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BOSNIA AND HERZEGOVINA ENERGY POLICY ACTIVITY (EPA)

IMPLEMENTATION OF AGGREGATORS - GUIDELINES

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BOSNIA AND HERZEGOVINA ENERGY POLICY ACTIVITY (EPA)

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ABBREVIATIONS

ACER	Agency for the Cooperation of Energy Regulators
aFRR	Automatic Frequency Restoration Reserve (secondary regulation)
AGR	Aggregator
ARP	Allocation Responsible Party (ISO BiH)
BiH	Bosnia and Herzegovina
BRP	Balance Responsible Party
BRP _{AGR}	Balance Responsible Party (aggregator)
BRP _{SUP}	Balance Responsible Party (supplier)
BRP _{EXT}	Balance Responsible Party – external
BSP	Balancing Services Provider
CAPEX	Capital Expenditures
D	Current day
DER	Distributed Energy Resources
DSO	Distribution System Operator
EBGL	Electricity Balancing Guideline
ENTSO-E	European Network of Transmission System Operators for Electricity
EPA	Energy Policy Activity (a USAID project implemented by DT Global)
EU	European Union
FAT	Full Activation Time
FCR	Frequency Containment Reserve
FRR	Frequency Restoration Reserve
GCT	Gate Closure Time
H	Current hour
IEC	International Electrotechnical Commission
ISO BiH	Independent System Operator in BiH
ISP	Imbalance Settlement Period
IT	Information Technology
M	Current month
MDC	Meter Data Company
mFRR	Manual Frequency Restoration Reserve
MW	Megawatt
OPEX	Operational expenses
RR	Replacement Reserve
SERC	State Electricity Regulatory Commission
SCADA	Supervisory Control and Data Acquisition
SUP	Supplier
SOGL	System Operations Guidelines
TSO	Transmission System Operator
USAID	U.S. Agency for International Development
USEF	Universal Smart Energy Framework
VPN	Virtual Private Network
Y	Current Year

I. INTRODUCTION

Aggregators represent a new category of electricity market participants, which aggregate distributed energy resources (distributed generation, controllable loads, electricity storage devices), and which independently, or through a balance responsible party, enters the electricity market and ancillary services market. By aggregation of the distributed energy resources, aggregators form an entity that is in the literature and practice often referred to as a “virtual power plant”.

The aggregators’ appearance in the electricity market is relatively recent. It is the result of technological progress in the management of distributed resources, as well as of the growing needs for flexibility in the electricity system due to the increased share of variable renewable sources in total electricity production. The aggregation of distributed energy resources (DERs) can play a significant role in enabling the integration of intermittent generation, encouraging the installation of new distributed resources, reducing network congestion management costs, optimizing portfolios, and increasing the security of supply. In addition, the opening of the electricity and ancillary services markets for aggregators opens space for innovation and promotes the application of smart technologies in the management of the power system.

The concept of aggregators is formally defined in the new European Union (EU’s) “Clean Energy Package”¹ through the provisions of EU Directive 2019/944 on common rules for the internal market in electricity². Flexibility services in a given context are considered to be the management of generation/demand of distributed resources with the aim of providing services for the power system balancing, network management and portfolio optimization. The implementation of the aggregator concept should provide benefits to customers and the power system as a whole and should not be an end in itself, which would be contrary to the goals defined by the EU’s “Clean Energy Package”.

The five key regulatory requirements for establishing the concept of an independent aggregator, defined by Directive 2019/944, which should ensure equal treatment of aggregators, are:

- Access to all electricity markets (wholesale electricity market and balancing market),
- Non-discrimination,
- Data exchange,
- The right of the electricity customer to contract aggregation services without being charged undue fees (penalties),
- Aggregator’s access to markets without obtaining approval from other market participants.

It is important to emphasize that Directive 2019/944 in its recital (39) states that Member States should independently choose the appropriate implementation model of an independent aggregator, respecting the general principles given by this Directive.

The existing regulations in Bosnia and Herzegovina (BiH) do not explicitly provide for the possibility of aggregation of DERs and establishment of aggregators with the aim of joint participation in the wholesale and ancillary services markets. In this regard, BiH does not lag significantly behind other signatories to the Energy Community Treaty, nor most EU countries, given that most projects of aggregation of distributed energy resources and demand management in the EU are at the level of research pilot projects. Significant development of the DER aggregation services markets took place in Germany,

¹ https://ec.europa.eu/energy/topics/energy-strategy/clean-energy-all-europeans_en.

² Directive (EU) 2019/944 of the European Parliament and of the Council of 5 June 2019 on common rules for the internal market for electricity <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32019L0944>.

United Kingdom, Belgium, Norway, and several other countries with developed electricity markets. In this context, it is worth to note that secondary legislation in the field of aggregators is not standardized at the EU level.

In general, the business model of the aggregator is based on revenues in the reserve capacity market and revenues which are based on the difference between prices in the balancing and intraday markets in relation to prices in the wholesale bilateral market and the day-ahead market (depending on the chosen method for determining the price of transferred energy). From the perspective of viability of the aggregator's business model, it is important to emphasize that increasing the share of variable sources in total electricity generation, as well as increasing electricity consumption due to the electrification of the transport and space heating sectors, are expected to cause an increase in the volatility of wholesale electricity prices, as well as the growing demand for flexible resources.

This document defines a set of guidelines for amendments to the legal and regulatory framework in BiH and the entities, the implementation of which will remove the barriers and enable the DERs aggregation and the establishment of aggregators as a new category of participants in the electricity and ancillary services markets. The guidelines are the final component that completes a set of documents³ that should serve as a basis for enabling the participation of small-scale renewable power generators and other DERs in the electricity and ancillary services markets.

The guidelines address all important aspects for enabling the DER aggregation and define recommendations whose implementation will enable the level playing field for the participation of aggregators in the electricity and ancillary services markets. The level playing field for the market participation of aggregators implies non-discriminatory treatment of these entities in relation to the conventional market participants in terms of the right to participate, participation conditions, rules for the activation of contracted services and valuation of the delivered electricity and capacity. The document lists the laws and bylaws to be developed or amended, in order to create the legal and regulatory framework that will enable the aggregation of distributed resources.

In the absence of a standardized regulatory framework for integration of aggregators at the EU level, the guidelines are based on EU best practices and the application of the predefined aggregator implementation models⁴, adapted to the local conditions in the electricity and ancillary services markets in BiH. In that context, currently it is not possible to harmonize the regulatory framework for aggregators in BiH with the neighboring countries that have not defined their respective frameworks yet.

³ Already created documents:

“Virtual Power Plants - International Practice Report” April 2020;
“Aggregators – Gap Analysis of Regulations in BiH” November 2020;
“Aggregator Implementation Model” April 2021.

⁴ USEF: Workstream on Aggregator Implementation Models,
<https://www.usef.energy/app/uploads/2017/09/Recommended-practices-for-DR-market-design-2.pdf>

2. GENERAL ISSUES

The implementation of the aggregator concept inevitably leads to the increase of complexity in the power system operation, the degree of which depends on the selected concept and implementation model. The increase in complexity is particularly reflected in the following areas:

- Contractual relations between market participants,
- Balance responsibility of market participants,
- Planning of generation/consumption and flexibility services,
- Measurement and validation of performed flexibility services,
- Treatment of the "rebound" effect⁵ (subsequent change in consumption as a result of the activation of flexibility services),
- Data exchange between participants in the flexibility services market,
- Energy transfer and settlement between aggregators and suppliers, and
- Quantification of imbalances during the flexibility services activation period and during the occurrence of the "rebound" effect.

The roles and responsibilities of all market participants need to be precisely defined. The flexibility services, for which the aggregator is responsible, should be separated from the supply/purchase of electricity for which the supplier is responsible. In order to effectively separate flexibility, aggregator responsibilities should be limited to:

- Flexibility services activation period,
- Flexible resources that are activated, and
- Deviations of activated flexibility in relation to the nominated values.

The document "Aggregator Implementation Model" defines the entities that can perform the role of the aggregator, proposes the appropriate aggregator implementation models depending on the type of services provided by flexible resources, and gives the basic characteristics of each of the proposed models. The role of the aggregator, as defined by this document, can be performed by the:

- Suppliers who purchase electricity from distributed generators and/or supply the final customers,
- Independent aggregators that are not involved in the activities of supplying final customers or purchasing the electricity from generators and which are active exclusively in the field of flexibility services, and
- An independent aggregator and supplier in cooperation (the so-called hybrid model), jointly acting towards the individual flexibility service provider within the same balance responsible party.

