price signals).

Table 11 shows the respective template for this PARITY BM.

Table 11. Business model template for the BM Supplier as LEMO and FLESCo.

#	BM Element	Description
1	Service Provider	Supplier
2	Customers	Prosumers, DSO (in case of explicit LFM), high-level aggregator
3	Problem	Prosumers want to make optimal use of their surplus energy from DGs and of the flexibility potential of their DERs. At the same time, they want to consume locally generated renewable energy. Prosumers also want to optimally exploit the flexibility potential of their DERs. Flexibility requesting parties (FRPs) (=TSO, DSO, BRPs) want to meet their flexibility demand in the most cost-efficient way. Utilising demand side flexibility is promising in this respect but DERs need to be bundled in order to harness this potential.
4	Service	Firstly, a supplier provides a platform where prosumers can virtually exchange electricity with each other. Each prosumer needs to engage in a supply contract with this service provider. Then, prosumers can sell and purchase electricity on the LEM via the supplier. In times a prosumer doesn't source enough energy on the LEM to meet its demand, the residual electricity is sourced and supplied by the supplier. Secondly, for optimally sourcing energy on the LEM, the supplier also offers the FLESCo functionality in this BM in order to optimise the prosumer's load profile. Thirdly, the LEMO offers explicit flexibility services to FRPs (to DSO on explicit LFM and to a high-level aggregator). The LEMO activates this flexibility by translating the request into price signals for the prosumers. As the LEMO is a supplier, the flexibility would be mainly used for its associated BRP to perform portfolio optimisation.
5	Value Proposition	The supplier offers its typical supply service and additionally enables the prosumers to source and sell electricity locally in an optimal way as well as enables prosumers to optimise their load/generation profiles according to the price signals. FRPs can meet their flexibility needs in a cost-efficient manner.

6	USP	The supplier is a one-stop-shop for the prosumers for electricity supply as well as exploiting revenues from DERs' flexibility. Only one contractual relationship is required for supply, LEM participation and participation in other markets (wholesale market, balancing market or explicit LFM). Also, a single entity controls the flexible assets in a way that the prosumer maximises its benefit.
7	Resources	Smart contract-enabled P2P trading platform; tools providing the FLESCO-service of optimising the load profile. Tools to translate explicit flexibility requests (from high-level aggregator and explicit LFM) into price signals, taking into account the individual prosumer's price elasticity.
8	Revenue Model	Supply price for energy supplied and a transaction fee on each LEM trade. In addition, revenues are created by selling prosumers' flexibility to a high-level aggregator.
9	References	Rocha, Villar and Bessa (2019), partner proposals (9), (8), Blockchain Grid (Energienetze Steiermark 2020) Need for a supplier role in P2P trading frameworks (cf. Zhang et al. 2017, Klein et al. 2019, CEER 2018)

7.4.4 Energy Community as LEMO

The next PARITY BM proposes an Energy Community itself to take on the role of the LEMO, facilitating direct P2P trade among prosumers, independently from their existing supply contracts. In this way, the principle of "free choice of the supplier" can be maintained within the energy community.

Also, this BM is generally applicable in **GREEN** grid operation regime. In case an **implicit LFM** is implemented, it **also works in YELLOW** regime.

As an analogue to the supplier BMs above, the more basic option of implementing P2P trading in an Energy Community is by just providing the market platform and enforcing trades automatically via smart contracts. Here, the load profiles of the prosumers are not changed by the service provider.

Table 12 shows the respective BM template.

Table 12. Business model template for BM Energy Community as LEMO.

#	BM Element	Description
1	Service Provider	Energy Community
2	Customers	Prosumers
3	Problem	Prosumers want to make optimal use of their surplus energy from DGs. At the same time, they want to consume locally generated renewable energy.
4	Service	The administration of the Energy Community provides a platform where prosumers can virtually exchange electricity with each other.

5	Value Proposition	P2P trading enables the prosumers to virtually source their electricity as much as possible from locally generated renewable energy. This means that the money flows to local peers instead of centralised suppliers (to the extent of the local trades).
6	USP	P2P trade can be facilitated without any arrangement with existing suppliers and their BRPs. Also, local prosumers contracted with different suppliers can trade with each other.
7	Resources	Smart contract-enabled P2P trading platform, based on the blockchain technology. Communication of the platform with the prosumers' smart meters and the DER controlling gateway of a FLESCO, if applicable.
8	Revenue Model	Flat subscription fee from prosumers (e.g., monthly), or a transaction fee on each trade.
9	References	Renewable Energy Directive (2018)

7.4.5 Energy Community as LEMO and FLESCo

In this more comprehensive alternative, the Energy Community assumes also the FLESCo role. Following added values apply:

- Actual (not only virtual) local consumption of locally generated electricity
- Community self-balancing which may avoid grid constraints at certain nodes (not necessarily always the case; it can also trigger constraints e.g., at single power lines/connections)
- Provision of explicit DR services through the LEMO (who translates the explicit requests in price signals).

Table 13 shows the respective BM template.

Table 13. Business model template for BM Energy Community as LEMO and FLESCo.

#	BM Element	Description
1	Service Provider	Energy Community
2	Customers	Prosumers, DSO (in case of explicit LFM), high-level aggregator
3	Problem	Prosumers want to make optimal use of their surplus energy from DGs. At the same time, they want to consume locally generated renewable energy. Prosumers also want to optimally exploit the flexibility potential of their DERs.
4	Service	The administration of the Energy Community provides a platform where prosumers can virtually exchange electricity with each other. This is only feasible if direct P2P trade is legally enabled.

		In addition, the Energy Community offers FLESCo (Flexibility Service Company) services in order to optimise the prosumer's load profile in reaction to supplier prices, LEM prices and grid prices. Also, the LEMO offers explicit flexibility services to FRPs (to DSO on explicit LFM and to a high-level aggregator). The LEMO activates this flexibility by translating the request into price signals for the prosumers.
5	Value Proposition	P2P trading enables the prosumers to virtually source their electricity as much as possible from locally generated renewable energy. This means that the money flows to local peers instead of centralised suppliers (to the extent of the local trades). By receiving also load shifting services, prosumers minimise their energy costs in an LEM (also grid costs in an implicit LFM). FRPs can meet their flexibility needs in a cost-efficient manner.
6	USP	P2P trade can be facilitated without any arrangement with existing suppliers and their BRPs. Also, prosumers contracted with different suppliers can trade with each other Only one contractual relationship is required for LEM participation and participation in other markets (wholesale market, balancing market or explicit LFM). Also, the benefits from trading on the LEM are maximised through the load shifting services that are integrated in this BM.
7	Resources	Smart contract-enabled P2P trading platform, based on the blockchain technology. Tools to translate explicit flexibility requests (from high-level aggregator and explicit LFM) into price signals, taking into account the individual prosumer's price elasticity.
8	Revenue Model	Flat subscription fee from prosumers (e.g., monthly), or a transaction fee on each trade.
9	References	Initial BC1 Renewable Energy Directive (2018)

7.4.6 PARITY LEMO balance responsibility options

Coming back to the issue of balance responsibility, each of the LEMO BM options need to implement one of the balancing settlement models introduced in section 7.4.1.

The balance responsibility for prosumers supplied by the same supplier also remains with one BRP. Hence, the balancing settlement in the BMs **Supplier as LEMO** and **Supplier as LEMO and FLESCo** can be implemented either through (i) *Small BRPs* or (ii) *Multiple Suppliers*.

(i) In the first option, the LEMO would be the one and only supplier of the prosumers in the LEM. The LEMO would need to facilitate P2P trade, but also source the residual energy for all the prosumer's needs.
(ii) In the second option, the LEMO would be one of two suppliers contracted with the prosumer. The LEMO would be a supplier for specific devices (e.g., EV charging station) and would need to facilitate P2P trade, but also source the residual energy for these certain devices.

This is different for the BMs **Energy Community as LEMO** and **Energy Community as LEMO and FLESCo**. Here, the principle of "free choice of supplier" needs to be guaranteed in the energy community. Balancing settlement as an (i) *Independent Aggregator* is fully in line with this principle and the (ii) *Multiple Suppliers* approach is partially applicable to this principle.

(i) In the first option, the LEMO is only providing P2P supply. The residual energy not sourced from local peers, would still be provided by a traditional supplier.
(ii) In the second option, the LEMO would be one of two suppliers contracted with the prosumer. For certain devices (e.g., EV charging station), the LEMO would provide P2P supply, but also the residual energy for these devices. In this sense, the prosumer can freely choose the supplier for all the other loads (e.g., home appliances etc.), but for P2P trading relies on a supply contract with the LEMO.

Summarising these considerations, following options to implement balance responsibility in the LEMO business model are identified (Table 14).

Table 14. PARITY LEMO business model options.

	Smaller BRP	Multiple suppliers	Independent aggregator
Supplier as LEMO	applicable	applicable	not applicable
Supplier as LEMO and FLESCo	applicable	applicable	not applicable
Energy Community as LEMO	not applicable	possibly applicable	applicable
Energy Community as LEMO and FLESCo	not applicable	possibly applicable	applicable

8. Business Model Canvas Analysis

In this chapter, a first qualitative validation of the proposed BMs is performed. This is achieved in close collaboration with all the market participants (DSOs, aggregators, retailers) and technology developers within the PARITY consortium.
For this analysis a Business Model Canvas (BMC) methodology is applied. The BMC based on Osterwalder and Pigneur (2011) is one of the most common tools for business model development. It provides a framework that helps to structure business ideas and to evaluate their marketability, still being flexible for adaptations and the integration of new elements.

The general structure of the BMC consists of the following parts:

- The right side summarizes those **business model elements that are connected with the customer**: customer relationship, channels for customer approach, customer segments and revenue streams;
- The left side is related to business model elements that describe the **internal situation and challenges at the provider's side**: Key activities connected with the implementation of the business model, key resources required to implement the key activities, key partners and cost structure.
- Both sides are connected by the most crucial element of each business model, the so-called **value proposition**, which refers to the following key questions: Which problems at the customer's side is the service/product helping to solve? Which customer needs are satisfied by the service/product? What is the specific offering? What features or benefits match customer needs?

For the PARITY BMs, the BMC of Osterwalder and Pigneur has been slightly adapted (Figure 16):

- The section "Regulation" has been added to describe regulatory implications of the BM.
- The section "Problem" has been added to clearly state the problem of the customer to be solved by the service provider.
- The sections "Key Activities" and "Key Resources" have been merged.
- The sections "Customer Relation" and "Channels" have been merged.
- The section "USP" has been added to highlight the convincing advantage of each BM.

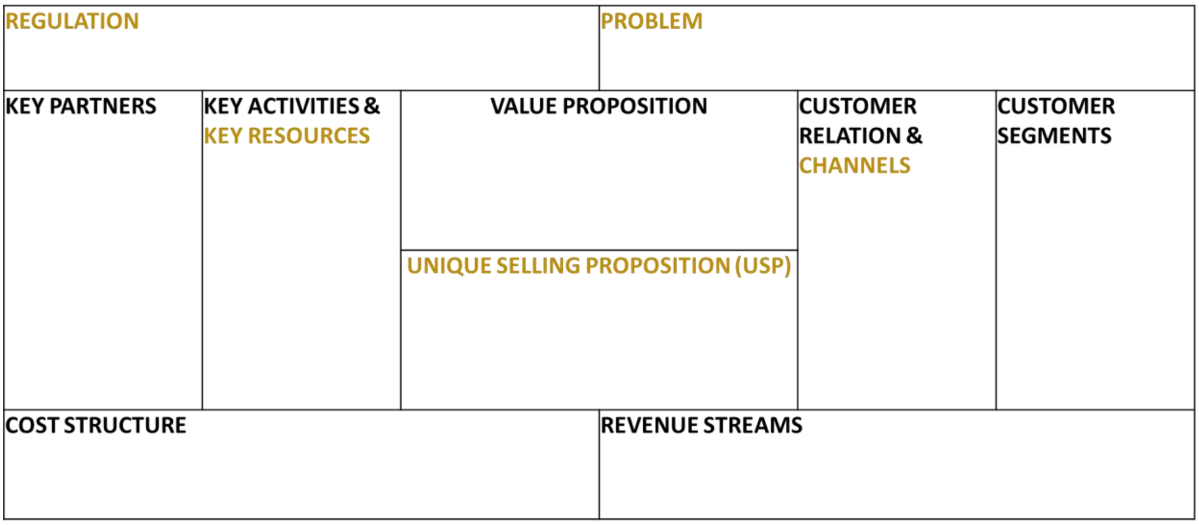

Figure 16. Customised Business Model Canvas (Source: e7, adapted from Osterwalder and Pigneur 2011).

