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KORIŠĆENJE FLEKSIBILNOSTI U DISTRIBUTIVNOM SISTEMU

DEMAND RESPONSE IN THE DISTRIBUTION SYSTEM

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KRATAK SADRŽAJ

Paket čiste energije (Clean Energy Package - CEP) Evropske unije predviđa postepen prelazak na obnovljive izvore energije. Predviđa se korišćenje distribuiranih izvora električne energije, koji će biti integrisani pretežno u elektrodistributivnu mrežu odnosno sistem (DS). Prijelaz također uključuje prelazak na korišćenje električnih vozila i promenu načina grejanja, pre svega kroz korišćenje toplotnih pumpi. Potrebna će biti značajna ulaganja u DS kako bi se omogućilo povezivanje svih novih izvora i zadovoljila povećana potrošnja električne energije. Postizanje ovih ciljeva neće biti moguće bez drugačijeg pristupa upravljanju i planiranju sistema. Operator distributivnog sistema (ODS) će ubuduće koristiti usluge fleksibilnosti za rad DS. Usluge fleksibilnosti omogućavaju korisnicima DS da prilagode svoju potrošnju ili proizvodnju električne energije prema potrebama sistema. To će zahtevati uspostavljanje novih procesa kako za ODS, tako i za operatore prenosnog sistema (OPS), zajedno s saradnjom i razmenom podataka u oblasti operacija i planiranja. Evropska unija je svesna ovoga i započela je sa reformama regulative na tržištu električne energije, uključujući izmene kodova mreže i razvoj novih kodova mreže za prilagođivanje potrošnje. Ovaj članak predstavlja nadolazeću regulativu, fokusirajući se na zahteve kodova mreže za prilagođivanje potrošnje. Mogući načini pružanja usluga fleksibilnosti definisani su na implicitan način (predstavljen je novi tarifni sistem u Republici Sloveniji) i eksplicitan način. Postavljeni su zahtevi uspostavljanje registra fleksibilnosti i platforme za razmenu podataka između operatora. Prikazana su uputstva za fleksibilnost u Republici Sloveniji. Naglašeni su budući izazovi i zadaci.

Ključne reči: fleksibilnost, distributivni operater, operater prenosnog sistema, zakonodavstvo, tarifni sistem

ABSTRACT

The Clean Energy Package (CEP) of the European Union envisions a gradual transition to renewable energy sources. It anticipates the use of distributed sources of electrical energy, primarily integrated into the distribution system. The transition also includes a shift towards electric vehicles and a change in heating methods, particularly using heat pumps. All these changes will place a significant burden especially on electrical distribution systems (DS). Substantial investments in DS will be required to connect all new sources and meet the increased demand for electrical energy. Achieving these goals will be impossible without a different approach to system management and planning. The distribution system operators (DSO) will now utilize flexibility services for DS operation. Flexibility services allow users of the DS to adjust their electricity consumption or production according to the system's needs. This will necessitate the establishment of new processes for both DSOs and TSOs, along with collaboration and data exchange in operation and planning. The European Union is aware of this and has initiated regulatory reforms in the electricity market, including changes to network codes and the development of new network codes on demand response. This article presents the upcoming regulations, focusing on the requirements of network codes for demand response. Possible ways of providing flexibility services are defined in both implicit (a new tariff system in the Republic of Slovenia is presented) and explicit ways. Requirements for organizing a flexibility register, and a data exchange platform between operators are outlined. Instructions for flexibility services in the Republic of Slovenia are presented. Future challenges and tasks are highlighted.