It is important to emphasize that formalization of the role of an independent aggregator that has the right to aggregate individual DERs and provide flexibility services, is one of the key elements of the EU's "Clean Energy Package." Article 13 of EU Directive 2019/944 regulates the issue of concluding an aggregation contract, by prescribing the rights of all customers to conclude an aggregation contract with an electricity entity of their choice without obtaining the consent of their electricity supplier. Article 17 of the same Directive prescribes the right to enter the electricity markets for any market participant engaged in aggregation, including independent aggregators.

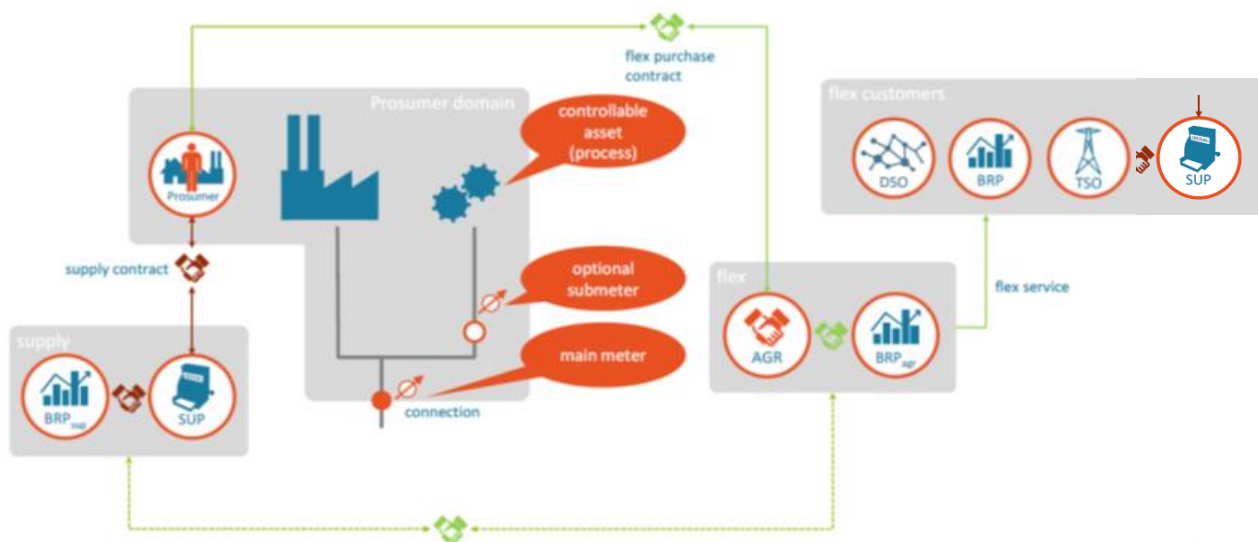
⁵ The "rebound" effect is a side effect of the flexibility activation, which is manifested as a deviation from planned consumption/production outside the flexibility activation period.

The application of Article 13 of EU Directive 2019/944 implies that customers are free to conclude a contract with an independent aggregator, whereby the supplier has no right to prevent the conclusion of that contract.

The concept of an independent aggregator requires significant changes of not only the regulatory framework, but also of business processes in the wholesale and ancillary services markets in which the aggregators participate.

An indicative overview of commercial and contractual relations in the flexibility services market, where the concept of independent aggregator is implemented, is depicted in Figure 1:

Figure 1: Commercial and contractual relationships in the flexibility services market



(Source Universal Smart Energy Framework (USEF)⁶)

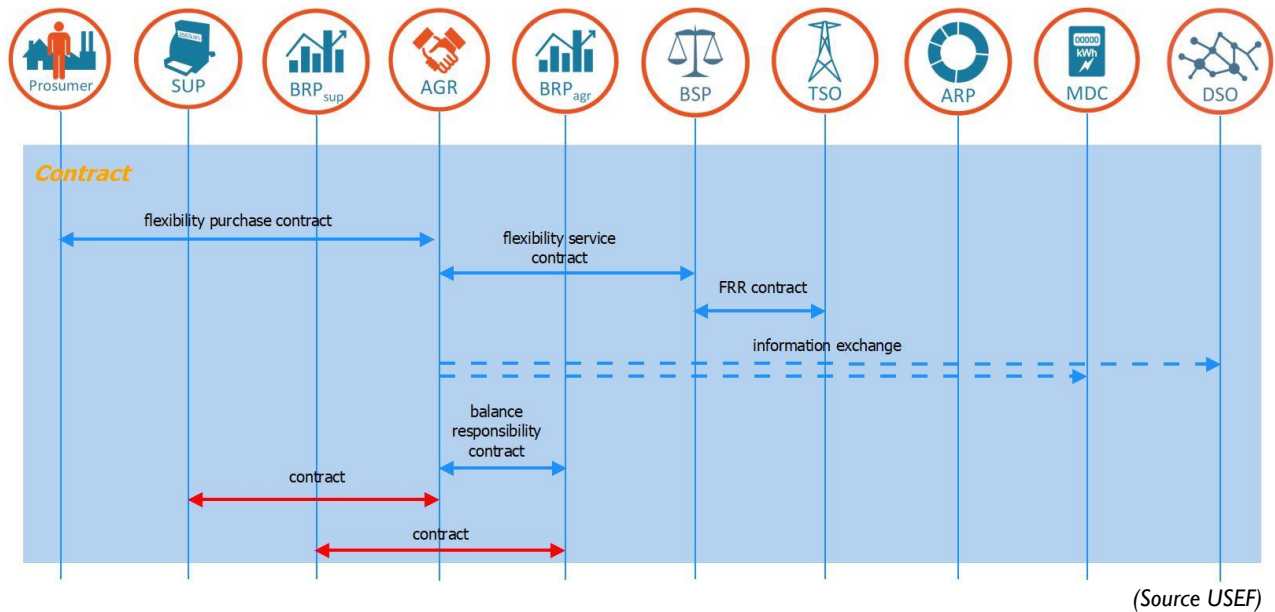
The selection of the aggregator implementation model was made in the document “Aggregator Implementation Model.” For the concept of an independent aggregator, the document proposes the application of the contractual model for flexibility services provided in the wholesale market and balancing market for the procurement of automatic and manual frequency restoration reserves (aFRR and mFRR). The proposed aggregator implementation models, as well as the roles and responsibilities of market participants, must be harmonized with the legal and regulatory principles of the electricity and ancillary services markets in BiH.

A schematic representation of the interactions between market participants during the flexibility service contracting phase is depicted in Figure 2⁷.

⁶ *Op. cit.*, fn. 4, p. 13.

⁷ *Op. cit.*, fn. 4, p. 19.

Figure 2: Interaction between participants during the contracting phase (contractual model)



When the balancing responsibility of aggregators is addressed, it is important to note the provisions of Article 17.3 (d) of EU Directive 2019/944, which stipulates that market participants providing aggregation services are financially responsible for imbalances they cause in the electricity system.

The energy transfer between the independent aggregator and the supplier and the payment of compensation are partially addressed in Article 17.4. of the Directive (EU) 2019/944. This Article stipulates that Member States may establish an appropriate mechanism to compensate suppliers for energy “taken over” by the aggregator through the flexibility services activation, provided that the compensation does not constitute an undue barrier to enter the market, does not lead to overcompensation and is not discriminatory. The Directive further stipulates that the method of calculating compensation may take into account the benefits that the independent aggregators bring to other market participants and, where it does so, the aggregator may be required to pay compensation to the extent the benefits to all suppliers, customers, and their Balance Responsible Party (BRPs), does not exceed the direct costs incurred⁸.

The compensation for energy transfer is particularly relevant for the segments of the balancing market where the quantities of the activated balancing energy are not negligible (aFRR and mFRR frequency regulation services).

This chapter provides recommendations related to the general aspects of the aggregator’s market participation, such as the definition of the term aggregator, allowing the participation of aggregators in the wholesale and ancillary services markets, selection of the aggregator implementation concept and model, role and tasks of the aggregator, balance responsibility, and the relationships with other market participants in connection with the provision of flexibility services.

⁸ Op. cit., fn. 2, Article 17.4.

The recommendations for amending the legal and regulatory framework regarding general aspects which are relevant to the establishment of aggregators and enabling their market participation are given in Table I.