In the following sections, the PARITY BMs are assessed based on this customised BMC. The Aggregator and ESCo BMs already have been discussed in-depth in the literature (cf. section 6), whereas the LFMO and LEMO BMs are very specific and unique to the PARITY framework. Therefore, this analysis is limited to the LFMO and LEMO BMs.

8.1 LFMO Business Model

Note, that the LFMO business models refer to an explicit LFM, as the role of the LFMO is only needed in an explicit market.

8.1.1 DSO as LFMO

PROBLEM

This BM tackles the DSO's need for explicit procurement of flexibility. This is the case, if the national regulator opts for a market-based flexibility procurement for DSOs. The DSO needs this flexibility in order to ensure proper system functioning while avoiding grid reinforcement or RES curtailment. More specifically, the procurement of flexibility is not employed only as an investment avoidance tool for the DSO, but as a cost-effective solution in cases where investments are not favoured based on a Cost Benefit Analysis (CBA).

On the other hand, flexibility providers like larger prosumers or aggregators (and aggregator-like actors such as the LEMO) want to optimally market their pool of flexibility and as a result maximise their profit. Without a proper market platform, they cannot offer flexibility to the DSO in a competitive manner (without making long-term contracts with the DSO).

VALUE PROPOSITION

On the one hand, the added value for flexibility providers is that they can transparently compete for providing flexibility to the DSO.

On the other hand, the DSO can select the most attractive offers. Attractive means not only in economic terms (cheapest offer), but more importantly considering technical issues. If only the most economic option is selected, some other problems could arise in other parts of the grid.

However, the problem stated above can be solved only if a sufficient number of flexibility providers decide to participate in the LFM and their location must coincide with the flexibility needs of the network.

UNIQUE SELLING PROPOSITION

Generally, applying this BM, the DSO can operate the grid with a cost-effective approach and cover its grid requirements without promoting unnecessary investments.

More specifically, integrating the role of the LFMO into the existing DSO role avoids costs of having an external LFMO and especially an additional interface between a third-party LFMO and the DSO (Schittekatte and Meeus 2020).

REGULATION

DSO as a regulated entity needs to have the regulatory mandate to procure flexibility through an own dedicated marketplace.

CEER generally favours the approach of market-based procurement, but national legislation might be different. In some EU member states, DSOs cannot procure flexibility and a regulatory framework for a market-based flexibility procurement from the DSO is not expected even with the implementation of Target Model.

CUSTOMER SEGMENT

The explicit LFM is a platform-based business model and therefore connects two groups of customers.

Firstly, the DSO itself is a customer in this BM and the only buyer in this market. This means, that the DSO has significant power in the market (monopsony) and also acts as the MO at the same time.

The second customer segment are the flexibility providers placing offers on the LFM. Those include larger prosumers or aggregators (and aggregator-like actors such as the LEMO).

CUSTOMER RELATIONS & CHANNELS

Customer acquisition in this BM means, that the DSO needs to identify promising actors that can provide flexibility and encourage them to participate in the LFM. The DSO can approach aggregators/prosumers/LEMOs located specifically in areas with significant needs for flexibility in order to inform them. These customers can add the most value in the implementation of this BM. This could be done even prior to the prequalification phase during the initial implementation of the LFM concept or when the needs of flexibility change.

Officially, the DSO would publish a formal notice on its website inviting flexibility providers for prequalification. During the prequalification process, there might be close personal contact. Once the prequalification has been concluded successfully and a framework agreement has been signed, the flexibility offers can be submitted manually or automatically via an online tendering and trading platform. The tender results will also be communicated through this platform.

REVENUE STREAMS

The revenue for the DSO in this BM is determined by following aspects:

- The extent of how much the load flows at different nodes in the distribution grid can be optimised, in terms of avoiding short-term constraint violations.
- The potential savings on grid reinforcement interventions (long-term effect)
- The hypothetical costs of restoration (partial or total) of the grid in case of default.
- The cost savings from having the opportunity to efficiently purchase flexibility from the best bidding market participant.

However, in case of high flexibility costs (i.e., as a result of low participation of flexibility providers) DSOs’ cost-benefit analysis may propose that cost savings from market-based flexibility are not enough to prevent other measures such as grid reinforcement.

KEY ACTIVITIES & KEY RESOURCES

To register flexibility providers on the LFM, automated prequalification and registration procedures through the LFM Management Application module need to be implemented, accessing the LFM Off Chain Tools of the LFM Platform. Before allowing participation in the market, the DSO as LFMO should validate administrative requirements such as licences and the technical requirements of the assets (activation speed, duration, ramp rate).

Before placing bids on the LFM, the DSO needs to assess the grid status and forecast any grid constraint violations. Therefore, the DSO needs to apply continuous active network management and grid monitoring through the Network Monitoring Tool and the Active Network Management component existing in the DSO toolset to monitor and forecast potential constraints in its grid area.

Then, the DSO at first uses its own flexible assets such as STATCOMs and, if applicable, battery storages (which are key resources). If more flexibility is required, the DSO places a flexibility request on the LFM platform in an automated way, enabling real-time flexibility procurement.

The LFM platform itself is operated and provided by the DSO in this BM. The platform facilitates automated and continuous market clearing. Whether the use of blockchain-based smart contracts is beneficial in this BM and whether it is the preferred solution for clearing the explicit LFM, needs to be further examined. Finally, the market transactions are settled by the DSO as a LFMO. For operating this platform, the DSO needs to provide or outsource the required IT infrastructure and licenses.

A key resource in this BM is the DSO's regulatory mandate to procure flexibility in a market-based way.

Also, the DSO needs reliable cost-benefit analysis tools in order to evaluate the long-term benefits of operating and participating in an LFM.

KEY PARTNERS

The key partners of the DSO in this BM are a range of technology providers, providing especially following tools:

- Grid monitoring tools
- Load flow forecasting tools
- Algorithms to calculate the needed flexibility
- Online flexibility procurement platform
- Market clearing mechanisms (maybe through smart contracts)
- IT and communication infrastructure

COST STRUCTURE

The main cost elements for the DSO include:

- Costs for flexibility procured from flexibility providers (financial remuneration)
- Customer acquisition costs (staff costs)
- Prequalification process (staff costs)
- Grid monitoring and forecasting tools (licenses, equipment)
- Grid monitoring activities (staff costs)
- Platform costs (licenses, IT infrastructure)
- Platform operation (staff costs, licenses, support)

8.1.2 External LFMO

PROBLEM

This BM tackles the DSO's need for explicit flexibility. This is the case, if the national regulator opts for a market-based approach for DSOs to gain flexibility. The DSO needs this flexibility in order to ensure proper system functioning while avoiding grid reinforcement or RES curtailment. More specifically, the procurement of flexibility is not employed only as an investment avoidance tool for the DSO, but as a cost-effective solution in cases where investments are not favoured based on a Cost Benefit Analysis (CBA).

On the other hand, flexibility providers like larger prosumers or aggregators (and aggregator-like actors such as the LEMO) want to optimally market their pool of flexibility and as a result maximise their profit. Without a proper market platform, they can't offer flexibility to DSOs in a competitive manner (without making long term contracts with a specific DSO).

VALUE PROPOSITION

On the one hand, the added value for flexibility providers is that they can transparently compete for providing flexibility to the several DSOs.

On the other hand, an external LFM makes it easier for the DSO to find the best offers, which is a valuable service for the DSO. Attractive means not only in economic terms (cheapest offer), but more importantly considering technical issues. If only the most economic option is selected, some other problems could arise in other parts of the grid.

However, the problem stated above can be solved only if a sufficient number of flexibility providers decide to participate in the LFM and their location must coincide with the flexibility needs of the network.

UNIQUE SELLING PROPOSITION

Generally, applying this BM, the DSO can operate the grid with a cost-effective approach and cover its grid requirements without promoting unnecessary investments.

More specifically, an independent market operator has following USP: (1) ensures transparency and neutrality of the MO, (2) may have experience in running an organised marketplace, (3) can minimise MO costs through bundling of several LFMs in one platform, (4) takes the burden of prequalification process from the DSOs (Schittekatte and Meeus 2020).

Especially point (3) is a distinctive feature compared to the previous BM. Of course, demand side flexibility can only be offered to the DSO of the specific area where the flexibility is sourced. But having an LFM which is operated by an external LFMO and where several DSOs can place their bids gives especially larger flexibility providing entities (e.g., aggregators with an extensive portfolio covering different geographical regions or an independent aggregator or supplier operating several LEMs) the opportunity to have one market place for making offers to many DSOs. This could be especially relevant in countries with a high fragmentation of distribution grids with many different DSOs. For example, in Germany there are about 800 DSOs (Prettico et al. 2019).

REGULATION

The external LFMO needs the permission to operate a regulated organised market. Hence, this role could be assumed by the operator of the TSO-level ancillary services market or by wholesale market operators (spot market operators).

A precondition for this BM is that DSOs are enabled and encouraged by legislation to gain flexibility in a market-based way from market platforms. CEER generally favours the approach of market-based procurement, but national legislation might be different. In some EU member states, DSOs cannot procure flexibility and a regulatory framework for a market-based flexibility procurement from the DSO is not expected even with the implementation of Target Model.

CUSTOMER SEGMENT

The explicit LFM is a platform-based business model and therefore connects two groups of customers.

DSOs are the first customer segment in this BM and act as the buyers in this market. The DSOs are influencing the market design of the LFMO, as they can determine the product specifications of the flexibility products traded on the LFM. This includes also the question if the flexibility products are conditional (meaning that capacities are reserved for activation) or unconditional (traded for actual activation only). Additionally, the DSOs also will determine their prequalification requirements for flexibility providers.

The second customer segment are the flexibility providers placing offers on the LFM. Those include larger prosumers or aggregators (and aggregator-like actors such as the LEMO).

CUSTOMER RELATIONS & CHANNELS

The LFMO needs to establish channels to both customer segments: the DSOs and flexibility providers.

Regarding DSOs, the relationship might be more a partnership than a typical provider-customer relationship. This is because the DSOs determine the product specifications and prequalification requirements and therefore actively shape the market design. Between LFMO and DSOs, there will be an extensive framework contract and close relationships with dedicated staff to treat DSOs' inquiries through personal communication.

Regarding flexibility providers, the LFMO firstly needs to identify promising actors that can provide flexibility and encourage them to participate in the LFM. The LFMO should approach aggregators/prosumers/LEMOs located specifically in areas of the partner DSOs, where significant needs for flexibility exist. These customers can add the most value in the implementation of this BM. This could be done even prior to the prequalification phase during the initial implementation of the LFM concept or when the needs of flexibility change. Operational communication between flexibility providers and LFMO would be routed via an online platform, where the flexibility offers can be submitted. The market clearing results will also be communicated through this platform.

REVENUE STREAMS

The LFMO will incur a transaction fee from both buyers and sellers (although it might be different for these two groups). As a result, the revenue for the LFMO depends on the prices and traded volumes on the LFM.

From the perspective of the DSO the prices depend on following aspects:

- The extent of how much the load flows at different nodes in the distribution grid can be optimised, in terms of avoiding short-term constraint violations.
- The potential savings on grid reinforcement interventions (long-term effect)
- The hypothetical costs of restoration (partial or total) of the grid in case of default.
- The cost savings from having the opportunity to efficiently purchase flexibility from the best bidding market participant.