Key words: flexibility, distribution system operator, transmission system operator, legislation, tariff system

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1. INTRODUCTION

The traditional operation model of the electricity system is undergoing significant changes as energy-environmental policies increasingly rely on renewable electricity sources connected to the distribution grid, while electricity consumption continues to rise and its dynamics changes (e.g., due to e-mobility and use of heat pumps for heating). Increased production of dispersed electricity sources and increased consumption, particularly the growth of peak power, strongly affect power flows in the distribution grid, which can bring the distribution grid closer to its technical operational limits. As a result, there is overloading of the power system elements (transformers, power lines) and issues with voltage profiles, leading to reduced security of electricity supply. The European Union is already facing significant problems with overloads in the transmission system (Germany) and overloads and voltage problems in local medium and low-voltage grids. An alternative approach to the necessary reinforcement of the grid is the introduction of flexibility, which enables the distribution grid to avoid dangerous operational states while postponing infrastructure investments in the grid. Additionally, the flexibility of sources connected to the distribution system can serve as a source for providing ancillary services to the transmission system operator and other stakeholders in the electricity market.
The European Commission promotes the development of flexibility markets as they can contribute to achieving the set goals of climate neutrality by 2050. Introducing flexibility markets in the distribution system (DS) requires a comprehensive approach for its development and operation. Distribution system operators (DSOs) will increasingly utilize the available flexibility of active users to operate the DS. The transmission system operators (TSO) are already realizing that an increasing portion of the need for flexibility will be provided by generation sources and end-users connected to distribution grids. This results in an additional need and incentive for coordination in utilizing flexibility potential between a TSO and DSOs.
In Slovenia, there is currently no organized flexibility market in the DS. In contrast, in the European environment, there are several operational markets that exploit flexibility sources in the DS, but these sources primarily serve for providing ancillary services to TSOs. The increasing need for DSOs to use flexibility services requires a gradual regulation and organization of the flexibility market and the introduction of appropriate platforms with transparent rules for the participation of all interested stakeholders.

2. TYPES OF FLEXIBILITY SERVICES

In Europe, there is no uniform definition of flexibility. Various definitions can be found in literature and documents. In Slovenia, for flexibility in the new System Operating Instructions for the Distribution Network (SONDSEE) [1], the following definitions are provided:

- "**flexibility**" is the ability of a system user to deviate from its predicted electricity consumption or production in response to an external signal, encompassing consumption, production, and energy storage,
- "**flexibility services in the DS**" are system services in the DS and congestion management in the DS used by the DSO, as defined by the DSO in the SONDSEE.

Simply put, flexibility is the willingness of a system user, consumer, or producer to change their electricity consumption, production, or storage at a given moment according to the needs or requests of an external stakeholder or service user. Such a user is referred to as an active user. An active user can offer the service independently by himself or through an aggregator (dependent or independent). An aggregator is a legal entity that combines multiple users and offers their services as joint products to service users. An aggregator might be dependent, i.e. supplies also energy to the system user, or independent where he has no obligation to supply electricity to the system user. In this case, the aggregator or active user is referred to as a flexibility service provider. A flexibility service provider manages one or more flexibility sources. A flexibility source represents a device that consumes electricity, a production device, or an energy storage device that can adjust its electricity consumption or production. DSOs, TSOs, and balancing responsible groups (BRPs) represent users of these services. They use them to perform their tasks. Flexibility services represent various ways and purposes of changing electricity production and consumption, described as flexibility products. A flexibility product represents a service described in a predetermined manner, in the form of attributes such as duration, maximum and minimum power or energy, etc. Depending on the purpose of flexibility services, there are several groups of services, schematically shown in Figure 1.
TSOs primarily use system balancing services, as well as services for congestion management (redespatching), while DSOs use services for voltage control and congestion management or to provide sufficient grid capacity to end users. Flexibility services can be provided or procured/activated in various ways. Basically, they are divided

into implicit and explicit services. In simplified terms, in the case of implicit flexibility services, the provider and the user do not enter into a specific agreement on cooperation, and the provider independently decides whether to offer the services or not. The simplest example is adjusting consumption or production to different time periods based on different grid usage tariffs. In this way, the user can achieve savings in system usage, while helping the operator to maintain normal operational conditions in the system. In the case of explicit flexibility services, the provider and the user of the services enter into a mutual agreement in the form of a contract or participation in an organized market, where the service provider is obliged to provide these services to the user when needed, of course, under agreed conditions.