Table I: General issues

ISSUE	BiH REGULATIONS - RECOMMENDATIONS
Definition of the term aggregator	Law on Transmission, Regulator and Operator of the Electric System in BiH FBiH – RS – Brcko District Electricity Laws
	<p>COMMENTS AND RECOMMENDATIONS</p> <p>The term aggregator and the right to aggregation of DERs should be explicitly defined and consistently applied by the relevant primary legislation in both entities in BiH and in the Brcko District, and by the Law on Transmission, Regulator and Operator of the Electricity System in BiH.</p> <p>The aggregator should be defined as a service provider that aggregates a large number of generators, consumers, and energy storage devices, with the aim of joint participation in the electricity market, including the balancing market.</p> <p>The aggregation should be defined as a commercial activity of joint management of electricity generation and consumption of a large number of aggregated resources with the aim of selling electricity and reserve capacity in any segment of the electricity market.</p>
Definition of the term flexibility	Law on Transmission, Regulator and Operator of the Electric System in BiH FBiH – RS – Brcko District Electricity Laws
	<p>COMMENTS AND RECOMMENDATIONS</p> <p>The relevant primary legislation at the entity level and in the Brcko District, as well as the Law on Transmission, Regulator and Electricity System Operator in BiH, needs to explicitly define the term flexibility and apply it consistently through their legal and regulatory frameworks.</p> <p>From a service provider’s perspective, flexibility can be defined as a change in electricity generation and/or consumption at the individual or aggregate level, in order to trade flexibility services in the electricity market (explicit flexibility) or as a response to an external price signal (implicit flexibility).</p> <p>From a power system perspective, flexibility can be defined as the ability of an electricity entity to respond to a request from a relevant system operator to change the power output in order to meet the power system needs.</p>
The right of participation of aggregators in the wholesale and ancillary services markets	Law on Transmission, Regulator and Operator of the Electric System in BiH FBiH – RS – Brcko District Electricity Laws Market Rules
	<p>COMMENTS AND RECOMMENDATIONS</p> <p>Since the existing regulations in BiH do not allow the participation of aggregators in the electricity market, the right of aggregators to participate in the wholesale electricity</p>

	<p>market and the ancillary services market on a level playing field basis with the conventional market participants, should be defined by the relevant primary legislation at the entity level and in the Brcko District, and the Law on Transmission, Regulator and Electricity System Operator in BiH as well.</p> <p>The right to participate in the wholesale electricity market and the ancillary services market should be exercised by obtaining a license from the relevant regulator.</p>
Aggregator concept	Law on Transmission, Regulator and Operator of the Electric System in BiH FBiH – RS – Brcko District Electricity Laws
	<p>COMMENTS AND RECOMMENDATIONS</p> <p>The primary legislation at the entity level and in the Brcko District, and the Law on Transmission, Regulator and Operator of the Electricity System in BiH, should define that the role of aggregators can be equally performed by⁹:</p> <ol style="list-style-type: none"> 1. A supplier - aggregator, 2. An independent aggregator, or 3. An aggregator in cooperation with the supplier (hybrid concept).
Licensing of aggregators	FBiH – RS – Brcko District Electricity Laws
	<p>COMMENTS AND RECOMMENDATIONS</p> <p>Given the fact that the flexibility services market is in the initial stage of development, and that there is a need to establish the appropriate mechanisms for market supervision, prevention of market abuse and protection of the rights of customers – flexibility service providers, it is recommended that, in the initial phase, the aggregators should be subject to licensing by the competent regulatory commission.</p> <p>In support of the licensing of aggregators, it should be noted that EU Directive 2019/944 on common rules for the internal market for electricity defines an “electricity undertaking,” as a natural or legal person performing at least one of the following functions: generation, transmission, distribution, aggregation, demand response, energy storage, supply or purchase of electricity and who is responsible for commercial, technical or maintenance tasks related to those functions, but does not include the final customers. In the given context, the function of the aggregator is equated with other functions in the electricity sector.</p> <p>Regardless of the chosen system of licensing/registration of aggregators, the legal and regulatory framework should prescribe that the competent regulatory commission supervises aggregators as a separate category of market participants.</p>

⁹ For more information on the proposed aggregator concept, please consult the document: USAID EPA “Aggregator Implementation Model,” April 2021, and the document USAID EPA “Aggregators – Gap Analysis of the Regulations in BiH,” November 2020.

Registration of the aggregator’s delivery points	Market Rules														
	<p>COMMENTS AND RECOMMENDATIONS</p> <p>Since the existing Market Rules are tailored to the registration of conventional market participants, the Market Rules should be amended to enable the registration of aggregators as a specific category of market participants.</p> <p>In addition to adapting the registration procedure for market participants, the possibility that different market participants (aggregator and supplier) may have a balancing responsibility at the same delivery points should be particularly emphasized. The balancing responsibility of the aggregator in relation to the subjects that have balancing responsibility at the same delivery points, would be differentiated according to the time periods (service providing period or outside it), and by the segments of the total electricity demand at the delivery point (baseload and flexible load) during the service activation period.</p> <p>Aggregator can participate in the electricity markets independently or through its balancing responsible party.</p>														
Aggregator implementation model	FBiH – RS – Brcko District Electricity Laws Market Rules														
	<p>COMMENTS AND RECOMMENDATIONS</p> <p>The appropriate aggregator implementation models for selected concepts should be defined, depending on the market segment and the type of flexibility services¹⁰.</p> <p>Frequency Containment Reserve (FCR) services and congestion management services in the transmission network by DERs at the distribution level are excluded from further analysis and selection of the appropriate aggregator implementation model¹¹.</p> <p>The following aggregator implementation models are recommended to be defined by the Market Rules amendments, depending on the type of services in the electricity market¹²:</p> <table border="1" data-bbox="451 1304 1432 1562"> <thead> <tr> <th rowspan="2">Service type</th> <th colspan="2">Aggregator type</th> </tr> <tr> <th>Supplier-aggregator and hybrid concept</th> <th>Independent aggregator</th> </tr> </thead> <tbody> <tr> <td>Wholesale market</td> <td>Integrated model</td> <td>Contractual model</td> </tr> <tr> <td>Balancing market – aFRR products</td> <td>Integrated model</td> <td>Contractual model</td> </tr> <tr> <td>Balancing market – mFRR products</td> <td>Integrated model</td> <td>Contractual model</td> </tr> </tbody> </table> <p>The integrated model is a model in which the role of aggregator is performed by the supplier.</p> <p>The contractual model is a model in which the market participants (aggregator, supplier and balancing responsible parties) conclude mutual agreements to regulate market</p>	Service type	Aggregator type		Supplier-aggregator and hybrid concept	Independent aggregator	Wholesale market	Integrated model	Contractual model	Balancing market – aFRR products	Integrated model	Contractual model	Balancing market – mFRR products	Integrated model	Contractual model
Service type	Aggregator type														
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Balancing market – mFRR products	Integrated model	Contractual model													

¹⁰ Op. cit., fn. 4

¹¹ For more information, please consult the document: USAID EPA “Aggregator Implementation Model,” January 2021, and the document USAID EPA “Aggregators – Gap Analysis of Regulations in BiH,” November 2020.

¹² Ibid

	<p>participation of the aggregated resources, transfer of energy and the method of calculating imbalances due to the activation of flexibility services.</p> <p>When congestion management services at the distribution level are addressed, it is recommended that the primary legislation at the entity level and in Brcko District should be amended to prescribe that flexibility services can be provided on a bilateral basis between the Distribution System Operator (DSO) and distribution network users (service providers).</p>
Roles and responsibilities of the aggregator and DSO	FBiH – RS – Brcko District Electricity Laws
	<p>COMMENTS AND RECOMMENDATIONS</p> <p>Entity and Brcko District Laws on Electricity need to define the roles and responsibilities of aggregators, which include:</p> <ul style="list-style-type: none"> • Aggregation of DERs, • Managing the DER’s flexibility, • Sales of flexibility services to Transmission System Operators (TSOs), DSOs, BRPs or suppliers, • Settlement and payment of flexibility services for individual DER, and • Settlement and collection of payments for the delivered flexibility services from flexibility customers (TSO, DSO, BRP or supplier). <p>Entity and Brcko District Laws on Electricity need to define the roles and responsibilities of the DSO in relation to aggregation services, which include:</p> <ul style="list-style-type: none"> • Assessment of the impact of flexibility services activation at the distribution level on the operational parameters of the distribution network, • Procurement of ancillary services for the needs of the distribution system, and • Collection, validation, and exchange of metering data.
Roles and responsibilities of TSO	Law on Transmission, Regulator and Operator of the Electricity System in BiH
	<p>COMMENTS AND RECOMMENDATIONS</p> <p>The Law on Transmission, Regulator and System Operator needs to define the roles and responsibilities of the TSOs related to aggregation services, which include:</p> <ul style="list-style-type: none"> • Supervision over the pre-qualification of aggregators as balancing service providers, • Procurement of balancing services, • Collection and validation of metering data, and • Calculation and allocation of imbalances of market participants.
Balancing responsibility of aggregator	Market Rules
	<p>COMMENTS AND RECOMMENDATIONS</p> <p>For the participation of independent aggregators in the market, the use of dual balancing model should be allowed, which enables the independent aggregator to delegate the balancing responsibility to its own balancing responsible party which is not the balancing</p>

