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RETRACTED: Policy Framework Enabling Flexibility Markets—Bulgarian Case

Valeri Mladenov ^{1,*} , Vesselin Chobanov ¹ and Verzhinia Ivanova ²

¹ Faculty of Automatics, Technical University of Sofia, 1000 Sofia, Bulgaria

² Entra Energy, 1000 Sofia, Bulgaria

* Correspondence: valerim@tu-sofia.bg

Abstract: The legislation at the EU level is decisive in developing the local flexibility market. At the current stage, there are far-from-sufficient regulations on the local flexibility market, which can be perceived as a major barrier. The scope of this article is to explore the operational principles of the European local flexibility market and to assess the regulation of emerging flexible markets in order to help a new policy framework that facilitates the integration of flexible assets in the distribution grid. Although the evaluation primarily focuses on current regulations, numerous modifications are still being made to them, such as those brought about by the implementation of the Clean Energy Package. The possibility of the research material quickly becoming outdated makes this difficult. To reduce this risk, we also examine current debates over potential restrictions; nonetheless, the core of the report mainly applies to laws and policies that were in force prior to the second half of 2022. An examination and analysis of potential flexibility providers' motives to offer flexibility on a local flexibility market were conducted concurrently with the regulatory assessment. The inquiry was initiated by identifying resources that may be used to improve the flexibility of the electrical system but are underutilized. Underutilized resources refer to assets that are already part of society, such as efficient energy use, support for behavioral changes, heating systems (such as district heating, heat pumps, and thermal inertia), as well as underutilized energy storage capacities that are underutilized in terms of supplying flexibility to the electric grid. Resources were found via conducting interviews and studying scientific literature. The rules and guidelines for the emerging local flexibility markets are examined in this study. The regulations need to be continually improved because they are far from complete.

Keywords: policy framework; flexibility market; regulation; DSO; TSO



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1. Introduction

Energy transitioning toward 2030 Climate Energy and the negotiation of the Clean Energy Package were all brought about by the demand for electricity in the internal market of Europe. The adoption of a centralized market approach came first. The decentralization of a generation with renewable and variable power demand, as well as the electrification of the heating and transportation sectors, are components that have already gained significant momentum in Europe. The outcome is a change to an energy system with significant supply elasticity and supply volatility. This poses a number of operational difficulties for “managing electricity distribution grids to ensure affordability of energy, security, and stability of supply”, particularly for the 2350 small and medium distribution system operators (DSOs) who serve as the intermediaries between the functionality of the electricity system's technologies and the majority of market transactions and policy framework. There is a significant body of research on optimal power system dispatch that fairly demonstrates existing models and knowledge gaps [1–7]. However, the aim of the present work is to focus mainly on the regulatory challenges of upgrading energy systems.

The implementation of regulations by public authorities and governmental agencies in order to affect the conduct of private actors in the economy is typically referred to as regulation [8]. Regulations are a set of guidelines and acceptable conduct that individuals and organizations should adhere to [9]. The maximization of collective welfare, which includes improving economic and social outcomes and improving the lives of citizens and businesses, justifies the application of such rules.

The process of implementing and operating a set of assets through the monitoring, transfer, and analysis of data generated by one of the actors in the energy system is referred to by the European Union as digitalization. The energy sector has undergone digitalization, which enables connections to be made between the various actors in the energy system, such as markets and services, that would not otherwise be possible.

Throughout the whole energy value chain, from production to customer relationship management, the digitization of electrical distribution will enhance operations and boost flexibility.

In order to define scenarios for customers and to create a local energy market, the creation of a self-adaptive energy system and the creation of business plans require an appropriate and reliable policy framework. To create a local energy market for peer-to-peer and centralized technologies for energy exchange and network service provision, create a self-adaptive, automated market structure based on the actual state of the grid, assess flexibility for energy exchange and network service delivery, create business plans for stakeholders, and propose a regulatory framework for implementation to allow market flexibility, an appropriate policy framework is needed.

Flexibility is a relatively new concept in power systems, but it has already sparked a lot of interest [10]. Additionally, there is a growing demand for operational flexibility [11].

Despite its significance, flexibility has not been universally defined, and several studies in the literature have taken varied approaches to it. Planning and operational flexibility have been divided into two primary separate categories in the literature, with the latter being the focus of the majority of studies. Long-term planning related to transmission system architecture is primarily concerned with planning flexibility [12]. On the other hand, operational flexibility is connected to the generation system's machinery and to its ability to react in real time to changes in power [13]. Furthermore, the term "exported flexibility" has become more common as a result of the significantly enhanced interconnections among power networks operating in between various regions and managed by various Transmission System Operators (TSOs). This phrase describes the degree of operational freedom that a TSO can provide to a nearby network via tie points [14]. It is agreed that the more accurate generic definition of flexibility in [15] is "the ability of a system to deploy its resources to respond to changes in net load." Finally, flexible power systems need to be well-resourced, run efficiently, and must possess good planning management [10].

The fact that local flexibility markets are still in their infancy is primarily demonstrated by a few pilot programs and research endeavors. Many large-scale demonstration pilots are being developed across many European nations. The impact of regulation on a nascent market might be significant. Markets must have effective laws in order to operate well, yet some restrictions might have a detrimental effect on how well the market performs. Although the regulatory environment should be suitable, both too little and too much regulation can be detrimental to the growth of a new market [16]. On the one hand, establishing higher level standards at the EU or national levels would make it simpler for market participants to employ flexible assets and boost market liquidity. Because national market structures vary greatly across the EU, we do anticipate that any prospective EU regulations will be relatively high-level. Conducting an in-depth investigation and developing laws based on solid facts are crucial to build rules that are of sufficiently high quality and level inside the EU. The use of a Regulatory Sandbox could be used to test specific laws in a controlled environment while adhering to a set of guidelines and supervisory requirements. This strategy can be applied in many places and nations to assist in the removal of regulatory obstacles from local flexibility marketplaces. As local markets

for flexibility develop over time, the regulations will likely also change. Additionally, DSOs are regulated monopolies by nature whilst also being one of the key stakeholders and consumers of flexibility provision in a local flexibility market. In order to guarantee that DSOs can engage in specific activities without affecting competition, further attention should be given.