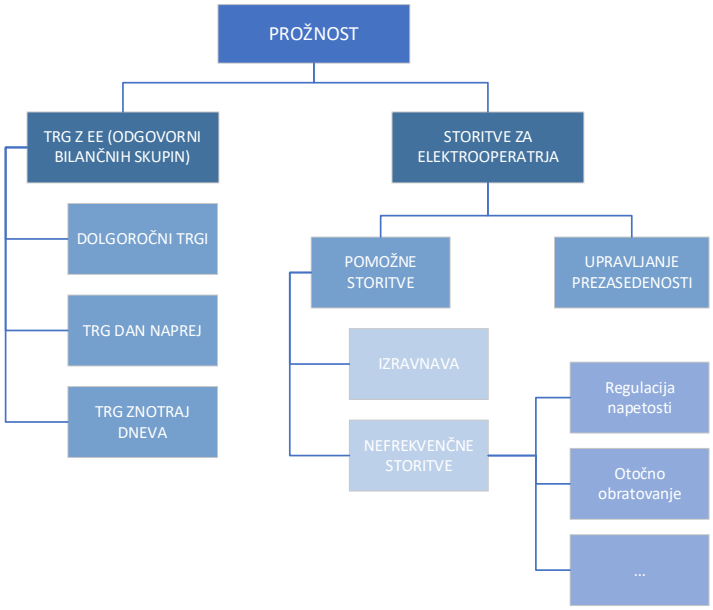

Figure 1 – Types of flexibility services

The Council of European Energy Regulators (CEER), in its concluding document on the Use of Flexibility at Distribution Level [2], describes four approaches that DSOs can use to access flexibility offers:

1. Rule-based approach (defining flexibility requirements through codes and terms and conditions).
2. Network tariffs (designing cost-reflective network tariffs).
3. Connection agreements (DSOs could negotiate with consumers to provide flexibility in exchange for cheaper connections).
4. Organized flexibility market (flexibility is supplied through market procedures on an organized market or via bilateral contracts with providers).

The rule-based approach, as used or planned in Germany [3], gives a DSO a possibility to limit the consumption or production of electricity by system users to a certain level. Users will receive a predetermined financial compensation, which is a lump sum and not tied to a limited amount of energy or power.

With appropriately designed network tariffs, which are time-dependent and reflect system operational conditions, users are incentivised to adjust their consumption to system conditions/needs. In this case, users independently decide whether to adjust their consumption or production. Slovenia is one of the first EU countries to revise its network tariffs to reflect the needs of the future grids. A new tariff set up shall enter into force this year and is described in more detail in Chapter 2.1.

The operator and system user may enter into a connection agreement, which specifies the maximum connection power at which the user may consume/generate electricity. So-called fixed connection agreements have been used until now. New European legislation envisages the use of so-called flexible connection agreements (non-firm or flexible connection agreements). This agreement specifies the connection power, which may be dependent on time of a day or other external conditions. Users are expected to be financially rewarded for such agreements. This way, more users could be connected to the same grid, as restrictions usually only occur in certain and limited time periods.

The European Union incentivises the introduction of local flexibility markets, where DSOs, as well as TSOs, will order flexibility services. A local flexibility market is an organized market, most likely on a unified trading platform, with precisely defined trading rules. In Slovenia, a local flexibility market to be used by DSOs has not yet been established. Based on the information available to the authors, this is also not the case in the European Union. Some local markets operate mainly in the Netherlands and Scandinavian countries, where these markets are established within pilot projects and are currently in trial operation. According to our information, the only

"regularly" functioning market in Europe is in Great Britain. It is worth noting that, in accordance with European legislation, anyone can be the market organizer, a TSO, a DSO, market operator/power exchange, or a third independent entity. The only condition is to operate the market in accordance with the rules of the European Union and the Member States.

2.1 Network tariff system in Slovenia

In Slovenia, starting from July 1, 2024, a new methodology to define the network tariffs will enter into force (Akt o metodologiji za obračun omrežnine za operaterje [4]), issued by the Slovenian national regulatory authority, the Energy Agency. A new methodology will replace the existing tariff system, which has been in use for several years, and it is based on different tariffs depending on the season (summer, winter season) and time of day (higher, lower tariff).
The new tariff system is based on the following principles:

- Settlement based on 15-minute values, and per different user groups (until the full implementation of advanced metering systems by the end of 2025, special calculation methods are determined for system users who do not yet have 15-minute measurements).
- Introduction of two seasons, higher season from November to February and lower season from March to October.
- Five time-blocks.
- Minimum agreed accounting power.
- Agreed and excess accounting power.
- Network charges are calculated based both on consumed power and energy, with charges for power and energy being highest in the first block and lowest in the fifth block.