	<p>responsible party of the DER/electricity supplier. The application of a dual balancing model allows an independent aggregator to provide services without restrictions related to the DER's balancing responsibility group/party. In other words, the application of a dual balancing model allows the aggregator to aggregate DERs that have contracts with different suppliers and balancing responsible parties.</p> <p>The Market Rules should be amended to define that the balancing responsibility of aggregators, depending on the type of aggregator, is regulated as follows:</p> <ul style="list-style-type: none"> • Aggregator-supplier and hybrid model - through the balance responsible party of the supplier, and • Independent aggregator - through its own balance responsible party (which may be different from the BRP supplier). <p>Generally speaking, an independent aggregator should have balancing responsibility only for the activated flexibility resources. Accordingly, the Market Rules should prescribe that the balancing responsibility of an independent aggregator is limited to the:</p> <ul style="list-style-type: none"> • Period of services activation, • Resources that provide flexibility services, and • Load of the activated resources. <p>Furthermore, it should be defined that the independent aggregator is balancing responsible for the deviations of the activated resources response in relation to the contracted volume (flexibility service).</p> <p>When the “rebound” effect is addressed, the recommendation is that the supplier should have balancing responsibility during this period, since the application of the model where an independent aggregator has balancing responsibility during the “rebound” effect would be complex in practice. The supplier should not be compensated for the associated costs due to the “rebound” effect (through the price of energy between the aggregator and the supplier). In this way, the costs of the “rebound” effect should be socialized or passed on to the network user that provides flexibility services through an increase in supply prices or a decrease in the generation purchase price.</p> <p>The existing deadlines for changes of the balancing group composition in BiH can be assessed as too long from the aggregator's perspective. In this regard, it is recommended that Market Rules should be amended to allow greater flexibility in changing the composition of the aggregator's balancing group.</p>				
<p>Contractual relations</p>	<p>FBIH – RS – Brcko District Electricity Laws Market Rules</p>				
	<p>COMMENTS AND RECOMMENDATION</p> <p>Given that the “integrated model” and the “contractual model” have been proposed for the implementation, following contracts between market participants should be concluded:</p> <table border="1" data-bbox="451 1623 1427 1883"> <thead> <tr> <th data-bbox="451 1623 691 1703">Integrated Model</th> <th data-bbox="691 1623 1427 1703">Contractual Model</th> </tr> </thead> <tbody> <tr> <td data-bbox="451 1703 691 1883"> <p>A contract for the provision of flexibility services between an aggregator</p> </td> <td data-bbox="691 1703 1427 1883"> <ul style="list-style-type: none"> • The aggregator has a contract with its balance responsible party for the imbalance's calculation and market participation. • The aggregator has a bilateral contract on energy transfer with the supplier (if needed, a contract between BRP_{agr} and BRP_{sup} too). </td> </tr> </tbody> </table>	Integrated Model	Contractual Model	<p>A contract for the provision of flexibility services between an aggregator</p>	<ul style="list-style-type: none"> • The aggregator has a contract with its balance responsible party for the imbalance's calculation and market participation. • The aggregator has a bilateral contract on energy transfer with the supplier (if needed, a contract between BRP_{agr} and BRP_{sup} too).
Integrated Model	Contractual Model				
<p>A contract for the provision of flexibility services between an aggregator</p>	<ul style="list-style-type: none"> • The aggregator has a contract with its balance responsible party for the imbalance's calculation and market participation. • The aggregator has a bilateral contract on energy transfer with the supplier (if needed, a contract between BRP_{agr} and BRP_{sup} too). 				

	<p>(supplier) and a service provider.</p> <ul style="list-style-type: none"> • The aggregator has contracts with flexibility service providers. <p>In order to remove possible barriers to market participation of aggregators, it should be explicitly defined that the supplier has no right to prevent the provision of flexibility services and the conclusion of contracts between the electricity customer/generator (service provider) and the independent aggregator. In addition, the obligation of the supplier to conclude a contract with an independent aggregator should be prescribed, to address the energy transfer that is the result of flexibility services activation at a price determined based on a predefined methodology.</p> <p>In order to protect the commercial interests of suppliers, the right of suppliers to change the terms of the energy supply/purchase contract due to the provision of flexibility services by the customer/generator should be envisaged, to address the supplier's compensation for costs due to the "rebound" effect and increased electricity sourcing costs. It should be specified whether the supplier has also the right to change the contractual terms for the final customers who are supplied at unit prices that are publicly available (households and small commercial customers) or only for larger customers with whom the terms of the supply contract are defined on a bilateral basis. On the other hand, the legislation should protect network users who have concluded a contract with an independent aggregator from the imposition of unjustified costs by suppliers. The electricity supply/purchase contract can be amended in advance (at the conclusion of the contract, regardless of the subsequent provision of flexibility services), at the time of concluding the flexibility services contract or subsequently after a defined period of time.</p> <p>Contractual relationships should be unambiguous and simple, reflecting the relevant costs and risks to the parties.</p> <p>The development of standard contract templates should be foreseen, they should be binding for market participants, thus facilitating the contracting process and the regulatory supervision.</p>
<p>Recovery of DSO costs related to the aggregator model</p>	<p>FBiH – RS – Brcko District Electricity Laws</p>
	<p>COMMENTS AND RECOMMENDATION</p> <p>The primary legislation and relevant tariff methodology should envisage the right of the DSO to reimburse the increased capital and operating costs, that are result of new roles and responsibilities related to the aggregator model (such as network supervision and management, increasing "network visibility," metering data management, IT, and telecom systems).</p>

3. COMMERCIAL REQUIREMENTS

In general, the regulatory framework should allow for the removal of unnecessary commercial barriers to aggregator participation in the wholesale and ancillary services markets, in a way that promotes and protects the rights and interests of aggregators, without negative implications for other market participants and the electricity system security.

Directive 2019/944 requires Member States to non-discriminatorily treat customers who have a contract with a market participant engaged in aggregation in terms of technical and administrative requirements, procedures, or costs by their supplier¹³. In addition, Member States should ensure that TSOs and DSOs treat market participants engaged in aggregation in a non-discriminatory manner according to their technical capabilities¹⁴. Final customers who have a contract with an independent aggregator may not be subject to undue payments, penalties or other undue contractual restrictions by their suppliers¹⁵.

This chapter defines the recommendations related to the commercial requirements for products on the balancing market and the congestion management market in the distribution network, which are the responsibility of the regulated undertakings - transmission system operators and distribution system operators. The recommendations do not cover products on the organized day-ahead and intraday market, given that these are the segments of the wholesale market that have not yet been established in BiH¹⁶. In addition, it is important to note that the wholesale market is an unregulated segment, whose regulatory framework does not require the level of details as in the case of markets administered by TSOs and DSOs.

With regard to the congestion management in the distribution network, it is important to emphasize that Article 32 of Directive 2019/944 requires Member States to provide incentives for DSOs to procure local flexibility services and define standard products on the market.

Commercial requirements refer to the type and characteristics of products on the ancillary services market, the way and period of services procurement, the ancillary services price formation method, and the method of calculating the remuneration for the delivered services. Commercial requirements are primarily assessed from the perspective of their adjustment to enable the participation of aggregators in the ancillary services market, to harmonize requirements with the requirements of the European network codes for balancing market products (product standardization and creation of a more flexible framework that enables submission of bids in shorter Gate Closure Time [GCTs]) and to amend the methods of remuneration calculation in terms of reducing market participation risk and encouraging participation of aggregators in the market.

As an illustration, Figure 3 gives a graphical representation of the characteristics of a standard product in the ancillary services market.