From the perspective of the flexibility provider, the prices depend in theory on the opportunity costs of selling flexibility on other markets (AS/WS markets). This should trigger a significantly higher price for the flexibility. Therefore, by disabling the trade of local flexibility in AS/WS markets during yellow grid operation regime, this interdependency is cut off, so the DSO is the only buyer during this regime.

KEY ACTIVITIES & KEY RESOURCES

To register flexibility providers on the LFM, automated prequalification and registration procedures through the LFM Management Application module need to be implemented, accessing the LFM Off Chain Tools of the LFM Platform. Before allowing participation in the market, the LFMO should validate administrative requirements such as licences and the technical requirements of the assets (activation speed, duration, ramp rate) according to the rules of the participating DSOs.

Based on the grid forecast of the DSO (DSO toolset), automated Traffic Light Control (TLC) needs to be implemented in the LFM platform. The LFM platform itself is operated and provided by the external LFMO in this BM. The platform facilitates automated and continuous market clearing. Whether the use of blockchain-based smart contracts is beneficial in this BM and whether it is the preferred solution for clearing the explicit LFM, needs to be further examined. Finally, the market transactions are settled by the LFMO.

Another key resource is the common platform for data sharing which collects all the data from the DSO (congestion points) and the flexibility providers. For the DSO this is a critical point, as the external agent would need to have access to the grid topology, data from the meters and data from the substations. On the one hand, some of these data are confidential (DSO might not be willing to share them) and on the other hand there is a need for standardised data formats and procedures to transmit this information. In this respect, secure data transfer is a key requirement for this BM.

KEY PARTNERS

Firstly, key partners of the LFMO in this BM are a range of technology providers, providing tools or supporting the key activities.

Secondly, as described above, DSOs are considered not only as customers but also as key partners with significant power to shape the market.

COST STRUCTURE

The main cost elements for the LFMO include:

- Customer acquisition costs (staff costs)
- Prequalification process (staff costs)
- Platform costs (licenses, IT infrastructure)
- Platform operation (staff costs, licenses, support)
- Costs for data sharing platform (handling, integration of different data sources etc.)

8.2 LEMO Business Model

8.2.1 Supplier as LEMO

PROBLEM

Consumers are increasingly evolving to prosumers with own DG assets such as PV. In this BM the problem is tackled, that prosumers want to make optimal use of their surplus electricity. In the current situation, prosumers are remunerated for their surplus only by fixed feed-in-tariffs which are lower than the price for energy obtained from the grid. Additionally, prosumers want to source their electricity as cheap as possible, but prefer to consume renewable energy.

From the supplier's perspective, this innovative offering may serve as an incentive for customer retention. Especially incumbent suppliers are looking for new ways for customer retention, as liberalised markets have increased competition for them. But also new supplier, such as start-ups, might apply this BM to "stand out from the crowd".

VALUE PROPOSITION

In this BM, the value proposition is relatively simple and straightforward. It entails the typical supply service of an energy supplier, who additionally enables the prosumers to source and sell electricity locally. This gives prosumers the possibility to decide who can buy their surplus electricity and at which price. Vice versa, the prosumers can decide where their electricity is sourced and what they are willing to pay for it. Note, all these trades happen virtually within the same balance group. The physical power flows are not necessarily affected by these trades, as long as no load shifting activities are initiated by the prosumers.

UNIQUE SELLING PROPOSITION

The key advantage of this BM is that the supplier is a one-stop-shop for the prosumers for electricity supply. Only one contractual relationship is required for having guaranteed centrally sourced electricity supply as well as having the possibility to participate in an LEM.

In addition, as all of the prosumers in the LEM are associated with the same balance group, there are no specific requirements for imbalance compensation between BRPs, which makes it the least complex of the LEMO BMs.

REGULATION

In general, this BM can be considered regulatory feasible, as it has been already implemented by innovative enterprises across Europe (e.g., e-friends in Austria, Powerpeers in the Netherlands). This is because the whole LEM simply acts as a common balance group.

However, as this model is based on a balance group, there are no "local" boundaries (except from the borders of the bidding zone). Hence, this BM prosumers don't benefit from a reduced local grid tariff, which is emerging in many EU member states.

A major concern regarding the use of a blockchain-based market platform is, that currently there might not exist a regulatory basis to agree on legal terms through smart contracts. However, the blockchain might be redundant in this BM, as smart contracts don't need a centralised entity such as a supplier to process the contracts.

CUSTOMER SEGMENTS

Both prosumers and pure consumers can take part as customers in such a BM. As there is no load shifting initiated by the LEMO, it is not necessarily required to have flexible DERs to be a customer. However, the benefit from participating might increase if flexible DERs are available that can at least be controlled manually (e.g., simple EV charging station). In terms of other technical infrastructure, a smart meter is required, which needs to be capable of communicating the actual load and generation data to the supplier's platform. However, such a meter can be upgraded when engaging in a contract with the supplier, as well as a local computing unit which might be required.

Generally, customers targeted in this BM currently still might be early adopters. However, this BM does not require significant changes for the end-users (no load shifting, only meter data are communicated and processed) and the concept is rather easy to understand (using surplus renewable energy from your peers). Hence, it could be the "icebreaker" for more advanced P2P business models (like the LEMO BM in the next section), lowering the general reluctance and increasing user acceptance for similar approaches.

CUSTOMER RELATION & CHANNELS

As the customer segment does not differ significantly from the target group of a supplier, existing suppliers applying this BM can use their existing channels to make an offer for consumers and prosumers that are already under a supply contract. If the supplier is a novel entity (e.g., start-up) that is focussed on P2P trading as their USP, customer acquisition efforts are significantly higher as also public legitimacy needs to be established for this BM and prejudices need to be removed as barriers.

The necessary hardware is limited and it is expected that any installation or configuration can be done by the customer itself. Hence, no on-site visit should be required.

Once contracted, costs for customer interaction need to be minimised as much as possible. Hence, customer contact preferably should be routed via an online platform with online billing and an online helpdesk for troubleshooting.

REVENUE STREAMS

For its service as a P2P facilitator, the LEMO could charge a flat rate fee for access to the trading platform, combined with a small transaction fee on each trade. For instance, existing business applying similar BMs charge a transaction fee of 10% (e-friends 2020) or a flat rate platform fee of about 40€ per year (Our Power 2020).

Besides that, the LEMO receives revenues from selling centrally supplied electricity in times there are not enough offers on the P2P market. This electricity is usually renewable energy purchased on the spot market. The price for prosumers for the energy sourced not from peers is typically significantly higher than in "normal" renewable energy contracts, which is due to the higher imbalance risks for the LEMO having mainly fluctuating DGs (mainly PV) in its portfolio.

The offering of new services, such as P2P trading in this BM might also serve as a USP, differentiating the supplier from the competitors. This could create increased revenues indirectly.

KEY ACTIVITIES & KEY RESOURCES

The main key resource of the LEMO is its P2P trading platform. As discussed above, in this BM it might be not necessary to develop it based on blockchain enabled smart contracts. A clearing mechanism is needed in case the market is cleared centrally by the LEMO. Existing similar businesses give the full decision authority to the prosumers to individually decide which offers are accepted and what is the price of a bid made on the LEM.

A key activity is sourcing of centrally supplied energy, if there is a deficit of energy in the LEM (and vice versa selling it if there is an overall surplus). Furthermore, the settlement of imbalances within the LEM (deviations of actual energy flows from contracted amount of energy traded) and resulting overall imbalances of the LEMO's balance group are also key activities. Finally, establishing contracts with the end-users and also billing is a key activity of the LEMO.

Regarding technical infrastructure, the trading platform needs to have a communication interface with the prosumers' smart meters. Regarding privacy requirements, the LEMO needs to ensure GDPR conformity when handling data from prosumers, especially if they are obtained with high granularity in real time. Although this BM facilitates P2P trading the payments need to be routed securely via the LEMO (peer-to-platform approach).

KEY PARTNERS

Key partners in this BM are mainly technology providers offering different parts of the technological resources needed in this BM. Regarding hardware, a local computing unit installed at the prosumers' premises needs to be developed by a technology provider. Similarly, the development of the software for the IT platform can be outsourced to a software developer, as well as the server capacities for hosting.

Another potential partner would be a service provider offering balance group management or portfolio management taking over fully or partly the tasks and responsibilities of the BRP.

COST STRUCTURE

The main cost element specific to this BM is the cost for platform operation. This includes software development and licenses to external technology partners, maintenance costs, server costs, customer and support.

A second major cost element relates to sourcing of centrally supplied electricity on the spot market. In this respect, minimising imbalance costs plays an important role. This is a critical risk in this BM, as in a LEM, PV and other fluctuating renewable energy sources might be the main source of electricity, which might result in high deviations from the planned schedule and accordingly to high imbalance charges.

8.2.2 Supplier as LEMO and FLESCo

PROBLEM

Similarly, as in the previous BM, prosumers want to make optimal use of their surplus electricity and also prefer to consume renewable energy. Additionally, prosumers increasingly deploy flexible DERs such as heat pumps or battery storages. In order to reduce energy costs, prosumers want to make use of the flexibility from these assets. DERs are also often not utilized to full capacity. That is why additional revenue streams need to be tackled to increase the DER's value and lower costs. One example are home battery storages – it might be beneficial for the LEM and the owner to utilize them optimally at full capacity.

From a different perspective, FRPs (DSO, but also BRPs and TSO) want to meet their flexibility demand in the most cost-efficient way. Utilising demand side flexibility is promising in this respect but DERs need to be bundled in order to harness this potential. High-level aggregators are also only interested in pooling assets of a significant size (they don't want to interact with single households that have very limited flexibility potential, for instance).

VALUE PROPOSITION

Compared to the previous BM, this value proposition is more comprehensive. The supplier offers its typical supply service and enables the prosumers to source and sell electricity among each other. But additionally, the supplier promises to optimise their load/generation profiles according to the price signals arising from (i) demand and supply in the LEM, (ii) variable grid tariffs in an implicit LFM, (iii) other translated price signals from AS/WS markets and (iv) ToU prices of the centrally supplied electricity. Latter means, that the supplier can also use this flexibility to optimise its sourcing costs for the energy centrally sourced on the wholesale market.

From the perspective of high-level aggregators, the sector of small loads (such as households) is getting more interesting, as they only need to make one contract with the supplier in this BM to include a large number of small prosumers in their aggregated portfolio at once. As a result, FRPs on the AS/WS market can procure flexibility also from small prosumers through aggregators.

Finally, the DSO has the possibility to procure local flexibility from prosumers (in an explicit LFM), or prosumers are increasingly reacting to the DSOs' price signals (in an implicit LFM).

UNIQUE SELLING PROPOSITION

The supplier is a one-stop-shop for the prosumers for electricity supply as well as exploiting revenues from DERs' flexibility. Only one contractual relationship is required for supply, LEM participation and participation in other markets (AS/WS market or explicit LFM). Also, a single entity controls the flexible assets in a way that the prosumer maximises its benefit.

Also, as all of the prosumers in the LEM are associated with the same balance group, there are no requirements for imbalance compensation between BRPs when trading P2P.

REGULATION

Latter is also an advantage in this BM from a regulatory perspective. As all the prosumers within the LEM are contracted with the same supplier, no additional procedures for imbalance compensation between BRPs is needed.

However, as this model is based on a balance group, there are no "local" boundaries (except from the borders of the bidding zone). Hence, this BM prosumers don't benefit from a reduced local grid tariff, which is emerging in many EU member states.

Also in this BM, the concern about the regulatory feasibility of blockchain-based smart contracts applies. Also here, a centralised entity is available to safeguard all the transactions. However, compared to the previous BM, the application of blockchain-based smart contracts is more attractive, because the prosumers' DERs are automatically reacting to the price signals and instantly adapting their trading strategy based on their flexibility potential.

In case an implicit LFM should be applied as the main driver of the LEM, it is not clear if a highly granular differentiation of the grid price would be granted by the regulator.