In theory, there are several overarching and crucial components of a healthy market [17]:

- Full information
- Rational actors
- Standardized products
- Liquidity
- Low entry and exit costs
- Low transaction costs

Establishing trading regulations, fostering competition, and preventing the misuse of market dominance or other unfair trading practices are the main objectives in the creation of the local flexibility market. The particular legislative structure for the availability and use of flexibility will differ among Member States to reflect national specifics, despite the fact that some fundamental principles can be set at the European level. As previously indicated, overly specific regulations may prevent the innovation that the local flexibility market needs.

2. Themes of Regulation

To ensure that all flexibility service providers engage fairly and equally, the Clean Energy Package establishes a wide framework for reorganizing the energy market (FSPs). Additionally, it recognizes how DSOs and TSOs are modifying their functions and technological frameworks to support more active system management. Currently, these new requirements are being incorporated into the Member State national legislation. Local flexibility markets, a part of the electricity market, enable localized flexibility trading by generating market signals and modifying supply and demand.

The analysis focuses on European nations that have made varying degrees of progress in using flexible solutions to provide services for the electrical grid. The purpose of this study is to examine the operational tenets of local flexibility markets in Europe, evaluate growing flexibility market regulation, and suggest new policy frameworks that facilitate the integration of flexible assets into the distribution grid. As of this writing, many important local flexibility market activities are directly addressed by neither the national legal framework nor by EU law. As a result, the current laws neither explicitly permit nor forbid them. The summary is consistent with the ideas that are emphasized in Table 1. Table 2 provides an overview of the regulatory environment as it stands right now.

Table 1. The highlighted themes and sub-themes for regulation analysis in this report.

Themes	Sub-Themes
Market actors	<ul style="list-style-type: none"> • Aggregator • Balance Responsible Party (BRP) • Citizen energy communities • Distribution System Operator (DSO) • Market operator
Market and product	<ul style="list-style-type: none"> • Market entry and exit and market platforms • Product characteristics (e.g., prequalification, standardization, baseline)
Infrastructure	<ul style="list-style-type: none"> • Smart metering systems • Energy storage • Network expansion
Contract, bidding, and settlement	<ul style="list-style-type: none"> • Contract • Bidding, billing, and settlement
Data security	<ul style="list-style-type: none"> • Access to data, data security, and privacy protection

The Bulgarian flexibility market is the review subject of this paper. Gaps and obstacles to the growth of the local flexible market are also noted in order to create pertinent country-specific recommendations.

Regulatory Overview

Member States must create and publish implementation plans with timetables to take action to address any detected regulatory distortions or market failures in the internal electricity market [18,19] in accordance with EU Regulation 2019/943. The EU Directive 2019/944 urges the Member States to use flexibility in distribution networks, particularly DSOs should be able to purchase such services from providers of distributed generation, demand response, or energy storage and encourage the adoption of energy efficiency measures. Additionally, specifications and standardization should be provided for flexible goods and services, at least at the national level. To guarantee the best possible use of resources, all pertinent information must be shared. Payment should be made for the purchase of flexible goods and services. Finally, all market actor engagement should be based on open, inclusive, and competitive markets [20] This is viewed as the entry point to help with the creation and planning of local flexibility markets.

Local flexibility markets are not yet developed enough. Market designs of related projects could be very different from one another. This fact is useful because it indicates that the regulations are still incomplete. We anticipate that the continued experimentation, development, and application of regional flexibility market practices will go hand in hand with the creation and formulation of rules. The development of flexible services in the distribution grid and the functioning of flexible markets at the national level varied greatly within various European countries, despite the existence of a comprehensive European energy policy framework. The regulatory and policy frameworks at the national level heavily influence this.

Many pertinent LFM (local flexibility market) activities are currently not expressly covered by either the national regulatory framework or EU law. Therefore, they are neither explicitly permitted nor prohibited by present laws. The regulatory environment's current state is summarized in Table 2 below.

Table 2. The regulation overview at EU level and Bulgarian local flexibility market.

Themes	Sub-Themes	EU	Bulgaria
Market actors	Aggregators	Yes, concept was proposed. Regulations are at a high level.	No, discussions are ongoing. Bulgaria follows and adheres to all European regulations and directives.
	Balance Responsible Party	Yes, but not sufficient and need to adapt to LFM designs.	Yes, regulations and guidelines are not discriminatory towards any actors or technologies and should not limit LFM. Some degree of adaptation may be required.
	Citizen energy community	Yes, concept was proposed. Regulations are at a high level.	Yes, but regulations and guidelines are still under development and not easy to comprehend (can be hard to understand and there are some bureaucratic hassles).
	Distribution System Operator (DSO)	Yes, established regulations do exist, but they need to be adapted to LFM designs.	No, guides or regulations for DSO involvement in LFM are yet to be established.
	Market operator	Yes, discussions are ongoing.	No, guides or regulations are to be established.

Table 2. Cont.

Themes	Sub-Themes	EU	Bulgaria
Market and product	Market entry and exit	Yes, regulations and guidelines are at a high level.	No, discussions are ongoing.
	Market platforms	Yes, regulations and guidelines are at a high level.	No, guides or regulations are to be established.
	Product characteristics	No, guides or regulations are to be established.	No, guides or regulations are to be established.
Infrastructure	Smart metering systems	Yes, but they need to adapt to LFM designs.	No, installation is currently under consideration.
	Energy storage	No, guides or regulations are to be changed or adapted to LFM designs.	Yes, discussions are ongoing.
	Network expansion	Yes, but need to adapt to LFM designs.	Yes, discussions are ongoing.
Contract, bidding, and settlement	Contract	Yes, but they need to adapt to LFM designs.	No, specific regulations or guidelines for LFM do not exist, but other regulations and guidelines may be sufficient.
	Bidding, billing, and settlement	No, guides or regulations are yet to be established.	No, guides or regulations are yet to be established.
Data security	Access to data, data security, and protection of privacy	Relatively established.	Yes, but may need adaptation to LFM designs.