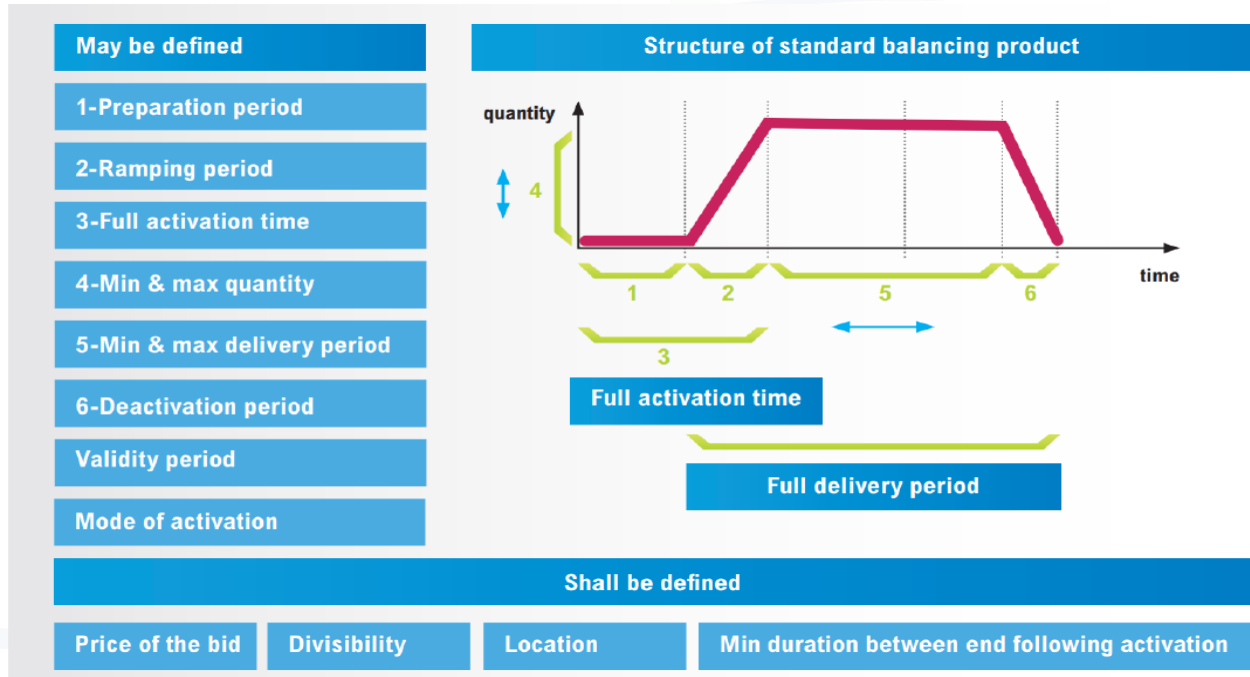
¹³ Op. cit., fn. 2, Article 13.4

¹⁴ Op. cit., fn. 2, Article 17.2

¹⁵ Op. cit., fn. 2, Article 17.3

¹⁶ The guidelines will be amended once the design of the day ahead and intraday market is defined.

Figure 2: Standard product characteristics.



(Source ENTSO-E¹⁷)

The commercial aspects analyzed in this chapter are generally applicable, regardless of the adopted implementation model.

Table 2: Commercial requirements

ISSUE	BiH REGULATIONS - RECOMMENDATIOIOS
Participation of aggregator in the market	Market Rules
	<p>COMMENTS AND RECOMMENDATIONS</p> <p>Market rules should explicitly define the right of aggregators to participate in the wholesale electricity market and the ancillary services market. Taking into account the current level of development of the ancillary services market in BiH, the Market Rules should be amended to allow the aggregators to provide the aFRR (secondary regulation) and mFRR (tertiary regulation) frequency regulation services.</p> <p>In this phase the aggregators should not be allowed to participate in the provision of FCR services (primary frequency regulation) and congestion management services in the transmission network.</p>

¹⁷ ENTSO-E, 'An Overview of the European Balancing Market and Electricity Balancing Guideline', no. November 2018, p. 8, https://eepublicdownloads.entsoe.eu/clean-documents/Network%20codes%20documents/NC%20EB/entso-e_balancing_in%20_europe_report_Nov2018_web.pdf

	<p>The primary frequency regulation service should be excluded from considerations, as this service is currently provided as a mandatory system service by entities connected to the transmission network, without financial compensation for the delivered services.</p> <p>The congestion management services in the transmission network provided by DERs connected to the distribution network should also be excluded from considerations, as it is not likely that these services shall be implemented in the BiH ancillary services market in the medium term.</p>
<p>Characteristics of the balancing market products</p>	<p>Market Rules</p>
	<p>COMMENTS AND RECOMMENDATIONS</p> <p>Given the requirements defined by the Electricity Balancing Guideline (EBGL), which provides for the establishment of a European balancing energy market, it is recommended that any future changes in the type and characteristics of balancing market products should be made in accordance with EBGL and the documents prepared on its basis.</p> <p>As a prerequisite for the participation of the Independent System Operator (ISO) in BiH, the platforms for joint procurement and activation of balancing energy of aFRR, mFRR and Replacement Reserve (RR) frequency regulation services is a product standardization in accordance with the relevant documents approved by regulatory authorities¹⁸ or Agency for the Cooperation of Energy Regulators (ACER)^{19 20}.</p> <p>The present non-compliance of standard balancing market products in BiH with the adopted documents at the European Network of Transmission +System Operators for Electricity (ENTSO-E) level is reflected in the:</p> <ul style="list-style-type: none"> • Lack of separate upward and downward aFRR balancing energy products, • Lack of “voluntary” bids of aFRR balancing energy, • Inability of scheduled activation of mFRR balancing energy services, • Different GCTs for all types of services, and • Different billing time periods, • Different bid validity periods, • Different full activation times, • Different minimum full delivery periods. <p>Through the gradual changes of the characteristics of standard aFRR, mFRR and optionally RR balancing products, in order to prepare for membership and participation of ISO BiH on relevant European balancing platforms, the conditions for participation of aggregators at a wider regional level should be harmonized at the same time.</p>

¹⁸ Approval by relevant regulatory authorities on the proposal of all transmission system operators performing the reserve replacement process for the implementation framework for the exchange of balancing energy from replacement reserves in accordance with article 19 of Commission Regulation (EU) 2017/2195 of 23 November 2017 establishing a Guideline on electricity balancing, 14 December 2018, <https://acer.europa.eu/en/Electricity/MARKET-CODES/ELECTRICITY-BALANCING/02%20RR%20IF/Action%202%20-%20RR%20IF%20NRA%20approval.pdf>.

¹⁹ ACER, Decision No 03/2020 on the Implementation framework for a European platform for the exchange of balancing energy from frequency restoration reserves with manual activation, 24 January 2020, <https://acer.europa.eu/en/Electricity/MARKET-CODES/ELECTRICITY-BALANCING/05%20mFRR%20IF/Action%203%20-%20mFRR%20IF%20ACER%20decision.pdf>.

²⁰ ACER, Decision No 02/2020 on the Implementation framework for the European platform for the exchange of balancing energy from frequency restoration reserves with automatic activation, 24 January 2020, <https://acer.europa.eu/en/Electricity/MARKET-CODES/ELECTRICITY-BALANCING/06%20aFRR%20IF/Action%203%20-%20aFRR%20IF%20ACER%20decision.pdf>.

	<p>Standardization of products in the balancing market would eliminate the obligation of the entities engaged in aggregation services to adapt to the requirements of each individual national markets.</p> <p>The deadline for harmonization of local requirements for participation in balancing markets platforms is 30 months from the date of approval of the implementation framework by ACER (approval date 24.01.2020), by which time it is necessary to harmonize requirements as a precondition for participation in respective platforms for joint procurement and activation of balancing energy.</p>
<p>Voluntary energy bids in the ancillary services market</p>	<p>Market Rules</p>
	<p>COMMENTS AND RECOMMENDATIONS</p> <p>Since the existing Market Rules allow for the voluntary energy bids in the BiH ancillary services market only for the mFRR frequency regulation services, it is recommended to allow the submission of voluntary balancing energy bids for the aFRR frequency regulation services too.</p> <p>Enabling the submission of voluntary balancing energy bids for the aFRR frequency regulation services would also harmonize the Market Rules with the EU guideline on electricity balancing²¹, which in Article 16 (7) prohibits discrimination between balancing energy bids submitted by providers with concluded balancing capacity contract and balancing energy bids submitted in the daily market.</p> <p>In addition to complying with the provisions of the EU guideline on electricity balancing, enabling the submission of voluntary aFRR balancing energy bids would facilitate market participation of aggregators, since there would be no obligation to pre-contract aFRR balancing capacity services, thus reducing the risks related to the quality of planning and resource availability in the long-term aFRR reserve capacities market.</p> <p>It is recommended to amend Article 32 of the Market Rules which should define that the daily balancing energy market includes aFRR and mFRR frequency regulation. Participation in the markets should be allowed to participants who have concluded balancing capacity contract, as well as to participants who have not previously contracted the balancing capacity (voluntary bids).</p> <p>In accordance with the proposed changes to the Market Rules, the Rulebook on the operation of the daily balancing energy market should be harmonized as well.</p>
<p>Asymmetric products in the ancillary services market</p>	<p>Market Rules</p>
	<p>COMMENTS AND RECOMMENDATIONS</p> <p>Since the existing Market Rules allow for the asymmetric products on the BiH ancillary services market only for the mFRR frequency regulation services, it is recommended to allow the submission of asymmetric bids for balancing reserve capacity and balancing energy of the aFRR frequency regulation services too.</p>

²¹ COMMISSION REGULATION (EU) 2017/2195 of 23 November 2017 establishing a guideline on electricity balancing, Article 16, <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32017R2195>.