The time blocks are shown in Table 1.

Table 1: Time-blocks of the new tariff system in Slovenia.

SEZONA	OBDOBJE		1	2	3	4	5
	VIŠJA	DELOVNI DAN	7.00 DO 14.00 16.00 DO 20.00	6.00 DO 7.00 14.00 DO 16.00 20.00 DO 22.00	0.00 DO 6.00 22.00 DO 24.00		
		DELA PROST DAN		7.00 DO 14.00 16.00 DO 20.00	6.00 DO 7.00 14.00 DO 16.00 20.00 DO 22.00	0.00 DO 6.00 22.00 DO 24.00	
	NIŽJA	DELOVNI DAN		7.00 DO 14.00 16.00 DO 20.00	6.00 DO 7.00 14.00 DO 16.00 20.00 DO 22.00	0.00 DO 6.00 22.00 DO 24.00	
		DELA PROST DAN			7.00 DO 14.00 16.00 DO 20.00	6.00 DO 7.00 14.00 DO 16.00 20.00 DO 22.00	0.00 DO 6.00 22.00 DO 24.00

For existing network users, the agreed settlement power is determined based on the peaks power reached in individual blocks over the past 12 months. The agreed settlement power in time block b+1 can be equal to or higher than the agreed settlement power for time block b.
The minimum agreed settlement power is the power in the first time-block below which the agreed power cannot be determined. It is determined based on a certain percentage of the connection power specified in the connection agreement. Excess settlement power is the difference between the realized (metered) power and the agreed settlement power in each 15-minute interval and in each time block.
Specific incentives are provided for flexibility service providers, with different treatment of providers offering flexibility services with energy storage systems (ESS) and providers offering services using other devices. Therefore, a flexibility service provider with ESS is exempt (both based on settlement power and energy) from paying network charges for both storage and discharge of electricity due to the activation of flexibility services. A flexibility service provider with other devices is exempt from paying network charges (settlement power and energy) for the electricity taken during the activation of flexibility services if the service increases electricity consumption from the distribution system.

3. LEGAL FRAMEWORK

Within the legislative package "Clean Energy for All Europeans" (CEP), the European Union has recognized the introduction of flexible electricity consumption as one of the key factors enabling decarbonization of Europe. The CEP, through documents such as the Regulation on the Internal Electricity Market [5] (Regulation) and the Directive on Common Rules for the Internal Electricity Market [6] (Directive), introduces rules for the functioning of the electricity market and the operation of the European electricity system. Article 32 of the Directive sets out rules for incentives for the use of flexibility in distribution systems. Article 59 of the Regulation also envisages the introduction of network codes at the EU level to exploit the potential of flexibility. Additionally, guidelines for electricity transmission system operation [7] and guidelines for electricity balancing [8], which also specify the provision of balancing services, require the introduction of flexibility. It's worth emphasizing that the CEP also places operators in the role of promoters of flexibility use, which imposes new requirements on them.

In 2021, Europe faced an energy crisis, resulting in or caused by a significant increase in electricity prices. While the electricity market continued to operate during the crisis, certain weaknesses were revealed, particularly in terms of protecting users from uncontrolled price increases. As a result, the European Union prepared a regulation to improve the design of the electricity market in the Union [9], i.e. the electricity market design reform. At the time of writing the article, it is in the process of adoption and is expected to be adopted in the spring of this year. Its provisions also affect the preparation of new network codes, as described below. The main highlights affecting the use of flexibility are:

- The use of dedicated measuring devices (DMDs),
- Assessment of flexibility needs, and
- Establishment of a framework for the use of flexible connection agreements.