3. Main Regulations, Regulation Gaps, and Barriers

The methodology we used is based on our look over the publicly accessible documents where headings contained “Law,” “Regulation,” “Directive,” “Decision,” and even “Recommendation,” “Opinion,” and “for public comment” to identify the current laws and regulations as well as their dynamic modifications. We extensively mentioned EU Directives and Regulations among these. To be clear, an EU Directive is a legislative act that establishes a requirement that all nations must meet, but an EU regulation is a binding legislative act with binding legal force throughout all Member States. However, it is up to

each Member State to create its own laws to accomplish these objectives. Despite the fact that the terms “regulation” and “legislation” may have different connotations in a legal setting, we use them interchangeably in this report.

A standardized evaluation of the EU-level regulations is based on:

- Justification: Why are the laws governing these themes more pertinent and significant to the growth of the local flexibility market?
- Review of the law: Does the existing EU regulatory framework meet the sub-theme Y addressing the local flexibility market for each highlighted theme X?; What is the present EU regulatory framework’s description of sub-theme Y in relation to the local flexibility market?; To what extent does the current framework address (or do not address) sub-theme Y?; Explain which regulations are essential, emphasize any options or conflicts, identify any missing or excessive regulations, and mention any other significant regulatory difficulties.

We apply the comparable evaluation along with a consistency assessment based on Bulgaria’s legislation.

3.1. Market Actors

3.1.1. Aggregator

In EU Directive 2019/944, the term “aggregator” refers to a market participant who “performs the role of combining numerous customer loads or generated electricity for sale, purchase, or auction in any electrical market” [21]. It was also defined as “a market participant involved in aggregation who is not linked with the customers’ supplier” when the term “independent aggregator” was first established. Because they will serve as intermediaries between various client groups and the flexibility market, these two ideas are crucial components of a local flexibility market. EU Regulation 2019/943, which states that it should be made easier for the distributed supply and demand to aggregate, supports this [22]. Final users and small businesses should be able to access the electrical market, especially with the help of aggregation [23]. The internal electrical market design is specifically covered by this. However, we think these ideas also apply to designing local flexibility markets.

The facilitation of active consumer engagement in the energy market is one of the key elements of the Bulgarian Implementation Plan, and it is considered one of the key components of having an effective energy market.

As was already indicated, discussions about the proper regulation of aggregators in Bulgaria are actively ongoing, but at the moment, this business model is absent in Bulgaria and is only being presented as another responsible party for balancing.

It is crucial to remember that there are numerous regulatory barriers and market failures in Bulgaria that are incompatible with the requirements of Regulation 2019/943 of the EU. Even if all of the current reform plans are carried out, there would still be “residual” market failures in the country’s internal electricity market.

One such “market failure” as of right now would be the absence of any non-discriminatory laws due to the lack of an aggregator licensing system.

Bulgaria’s Regulation on Aggregator’s Roles

As a European Union Member State, Bulgaria also follows and adheres to all European regulations and directives. Unfortunately, more often than not, the process of implementing the changes required by these sorts of documents is a bit slower in Bulgaria.

The first talks about aggregators in Bulgaria started with EU Regulation 2019/943, which formed the basis for a public discussion on a draft amendment to the Rules for Trade in Electricity hosted by the Energy and Water Regulatory Commission.

The results of the discussion were introduced in the National Implementation Plan [24], which was submitted to the EU. The plan stated that there still is no single united definition for aggregators, which is why they are currently being defined as yet another balancing responsible party. Aggregators are seen as responsible for providing consumption optima-

tion services (or in other words, flexibility services for decreasing energy consumption); however, at the time of writing, there are no active aggregators in Bulgaria, and there is no separate licensing regime for them.

A legal definition of aggregators “c” and “b” is seen in the Rules for Trading Electricity [25]; a company that is an electricity trader or a generator whose license has been supplemented with the rights and obligations for a balancing responsible party and whose balancing group includes sites of generators, sites of consumers, or storage facilities as direct group members (the trading schedules of the direct members are sent only by the aggregator to the balancing market operator). The Rules stipulate that all the entities that come under the aggregator need to be part of a single balancing group coordinator, which can be either the aggregator itself or another balancing group coordinator. As mentioned earlier, this actually makes the aggregator just another balancing responsible party.

The regulation that touches on the notion of an aggregator is actually the Report/Analysis of energy communities in Bulgaria [26]. Whilst not an official regulation, it is still an important document that highlights the current energy situation and provides recommendations on what regulations may be needed.

The report mainly focuses on energy communities, which are still in their conception phase (at least in Bulgaria) and refer to a group of people, organizations, or SMEs coming together with the purpose of consuming, storing, and/or selling energy from renewables that have been produced by an energy source of their own (owned by the community). In line with this, one type of energy community is actually aggregators.

In conclusion, there is still a need to draw up more detailed market rules on the aggregators’ activity and business models that are to be utilized in the electricity market.

In line with the National Implementation Plan and along with more documents such as the Report/Analysis of energy communities in Bulgaria, it is expected that real examples of aggregators in Bulgaria will soon be seen.

Bulgaria’s Regulation on Aggregators’ Financial Responsibility for the Imbalances

According to the current market rules and regulations, aggregators are viewed as another balancing responsible party.

All parties that are to be aggregated should be part of the same balancing group. According to the ‘RULES FOR TRADING ELECTRICITY’ [25], the aggregator transfers the responsibility for balancing to the balancing group coordinator (same as BRP).

In the current scenario this means that the aggregator being a BRP is solely responsible for any imbalances. Therefore, if the current regulation remains, when aggregators enter the market, their responsibilities in terms of managing balances/imbalances will still be handled by the balancing group coordinator.

Bulgaria’s Regulation on the Relation between Aggregators and BRPs

In view of the current legislation and the need to have all entities under the aggregator to be part of the same balancing responsible party, we cannot say that aggregators are “independent”.

It is important to note, however, that in light of the fact that there are still no aggregators on the Bulgarian energy market, this legislation will probably change based on:

- Lessons learnt from European directives and/or other European countries’ legislation practices.
- The needs and necessities of the Bulgarian energy market, especially when end consumers finally enter the liberalized market and are free to choose their own supplier.