	<p>Enabling the submission of asymmetric bids for the aFRR balancing services would also harmonize the Market Rules with the EU guideline on electricity balancing and the Implementation framework for the establishment of a European platform for the exchange of aFRR balancing energy²², which stipulate that the procurement of reserve capacity for FRR and RR services shall be performed separately for upward and downward directions (Article 32 of the EBGL), and that the aFRR balancing energy bids shall be submitted separately for the upward and the downward directions (Article 7 of the aFRR IF).</p> <p>The Article 30 of the Market Rules should be amended to define that the required capacity of aFRR frequency regulation is determined separately for the upward and downward regulation, and accordingly that the procurement of reserve capacities and balancing energy for both regulation directions shall be performed separately.</p> <p>In accordance with the proposed changes to the Market Rules, the Procedures for ancillary services and the Rulebook on the operation of the daily balancing energy market should be harmonized as well.</p>
<p>Availability of products</p>	<p>Market Rules</p>
	<p>COMMENTS AND RECOMMENDATIONS</p> <p>Market rules, Procedures for ancillary services and the Rulebook on the daily balancing energy market prescribe precise requirements regarding the products availability, the manner of determining penalties for unavailability, and the method of calculating the remuneration of service providers depending on the achieved level of availability. The time resolution for calculation of the availability, non-availability penalties, and service provider remuneration is one hour.</p> <p>The method of determining the delivered frequency regulation capacity by the aggregator should be defined, so that the calculation of penalties for non-provision of services would be unambiguous. Taking into account the character of the virtual power plants, with a larger number of aggregated low-capacity resources, it is recommended that the delivered capacity should be calculated as the average value of active power during the service activation period, within the permitted deviation limits. If the calculation of delivered capacity were based on the minimum (maximum) power values registered in the shorter periods during the activation of services, it would have a negative effect on aggregators, whose power response is characterized by the occurrence of power oscillations due to the participation of several small-scale service providers.</p> <p>Compensation for services not provided should be proportionate to the undelivered balancing energy.</p> <p>The availability requirements additionally need to prescribe the method of calculating the realized availability of aggregators during the standstill period that follows the activation of services (observed from the aspect of whether the reduction of available capacity during this period affects the calculated availability coefficient). It is recommended that unavailability during the standstill period that follows the activation of services should not be taken into account when calculating the unavailability coefficient.</p>

²² ACER Decision on the Implementation framework for aFRR Platform: Annex I, Implementation framework for the European platform for the exchange of balancing energy from frequency restoration reserves with automatic activation, https://documents.acer.europa.eu/Official_documents/Acts_of_the_Agency/Individual%20decisions/ACER%20Decision%202002-2020%20on%20the%20Implementation%20framework%20for%20aFRR%20Platform.pdf.

	<p>Dynamic change of the aggregator composition during the service provision period should be allowed only after the expiration of the billing period on the balancing market (Imbalance Settlement Period [ISP]), except when a failure in one of the services providing units occur. The aggregator should be allowed to provide replacement capacity in the event of a failure of one of the service providing units, either internally within the pool or externally by the procurement from a third party.</p> <p>It should be considered whether the flexibility customer (TSO) has the right to prohibit participation in the balancing market for the service providers who repeatedly fail to execute activation orders for unjustified reasons. It is recommended that the TSO should have the right to prohibit participation in the given circumstances, whereby the right to re-participate should be acquired by re-conducting pre-qualification tests or submitting valid documentation proving that the reasons for non-execution of the activation order have been eliminated.</p>
<p>Ancillary services procurement schedule</p>	<p>Market Rules</p>
	<p>COMMENTS AND RECOMMENDATIONS</p> <p>The inability to guarantee the long-term capacity availability, as well as the relatively high amount of compensation and penalties for non-performance of services, may be a barrier for aggregators intending to offer reserve capacity services on an annual and monthly basis. Shortening the procurement deadlines and introducing weekly auctions for the part of the required reserve capacity of the aFRR and mFRR frequency regulation, directly encourages the participation of aggregators in the balancing market by reducing the risk of capacity unavailability.</p> <p>The timetable of procurement of reserve capacity services of aFRR and mFRR frequency regulation in BiH can be assessed as the long-term, given that most of the required capacity is provided through the annual public procurement procedure. From this perspective, there is a significant inconsistency with the methodology that defines standard products of balancing capacities of FRR and RR reserves²³, developed in accordance with the Article 25 (2) of the EU guideline on electricity balancing, according to which standard products are products with a maximum validity of one week (Annex I of the Methodology).</p> <p>In order to harmonize Market Rules with the requirements of the EU Grid Codes and Guidelines, as well as to enable the participation of aggregators in the public procurement procedures for reserve capacity, it is recommended to gradually change the dynamics of procurement and contracting of ancillary services to achieve an appropriate balance in the usage of the long-term and short-term products in the balancing capacities market.</p> <p>In addition, the obligation to conclude a framework agreement with the aggregators which provide ancillary services should be considered as well (Ancillary Services Procedure - point 3.1.3 “Procurement of secondary reserve” and point 4.1.3. “Procurement of tertiary reserve”).</p>
<p>Gate Closure Times</p>	<p>Market Rules</p>

²³ ACER Decision on SPBC: Annex I Methodology for a list of standard products for balancing capacity for frequency restoration reserves and replacement reserves <https://documents.acer.europa.eu/en/Electricity/MARKET-CODES/ELECTRICITY-BALANCING/17%20SPBC/Action%202%20-%20SPBC%20ACER%20decision%20annex%201.pdf>.

	<p>COMMENTS AND RECOMMENDATIONS</p> <p>Present GCTs for aFRR and mFRR balancing energy products (D-1 by 14:30h) deviate significantly from the target times to be applied by TSOs intending to use aFRR and mFRR balancing energy exchange platforms (25 minutes before the beginning of the bid validity period for both products^{24 25}).</p> <p>Existing Market Rules allow for the aFRR and mFRR balancing energy bids to be modified from 18:00 h on day D-1 for deliveries in day D up to and including H-1 for deliveries in hour H (voluntary mFRR bids no later than H-30 min for deliveries in hour H) with specific restrictions.</p> <p>The conditions of the balancing market participation should be gradually harmonized with the requirements for participation in the aFRR and mFRR balancing platforms, in order to facilitate participation of aggregators in these markets, taking into account that shorter GCTs positively impact the aggregators participation in the balancing market.</p>
<p>Ancillary services pricing method</p>	<p>Market Rules</p>
	<p>COMMENTS AND RECOMMENDATIONS</p> <p>Present Market Rules stipulate those payments on the BiH balancing market for the reserve capacity and activated balancing energy of aFRR and mFRR frequency regulation services are made on a “pay-as-bid” basis.</p> <p>On the other hand, the EU guideline on electricity balancing stipulates that the methodology to determine prices for the balancing energy that results from the activation of FRR, and RR balancing energy bids should be based on the “pay-as-cleared” pricing principle (Article 30). The methodology to determine balancing energy prices and cross-border capacities used for the exchange of balancing energy or imbalance netting²⁶, defines in more detail that the “pay-as-cleared” pricing principle applies to all types of the balancing market products, to set prices of balancing energy at the platforms for exchanges of balancing energy.</p> <p>Having in mind the above, as well as the generally higher market efficiency of the “pay-as-cleared” pricing principle, it is recommended that Articles 30, 31 and 32 of the Market Rules should be amended to prescribe the application of the “pay-as-cleared” pricing principle for payments of the balancing capacity and activated balancing energy of the aFRR and mFRR frequency regulation services. The application of the “pay-as-cleared” pricing principle further facilitates the participation of aggregators in the balancing market, given that market participants in the given conditions are stimulated to bid product prices that reflect their current marginal costs.</p>
<p>Performed services payment</p>	<p>Market Rules</p>

²⁴ Op. cit., fn. 22, Article 8

²⁵ ACER “Decision on the Implementation framework for mFRR Platform: Annex I”, Article 8

https://extranet.acer.europa.eu/en/Electricity/MARKET-CODES/ELECTRICITY_BALANCING/05%20mFRR%20IF/Action%203%20-%20mFRR%20IF%20ACER%20decision%20annex%20I.pdf

²⁶ ACER “Decision on the methodology for pricing balancing energy: Annex I”, Article 4, 5.

https://documents.acer.europa.eu/Official_documents/Acts_of_the_Agency/Annexes%20to%20the%20DECISION%20OF%20THE%20AGENCY%20FOR%20THE%20C2/ACER%20Decision%20on%20the%20Methodology%20for%20pricing%20balancing%20energy%20-%20Annex%20I.pdf