CUSTOMER SEGMENTS

Both prosumers and pure consumers can take part as customers in such a BM. In contrast to the previous BM, the prosumers and consumers need to have available flexible DERs that can be used for load shifting, as this is a core part of the value proposition in this BM. Such devices include for example heat pumps and EV charging stations. Note, that these devices need to be interoperable to communicate with the IoT gateway provided by the LEMO and react to remote control signals coming from this gateway.

The prosumers and consumers engaging in such a BM are definitely considered front-runners. Hence, not only financial benefits will be an incentive, but rather their affinity towards innovative solutions and their willingness to contribute to the green energy transition. This affinity needs to outweigh all other concerns such as privacy, control of own comfort etc.

Besides prosumers, in this BM also DSOs and high-level aggregators (trading on wholesale and ancillary services markets) are considered as customers.

In case of an explicit LFM, the DSO can request explicit flexibility from the LEMO. In return, the LEMO is remunerated for this and shares the revenues with the end-users via dynamic price signals. In case of an implicit LFM, there is not necessarily a provider-client relationship between LEMO and DSO, as the price signals from the DSO are directly communicated to the end-users via the grid tariff. However, the DSO benefits from such a LEM as it enables the prosumers to react to the DSO's price signals, which would be unlikely without having a load controlling entity such as the LEMO. In other words, the existence of such BMs could be a prerequisite for DSOs to actually enforce highly dynamic grid tariffs.

Finally, the high-level aggregator is a customer of the LEMO when requesting explicit flexibility from the LEM. Again, the LEMO is remunerated for this and shares the revenues with the end-users via dynamic price signals.

CUSTOMER RELATION & CHANNELS

Similar to the previous BM, traditional suppliers making use of this BM can use their existing channels for customer acquisition, whereas novel actors need to build up channels and also create public legitimacy. In this BM, it is crucial to identify promising consumers and prosumers with significant flexibility potential (controllable DERs) that can be easily integrated into the virtual LEM platform (through standardised protocols).

The necessary hardware is more comprehensive than in the previous BM, as the IoT gateway needs to be installed and all relevant DERs need to be connected to the gateway. Hence, an initial on-site visit of professional staff might be required.

Once contracted, costs for customer interaction need to be minimised as much as possible. Hence, customer contact preferably should be routed via an online platform with online billing and an online helpdesk for troubleshooting.

The relation with the high-level aggregator is a bilateral framework agreement defining the terms and conditions for purchasing flexibility dispatches. In this framework agreement, product specifications and also price ranges might be determined. Based on that, the actual contracts are signed on request, if an offer is accepted by the aggregator.

The relation between DSO and LEMO in an explicit LFM is similar. The LEMO is prequalified as a market participant in the explicit LFM and can submit offers. In case of an implicit LFM, there is no such relationship.

REVENUE STREAMS

In theory, in this BM several revenue streams apply. Firstly, a transaction fee for each trade could be charged. Secondly, there could be a (flat or performance-based) fee for optimising prosumers' load profiles and create cost savings for them (from LEM trades, self-consumption, grid prices ion implicit LFM). Fourthly, the LEMO could create revenues by selling prosumers' flexibility to a high-level aggregator or the DSO on an explicit LFM (flexibility activated through price signals by the LEMO). Fifthly, the LEMO receives revenues from selling centrally supplied electricity in times there are not enough offers on the P2P market. This electricity is probably renewable energy purchased on the spot market.

In practice, the pricing model towards the prosumers might be more straightforward. The P2P trades are conducted automatically and the end-user does not need to state any trading preferences (only comfort preferences). Hence, the pricing model could consist of a combined fee for the prosumer which is a shared savings model (where the cost savings and revenues through optimal load shifting are shared between LEMO and prosumer) or even a flat fee per period (which is smaller than historic costs of the prosumer). In the former option, detailed M&V procedures need to be established, whereas latter option is less complex but means a significant level of risk for the LEMO.

The offering of new services, such as P2P trading in this BM might also serve as a USP, differentiating the supplier from the competitors. This could create increased revenues indirectly.

KEY ACTIVITIES & KEY RESOURCES

The key resource in this BM is the smart contract enabled P2P trading platform based on the blockchain technology. In this BM, P2P trading via the blockchain is supervised by the LEMO, who assumes balance responsibility for the whole LEM, as in the previous BM. Consequently, settling imbalances within the LEM and towards the Imbalance Settlement Responsible (who is settling deviations of the BRPs) are key activities of the LEMO. Again, the LEMO is also in charge of sourcing centrally supplied energy on the spot market. Finally, establishing contracts with the end-users and also billing is a key activity of the LEMO.

Furthermore, a crucial key activity of the LEMO is to translate explicit flexibility requests (from high-level aggregator and explicit LFM) into price signals, taking into account the individual prosumer's price elasticity. This needs to be done in terms of adapting the general price levels in the whole LEM (in case of high-level aggregator requests) or with high local granularity differentiated for each local group of prosumers (in case of requests from the explicit LFM). Based on these price signals, the LEMO also optimises the prosumers' load profile reacting to the price signals, resulting minimal costs for the end-users. In this respect, the LEMO needs to be able to also include price signals coming from an implicit LFM (from the DSO as grid tariffs) into the optimisation algorithm. To achieve an optimal dispatch, a range of tools need to be provided and applied by the LEMO. These include especially DER profile models for flexibility forecasting and Storage-as-a-Service tools. The development of these tools most probably would be outsourced to technical developers (key partners) and the tools would be bought in through a license fee. Generally, the whole IT infrastructure needs to be hosted (or outsourced) by the LEMO.

Also in this BM, the trading platform needs to have a communication interface with the prosumers smart meter, but also with the BEMS or IoT gateway to facilitate load shifting. Regarding privacy requirements, the LEMO needs to ensure GDPR conformity when handling data from prosumers, especially if they are obtained with high granularity in real time. Although this BM facilitates P2P trading the payments need to be routed securely via the LEMO (peer-to-platform approach).

KEY PARTNERS

Key partners in this BM are mainly technology providers offering different parts of the technological resources needed in this BM. This includes tools like the blockchain-based P2P trading platform, DER profiling, price signal estimation engine or the algorithms for optimising the individual load profiles.

Another potential partner would be a service provider offering balance group management or portfolio management taking over fully or partly the tasks and responsibilities of the BRP.

The high-level aggregator, who is a customer in this BM, can also be considered a key partner, as a long-term framework contract between the LEMO and the aggregator might be established. Hence, the aggregator is not only a customer but also brings value into this BM by requesting explicit flexibility.

Similarly, the DSO is a customer and key partner in case an explicit LFM is implemented. Also, if an implicit LFM is implemented the DSO can be considered a key partner, as the LEMO relies on an accessible interface where the grid prices for the individual prosumers are communicated in real time. This is essential because the LEMO needs to take into account also the grid prices when deciding on an optimal dispatch and trading schedule. Also, the DSO is a key partner for coordinating the market operation depending on the actual grid operation regime (traffic light).

COST STRUCTURE

The main cost element specific to this BM is the cost for platform operation. This includes software development and licenses to external technology partners, maintenance costs, server costs, customer and support. The costs for technological infrastructure are much more extensive than in the previous BM (c.f. section Key Activities and Key Resources).

Another major cost element relates to sourcing of centrally supplied electricity on the spot market. In this respect, minimising imbalance costs plays an important role, as PV and other fluctuating renewable energy sources might be the main source of electricity in the LEM, which might result in high deviations from the planned schedule and accordingly to high imbalance charges. Using the flexibility of the prosumers, portfolio management can be optimised. However, the benefits of this need to be shared with the end-users, which will be done again through price signals in the supply pricing scheme.

8.2.3 Energy Community as LEMO

PROBLEM

Consumers are increasingly evolving to prosumers with own DG assets such as PV. Recently, two European Directives laid the legal foundation for so-called Renewable Energy Communities (REC)[4] and Citizen Energy Communities (CEC)[5]. Energy communities (EC) facilitate various new services such as community generation, aggregation, P2P trading or charging services. This opens up a range of business opportunities for an EC and associated service providers. However, within an EC the prosumers still have the right to freely choose their energy supplier, which makes the previous “Supplier as a LEMO BM” unfeasible for an EC.

Generally, in this BM the problem is tackled, that prosumers want to make optimal use of their surplus electricity. In the current situation, prosumers are remunerated for their surplus only by fixed feed-in-tariffs, which are lower than the price for energy obtained from the grid. Additionally, prosumers want to source their electricity as cheap as possible, but prefer to consume renewable energy.

VALUE PROPOSITION

In this BM, the energy community facilitates virtual energy exchange between its members (local prosumers). This gives prosumers the possibility to decide who can buy their surplus electricity and at which price. Vice versa, the prosumers can decide where their electricity is sourced and what they are willing to pay for it. In this way, prosumers can source their electricity as much as possible from locally generated renewable energy. This means that the money flows to local peers instead of centralised suppliers (to the extent of the local trades) and incentivises investments in renewable energy production. Finally, prosumers will be compensated based on the value they are providing in their energy community, and can benefit also from DG investments made by others.

Note, that in this BM the physical power flows are not necessarily affected by the P2P trades, as long as no load shifting activities are initiated by the prosumers manually.

UNIQUE SELLING PROPOSITION

This BM aims for the USP to allow P2P trading within an energy community where the prosumers have different traditional energy suppliers and therefore are members of different balance groups. To achieve this, either the independent aggregator model or the multiple supplier model is applied in this BM (cf. section 7.4.6). Preferably this should be made possible without the need for a bilateral agreement between the LEMO and the BRPs of the prosumers (cf. market designs without bilateral agreement in ENTSO-E 2015).

If such a BM is applied specifically in a REC, which are limited to a narrower local geographical area, the prosumers can benefit from a reduced grid tariff for the energy that is traded locally among peers and doesn’t make use of higher grid levels (e.g., MV or HV grid). Such reduced tariffs are increasingly emerging in various EU member states.

[4] Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources

[5] Directive (EU) 2019/944 of the European Parliament and of the Council of 5 June 2019 on common rules for the internal market for electricity

REGULATION

Generally, P2P electricity trade within an EC fits into the policy intentions of the EU Clean Energy Package. However, direct P2P trade especially using the independent aggregator model or also the multiple supplier model is not yet feasible in practice in most EU member states.

Also, a major concern regarding the use of blockchain-based market platforms is, that currently there might not exist a regulatory basis to agree on legal terms through smart contracts.

CUSTOMER SEGMENT

Both prosumers and pure consumers can take part as customers in such an EC. As there is no load shifting initiated by the LEMO, it is not necessarily required to have flexible DERs to be a customer. However, the benefit from participating might increase if flexible DERs are available that can at least be controlled manually (e.g., simple EV charging station). In terms of other technical infrastructure, a smart meter capable of communicating the actual load and generation data to the LEMO's platform. However, such a meter can be upgraded when engaging in with the energy community, as well as a local computing unit which might be required.

Generally, customers targeted in this BM currently still might be early adopters. Essentially, the need to be interested in joining (or even initiating) an EC, which is a very new concept. The potential customers need to be aware of the benefits of such an EC and they need to be strongly interested in consuming as much as possible locally generated renewable energy. The customer segment that might be interested the most, might be those prosumers that are willing to invest/already invested in renewable DG (such as PV), because they have the biggest incentive to make the most of their surplus energy production. Besides economic benefits, potential customers should be much more interested in the improvement and optimization of the energy system and have a certain "green spirit".

However, this BM does not require significant changes for the end-users (no load shifting, only meter data are communicated and processed) and the concept is rather easy to understand (using surplus renewable energy from your peers). Hence, it could be the "icebreaker" for more advanced P2P business models (like the LEMO BM in the next section), lowering the general reluctance and increasing user acceptance for similar approaches.

CUSTOMER RELATIONS & CHANNELS

The customers in this BM are part of the specific EC. Therefore, there might be a close contact between the community administration who assumes the role of the LEMO and the members.