Dedicated measuring devices are devices for measuring electricity that are installed or attached to individual devices or flexibility sources (e.g. electricity meter in an electric vehicle charging station). The use of these devices presents a new challenge for distribution system operators, as accounting of provided flexibility services will now be performed at the official metering point at the connection point. These measurements can only be used for settlement and control of flexibility services where this cannot be ensured with the current official metering devices of the distribution system operator. Details regarding the use of DMDs will be specified in new network codes on demand response.

Member States will be required to prepare a flexibility needs assessment every two years for a period of at least 5 to 10 years, which must also be included in the ten-year development plans of operators.

Flexible connection agreements are expected to enable a greater number of grid users, particularly of renewable sources, to the grid. Many sources cannot be connected to the grid due to network limitations, both in terms of overloads and voltage problems. However, these limitations only occur during certain time periods. If the operation of these sources, as well as other devices, shall be restricted during these time periods, it would be possible to connect more sources to the grid without additional investments in the grid.

3.1 New Demand response network code

As required by the Regulation, the process of Demand response network code (DRNC) started. The Agency for the Cooperation of European Regulators (ACER) issued Framework Guidelines for Demand Response [10] (Guidelines) in December 2022. Regardless of the Guidelines title, they address both demand adjustment, production adjustment, and the use of energy storage. Based on [10] and a letter from the European Commission dated March 9, 2023, to start drafting the DRNC the European Network of Transmission System Operators for Electricity (ENTSO-E) and the EU DSO Entity are preparing a draft of new network codes. The draft is expected to be ready by May 2024 and submitted for review and approval by ACER. ACER is expected to submit the proposal to the European Commission by the end of 2024. The new rules are expected to be adopted in the first half of 2025. At the time of writing the article, the latest publicly available draft of the new network codes was published on February 29, 2023 [11] for public consultation.

The new codes[1], developed in line with [9] and [10], will comprehensively address the use of flexibility in the distribution and transmission systems. They will cover the following areas:

1. General provisions;
2. General provisions for market access (aggregation models, baseline and measurement calculations, settlement, etc.);
3. Market access - pre-qualification procedures (general, for balancing products, for local services, for special balancing services, etc.);

[1] As drafted by ENTSO-E and EU DSO Entity. The final text of DRNC as will be approved by European Commission may differ from the one drafted by the ENTSO-E and EU DSO Entity.

4. General model of the local flexibility market (national market conditions, ordering and pricing principles, cooperation between the local market and wholesale markets, market operator requirements, etc.);
5. DS development plans (methodologies, scenarios, OPS-ODS coordination, etc.);
6. DSO and TSO cooperation (levels of cooperation, forecasting and addressing congestion and voltage issues, network pre-qualification, flexibility registry, etc.);
7. Requirements for data exchange with network users;
8. Voltage regulation with reactive power (definition of national products, attribute lists, ordering principles, etc.);
9. Congestion management (definition of national products, attribute lists, ordering principles, etc.);
10. Deviations, harmonization, monitoring at the EU level.

It is worth noting that the new DRNC will establish common requirements for the use of flexibility, but most tasks will be delegated to member states, which will need to adopt national terms & conditions regarding market designs within an expected period of two years from the entering into force of the new network codes. It is also worth mentioning that draft proposal for DRNC [11] envisages separate processes for source qualification, provider qualification, network qualification, as well as "ex-ante" and "ex-post" procedures to be implemented to exploit flexibility. All of this will need to be incorporated into national terms and conditions defining the market design in the future.
Several stakeholders and individual external representatives are involved in the development process of DRNC, contributing with their expertise and knowledge to a common goal. In this context, it is also worth mentioning some important reports and documents that provide valuable input to the drafting process, like the Roadmap on the Evolution of the Regulatory Framework for Distributed Flexibility [12], ENTSO-E, All TSOs' proposal for the Key Organizational Requirements, Roles and Responsibilities (KORRR)) relating to Data Exchange [13], and the TSO-DSO Report: An integrated approach to active system management with the focus on TSO-DSO coordination in congestion management and balancing [14], to list a few of them.