Bulgaria’s Regulation on Aggregator’s Contract

In this regard, though slightly different (due to the view of aggregators as BRPs), Bulgaria’s situation is similar to Sweden—very general legislation and no specific model for aggregation.

3.1.2. Balance Responsible Party

EU's Regulation on Balance Responsible Party

The EU Regulation 2017/2195, sometimes known as “the Electricity Balancing Regulation”, establishes the foundation for an efficient and uniform European balancing market. TSOs must utilize balancing services to make sure that the same amount of electricity is delivered to the system as is used. This balancing service refers to balancing capacity, energy, or both [27]. Balance services, which TSOs purchase from suppliers for flexible production or consumption, are traded on the balance market. Aggregators, especially independent aggregators, are required to bear financial responsibility for the energy imbalances they produce, according to EU Directive 2019/944 [28].

Bulgaria's Regulation on Balance Responsible Party

Before going into the roles and responsibilities of BRPs and BSPs, here is a bit of background on how the balancing market in Bulgaria works. For the purposes of energy balancing, the TSO makes transactions with different market players, which, through their consumption and/or production, can cover the imbalances in the national energy market (definition given by the Rules for Trading Electricity in Bulgaria).

This happens in the so-called balancing electricity market, which aims to maintain a balance between production and consumption in the electricity system. This is achieved by stipulating schedules (deficit or surplus) for the production and consumption of electricity and performing balancing energy transactions for each settlement period. Therefore, in order to achieve that, all producers and consumers in the free market participate as members of balancing groups.

In the legislation, single market players could in theory also enter into direct transactions with the TSO, but in practice, market players participate in the balancing market through a balancing group.

It is important to note that the current legislation is still in the process of being changed and optimized according to the needs of the energy market as well as in line with European directives and legislation.

In accordance with the third package of energy liberalization directives, Bulgaria has started working towards creating favorable conditions for the development of the electricity sector and its market liberalization. This has also included implementing the necessary regulations for the functioning of the balancing energy market. Such conditions and regulations include the introduction of the “day-ahead” stock exchange segment in 2016 as well as the stock exchange segment “intra-day” in 2018 through the Bulgarian Independent Energy Exchange EAD (IBEX).

Having said that, and to complete the intro to the balancing market, we have to note that the balancing model in Bulgaria is transparent, as it provides equal conditions for balancing, regardless of production technology, the size of the objects/sites, and whether they are supplied at regulated or freely negotiated prices. Properly utilizing the use of the balancing market can lead to network developments that do not require huge investments and can also contribute to increasing the flexibility of the electricity system.

Going back to the balancing group we mentioned above, in the market framework of Bulgaria, a coordinated balancing group is actually both a BRP and a BSP. This makes it a market player, which on one side provides balancing services and on the other is in a way responsible for any imbalances that happen.

The actual financial responsibility, though, is as follows: the coordinated balancing group is financially liable to the TSO for any imbalances that it causes, while the market participants themselves (producers, consumers, prosumers) are financially liable for imbalances they have caused based on their agreed contract conditions with the balancing group.

The aim of having end-users, producers, and energy traders enter the balancing market through a balancing group (instead of directly) is to reduce or save completely the balancing costs that result from imbalances (deviations of measured consumption or

production compared to previously planned). The larger and more diverse the balancing group, the greater the preconditions for savings.

In the context of the local flexibility market, BRPs could be seen as potential early adopters of the concept. As they have fewer barriers and may directly benefit from a local flexibility market, it could be possible to first implement such a market and then later transfer it to DSOs (or a separate market operator) when the legislation allows it.

3.1.3. Citizen Energy Communities

EU's Regulation on Citizen Energy Communities

EU Directive 2019/944 encourages a citizen energy community to directly engage all customers in energy production, consumption, sharing, and market participation [29]. To do this, citizen energy communities might integrate the adoption of cutting-edge technology and consumption habits, like demand response and smart distribution grids. This idea is put forth in EU Directive 2019/944 and EU Directive 2018/2001 (often known as the "Renewable Energy Directive, RED") [30] along with the idea of "renewable energy community". Although comparable, they are not entirely consistent. The comparison of these ideas, though, is outside the purview of this paper. The energy community is analyzed in this research as a novel kind of market actor represented by the citizen energy community.

Bulgaria's Regulation on Citizen Energy Communities

Currently in Bulgaria, there are no provisions in the legislation on the creation and functioning of energy communities. However, "Integrated Plan in the Area of Energy and Climate of The Republic of Bulgaria 2021–2030" [31] encourages the promotion of local energy communities and their active participation in the energy market by prescribing that later on, legislative measures will be implemented in the local regulatory framework.

By the end of 2020, there still were not any energy communities in Bulgaria. However, starting around the middle of 2021, in line with the Revision of the Renewable Energy Directive (REDII), discussions and examples of such communities started emerging (mostly from older projects that were not introduced as such due to there being no legislation about energy communities to speak of at that time). Despite not having detailed or energy communities-directed legislation, the current legislation framework is still open to their participation in the energy market

However, some argue that as of yet, the overall legislation is still very complicated for the entry of this type of market player. In addition, general information, as well as the necessary procedures to create an energy community, are still not accessible or simplistic enough for the general public, making it hard to introduce energy communities and see many examples of them in Bulgaria.

There are many discussions about the different types and legal forms of energy communities, which aligns with the fact that currently there is no uniform definition of what energy communities are, but there are more definitions of what their characteristics and purposes are. Commonly, energy communities are powered by RES and owned directly by citizens, cooperatives, or bodies of local self-government (such as municipal authorities). In addition, energy communities usually have a purpose other than profit, such as fighting climate change, for example.

More projects that incorporate all the characteristics of energy communities are expected in the next few years. However, there are still some obstacles (how to raise capital, where to get more information) and possible risks (taxes, how is it taxed, how the legislation will change) associated with energy communities, and until they are resolved, the emergence of energy communities is likely to continue being slow.