Customer acquisition is performed in the course of acquiring members joining the energy community. Except from some potential key partners, there are no existing channels that can be used for getting in touch with potential customers. ECs are a very new concept and the future will show the practical barriers that need to be overcome by interested prosumers who want to establish an EC. Generally, energy communities should be established where there are existing DERs, for which participation in a community might be appealing as a way to increase the value of their resources. Other potential users will then be encouraged to join seeing the results, being convinced and also getting interested in investing in flexible DERs.

The necessary additional hardware for communication is limited in this BM and it is expected that any installation or configuration can be done by the customer itself. Hence, no on-site visit should be required.

REVENUE STREAMS

For its service as a P2P facilitator and EC administrator, the LEMO could charge a flat rate fee for access to the trading platform, combined with a small transaction fee on each trade.

As the LEMO does not provide an overall energy supply service (which is included in the suppler as LEMO BM) and also the local scope of an EC is very limited, the overall revenue streams will be extremely low in this BM. This is critical, especially with regard to the necessary technological infrastructure (licenses and server capacities for P2P platform, hardware for users etc.) which means very high costs compared to the limited revenues.

KEY ACTIVITIES & KEY RESOURCES

The main key resource of the LEMO is its P2P trading platform, which is based on blockchain-enabled smart contracts. Other than in the simple "Supplier as LEMO" BM, here the blockchain is an important instrument to ensure secure transactions between peers, because there is no central intermediary (such as the supplier). The blockchain-enabled smart contracts also facilitate the market clearing, billing of the end-users and verification of the trades (based on meter data).

Although, the LEMO in this BM does not act as a full energy supplier, imbalance settlement needs to be taken into account. Depending on the model chosen (c.f. section 7.4.6), the LEMO either needs to take on balance responsibility for the assets under control (multiple supplier model) or has to pay a fair compensation for the energy transferred and imbalances caused to other BRPs (independent aggregator model).

Regarding technical infrastructure, the trading platform needs to have a communication interface with the prosumer's smart meter. Also, the LEMO needs to provide appropriate IT infrastructure (server capacity etc.). Regarding privacy requirements, the LEMO needs to ensure GDPR conformity (using the blockchain), especially if data are obtained with high granularity in real time.

KEY PARTNERS

ECs are envisioned to be communities consisting of citizens, small enterprises and public bodies. This means a profit driven entity making a business out of ECs cannot be the actual founder of an EC. Entities promoting the initiation of ECs and being the driving force in such an initiative are therefore key partners in this BM. Those are especially municipalities or existing energy saving associations, for instance.

As ECs only consist of the members mentioned above, it is obvious that these non-profit driven actors don't have the knowledge and the resources to build up or operate an LEM on their own. Hence, a technical operator of the P2P platform is needed, who is providing all the key resources and performs the key activities. This could be a specialised entity such as a technical aggregator.

COST STRUCTURE

The main cost element specific to this BM is the cost for platform operation, which is a task outsourced to an external party. This includes software development and licenses to external technology partners, maintenance costs, server costs, customer and support.

Furthermore, in case of an independent aggregator model is implemented in this BM the fair compensation to other BRPs, where imbalances have been caused, could be a significant cost element. If a multiple supplier model is implemented, the LEMO is also responsible for the energy sourcing costs and related imbalance costs for the assets under control. This is a critical risk in this BM, as in a LEM, PV and other fluctuating renewable energy sources might be the main source of electricity, which might result in high deviations from the planned schedule and accordingly to high imbalance charges.

8.2.4 Energy Community as LEMO and FLESCo

PROBLEM

Consumers are increasingly evolving to prosumers with own DG assets such as PV. Recently, two European Directives laid the legal foundation for so-called Renewable Energy Communities (REC)[6] and Citizen Energy Communities (CEC)[7]. Energy communities (EC) facilitate various new services such as community generation, aggregation, P2P trading or charging services. This opens up a range of business opportunities for an EC and associated service providers. However, within an EC the prosumers still have the right to freely choose their energy supplier, which makes the previous "Supplier as a LEMO BM" unfeasible for an EC.

Prosumers want to make optimal use of their surplus electricity and also prefer to consume renewable energy. Currently, prosumers' surplus energy production is not compensated and incentivised based on its value in the local grid (only through fixed feed in tariffs). This creates flawed market dynamics and small-scale suboptimal investments in renewable generation and flexibility technology.

Additionally, prosumers increasingly deploy flexible DERs such as heat pumps or battery storages. In order to reduce energy costs, prosumers want to make use of the flexibility from these assets. DERs are also often not utilized to full capacity. That is why additional revenue streams need to be tackled to increase the DER's value and lower costs. One example are home battery storages – it might be beneficial for the LEM and the owner to utilize them optimally at full capacity.

From a different perspective, FRPs (DSO, but also BRPs and TSO) want to meet their flexibility demand in the most cost-efficient way. Utilising demand side flexibility is promising in this respect but DERs need to be bundled in order to harness this potential. High-level aggregators are also only interested in pooling assets of a significant size (they don't want to interact with single households that have very limited flexibility potential, for instance).

VALUE PROPOSITION

Compared to the previous BM, this value proposition is more comprehensive. The energy community LEMO facilitates P2P trading among the members of the EC and also promises to optimise their load/generation profiles according to the price signals arising from (i) demand and supply in the LEM, (ii) variable grid tariffs in an implicit LFM, (iii) other translated price signals from AS/WS markets and (iv) possible ToU prices of the centrally supplied electricity from the prosumers' individual suppliers. This means that other than in the previous BM, the physical power flows in the distribution grid are changed, so the exploitation of flexibility is also included in the LEMO service.

From the perspective of high-level aggregators, the sector of small loads (such as households) is getting more interesting, as they only need to make one contract with the energy community LEMO to include a large number of small prosumers in their aggregated portfolio at once. As a result, FRPs on the AS/WS market can procure flexibility also from small prosumers through aggregators.

Finally, the DSO has the possibility to procure local flexibility from prosumers (in an explicit LFM), or prosumers are increasingly reacting to the DSOs' price signals (in an implicit LFM).

UNIQUE SELLING PROPOSITION

Also, this BM aims for the USP to allow P2P trading within an energy community where the prosumers have different traditional energy suppliers and therefore are members of different balance groups. To achieve this, either the independent aggregator model or the multiple supplier model is applied in this

[6] Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources

[7] Directive (EU) 2019/944 of the European Parliament and of the Council of 5 June 2019 on common rules for the internal market for electricity

BM (cf. section 7.4.6). Preferably, this should be made possible without the need for a bilateral agreement between the LEMO and the BRPs of the prosumers (cf. market designs without bilateral agreement in ENTSO-E 2015).

In this specific BM, only one contractual relationship is required for LEM participation and optimal exploitation of the available flexible assets in other markets (wholesale market, balancing market or explicit LFM). The optimisation service also includes optimal adaption to a dynamic grid tariff in case of an implicit LFM. This means that the LEMO in this BM promises to minimise the costs for the individual prosumer as much as possible, but respecting user comfort at the same time.

If such a BM is applied specifically in a REC, which are limited to a narrower local geographical area, the prosumers can benefit from a reduced grid tariff for the energy that is traded locally among peers and doesn't make use of higher grid levels (e.g., MV or HV grid). Such reduced tariffs are increasingly emerging in various EU member states.

REGULATION

Generally, P2P electricity trade within an EC fits into the policy intentions of the EU Clean Energy Package. However, direct P2P trade especially using the independent aggregator model or also the multiple supplier model is not yet feasible in practice in most EU member states.

Also, a major concern regarding the use of blockchain-based market platforms is, that currently there might not exist a regulatory basis to agree on legal terms through smart contracts. Compared to the previous BM, the application of blockchain-based smart contracts is even more important, because the prosumers' DERs are automatically reacting to the price signals and instantly adapting their trading strategy based on their flexibility potential.

In case an implicit LFM should be applied as the main driver of the LEM, it is not clear if a highly granular differentiation of the grid price would be granted by the regulator.

CUSTOMER SEGMENT

Both prosumers and pure consumers can take part as customers in such a BM. In contrast to the previous BM, the prosumers and consumers need to have available flexible DERs that can be used for load shifting, as this is a core part of the value proposition in this BM. Such devices include for example heat pumps and EV charging stations. Note, that these devices need to be interoperable to communicate with the IoT gateway provided by the LEMO and react to remote control signals coming from this gateway.

The prosumers and consumers engaging in such a BM are definitely considered front-runners. Essentially, the need to be interested in joining (or even initiating) an EC, which is a very new concept. The potential customers need to be aware of the benefits of such an EC and they need to be strongly interested in consuming as much as possible locally generated renewable energy. Not only financial benefits will be an incentive, but rather their affinity towards innovative solutions and their willingness to contribute to the green energy transition. This affinity needs to outweigh all other concerns such as privacy, control of own comfort etc.

Besides prosumers, in this BM also DSOs and high-level aggregators (trading on wholesale and ancillary services markets) are considered as customers.

In case of an explicit LFM, the DSO can request explicit flexibility from the LEMO. In return, the LEMO is remunerated for this and shares the revenues with the end-users via dynamic price signals. In case of an implicit LFM, there is not necessarily a provider-client relationship between LEMO and DSO, as the price signals from the DSO are directly communicated to the end-users via the grid tariff. However, the DSO benefits from such a LEM as it enables the prosumers to react to the DSO's price signals, which would be unlikely without having a load controlling entity such as the LEMO. In other words, the existence of such BMs could be a prerequisite for DSOs to actually enforce highly dynamic grid tariffs.

Finally, the high-level aggregator is a customer of the LEMO when requesting explicit flexibility from the LEM. Again, the LEMO is remunerated for this and shares the revenues with the end-users via dynamic price signals.

CUSTOMER RELATIONS & CHANNELS

The customers in this BM are part of the specific EC. Therefore, there might be a close contact between the community administration who assumes the role of the LEMO and the members.

Customer acquisition is performed in the course of acquiring members joining the energy community. Except from some potential key partners, there are no existing channels that can be used for getting in touch with potential customers. ECs are a very new concept and the future will show the practical barriers that need to be overcome by interested prosumers who want to establish an EC. Generally, ECs should be established where there are existing DERs, for which participation in a community might be appealing as a way to increase the value of their resources. Other potential users will then be encouraged to join seeing the results, being convinced and also getting interested in investing in flexible DERs.

The necessary hardware is more comprehensive than in the previous BM, as the IoT gateway needs to be installed and all relevant DERs need to be connected to the gateway. Hence, an initial on-site visit of professional staff might be required.

The relation with the high-level aggregator is a bilateral framework agreement defining the terms and conditions for purchasing flexibility dispatches. In this framework agreement, product specifications and also price ranges might be determined. Based on that, the actual contracts are signed on request, if an offer is accepted by the aggregator.

The relation between DSO and LEMO in an explicit LFM is similar. The LEMO is prequalified as a market participant in the explicit LFM and can submit offers. In case of an implicit LFM, there is no such relationship.

REVENUE STREAMS

In theory, in this BM several revenue streams apply. Firstly, a transaction fee for each trade could be charged. Secondly, there could be a (flat or performance-based) fee for optimising prosumers' load profiles and create cost savings for them (from LEM trades, self-consumption, grid prices ion implicit LFM). Fourthly, the LEMO could create revenues by selling prosumers' flexibility to a high-level aggregator or the DSO on an explicit LFM (flexibility activated through price signals by the LEMO).

In practice, the pricing model towards the prosumers might be more straightforward. The P2P trades are conducted automatically and the end-user does not need to state any trading preferences (only comfort preferences). Hence, the pricing model could consist of a combined fee for the prosumer which is a shared savings model (where the cost savings and revenues through optimal load shifting are shared between LEMO and prosumer) or even a flat fee per period (which is smaller than historic costs of the prosumer). In the former option, detailed M&V procedures need to be established, whereas latter option is less complex but means a significant level of risk for the LEMO and therefore for the whole EC. However, with regard to the complexity of a shared-savings model and the small local scope of an EC, a simple flat fee might be more realistic. This would also better fit with the "community idea" of the EC, which could be more relevant for the EC members than just the financial savings.