In the Republic of Slovenia, a new Electricity supply act (ZOEE) [15] already transposed requirements from Directive [6] regarding demand response and use of flexibility into national legislation. It also considers some requirements of Regulation [5] and establishes basic rules for the use of flexibility in the distribution system, organization of local flexibility markets in Slovenia, as well as provide guidelines for aggregation. Operators are required to establish terms and conditions for market design, mutual coordination between TSO and DSO, and data exchange for use of flexibility in the distribution system, as well as to prepare flexibility products to be used in a day-by-day system operation by a TSO and a DSO.
Furthermore, the Energy Agency of the Republic of Slovenia has adopted a new Methodology Act for Determining the Regulatory Framework for Operators [16]. The act introduces incentives for operators to exploit flexibility.
Finaly, with the adoption of Electricity Market Design Reform regulations and a new DRNC, it will also be necessary to revise the ZOEE and consequently the System Operation Instructions for the Distribution Network (SONDSEE).

3.2 SONDSEE and flexibility

The new SONDSEE define the basic rules for the use of flexibility services by the DSO. They also specify the procedures for grid prequalification when the TSO uses flexibility resources that are connected to the distribution grid for its needs.
SONDSEE provides detailed procedures regarding the use of flexibility services by the DSO. It is important to note that this area is not yet developed in Slovenia, roles for service providers have not been assigned, and a local flexibility market has not been organized. Therefore, the procedures in SONDSEE regarding flexibility are written in a way that allows flexibility procurement through bilateral contracts or flexibility markets, and they will need to be supplemented when roles in Slovenia are precisely defined.
SONDSEE also foresees flexibility products, where each flexibility product is described by attributes. Generally, two types of products are envisaged: products for active and/or reactive power and products for active energy. Products for active and/or reactive power are long term products while on the other hand products for active energy are used for changing energy consumption or production on a shorter-term basis, i.e. on a day ahead or intraday timeframe. In Table 2, we provide an example of a product for active power for congestion management.
To ensure the utilization of flexibility services, it is necessary to develop flexibility services providers' qualification procedures and flexibility resources' qualification procedures, procurement procedures, activation procedures, measurement and accounting procedures, settlement procedures, and stakeholders data exchange

procedures. SONDSEE anticipates that DSOs can procure flexibility services either through an organized market or via bilateral contracts with providers if an organized market does not exist or if procurement via organized market is not economically efficient. As an example, we provide the qualification process (Figure 2).
From the flowchart, someone can observe that service providers apply for the tender based on the call for tenders and technical requirements. During the qualification process, the DSO verifies whether the provider meets the general and technical requirements for offering flexibility products. Generally, the provider qualifies to offer individual flexibility products. Furthermore, it will be necessary to define procedures or simplifications when a provider wishes to participate in multiple different flexibility services, even when participating in various electricity markets.

Table 2: Active power product for congestion management [1]

Attribute	Value	
	Corrective product	Predictive product
Procurement period	Duration of the flexibility procurement	
Time of activation	Months, day of the month, hour of the day	
Full time activation	Defined considering thermal limits of protected devices/components and activation times of flexibility provider.	Defined considering the DSO terms and conditions for flexibility providers
Min quantity	5 kW	
Max quantity	Depending on the technical capability of the flexibility source	
Min delivery period	15 min	
Max delivery period	unlimited	
Deactivation period	Defined considering the DSO terms and conditions for flexibility providers	15 min
Granularity	1 kW	
Type of activation	N/A	
Price for capacity	Included in the bid	
Price for energy	No	
Divisibility	Divisible bids allowed	Divisible and indivisible bids allowed
Location	Included in the bid	
Recovery period	Defined considering the DSO terms and conditions for flexibility providers	
Aggregation	Limited usage	Partly allow, considering the operational state and congestions in the grid
Symmetric/asymmetric product	Asymmetric	