	<p>COMMENTS AND RECOMMENDATIONS</p> <p>Penalty compensation mechanism for non-performance of the obligatory mFRR frequency regulation bids foresees that penalty is equal to the weekly reimbursement for the contracted reserve capacity of the tertiary regulation.</p> <p>The application of the service non-performance penalties that are linked to the weekly reimbursement for the contracted reserve capacity of the tertiary regulation might be in contradiction with the expected shortening of the procurement period and bid validity period on the reserve capacity markets (as foreseen by the implementation of the Electricity Balancing Guideline).</p> <p>Market rules should be amended to redefine the non-performance penalty calculation methodology of the mFRR frequency regulation services that are provided by aggregated service providers, in a way that will not represent a barrier to their participation in the mFRR capacity market.</p> <p>The proposed model should find a trade-off between the needs of TSO and certainty of delivery of contracted services on the one side, and elimination of the risks related to the market participation and revenue collection of the service providers on the other side.</p>
<p>Congestion management in distribution networks</p>	<p>Distribution grid codes Tariff methodologies for distribution system users</p>
	<p>COMMENTS AND RECOMMENDATION</p> <p>Distribution grid codes should prescribe the rules for constraint management services as an alternative to conventional network capacity reinforcement when the cost of flexibility services is lower than or equal to the sum of Capital Expenditures (CAPEX) and Operational Expenditures (OPEX) costs of avoided investments. An integral part of these rules should be the compensation rules of the distributed generators for the power curtailments performed when overloads, network overvoltage's, or excessive fault currents levels occur or when the system stability is endangered.</p> <p>Given that congestion management services at the distribution level are a local market to be established yet, with a potentially small number of service providers, it is recommended to apply a model in which service provision would be contracted bilaterally between the relevant DSO and the service provider.</p> <p>In the initial phase of the market establishment, it is expected that the target group of service providers will be the final customers and generators of larger installed capacity connected to the medium voltage network. Under the given conditions, congestion management services are expected to be primarily provided through the individual connection contracts or the individual long-term reserve capacity contracts.</p> <p>In this regard, present distribution tariff setting methodologies should be amended to explicitly define the right of DSO to recover operational expenditures related to congestion management in the distribution network.</p> <p>Since the activation of flexibility services for congestion management at the distribution level causes an imbalance in the power system, it is necessary to define the balancing responsibility of affected entities during the service providing period. The responsibilities for re-dispatching and establishing a power balance in the power system should be defined as well. In general, congestion management at the distribution level negatively</p>

	impacts the supplier's balance responsible party, unless the activated volume of electricity is negligible.
Contractual relations aggregator - individual service providers	FBiH – RS – Brcko District Electricity Laws
	<p>COMMENTS AND RECOMMENDATION</p> <p>The contract between the independent aggregator and the flexibility service provider should explicitly define the parts of the user's facilities that are used to provide flexibility services. The supplier must be informed of the elements of the user's facilities that will be used to provide flexibility services.</p> <p>The flexibility service provider should have explicit contractual obligations to avoid the simultaneous occurrence of a "rebound" effect during the service activation period (by changing the load of resources that do not participate in the provision of flexibility services in the opposite direction).</p> <p>Commercial relations between the aggregators and service providing units/groups in terms of quantification of delivered services, their valuation and payment, should be subject to regulation only in the parts that are related to the protection of customer rights. In this sense, the aggregator should be obliged to inform the flexibility service provider in advance about the terms of the contract to be concluded.</p>

4. TECHNICAL REQUIREMENTS

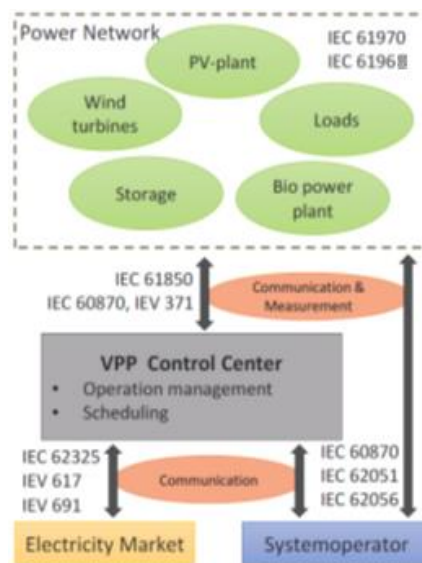
The technical requirements provided in this chapter primarily relates to the provision of flexibility services for the TSO need, under the existing market in which a regulated company (the TSO) acts as a flexibility customer.

Technical requirements for aggregators refer to the aggregator control center, aggregator's internal telecom systems, communication with the control centers of the flexibility services customers, communication protocols, metering of the generated/consumed electricity, and real-time data exchange systems between the control centers of flexibility services customers, aggregator control center and individual service providers. The fulfillment of technical requirements is subject to verification during the prequalification process.

The standardization of technical requirements, particularly for the communication protocols and interfaces in the individual service providers' facilities, achieves the interoperability of the systems of different vendors and thereby eliminates the risk of restricting competition. An adequate metering system should be established as a precondition for the flexibility services trading and the correct allocation of imbalances, based on which it would be possible to unambiguously determine that flexibility services have been performed, and quantify them.

An example of the general scheme of the virtual power plant/aggregator, showing the applicable communication protocols in communication with individual service providers and market participants in the electricity and ancillary services markets is given in Figure 4.

Figure 4: Virtual Power Plant – Communication scheme general design.



(Source²⁷)

²⁷ Richter, Andre & Hauer, Ines & Wolter, Martin. (2018), "Algorithms for Technical Integration of Virtual Power Plants into German System Operation," Advances in Science, Technology and Engineering Systems Journal 3, pp. 135-147, January 2018, <https://www.researchgate.net/publication/323899993>.

A special aspect of the technical requirements provided in this chapter refers to the metering system, where the standard practice is the installation of separate metering devices for flexible DERs. The submetering devices should be used as a basis for flexibility services billing, transfer of energy and imbalance settlement of the market participants.

The technical requirements addressed in this chapter are generally applicable, regardless of the applied aggregator concept and the selected implementation model.

It is important to note that the BiH Grid Code, in Chapter 5.6. “Telecommunications and SCADA,” provides general requirements for telecommunications systems for remote monitoring and network control, which are applicable to network users connected to the transmission network. This chapter does not specifically address requirements for aggregated resources.

Table 3: Technical requirements

ISSUE	BiH REGULATIONS - RECOMMENDATIO S
Aggregator architecture	Grid Code Prequalification rules
	<p>COMMENTS AND RECOMMENDATIONS</p> <p>The general principles of the aggregator architecture should be defined, depending on the selected implementation model and selection of specific technical solutions for Information Technology (IT) and telecommunication systems, metering systems and real-time measurement and monitoring. The general principles on which the architecture should be based include:</p> <ul style="list-style-type: none"> • Flexibility, • availability, • reliability, • security, • scalability, • centralized management, • use of standard protocols, • use of new technologies, • verifiability, and • cost-effectiveness.
Redundancy of the aggregator control center	Grid Code Prequalification rules
	<p>COMMENTS AND RECOMMENDATIONS</p> <p>Depending on the installed capacity of the aggregator’s portfolio and the offered volume of reserve capacity, requirements for redundancy of the aggregator control center (location, hardware, software, communication, and auxiliary power supply) can be prescribed.</p> <p>Redundancy regarding the physical dislocation of control centers may, as a rule, be requested from aggregators whose reserve capacity exceeds 10-30 MW.</p> <p>The telecommunication requirements should additionally take into account the conditions and manner of establishing communication links once physically dislocated</p>

	<p>redundant aggregator control centers are established. The redundancy of communication links to the TSO control center implies a completely redundant design without double use of any device or cable routes (i.e., without single point of failure²⁸). Under the given conditions, the TSO is responsible for prescribing the requirements for the time to transfer from the main to the reserve control center.</p> <p>It is recommended not to prescribe requirements for the redundant aggregator control center, as this would represent a significant market entry barrier due to the high upfront costs.</p>
<p>General requirements of IT and telecommunication systems</p>	<p>Grid Code Prequalification rules</p>
	<p>COMMENTS AND RECOMMENDATIONS</p> <p>The general requirements of IT and telecommunication systems relate to the availability, protection against unauthorized access, integrity, reliability (authentication of persons and devices participating in communication – “authenticity” and inability to deny message reception – “non-repudiation”) and data transfer speed in communication between the service providing unit, aggregator control center and TSO control center.</p> <p>The general requirements should also include requirements for protection against unauthorized access to premises, systems and network infrastructure which are used for the provision of ancillary services.</p>
<p>Technical requirements for the interface at the service providing unit/group</p>	<p>Grid Code Prequalification rules</p>
	<p>COMMENTS AND RECOMMENDATIONS</p> <p>Standardization of the interfaces through which the connection between the service providing unit/group and the aggregator control center is established, brings interoperability in terms of communication protocols. Furthermore, it removes the risk of competition restriction due to the service provider's dependence on specific technological solutions.</p> <p>The achieved level of standardization at the level of relevant international standardization bodies should be analyzed, and depending on the achieved level, the basic technical requirements should be prescribed for the interoperability of interfaces by which an individual service provider's facility is integrated into the aggregator system.</p>