KEY ACTIVITIES & KEY RESOURCES

The main key resource of the LEMO is its P2P trading platform, which is based on blockchain-enabled smart contracts. The blockchain is an important instrument to ensure secure transactions between peers, because there is no central intermediary in this BM (such as the supplier). The blockchain-enabled smart contracts also facilitate the market clearing, billing of the end-users and verification of the trades (based on meter data).

Although, the LEMO in this BM does not act as a full energy supplier, imbalance settlement needs to be taken into account. Depending on the model chosen (c.f. section 7.4.6), the LEMO either needs to take on balance responsibility for the assets under control (multiple supplier model) or has to pay a fair compensation for the energy transferred and imbalances caused to other BRPs (independent aggregator model).

Furthermore, a crucial key activity of the LEMO is to translate explicit flexibility requests (from high-level aggregator and explicit LFM) into price signals, taking into account the individual prosumer's price elasticity. This needs to be done in terms of adapting the general price levels in the whole LEM (in case of high-level aggregator requests) or with high local granularity differentiated for each local group of prosumers (in case of requests from the explicit LFM). Based on these price signals, the LEMO also optimises the prosumers' load profile reacting to the price signals, resulting minimal costs for the end-users. In this respect, the LEMO needs to be able to also include price signals coming from an implicit LFM (from the DSO as grid tariffs) and from the user's supply pricing scheme (e.g., a ToU contract) into the optimisation algorithm. To achieve an optimal dispatch, a range of tools need to be provided and applied by the LEMO. These include especially DER profile models for flexibility forecasting and Storage-as-a-Service tools. The development of these tools most probably would be outsourced to technical developers (key partners) and the tools would be bought in through a license fee. Generally, the whole IT infrastructure needs to be hosted (or outsourced) by the LEMO.

Also in this BM, the trading platform needs to have a communication interface with the prosumers smart meter, but also with the BEMS or IoT gateway to facilitate load shifting. Also, the LEMO needs to provide appropriate IT infrastructure (server capacity etc.). Regarding privacy requirements, the LEMO needs to ensure GDPR conformity (using the blockchain), especially if data are obtained with high granularity in real time.

KEY PARTNERS

ECs are envisioned to be communities consisting of citizens, small enterprises and public bodies. This means a profit driven entity making a business out of ECs cannot be the actual founder of an EC. Entities promoting the initiation of ECs and being the driving force in such an initiative are therefore key partners in this BM. Those are especially municipalities or existing energy saving associations, for instance.

As ECs only consist of the members mentioned above, it is obvious that these non-profit driven actors don't have the knowledge and the resources to build up or operate an LEM on their own. Hence, a technical operator of the P2P platform is needed, who is providing all the key resources and performs the key activities. This could be a specialised entity such as a technical aggregator.

The high-level aggregator, who is a customer in this BM, can also be considered a key partner, as a long-term framework contract between the LEMO and the high-level aggregator might be established. Hence, the high-level aggregator is not only a customer but also brings value into this BM by requesting explicit flexibility.

Similarly, the DSO is a customer and key partner in case an explicit LFM is implemented. Also, if an implicit LFM is implemented the DSO can be considered a key partner, as the LEMO relies on an accessible interface where the grid prices for the individual prosumers are communicated in real time. This is essential because the LEMO needs to take into account also the grid prices when deciding on an optimal dispatch and trading schedule. Also, the DSO is a key partner for coordinating the market operation depending on the actual grid operation regime (traffic light).

COST STRUCTURE

The main cost element specific to this BM is the cost for platform operation, which is a task outsourced to an external party. This includes software development and licenses to external technology partners, maintenance costs, server costs, customer and support. The costs for technological infrastructure are much more extensive than in the previous BM (c.f. section Key Activities and Key Resources).

Furthermore, in case of an independent aggregator model is implemented in this BM the fair compensation to other BRPs, where imbalances have been caused, could be a significant cost element. If a multiple supplier model is implemented, the LEMO is also responsible for the energy sourcing costs and related imbalance costs for the assets under control. Using the flexibility of the prosumers' DERs, the sourcing and imbalance costs could be minimised in this BM, as it includes optimal load shifting.

9. Conclusion on PARITY Business Models

For the development of the PARITY business models, an iterative and lean business modelling approach has been followed. Starting from the initial business cases and considering related literature and the viewpoints of the market participants in the PARITY consortium, several applicable business models have been formulated. As a general observation, it can be concluded that all PARITY BMs on the one hand face significant transaction costs including platform operation, registration/prequalification, IT and communication infrastructure, licensing for innovative technologies and also costs regarding imbalance settlement. On the other hand, the revenues rely mainly on transaction costs, subscription fees or (long-term) cost savings for the DSO. Whereas former might represent only a small profit margin, latter are difficult to quantify. Hence, the quantitative evaluation of (some) of the BMs towards the end of the project (WP 10) will need to have a close look on how the transaction costs affect the success of these BMs.

The first group of BMs focus on the role of the aggregator. In PARITY, BMs for a high-level aggregator (integrating an aggregated community of prosumers into a larger flexibility portfolio for trading on the AS/WS markets) and a low-level aggregator (supporting local prosumers to participate in a local energy market) are considered. The aggregator BMs can also be distinguished by their approach on how to address balance responsibility issues.

A second group of BMs comprise the ESCo business models, where the services of a pure FLESCo (shifting loads to optimise the benefit from a dynamic pricing scheme) and a flexibility-enhanced ESCo (as a provider of energy efficiency contracting services) are considered.

The BMs, more specific and exclusive to the PARITY market framework are the business models of the Local Flexibility Market Operator (LFMO) and the Local Energy Market Operator (LEMO).

The LFMO BMs are only applicable in case an explicit LFM is implemented. They strongly lean on the idea of previous projects such as GOPACS or Piclo Flex, which are platforms where DSOs can purchase flexibility for congestion management. In PARITY we consider the options that such a platform can be run by each DSO itself or by an external LFMO. For both options, advantages and disadvantages have been discussed. An external LFMO (e.g., existing spot market operators) might have more experience in market operations and can serve several DSOs with one platform. However, this would require an additional interface between DSO and LFMO and, more importantly, confidential information of the DSO might need to be shared with the LFMO, which is a critical aspect.

The LEMO BMs basically facilitate P2P trading, either from the perspective of a supplier or an energy community. Generally, in order to enable P2P trading, three different approaches for managing balance responsibility can be implemented. These include trading (i) between members associated with the same BRP, (ii) by making use of multiple supplier contracts and (iii) by applying the independent aggregator concept.

Table 15 shows the four different LEMO BMs and compares their key characteristics.

Table 15. Comparison of the LEMO BMs.

	LEMO BM			
Customers / Prosumers…	**Supplier as LEMO**	**Supplier as LEMO and FLESCo**	**Energy community as LEMO**	**Energy community as LEMO and FLESCo**
…benefit from optimal load shifting	no	yes	no	yes
…have a supply contract with the LEMO	yes	yes	no	no
…are members of an energy community	no	no	yes	yes
…benefit from local grid tariffs	no	no	yes	yes
…indirectly provide flexibility services to DSO/TSO/BRP	no	yes	no	yes

From the supplier perspective, the LEMO BM can be implemented as a simple P2P facilitator without providing any services for load shifting. This is similar to already existing BMs on the market.

In case the supplier assumes the LEMO role, the prosumers interested to participate in the LEM need to have a supply contract with the specific supplier. In a more comprehensive BM, the supplier as a LEMO also facilitates load shifting and enables the prosumers to optimally exploit the flexibility potential of their flexible DERs and to indirectly participate in AS and WS markets as well as provide flexibility services to the DSO.

From the perspective of energy communities, also the community could apply a simple P2P trading scheme without any automated load shifting. However, as this would be decoupled from energy supply, the margins are expected to be even smaller and the burden for operating such a platform would remain with the administration of the energy community.

Considering these aspects, from the perspective of energy communities, only a more comprehensive BM including the automated provision of flexibility (towards DSO or the AS and WS markets) might be economically feasible. In such a BM, members of an energy community can trade electricity among each other, but are not obliged to have a supply contract with the same supplier and also could eventually benefit from reduced grid tariffs for the energy traded locally. Note, that legislation on energy communities is in an initial state and currently P2P schemes for energy communities are not feasible in most European member states.

In general, all BMs discussed in this report would be applicable in the PARITY market model. However, the most relevant BMs considered for the next steps of the project are the LEMO BMs. That's because the LEMO BMs combine many of the unique aspects of PARITY such as blockchain-enabled P2P trading among prosumers, flexibility services for the DSO and participation in AS/WS markets. Hence, in the next steps in WP5, the focus is on refining the market design for the application of LEMO BMs and also on SLAs governing the relations especially between the LEMO and the local prosumers.

10. REFERENCES

Bertoldi, P., Berrutto, V., De Renzio, M., Adnot, J., Vine, E., 2003. How are EU ESCOs behaving and how to create a real ESCO market? eceee summer study 2003.

CEER 2019, Regulatory Aspects of Self-Consumption and Energy Communities - CEER report. Brussels: Council of European Energy Regulators.

De Heer, H. and Van der Laan, M., 2017. USEF Workstream on aggregator implementation models. Arnhem: USEF foundation.

Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources (recast)

Directive (EU) 2019/944 of the European Parliament and of the Council of 5 June 2019 on common rules for the internal market in electricity (recast)

e-friends, 2020. Besserer Strom, bessere Welt. Retreived from: https://www.efriends.at/ [Accessed on: 12.01.2021]

Energati, 2018. NOVICE project proposes new energy efficiency business model. Retrieved from: https://www.engerati.com/energy-retail/novice-project-proposes-new-energy-efficiency-business-model/ [Accessed on: 24.07.2020]

Energienetze Steiermark 2020. Blockchain Grid - Blockchain-enabled flexibility activation for distribution grid management. Retrieved from: https://www.e-netze.at/Strom/Projekte/Blockchain/Default.aspx [Accessed on: 27.07.2020]

ENTSO-E, 2015. Market Design for Demand Side Response. Policy paper. Brussels: European Network of Transmission System Operators for Electricity.

ENTSO-E, 2019. The Harmonised Electricity Market Role Model. Version 2019-01. Brussels: European Network of Transmission System Operators for Electricity

Fernández Aznar, G., Aranda Usón, J.A., Galán Hernandez, N., Zikos, S., Malavazos, C., Kapsalas, C., Villar, A., Rueda Quintanilla, J., Wingstedt, S., Rivola, D., Pressmair, G., Poretti, N., Stukelj, S., Minda, I., Borges Hernandez, C.E. and Daridou, E., 2020. PARITY Business use cases & Requirements. Deliverable 3.1. PARITY project.

JRC, 2016. Energy Service Companies (ESCOs). Retrieved from: https://e3p.jrc.ec.europa.eu/communities/energy-service-companies [Accessed on 18.11.2020].

Klein, L.P., Krivoglazova, A., Matos, L., Landeck, J., De Azevedo, M., 2020. A Novel Peer-to-Peer Energy Sharing Business Model for the Portuguese Energy Market. Energies 2020, 13, 125.

Leutgöb, K., Amann, C., Pressmair, G., Anagnostopoulos, S., Andreadou, N., Venizelou, V., Karagiannopoulos, G. and Papageogriou, I., 2019. DELTA Business Models, Deliverable 2.3, DELTA project.

Nielssen, C. and Bukh, N., 2011. What constitutes a business model: the perception of financial analysts. Int. J. Learning and Intellectual Capital, Vol. 8, No. 3, 2011.

Olivella-Rosell, P., Lloret-Gallego, P., Munné-Collado, I., Villafafila-Robles, R., Sumper, A., Ødegaard Ottessen, S., Rajasekharan, J. and Bremdal, B.A., 2018. Local Flexibility Market Design for Aggregators Providing Multiple Flexibility Services at Distribution Network Level. Energies 2018, 11, 822

Osterwalder, A. and Pigneur, Y., 2011. Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers. Hoboken, NJ: John Wiley & Sons

Our Power 2020. Die Energiecooperative. Retreived from: https://www.ourpower.coop/ [Accessed on: 12.01.2021]

Powerpeers, 2020. Samen groene Stroom delen. Retreived from: https://www.powerpeers.nl/ [Accessed on: 12.01.2021]

Pressmair, G., Amann, C., Borges Rampinelli, C., Kapassa, E., Themistocleous, M., Kapsalas, C., Malavazos, C., Zikos, S., Fernandez Aznar, G., Galan Hernandez, N., 2020. Integration of Local Flexibility Market into the existing Electricity Trading Frameworks. Deliverable 4.3, PARITY project.