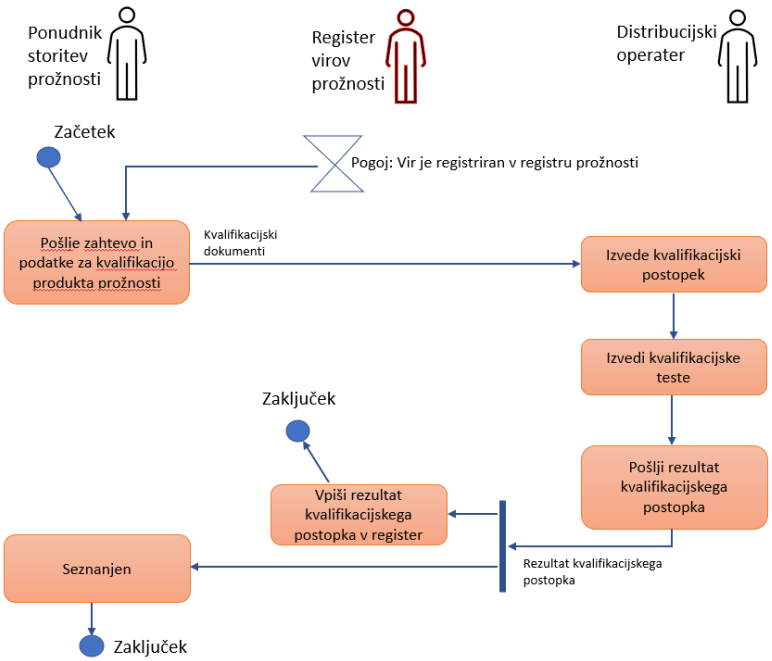

Figure 2: Flowchart of the flexibility services provider qualification process [1]

4. FLEXIBILITY REGISTER, TSO-DSO COORDINATION PLATFORM AND FLEXIBILITY MARKET PLATFORM

Many stakeholders are involved in the provision of flexibility services, including service providers, flexibility resource owners, (independent)aggregators, market operators, system operators, and balancing responsible groups. To successfully utilize flexibility services, it is crucial to establish a flexibility register, TSO-DSO coordination platform, and local flexibility markets. European legislation prescribes the introduction of these platforms but leaves the decision who shall be the operator(s) of each platform to the Member States. It is worth noting that a single functionality can also be organized as multiple platforms, but there are rules defined that platforms must comply with. The operator of each platform may be a DSO or a TSO, an existing market operator, or any another third party.

The TSO-DSO coordination platform must include network planning data and network operational state data. Part of the coordination platform also includes data on the current availability of individual flexibility resources - temporary restrictions (so-called "flexibility traffic light"). The flexibility traffic light can also be part of the flexibility register. Depending on the functionalities the coordination platform has to provide, the operator of the platform may be a TSO or a DSO in the Member State.

The local flexibility market platform represents a market platform where flexibility services are procured/traded. Each market platform has its own rules. In addition to basic functionalities such as bid submission, bid selection, notification, etc., it may also include additional functionalities such as marketing procedures, market analysis tools, messaging tools, etc. There may be several local market platforms, as well as operators, depending on the decision at the Member State level and considering interests of relevant market participants. The market operator can be a DSO or TSO, the operator of an existing flexibility market, or any another third party. A more detailed description of the coordination platform and market platform exceeds the scope of this paper.

To ensure efficient exchange of information and data between market participants, a centralized platform provides a framework for data exchange, allowing all market participants to access their data. The platform that enables data exchange is called the flexibility register. The flexibility register, however, is not necessarily a single information platform. Likewise, not all modules of the flexibility register necessarily need to have the same operator. In principle the flexibility register should be separate from the market operator/power exchange, as it may provide data to different flexibility markets and should therefore include all service providers connected to distribution grid and transmission grid. The primary task of the flexibility register is to collect and exchange relevant data about the available flexibility resources on the flexibility market and should include at least information from the qualification process. Each resource should also be flagged for availability (indicating whether the flexibility resource is available for activation or not). The flexibility resource register is basically a database, and each stakeholder in the flexibility market can be granted with an access to different data, considering their role on the market and their needs. In the report [12] a proposal for the flexibility register functionalities is provided, including:

- Identification data (e.g., location/measurement point, connection type, competent TSO/DSO/flexibility service provider, supplier, asset owner);
- Prequalification data (e.g. telemetry measurement). Can be different for different products;
- Deliverable flexibility, including static data and, possibly, the dynamic status of the asset (e.g. representing the resources availability, other asset performance-related information);
- Contractual information for relevant parties (e.g., agreement duration, responsible TSO/DSO), respecting who has access to any sensitive data. Market parties should not have access to data from other market parties;
- Settlement-related information (e.g. baseline, value stacking, financials).