3.1.4. Distribution System Operator (DSO)

EU's Regulation on DSO

The objectives of DSOs are precisely outlined in EU Directive 2019/944 [32], which provides a solid foundation for the creation of local flexibility markets. A DSO's major

responsibility is to operate, maintain, and create an economically viable, secure, dependable, and energy-efficient electrical distribution system in their region. They must also take appropriate measures to protect the environment and promote energy efficiency. DSOs need to take the necessary steps to build a flexible and robust network [33]. DSOs may be compelled to provide preference to producing stations that use clean energy or high-efficiency cogeneration [34]. In any case, DSOs shall not discriminate against any market actors in light of their monopolistic status with regulated income.

Bulgaria's Regulation on DSO

ESO EAD (Bulgaria TSO) is the owner and operator of the entire electricity transmission network of the Republic of Bulgaria. This is in line with Directive 2009/72/EC, which establishes common rules on how generation, transmission, distribution, and supply should be handled in the energy market in the European Union.

The distribution of electricity, on the other hand, is handled through DSOs, each of which has demarcated territories. All four DSOs are privately owned by foreign shareholders. The main DSOs of Bulgaria and their metrics in accordance with the Annual report to the European Commission prepared by the Energy and Water Regulatory Commission (EWRC) of Bulgaria in July 2021 [35] are as follows:

- CEZ Distribution Bulgaria AD /CEZ Group/: operates in West Bulgaria, covers around 40,000 sq. km, with market share of 40% (9,396,067 MWh)
- Electrodistribution North AD /Energopro/: operates in North Bulgaria, covers around 30,000 sq. km, with market share of 24% (5,515,228 MWh)
- Elektrorazpredelenie Yug EAD /EVN/: operates in South Bulgaria, covers around 42,000 sq. km, with market share of 36% (8,545,693 MWh)
- Electrodistribution Zlatni Piasaci AD: operates in a limited area of activity

In Bulgaria, DSOs have certain monopoly on the energy market. In order to limit their influence, they are strongly regulated and in line with these regulations they are highly conservative.

DSOs in Bulgaria have limited ability to conduct activities other than network operations. Changes in legislation are definitely necessary if we wish to have DSOs take a more active role on the electricity markets, particularly in the context of local flexibility markets.

3.1.5. Market Operator

EU's Regulation on Market Operator

According to EU Regulation 2019/943, a market operator is a company that matches offers to sell electricity with offers to buy electricity [36]. The organization in charge of running the most crucial elements of a local flexibility market, such as bidding, clearing, and the settlement of the market, is known as the market operator. A market operator must make sure that the design principles are followed when operating a flexibility market. An operator in the market might be proposed by national authorities.

Bulgaria's Regulation on Market Operator

On day-ahead and intraday market (as well as all other current energy markets), IBEX (independent Bulgarian energy exchange) acts as the market operator. There is no reason to think that flexibility markets would differ in any way.

However, it is possible to have new market operators emerging, especially in light of the fact that the full liberalization of the energy market will happen almost in parallel with the current power exchange for electricity license expires.

3.2. Market and Product

3.2.1. Market Entry and Market Platform

EU's Regulation on Market Entry and Market Platform

According to EU Directive 2019/944, rules must ensure that there are no unnecessary obstacles to new market entry, operation, and exit [37]. This holds true for the architecture

of local flexibility markets as well as the internal market for power. The Member States should, in particular, make it easier for aggregators to gain access to the network for new generation capacity, energy storage facilities, and to demand response. Additionally, any monetary compensation payments should not act as a barrier to entrance [38].

At the EU level, there are no rules governing market platforms for local flexibility markets. In order to ensure the cost-effective action of bids, platforms for the exchange of goods and services should use a model with merit order lists, according to the balanced market [39]. The non-discrimination concept and the assurance of fair treatment for all players should serve as the foundation of the market platform.

Bulgaria's Regulation on Market Entry and Market Platform

Relevant information for market entry is one of the aims Bulgaria has set in its "Integrated Plan in the Area of Energy and Climate of The Republic of Bulgaria 2021–2030" [31] in regard to the elimination of regulatory and trade barriers to consumers. Thus, it allows them to use, store, and sell the electricity they produce on the market and to participate in the market by providing system flexibility through energy storage and optimized consumption.

In addition, in the same plan, Bulgaria focuses on increasing flexibility in the electricity system by envisioning and starting dialogues through which to start creating appropriate conditions with the use of legislative measures for the establishment of active consumers, aggregators, or energy communities, as well as their active participation for the optimization of consumption of different market segments.

Most of this has not yet been implemented in the current legislation, but based on the natural path of development, we can assume that when changes are made, they will most probably be similar to the ones in Sweden.

IBEX is a designated and licensed market operator that aims to provide multiple electricity trading platforms based on the needs of the market. Since the legislation changes in 2018, all produced energy for the free market is traded on its platforms.

Other energy platforms have also started emerging on the Bulgarian market along with collaborations between with international partners/platforms.

Legislation that is exactly targeted at energy market platforms in Bulgaria is not available at this point.

3.2.2. Product Characteristics

EU's Regulation on Product Characteristics

To guarantee uniform circumstances for the trading on local flexibility markets, specific features for flexibility products and services must be taken into account. For instance, product prequalification, product standardization, and product baseline are some of these characteristics. In general, certain product attributes are unregulated. We make reference to comparable EU rules on the wholesale market, particularly the balancing market, in order to address this issue.

Bulgaria's Regulation on Product Characteristics

Bulgaria's policy in regard to innovations (products and services) is aimed at creating incentives and supporting the introduction of new technologies to achieve an overall reduction in energy costs, enable the transition to lower and more sustainable consumption of energy, and implement new standards for energy efficiency. The project that elaborates more on this is the Innovation Strategy for Smart Specialization of the Republic of Bulgaria 2021–2027 [40] (successor of a project with the same name that was active between 2014–2020).

Some of the highlights and targets, according to this project and its documentation for the new active period, are mainly connected to the European Green Deal, the transformation and digitalization of energy systems, and Industry 4.0, all of which, in one way or another, facilitate the development of products in line with local flexibility markets.

As of now, no relevant legislation defining the baseline can be found.