Prettico, G., Flammini, M.G., Andreadou, N., Vitiello, S., Fulli, G. and Masera, M., 2019. Distribution System Operators observatory 2018. JRC Science for Policy Report. Luxembourg: Publications Office of the European Union, 2019.

Repo, S., Kilkki, O., Annala, S., Terras, J.M. and Almeida, B., 2020. Local Flexibility Market Balance Settlement. CIRED 2020 Berlin Workshop, 22-23 September 2020.

Schittekatte, T., and Meeus, L., 2020. Flexibility Markets: Q&A with Project Pioneers. Utilities Policy 63

Specht, J.M. and Madlener, R., 2019. Energy Supplier 2.0: A conceptual business model for energy suppliers aggregating flexible distributed assets and policy issues raised, Energy Policy 135

USEF, 2015. USEF: The Framework Explained. Arnhem: USEF foundation.

Wåge D., Bremdal, B. and Crawford, G.E., 2018. Platform based business models in the future energy market. CIRED Workshop Ljubljana, 7-8 June 2018.

Wåge, D., Fjeld, P., Bremdal, B. and Puranik, S., 2018. Set of INVADE business models including classification framework simplified. Deliverable 9.4, INVADE project.

Zhang, C., C., Wu, J., Long, C., Cheng, M., 2017. Review of Existing Peer-to-Peer Energy Trading Projects. Energy Procedia 105 (2017) 2563 – 2568.

ANNEX A: Business Model Template

#	BM Element	Guiding question	Description
1	Service Provider	Who is the market participant providing a service in this BM?	
2	Customers	Who are the customers in this business model?	
3	Problem	What problems do the customers have?	
4	Service	What is the service offered by the provider to the customers?	
5	Value Proposition	How does this service solve a problem/deliver a benefit for the customer?	
6	USP	Why is the service provider convinced, that this specific BM will succeed on the market?	
7	Resources	What does the provider need to deliver this service?	
8	Revenue Model	How does the service provider earn revenue from the BM?	

ANNEX B: PARITY consortium partner business model proposals

1. Aggregator enabling participation of prosumers (not locally attached) in balancing market through retailer and BRP

The Business Model is applicable in grid regimes:

- In case of explicit LFM: GREEN (towards BRPs and TSO), YELLOW (towards DSO)
- In case of implicit LFM: GREEN, YELLOW

#	BM Element	Description
1	Service Provider	independent aggregator
2	Customers	Retailer (BRP involved too)
3	Problem	Electricity retail is a highly competitive market and having unique products and offerings towards customers (prosumers) is key. Given market trends and predictions, the ability for a prosumer to get the opportunity to offer flexibility through its retailer is of severe value.
4	Service	An aggregator would offer a system that handles a DER portfolio to the retailer. The retailer does in many cases have the main contract with a prosumer, why providing this additional feature through this same business relationship makes sense. The aggregators role is to subcontract the system to the retailer, but to operate the system extracting flexibility from prosumers. This flexibility is then sold to a BRP, which in turn sells it to the flexibility buyer (as frequency regulation, congestion management or other).
5	Value Proposition	Prosumers gain financial benefit from selling their flexibility. Flexibility Requesting Parties (DSO, BRPs and TSO) can satisfy their flexibility needs (ancillary services, portfolio optimisation etc.).
6	USP	While this scheme might struck as overly complex with multiple roles all needing a margin, it complies with current market regulation. One could make the case that the shortest way to solve electricity system issues is to work with existing regulation to speed up market establishment.
7	Resources	The aggregator needs tools and systems for extracting flexibility on building level, as well as careful knowledge about market platforms to ensure efficient handover and handling of flexibility by BRP.
8	Revenue Model	Revenues are generated by selling flexibility to the BRP, which in turn sells on the different flexibility markets.

2. Participation in Ancillary services market for frequency support

The Business Model is applicable in grid regimes:

- In case of explicit LFM: GREEN (towards BRPs and TSO), YELLOW (towards DSO)
- In case of implicit LFM: GREEN, YELLOW

#	BM Element	Description
1	Service Provider	Aggregator, prosumers
2	Customers	DSO, TSO, BRPs
3	Problem	Frequency deviations
4	Service	Aggregators and prosumers can sell their flexibility potential to DSO, TSO or BRPs. Flexibility Requesting Parties (DSO, BRPs and TSO) can buy the flexibility offered by the aggregator. Additionally, the DSO can enforce control-based mechanisms via the aggregator's platform in times of critical grid constraints (red regime).
5	Value Proposition	Flexibility Requesting Parties (DSO, BRPs and TSO) can satisfy their flexibility needs for frequency support.
6	USP	Ancillary services and especially frequency support is crucial for network stability.
7	Resources	The focus of the PARITY tools is here on the forecasting and aggregation functionality
8	Revenue Model	Revenues are generated by selling flexibility to flexibility requesting parties (TSOs, DSOs, BRPs) on the ancillary services market.

3. Aggregator enabling participation of prosumers in balancing/wholesale market

The Business Model is applicable in grid regimes:

- GREEN (towards BSPs BRPs and TSO), YELLOW (towards DSO)

#	BM Element	Description
1	Service Provider	Aggregator
2	Customers	Commercial/Industrial Prosumers as sources of flexibility Flexibility Requesting Parties: BSPs, BRPs and TSO, DSO

3	Problem	Prosumers: high electricity costs DSO: increasing constraints (voltage and congestions), due to RES production and new types of loads (e.g., EVs) in the distribution grid TSO: costs frequency control BRP: imbalance costs BSP: threaten regarding competitors with a new market opportunity
4	Service	Commercial/industrial Prosumers can sell their flexibility potential to an aggregator acting as BSP and BRP that will aggregate flexibility in the programming unit compensating deviation in the predictive flexibility offer to be sold in the flexibility market (different forms of contracts depending on time frame, flexibility markets targeted by the aggregator etc.) Flexibility Requesting Parties (DSO, BRPs and TSO) can buy the flexibility offered by the aggregator, which will happen on the dedicated market (e.g., balancing market wholesale market, bilaterally etc.). Additionally, the DSO can enforce control-based mechanisms via the aggregator's platform in times of critical grid constraints (red regime).
5	Value Proposition	Commercial/Industrial Prosumers gain financial benefit from selling their flexibility. Flexibility Requesting Parties (DSO, BRPs and TSO) can satisfy their flexibility needs (ancillary services, portfolio optimisation etc.).
6	USP	An aggregator is a specialist solely dedicated to bundling and marketing of flexibility resources and gaining the highest profit for it on all available markets. Aggregated predictive flexibility sold compensates the individual deviations obtained in the case of individual flexibility trading. Flexibility energy legislation states a minimum quantity of flexibility to trade with. In the case of the aggregator acting as BRPs it will be responsible of deviations liberating the prosumers from this responsibility contractually.
7	Resources	The focus of the PARITY tools is here on the forecasting and aggregation functionality and submitted offer to the flexibility market at the same time that providing the information to/from DSO and TSO.
8	Revenue Model	Revenues are generated by selling flexibility to flexibility requesting parties on the different flexibility markets. Revenues could be defined as a cost energy trade depending or fixed cost.

4. EV participation in flexibility mechanisms

The Business Model is applicable in grid regimes:

- In case of explicit LFM: GREEN, YELLOW (towards DSO)
- In case of implicit LFM: GREEN, YELLOW (towards DSO)

#	BM Element	Description
1	Service Provider	Aggregator, EV-owner
2	Customers	Green: aggregator, retailer, prosumer Yellow: aggregator, retailer, prosumer, DSO
3	Problem	Prosumers: high electricity costs DSO: increasing constraints (voltage and congestions), due to RES production and new types of loads (e.g., EVs) in the distribution grid
4	Service	EVs discharge in network points where network charges tend to rise (implicit), or electricity price tend to rise (explicit).
5	Value Proposition	Aggregator/retailer: portfolio optimization Prosumer: financial benefit according to their contract with the aggregators/retailers DSO: prevent or mitigate constraints
6	USP	Increased PV penetration leads to more volatile customer behaviours and rapid changes on energy provision and demand. So, there is the need for increased market participation and increased market opportunities for aggregators and retailers. Only opportunity for market participation for EV owners.
7	Resources	EV Profiling and Geo-Charging Services algorithms
8	Revenue Model	EV owner: financial benefit from selling their stored energy on grid peak hours, charge later in different prices (explicit: aggregator contract, implicit: network charges) EV owner: financial benefit from selling their flexibility potential.

5. ESCO providing building-level energy optimization services to minimize costs induced through an implicit LFM/highly dynamic price model

The Business Model is applicable in grid regimes:

- GREEN, YELLOW

#	BM Element	Description
1	Service Provider	ESCO, Retailer(DER Equipment provider)
2	Customers	Prosumers
3	Problem	Increasing costs because of high variability in electricity price, grid tariffs becoming dynamic and dependent on current local grid conditions and constraints and high peak loads.
4	Service	ESCO provision of building level energy optimization services can include software controlling EV charging, heating, lighting, stationary batteries, PV inverters and more. Services can optimize to compensate between phases, shave peaks and to consume electricity while retail price is low and/or grid capacity is cheap. This can result in lower energy costs, lower grid fees and decrease in fuse size. PARITY technologies allow for these services to be created and integrated with existing and future cost models, partly proposed through and working under the term "implicit LFM". The service can be provided directly from an aggregator to a prosumer with existing DER, or be sold together with DER hardware equipment as an off-the-shelf solution through for example a retailer.
5	Value Proposition	Directly: Prosumers gain financial benefit from lowering costs Indirectly: Grid can be operated with a lower cost resulting in benefits for DSO and electricity system as a whole.
6	USP	Market trends are pointing towards increased costs for consumers, meanwhile technology allowing operation of the proposed service becoming cheaper. Gradually the supply and demand will meet on a price level ensuring widespread success on the market.
7	Resources	The provider needs complex general algorithms paired with specific hardware integration and local market and pricing structural data.
8	Revenue Model	The system could be bought for a one-time fee or provided through a subscription.

6. Heating/Cooling as a service for providing grid management services

The Business Model is applicable in grid regimes:

- In case of explicit LFM: GREEN, YELLOW
- In case of implicit LFM: GREEN, YELLOW

#	BM Element	Description
1	Service Provider	The independent aggregator that is responsible for controlling the devices under specific circumstances (e.g., potentially for load shifting) at the prosumer premises.
2	Customers	The electricity consumer is the main customer in this Business Model.
3	Problem	The electricity consumer currently has to do manual actions in order to control its electric devices like Heat-Pumps and Domestic Hot Waters, facing many times discomfort, while cannot use these devices with an optimum way thus paying increased energy bills.
4	Service	The main service that is provided by the aggregator corresponds to comfortable heating and/or cooling along with energy efficiency. This means that the aggregator provides the customer with energy optimization in building/zone level, with an automatic non-intrusive way, keeping always the customer within its personal comfort boundaries.
5	Value Proposition	Implementing techniques like pre-cooling, pre-heating, load shifting in a non-intrusive, automatic and optimal (in terms of energy efficiency) way while not inducing any discomfort to the customer this service, it is not needed by the customer to do any action and gain serious benefits in terms of energy savings (reduced electricity costs) and comfort.
6	USP	Because this BM provides many benefits to the customer connecting and considering not only energy saving and reduced electricity costs, but also the personal comfort/discomfort, as well as the personal preferences of the customer and this is the key value. Moreover, the flexibility that will come as a result of this service will give many benefits to other market parties like the DSO, TSO and BRP.
7	Resources	Building-as-a-Battery component which is a cloud - based application is the main PARITY tool that is responsible to deliver this service properly. Also, complementary but of paramount importance, is expected to be the PARITY's Oracle with all the hardware and off-the-shelf equipment.
8	Revenue Model	Revenues are generated by selling the flexibility to the DSO/TSO or/and BRP or even optimal ToU optimization towards cheaper energy.