Figure 3 shows the flexibility register model developed as part of the INTERRFACE project.

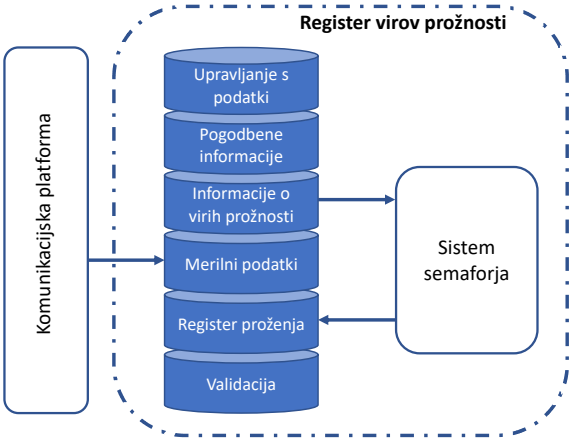

Figure 3: Proposed flexibility register set up (project INTERRFACE)

5. CONCLUSION

The contribution provides a high-level description of the flexibility services framework and the legislative framework that will define the use of flexibility in the EU's distribution systems. Demand response and services that shall be provided based on its flexibility represent an ongoing discussion in EU, since EU relies heavily on demand response as a key strategy for facilitating the green transition. Without the use of flexibility services, power grids (transmission and distribution) will not be able to support the green transition. In any case, the use of flexibility services primarily presents new challenges for DSOs:

1. DSOs are becoming "real" operators, meaning they use external services to manage the grid. Most DSOs lack the knowledge, tools, and resources for this, making it a significant challenge. DSOs have not previously operated on electricity markets (except buying electricity to cover distribution losses) and need to develop these procedures.
2. Grid planning needs to consider the use of flexibility services. DSOs and TSOs lack the methodologies and knowledge for this. New harmonised methodologies will need to be developed.
3. DSOs and TSOs need to collaborate more than they have in the past. Due to increasing distributed generation, there are reverse power flows from distribution grids to transmission grids. Initially, flexibility resources on the distribution system will mainly be utilized by TSOs, meaning DSOs are no longer independent in the operation of their system. This results in extensive data exchange and the need for common rules.
4. Operators need to promote flexibility usage. They must provide appropriate signals and incentives to users to encourage them to offer flexibility services.
5. The use of dedicated metering devices for flexibility services. Previously, the operator only used metering data from "its" meters. Now, users' meters will also be used.

Key tasks for stakeholders in the power sector (especially TSOs and DSOs) include:

1. Establishing a flexibility register and a TSO-DSO coordination platform. A decision needs to be taken on the content or data that will be part of each platform and who shall operate them. It is believed that the DSO would be an appropriate operator since most data and information flow through them.
2. Organizing a local flexibility market. A market design must be defined that should include cooperation/coordination between several different markets, thus giving the opportunity to market participants to fully utilize their flexibility and at the same time provide needed services to TSOs and DSOs. A decision must be made whether to develop a new market platform from scratch or to re-use one of the commercially available solutions.
3. Agreeing on the of settlement (billing) methodology of demand response and agreeing on the methodology how to define a baseline, which is a precondition to a widely deployment of demand response.
4. Where appropriate, DSOs should start using flexible connection agreements.

5. New terms and conditions for flexibility providers needs to be developed, as prescribed by new European network code.
6. To successfully utilize flexibility, observability of the power system at all voltage levels needs to be increased through the implementation of an advanced metering systems and the introduction of additional sensors. Procedures and methods for detecting network weaknesses need to be developed including implementing grid development planning considering flexibility.

Without adequate collaboration among all involved operators, the national regulatory authority, the ministry, as well as aggregators, suppliers, and users, both at the national and European levels, achieving these goals will be challenging.

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