3.3. Infrastructure

3.3.1. Smart Metering Systems

EU's Regulation on Smart Metering Systems

The consideration of time-differentiated network tariffs to better reflect network usage is based on smart metering systems. The full implementation of smart metering systems ought to be advantageous to all consumers. They may be able to receive correct billing information based on actual electricity consumption and change their consumption in accordance with real-time price signals as a result [41]. DSOs may also gain from smart metering systems in the form of improved network visibility and a consequent drop in operation and maintenance expenses. Lower distribution tariffs should eventually be passed through to the customers as a result of the cost reduction.

Bulgaria's Regulation on Smart Metering Systems

In accordance with the National Implementation Plan, currently, it is being considered (it would be decided based on Cost-Benefit Analysis) whether smart meters, also called intelligent metering devices, should be installed to all customers without costs or charges for them or at the very least to be able to be installed on demand based on a customer's request.

This would enable them to be able to easily participate in flexibility markets, be it alone or as part of an aggregator's group. In addition, this way, customers will have more information about their own consumption and thus make more informed decisions on who their energy supplier should be or whether and how they can take part in flexibility markets.

It is important to mention that the Third Energy Package (2019), the Clean Energy Package (2019), as well as the Electricity Directive (2019/944), greatly elaborate on the need to give consumers the right to be able to request the installation of smart meters as part of their active participation in the digitalization of the energy system.

Most probably, such Cost-Benefit analysis will be done once the whole energy market in Bulgaria has been liberalized as there are more present-day market failures that need to be addressed beforehand. However, in the National Implementation Plan, Bulgaria does promise that at some point it will try to ensure that all consumers at regulated prices It is in a way indicated and assumed that consumers at regulated prices will probably be energy-poor or vulnerable customers (a term that has yet to be defined in the legislation) who will be able to have smart measuring devices installed free of charge and will be directly informed about this possibility whilst also being provided with the appropriate assistance.

3.3.2. Energy Storage

EU's Regulation on Energy Storage

All power-to-power options, such as batteries, pumped hydro storage, and compressed air storage, are included in the power system's energy storage. When the generated hydrogen is utilized for re-electrification, it also includes power to hydrogen. These storage facilities ought to compete in the power market within a regulated environment. The grouping of cargoes allows a wider and more effective use of storage facilities for the local flexibility market. The ability of consumers to generate and use their own electricity will also result in a rise in the need for storage services and compact storage options. Owners of storage units should obtain advantages from participating in regional marketplaces for flexibility.

In the energy markets, let alone local flexibility markets, energy storage has not yet realized all of its potential. This is due to the lack of widespread development in both the regulatory framework and the technologies. As a result, there are no regulatory inconsistencies with regard to energy storage among the Member States. For instance, storage facilities may pay grid costs as both consumers and producers in some nations and only as producers in others, or they may be subject to other unique agreements [42].

Bulgaria's Regulation on Energy Storage

For the purposes of adding more flexibility to the energy system in Bulgaria, the current legislation has been focusing on using energy storage.

In the “Integrated Plan in the Area of Energy and Climate of The Republic of Bulgaria 2021–2030” [31] as well as the current Bulgarian Energy Commission discussions, further development and adding new storage capacity are seen as some of the most effective and optimized ways of reinforcing the grid and enabling flexibility.

The work towards increasing energy storage has been continued by the National plan for Recovery and Resilience [43] with its latest version from the 06th of April 2022. The plan introduces the so-called RESTORE (National infrastructure for storage of electricity from RES) project. The aim of the project is to allow RES to actively participate in the balancing of the energy system by providing equal and non-discriminatory commercial opportunity to producers of renewable electricity in order to preserve the energy generated by them.

Access to energy storage will be achieved by providing access to infrastructure for different types of services such as storage of energy by third parties. The idea is that this infrastructure for “rent” can be used under standardized commercial conditions and schedules and thus allow renewable asset owners to store surplus energy in them and have the option to decide what to do with it afterward. The general idea is to use this additional stored energy as a flexibility resource to aid the balancing of the system

The ideas represented in this plan have received good reviews from the European Commission.

3.3.3. Network Expansion

EU’s Regulation on Network Expansion

EU Directive 2019/944 mandates that DSOs integrate a new electrical generation, particularly installations that produce electricity from renewable sources, as well as new demands, such as loads brought on by heat pumps and electric vehicles, in a cost-effective manner. DSOs should strive to operate their networks cost-effectively while avoiding costly network extensions by utilizing DER services such as demand response and energy storage [44]. The DSOs could obtain the services they need from the local flexibility market to accomplish these objectives. The EU Directive 2019/944 further stipulates in Articles 32 and 51 that the network development plan must include the consideration of demand response, energy efficiency, energy storage facilities, and other resources that the DSO may deploy as alternatives to system expansion [45].

Bulgaria’s Regulation on Network Expansion

When talking about network expansion, Bulgaria’s goal is both the development (expansion) of the network (energy infrastructure) as well as its modernization.

The outline of the expected network expansions can be found in the “The plan for the development of transmission electricity network of Bulgaria for period 2017–2026” [46] prepared by the Bulgaria TSO—ESO EAD. The plan has been prepared in accordance with the requirement set by ENTSO-E.

The plan envisions building additional capacities of TPPs and NPPs. In accordance with the directives of the European Union, it also sets a plan to maintain the pace of adding renewable sources to the energy mix in Bulgaria. In order to be able to keep the balance between consumption and production and to be able to handle the volatility of wind and solar power plants, their addition to the network is limited.

As the EU Directive 2019/944 has still not been transposed into the Bulgarian legislation, the network development plans for distribution systems are not introduced yet as an activity to the DSOs.

3.4. Contract, Bidding, and Settlement

3.4.1. Contract

EU’s Regulation on Contract

On the notion of local flexibility market contracts, there is no set regulation. One of the guiding concepts is that, more generally than specifically, different markets’ terms and

conditions ought to be made as compatible as they are feasible in order to involve flexibility service providers and aid in boosting liquidity [47].

Another rule governing how electricity markets operate is that long-term hedging products must be traded transparently on exchanges and long-term electricity supply contracts must be negotiated over the counter. This rule is in place to protect market participants from risks associated with price volatility and to reduce uncertainty regarding future returns on investment [48]. Consider applying this idea to the local flexibility market as well.