7. Self-optimization for electricity cost reduction, sharing and self-consumption

The Business Model is applicable in grid regimes:

- In case of explicit LFM: GREEN
- In case of implicit LFM: GREEN

#	BM Element	Description
1	Service Provider	An ESCO (energy service community) is the main market, providing with the appropriate equipment (PV and a stationary battery) the customer.
2	Customers	The prosumer is the customer as it is the main beneficiary in terms of cost reduction and energy balancing optimization.
3	Problem	High electricity costs and standard tariffs charging by a commercial energy supplier. In addition, currently the prosumers cannot exclusively sell a part of the energy they produce to other electricity consumers or to other energy providers.
4	Service	To be as much self-balanced (in terms of energy) as possible, matching the energy demand with the energy supply produced by a RES.
5	Value Proposition	This service provides the customer with serious benefits like energy autonomy, reliability (avoiding any issues derived from grid problems), reduced energy costs or possibly zero electricity costs (in the case of 100% self-consumption) and also the utilization of pure green energy. Also, the prosumer will have the capability of selling energy surplus to other consumer or energy providers.
6	USP	There is a growing number of active residential PV owners who probably desire the optimal use of their PV production in terms of self-consumption in individual level as well as energy surplus sharing among the stakeholders of an energy community.
7	Resources	Storage-as-a-Service component (which is a cloud - based application) that PARITY project will develop along with the LFM platform are the main output of the project that correspond to the key – tools that are expected to provide the necessary services to the provider (prosumer) for this business model.
8	Revenue Model	From the serious electricity cost reduction coming from the prosumer separation from a commercial energy supplier/retailer, but also from the capability of selling a surplus of its produced energy to the grid operator (DSO), to another energy provider or to another consumer who belongs to the local network.

8. Supplier leasing local battery storage capacity to prosumers

The Business Model is applicable in grid regimes:

- In case of explicit LFM: GREEN (end-customers, prosumers, aggregator)
- In case of implicit LFM: GREEN, YELLOW (end-customers, prosumers, aggregator, DSO)

#	BM Element	Description
1	Service Provider	Electricity retailer/supplier
2	Customers	End-customers (light industry, commercial, households, …), prosumers
3	Problem	Prosumers: Not enough capacity (supply, transmission bottlenecks) resulting in high electricity prices Might inhibit everyday life – households, industrial processes, … Curtailment of RES Limited connection power (by fuse size, cabling, transformer…) Low acceptance of eventually intrusive flex technologies – not only regarding privacy & risk of comfort loss, but also equipment and installation costs Aggregator: dynamic and highly available flexibility DSO: interface towards customers/implicit LFM yellow regime
4	Service	Prosumer: Installing a local battery system to lease capacity to customers and share revenues from electricity markets, P2P buffer operation, avoidance of grid reinforcement costs (i.e., local buffer operation to provide higher power than physically possible) Energy monitoring (incl. i.e., loss avoidance), cost overview Supply, buy, manage energy and associated risk, invoice energy to its customers Aggregator: highly dynamic and available flexibility, ease of access, simple forecast of behaviour and characteristics DSO: providing interface for locational grid pricing and billing
5	Value Proposition	Prosumer: Security of supply (in terms of being less dependent of a volatile electricity price) Not limiting customers in their everyday life – keep doing what they are doing Avoidance of grid reinforcement costs Electricity cost reduction – shared revenue from trading Carefreeness Aggregator: i.e., to cover for flexibility outages

		DSO: provision of flex-availability and status, no need for further interaction with prosumers
6	USP	Continued everyday life Other flex solutions difficult to implement Low customer involvement (installation, information gathering, …)
7	Resources	Monitoring infrastructure, battery system, communication equipment Forecast of customer behaviour Good knowledge about grid/information Trading platform Probably to lease all the battery capacity/high demand and rather mid- to long-term leasing contracts
8	Revenue Model	Share of revenues generated from trading/market participation, leasing and implicit LFM handling, invoice energy to its customers

9. Supplier supplying energy and providing LEM platform contracted with aggregator

The Business Model is applicable in grid regime:

- In case of explicit LFM: GREEN (end-customers, prosumers, aggregator, DSO)
- In case of implicit LFM: GREEN, YELLOW (end-customers, prosumers, aggregator, DSO)

#	BM Element	Description
1	Service Provider	Retailer/electricity supplier
2	Customers	End-customers (light industry, commercial, households, …), prosumers, aggregator, DSOs
3	Problem	Available loads but lacking ability to utilize them to access further revenue streams Desire for local renewable energy generation but limited by distribution grid Improvement of energy efficiency und sustainability – reduction of losses and green energy supply High investment costs and long amortisation periods if RES only used at their own facility Need of entity that integrates their flexibility into LEM/LFM -supplier might be first choice as customers are most likely contracted already

		A separate aggregator as a second entity that customers need to approach besides the LEMO might get complex and cause problems with coordinating flexibilities (LEM vs. market trading via aggregator)
4	Service	Prosumers: One-stop service provider Energy monitoring, cost/savings overview Supply, buy, manage energy and associated risk, invoice energy to its customers Flexibility assessment LEM trading platform Aggregator: Flex provision towards the aggregator, forwarding of information/ flexibility portfolio stacking DSO: local balancing via P2P trading, thus freeing up transmission capacity – preventive congestion management and peak-shaving/peak-shifting Reducing energy imports and loss reduction
5	Value Proposition	Ease-of-use billing local generation and consumption multiple revenue streams preventive congestion management
6	USP	The supplier has experience and expertise on market mechanism and trading of energy. Furthermore, the supplier is most likely contracted already by customers, having knowledge about their needs and energetical behaviour. Aggregating and bundling them in a LEM and accessing further revenue streams to be cost effective and sustainable is the next step.
7	Resources	Monitoring infrastructure and communication equipment Forecast and knowledge of customer behaviour/equipment Good knowledge about grid Trading platform LEM - Aggregator platform Interface towards aggregator and DSO
8	Revenue Model	Share of revenues generated from trading/market participation, provision of aggregator services and LEM platform, local balancing, grid support – peak-shifting/shaving and loss reduction/preventive measures as well as implicit LEM participation

10. DSO acting as LFMO cooperating with the Aggregator

The Business Model is applicable in grid regime:

- YELLOW (towards DSO & Aggregator & LFM) & RED (towards DSO & Aggregator)

#	BM Element	Description
1	Service Provider	Aggregator -> Managing the flexibility from the prosumers side DSO -> Managing the DERs in their grid
2	Customers	Commercial/Industrial Prosumers as sources of flexibility DSO: A DSO has a problem related with congestions and voltage deviations and search for an optimal solution in the LFM. DERs from the DSO side: The assets from the DSO can be affected providing the flexibility needed.
3	Problem	Prosumers: high investment needs an adequate benefit & they need to adapt to this new market DSO: increasing constraints (voltage and congestions), due to RES production and new types of loads (e.g., EVs) in the distribution grid. DERs from the DSO side: If they provide the flexibility other problems can occur in the grid like instability or grid black outs. If they are far away from the problem event, even the losses can be higher for the DSO than the solution.
4	Service	Commercial/industrial Prosumers can sell their flexibility potential to an aggregator that will aggregate flexibility in the programming unit compensating deviation in the predictive flexibility offer to be sold in the flexibility market (different forms of contracts depending on time frame, flexibility markets targeted by the aggregator etc.) DSO can buy the flexibility offered by the aggregator or activating their own DERs, trying to optimize the best solution for the grid performance considering the cost incurred.
5	Value Proposition	Commercial/Industrial Prosumers gain financial benefit from selling their flexibility. DSO acquires flexibility and an optimal manner to solve grid congestions or voltage deviations.
6	USP	From the DSO side, RES curtailment and grid reinforcement will be avoided, If the market works properly the flexibility acquired will be cheaper than the costs related with the current problems that a DSO face. From the aggregator side, an aggregator is a specialist solely dedicated to bundling and marketing of flexibility resources and gaining the highest profit for it on all available markets. Aggregated predictive flexibility sold

		compensates the individual deviations obtained in the case of individual flexibility trading.
7	Resources	Forecasting & aggregation functionalities are needed. We need to forecast the problem prior that it occurs to find a solution for preventing the damage. A coordination is needed between the offer from the aggregator and the forecasting of the problem from the DSO side.
8	Revenue Model	From the DSO side, the cost investment in reinforcement or new assets are reduced. From the aggregator side revenues are generated by selling flexibility to DSOs on the flexibility markets.

11. Aggregator in RED operation regime

The Business Model is applicable in grid regime:

- RED

#	BM Element	Description
1	Service Provider	Aggregator
2	Customers	DSO
3	Problem	The DSO needs to enforce load control to prevent grid outages as an emergency measure. Using its own infrastructure turning down whole connections may be an “overkill”, meaning the specific problem is not efficiently targeted.
4	Service	The aggregator uses its infrastructure installed at prosumers’ sites to enforce load control at the DSO’s request in RED regime.
5	Value Proposition	The aggregator solves the grid constraints for the DSO. The DSO only has to publish the congestion/constraint points to the contracted aggregator(s).
6	USP	By contracting the aggregator to enforce load control, grid constraints can be more specifically targeted, e.g., by turning down very specific loads at very specific locations in RED regime. This leads to less interference with prosumers’ security of supply and comfort.
7	Resources	High granularity of control functionality is needed on the aggregator side. The DSO needs to be able to communicate the exact locations and types of problems (forecasting).

8	Revenue Model	The aggregator is remunerated by the DSO for providing its infrastructure in case of a RED grid regime. The remuneration is determined by the volume of flexibility that can be activated on request.

ANNEX C: Guiding questions for BMC analysis

<table>
<tr><td colspan="3">REGULATION
Are there (other) regulatory aspects that could make this BM unfeasible?
Are there (other) regulatory aspects making this business model attractive?
Is this business model feasible in your national context? Which regulatory changes would be needed?</td><td colspan="2">PROBLEM
Is the hypothesis stated true?
What would you change from your perspective?</td></tr>
<tr><td rowspan="2">KEY PARTNERS
Are there any other partners that could be crucial for the success of this BM?

Think of all different stages in the value chain where the service provider could outsource activities (customer acquisition, operation, technology provision etc.).</td><td rowspan="2">KEY ACTIVITIES & KEY RESOURCES
Please specify the most relevant PARITY tools and their technical functionalities that are required to implement this BM.

What are the activities the service provider has to perform when operating these tools?

Which security and privacy standards need to be met?

Are there other important resources and activities except from these tools?</td><td>VALUE PROPOSITION
Is the value proposition appealing to the customer?

Does it solve the problem stated above?

What are the risks to fail to deliver this value proposition?</td><td rowspan="2">CUSTOMER RELATION & CHANNELS
Is this strategy appropriate to acquire the right customers/a sufficient number of customers?

Is the service provider in a good position to reach the customer segment?

Does the customer relation approach and the user journey seem convenient for the customer?

Which changes would you suggest in this strategy?</td><td rowspan="2">CUSTOMER SEGMENTS
Are there other actors gaining value in this BM?
Are they paying for this value?

Is the customer segment defined specific enough or is it too broad?

What are the risks related to this costumer segment?</td></tr>
<tr><td>UNIQUE SELLING PROPOSITION
What are the unique strengths of the value proposition?
What is the innovative element of the value proposition?</td></tr>
<tr><td colspan="3">COST STRUCTURE
Are there other relevant cost elements for the service provider?
Which are the most critical cost elements?

What are the risks that these costs could be too high, making the BM unfeasible?</td><td colspan="2">REVENUE STREAMS
Are there other revenue streams the service provider could tap into?
How promising are these revenue streams?

What are the risks that these revenue streams fail, making the BM unfeasible?</td></tr>
</table>