Bulgaria's Regulation on Contract

The only way local flexibility markets are represented in Bulgaria is through demos of European projects. There is still no legal mechanism on how they will be set up or managed or on their modes of operation.

So, it could be said that contracts about local flexibility market will most probably follow the approach of European directives. This will probably be in line with what has been written in the EU paragraph part of this point.

Furthermore, there is quite extensive legislation on the different types of contracts available in the electricity market today, so new legislation will probably use it as a reference and build upon already established practices.

3.4.2. Bidding, Billing, and Settlement

EU's Regulation on Bidding, Billing, and Settlement

There is no defined regulation on the local flexibility market contract. One of the guiding principles is that, generally speaking, it is best to make multiple markets' terms and conditions as compatible as possible in order to involve flexibility service providers and support the growth of liquidity [47].

Long-term hedging products must be traded transparently on exchanges, and long-term electricity supply contracts must be negotiated over the counter, according to another guideline governing how electricity markets function. This regulation was put into place to safeguard market participants from the dangers of price volatility and to lessen the uncertainty around potential investment returns [48]. Think of utilizing this concept in the neighborhood flexibility market as well:

- **Validity period.** This is the window of time during which the flexibility service provider's bid can be implemented while still honoring all of the product's specifications. A start time and an end time specify the validity period. In EU Regulation 2017/2195, there is no definition of a flexibility product other than balancing. It is suggested that new definitions for flexibility products be included to the new network code, or that the EU Regulation 2017/2195's restrictions on balancing goods be expanded to cover all flexibility products, as well as their inclusion in the definition of "standard product".
- **Recovery time.** This is the shortest amount of time between the conclusion of the deactivation period and the activation that comes next. Although it is not defined explicitly, EU Regulation 2017/2195 makes reference to it as one of the changeable attributes of a standard balancing product bid. However, it does not require regulation involvement; thus, there are not any special characteristics that call for a formal definition.
- **Minimum and maximum quantity.** Depending on the type of product, this refers to the minimum and maximum amount of a bid that is exchanged on the market. It may be capacity- or energy-based. Although it is not defined expressly, EU Regulation 2017/2195 makes reference to it as one of changeable attributes of a standard balancing product bid. However, it does not require regulation involvement, thus there are not any special characteristics that call for a formal definition.
- **Direction of activation.** This describes whether the device is activated in the up or down direction. Although it is not defined expressly, EU Regulations 2017/2195

and 2019/943 make several allusions to it. However, it does not require regulation involvement; thus, there are no special characteristics that call for a clear definition.

- **Divisibility.** In terms of power activation or time length, this refers to the option for a DSO to employ only a portion of the bids. Other than balance, there is no definition for flexibility products. The EU Regulation 2017/2195 contains some references to balancing products and lists this as one of the qualities for standards products. It is suggested to create new definitions in the new network code for flexibility goods or to incorporate them in the definition of “standard product” and the laws on balancing products in EU Regulation 2017/2195.
- **Ramping period.** This is one of the traits listed in EU Regulation 2017/2195 for standards products. No particular features are suggested for which a formal definition is necessary.

The DSO, BRP, aggregators, and local flexibility market operator consult with one another throughout the contracting and bidding process to agree on the flexibility trading price and quantity. The local flexibility market operator receives requests for flexibility provision from DSOs after they determine whether and where there are issues with congestion or voltage violations. In the meantime, BRPs receive portfolio predictions, predict future imbalances, and, if necessary, issue requests for flexibility provision. The local flexibility market operator will send a notice to the aggregators based on all requests, and the aggregators will compile the flexibility proposals from their prosumers to provide flexibility bids.

Following the bidding procedure, DSOs and BRPs would send requests for activation to the market operator in order to begin using the flexibility items and services they had purchased. Prosumers would then receive the request signals after being passed along to aggregators. The loads will be scheduled and controlled in order to deliver the flexibility products and services. Following the activation procedure, all market actors conduct transactions through settlement platforms [49].

Bulgaria’s Regulation on Bidding, Billing, and Settlement

As stated, there is still no local flexibility market mechanism in Bulgaria thus bidding in the context of local flexibility market has still not been regulated. Most probably, when regulations start appearing, they will be in line with what is going on in EU, and for example, again in Sweden.

When it comes to billing, a solution has yet to be found. Most likely, regulations will be based on the demos carried out in Bulgaria that have proven to have a successful business model or are based on other successfully implemented legislations across Europe. Based on that, for example, taking FlexiGrid’s demos, the billing process will be handled through:

- **Blockchain** (transaction recorded in a ledger and accepted as a form of a recognized expense/income = invoice): which will require some Fintech regulations before it can be implemented
- **Market operator:** having a market operator that handles the billing process
- **Automated or manual billing process** for DSO and FSPs (or other players) participating on the flexibility market
- **Deduction from current bills**, which would need some automation in DSOs (probably direct connection to flexibility market platform)

Similar to billing, as there still is not a local flexibility market, there are still no regulations in regard to market clearing. The most obvious option would be that it is done automatically based on pre-defined conditions such as the price, location, and/or size of the flexibility service.

3.5. Data Security

3.5.1. EU’s Regulation on Data Security

The existing EU legislation only covers a portion of this subject. The challenges linked to data privacy have been mainly addressed by EU legislation, GDPR. This section is

covered by EU Directive 2019/944 [50] and various earlier directives [50–52]. To summarize these standards, we could say that data sharing should adhere to fair and open rules and practices. In the meantime, consumers' personal data and commercially sensitive information should be completely safeguarded [53,54]. The local flexibility market design is also subject to these rules.

According to EU Regulation 2019/943, the DSO is responsible for assisting other authorities in developing data management, cybersecurity, and data protection. To facilitate data access, multilateral data interchange, and data security in local flexibility markets, further research by market operators is required. Access to more information ought to minimize entry barriers for all market players and boost market liquidity. As buyers of flexibility products, DSOs might expect to pay less as a result. To avoid gaming or market misuse, information and data should be handled carefully. To prevent particular market participants from acquiring any unwarranted competitive advantage, sharing sensitive data should be discouraged.

3.5.2. Bulgaria's Regulation on Data Security

Data protection in DSOs in Bulgaria is regulated through GDPR and EU Directive 2016/679. DSOs are registered as Personal Data Protection Officers and in line with that they collect and process the necessary personal data of their customers.

Each DSO has their own "privacy and data protection policy" that is part of every contract or service that the DSO procures for its customers. The full policy can also be found on the websites of each respective DSO. The type of data that is gathered for customers is also regulated in the Energy Law, the Law on Energy from Renewable Sources, the Spatial Planning Act, the Rules for measuring the amount of electricity, and the Rules for electricity trading, just to name a few.

The Energy act prescribes that the DSOs and the electricity suppliers shall provide complementary information on:

- Cumulative data for at least the three previous years or the period since the start of the electricity supply contract, if that period is shorter. The data shall correspond to the intervals for which frequent billing information has been produced.
- When an intelligent measurement system has been in place—Detailed data according to the time of use for any day, week, month, and year, which is made available to the final customer via the internet or the meter interface, covering the period of at least the previous 24 months or the period since the start of the electricity supply contract, if that period is shorter.

4. Conclusions

This paper reviews the regulations and policies for the upcoming local flexibility markets. The regulations are far from ready yet and therefore need continuous development. Some conclusions for the EU and Bulgarian legislations were presented.

In order to make the transition to future active and intelligent distribution grids, technologies and market solutions must be developed and tested. This will enable end users as well as grid owners and operators to make the best possible use of grid infrastructure, local producers, and consumers' resources.

The difficulties in this paradigm shift are complex and exist mainly within the provision of guarantees for the security and reliability of the energy supply, the increase of the penetration of renewable energy sources in the energy mix, the coordination of storage systems, and the preservation of synergies between market and network operations. An appropriate regulatory framework for implementation is needed in order to allow flexibility in the market.

The development of the local flexibility market is largely dependent on EU regulation. The lack of adequate rules for the local flexibility market at this time can be seen as a significant hindrance. The main goal of creating local flexibility markets is to create trading regulations that encourage competition and avoid the exploitation of market dominance or

other unfair trading activities. While some fundamental principles can be established at the European level, the specific legal framework governing the use and access to flexibilities should differ from Member State to Member State in order to reflect national standards. As was already mentioned, overly complex regulations could deter the innovation required in regional flexibility markets.

On one hand, giving a greater degree of principles at the national or EU levels may result in more market liquidity and easier access to flexible assets for market participants. One of the most crucial pillars of EU legislation governing the electricity market is the non-discriminatory and fair norm. Due to the vastly varied market arrangements at the national level throughout the EU, we do anticipate that possible EU regulations will be relatively expensive. However, it is preferable to have a comprehensive regulatory framework in place than to start out ignoring some parts. As the local flexibility market develops and becomes more established, these regulations are likely to change over time. Additionally, DSOs are effectively regulated monopolies while also being one of the main stakeholder categories and buyers of flexibility provisions in the local flexibility market. Making sure DSOs carry out specific tasks without stifling competition should get special attention. However, overly rigid regulations can be detrimental for emerging markets.

Legislation in the EU is being developed to adapt current actors, such as DSOs, BRPs, and so on, as well as emerging new actors, such as aggregators, citizen energy groups, and market operators. The concept of flexibility products and services could be used to describe the current energy markets, such as the wholesale market that includes the balancing market. Future regulations, however, must take into account the distinctiveness of flexibility products and services as well as their intended use. Consequently, the bidding procedure, billing, and market settlement should all be governed. The development of local flexibility markets should also be supported by solid infrastructure, such as energy storage and smart metering. Last but not least, in order to protect customers, it must be ensured that relevant data flow and communication be adequate, and that data security measures should adhere to EU security rules.

The assessments of the regulations show various phases of the growth of the local flexibility market. Many debates and proposals are now being held, which could have an effect on incoming laws and influence the layout of local flexibility markets. Numerous novel ideas and new players are put out, including aggregators and citizen/renewable energy communities, although the related laws are more general than precise. As a result, ambiguities and conflicts surrounding the legal and financial linkages between these new actors and the current actors start to appear (e.g., Balance Responsible Parties). Data security, data interchange, and data access are three examples of legislations that already exist to a great extent but still need to be adjusted to the local flexibility market setting. Since there are differences in opinion among market participants, some topics, like the theme of the market operator, should be appropriately clarified by the ensuing legislation. Additionally, there are some regulations that are completely absent, such as those pertaining to baseline flexibility product and service designs, standardization, and product prequalification. Contractual agreements, competitive bidding, and market settlements must all be adjusted to the local flexibility market in addition to the regulations currently in place for the electricity market. Local flexibility markets are likely to need cutting-edge metering infrastructure, as well as IT systems that can handle the data efficiently. A costly obstacle to overcome would be a lack of such infrastructure. The developing local flexibility market should also be protected by additional essential infrastructure, such as energy storage facilities and network development.

Local flexibility market design is, as has been emphasized numerous times in this article, largely still in the conceptual stage, making it a market mechanism that does not exist in any of the nations discussed in this research, Bulgaria included. Before such a business/market model can be implemented in Bulgaria, as can be shown from the examination of local flexibility market-related rules, there is still more work to be done. Although dis-

ussions are still ongoing, many elements of the legal system already indicate that the local flexibility market will eventually become much more than simply a theoretical concept.

It is crucial to remember that there will not be a single definition or operation method for the local flexibility market. Depending on how their power markets operate, many nations will have different legislation pertaining to local flexibility markets. Therefore, even though there are several directives in the EU with rather specific and precise requirements pertaining to flexibility markets, most nations have the freedom to decide when and how to adopt the required legal adjustments. EU directives are very progressive in this regard, while Bulgaria takes a more conservative approach by internally discussing necessary regulatory changes in depth while simultaneously observing the effect of similar changes in the countries that have already adopted them. Many regulatory changes and adaptation schemes would be necessary to enable Bulgaria's electricity market to host a local flexibility market, but changes are happening. It is with certainty that one can state that within a period of 5–10 years, the materialization of such a market in Bulgaria would be more than possible.

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