²⁸ Also known as a “SPOF”

Requirements for communication between Aggregator control center and TSO control center	Grid Code Prequalification rules
	<p>COMMENTS AND RECOMMENDATIONS</p> <p>Requirements for communication links between the TSO control center and the aggregator control center should ensure reliable and secure communication.</p> <p>The TSO should prescribe the minimum requirements for availability of telecommunication links between the aggregator’s and TSO’s control centers, requirements regarding the troubleshooting times for telecom systems, as well as requirements regarding exchange of information and elimination of consequences when telecom systems security is compromised and endangered.</p>
Requirements for the aggregator’s internal telecom system	Grid Code Prequalification rules
	<p>COMMENTS AND RECOMMENDATIONS</p> <p>Requirements for the separation of the aggregator communication system (system of individual service providers and aggregator control center) from other user networks (e.g., internet, communication network of other providers) should be prescribed. These requirements may be fulfilled using closed user groups which include only individual service providers and the aggregator control center.</p> <p>Internal communication within the group should be performed exclusively for the purpose of providing flexibility services. Any communication with external systems, including the public internet network, should be prohibited. Individual service providers should not be allowed to communicate with each other.</p> <p>The obligations regarding the “end-to-end” encryption of the aggregators’ internal traffic should be prescribed, providing the specific requirements and standards for encryption.</p> <p>Specific requirements should be prescribed for the availability of telecom links between the service providing units/groups and the aggregator control center (standard 95%).</p>
Communication protocols	Grid Code and Distribution network rules
	<p>COMMENTS AND RECOMMENDATIONS</p> <p>Requirements should be prescribed for communication protocols to be applied for exchange of data, measurements and control signals between the TSO (DSO) control center and the aggregator control center.</p> <p>Communication protocols for communication between the regulated undertakings (TSO and DSO) and aggregators should be prescribed as mandatory (application of standard communication protocols, e.g., the International Electrotechnical Commission [IEC] 101 or IEC 104), while communication protocols for communication between wholesale market participants should be prescribed as standardized.</p>

Specific communication requirements for low-capacity service providers	Grid Code Prequalification rules
	<p>COMMENTS AND RECOMMENDATIONS</p> <p>Specific requirements and derogations from the general principles may be allowed for aggregation of low-capacity service providers (e.g., up to 25kW) over the public internet network with the use of encrypted Virtual Private Network (VPN) traffic, with limitation of the total installed capacity of grouped units (e.g., up to 2 MW). Additional requirements need to be defined in the given conditions for setting the telecommunication links between the aggregated group and the aggregator control center.</p> <p>The installed capacity threshold should be prescribed for the low-capacity service providers, for which the use of public internet network for communication with the aggregator control center is allowed.</p>
Special requirements for external IT service providers	Grid Code Prequalification rules
	<p>COMMENTS AND RECOMMENDATIONS</p> <p>Information on external procurement of IT services must be explicitly stated in the pre-qualification documentation. Under these conditions, flexibility customer (TSO or DSO) has the right to request stricter conditions for the IT system protection.</p> <p>The aggregator is responsible for the IT systems security regardless of how these services are provided.</p>
IT and telecom data exchange	Grid Code Prequalification rules
	<p>COMMENTS AND RECOMMENDATIONS</p> <p>The requirements for the data and information exchange between the network operators and aggregators should be prescribed, covering the concept and characteristics of IT and telecom systems, IT security and availability, changes affecting network security, information on security incidents, data transmission problems, failures and the time required to rectify the fault.</p> <p>The network operator should be allowed to amend the IT and telecom requirements, which shall be binding for aggregators and service providers. The manner of publishing and informing the service providers should be defined as well.</p> <p>The documentation by which the aggregator proves compliance with IT and telecom requirements during the prequalification process should be defined. The documentation may include a detailed IT and telecommunication concept, IT requirements checklist with description of applied encryption, architecture, cybersecurity, standards, hardware configuration, antivirus, security monitoring, user authentication, remote access, maintenance, and reports.</p>

Energy measurements	Grid Code Distribution Grid Codes EP BiH – MH ERS – EP HZHB – Brcko District
	<p>COMMENTS AND RECOMMENDATIONS</p> <p>A prerequisite for the flexibility services trade and the allocation of balancing responsibility is an adequate metering system that verifies and quantifies the delivered services. The measurement interval must correspond to the accounting period in the balancing market.</p> <p>If flexibility services are not provided at the network user’s facility level (at the main metering device), it is recommended to install an additional submetering device on an individual generator/load that provides flexibility services (metering of sub-production/sub-consumption). In order to reduce the upfront costs of the aggregator integration, the possibility of applying alternative meters built into the devices itself (e.g., within inverters, electric vehicle chargers) should be considered for the purpose of measuring flexibility services.</p> <p>The BiH Grid Code and the distribution Grid Codes of the relevant DSOs need to define the requirements for additional submetering devices, which would, in a technically adequate and economically feasible way, provide metering data for quantification of delivered flexibility services when flexibility services are not provided at the whole facility level.</p> <p>An alternative to the installation of an additional submetering device is the use of metering data from a main metering device and the application of the complex mathematical models to allocate metered quantities to the flexible and “inflexible” segments of the total load.</p> <p>The periodicity of meter reading should be defined depending on the applied dynamics of imbalance calculation and settlement. At the request of the network user, metering data can be delivered in shorter time intervals, where it is necessary to prescribe whether the costs of processing and delivery of metering data are directly transferred to the specific user or socialized to all network users.</p> <p>Back-up generators installed within consumer facilities, which are providers of flexibility services, should have a separate metering in relation to other loads within the consumer’s facility.</p> <p>The costs of installing an additional metering device should in principle be borne by the aggregators, since the main purpose of these metering devices is to control the DER’s load for the aggregation purposes.</p> <p>Additional competences of the DSO need to be defined regarding the installation, maintenance and reading of metering devices within the service provider’s facility in order to operationally implement requirements for flexibility measurements.</p>
Real-time measurement and statuses	Grid Code Prequalification rules
	<p>COMMENTS AND RECOMMENDATIONS</p> <p>Supervision over the execution of flexibility services is performed by the real time measurements of DER’s generation/consumption.</p> <p>Service providing units/groups need to be allocated by portfolios (pools) formed for each type of service, for the purpose of communication with the aggregator control center.</p>

Consequently, a single aggregator can have several portfolios, the number of which corresponds to the number of services that are offered in the market. Reallocation of service providing units/groups between different portfolios is possible only at the end of the accounting period in the balancing market, with the exception when a failure occurs in one of the units/groups.

TSO as a user of aFRR and mFRR frequency regulation services should have at its disposal the following real-time data and measurements related to aggregators:

- Aggregated current value of net generation and consumption (in MW),
- Planned value of aggregated generation and consumption corresponding to the baseline diagram (in MW),
- Available capacity for service provision - separately generation and consumption (in MW),
- Current value of activated reserve capacity - separately generation and consumption (in MW),
- Energy delivered for the frequency regulation services - separately generation and consumption (in MWh),
- Allocation code of service providing units/groups by pools (Pool ID),
- Pool status by type of service (ON/OFF), and
- Energy capacity of providers with limited storage capacities (in MWh).

The TSO may additionally require the submission of “offline” data with the appropriate time resolution of data recording, registration and delivery.

Data should be submitted at the level of aggregators by type of services for both directions of regulation, and at the level of individual service providers at the request of the TSO. Data should be provided at the level of individual service providing units with an installed capacity exceeding 1.5 MW²⁹.

TSO, as a user of aFRR and mFRR frequency regulation services, sends the real time signal of the set active power value to the aggregator control center.

Where aFRR frequency regulation services are provided by the aggregators whose portfolio (virtual power plant) consists of generation and consumption units, the conditions should be provided for separate exchange of control signals for generation and consumption units with the TSO.

The TSO prescribes the periodicity of real-time exchange of signals and measurements between the TSO control center and the aggregator control center. It is recommended to apply a periodicity of 4 seconds.

Establishing real-time measurements and monitoring of the individual service providers is the responsibility of the aggregator.

Application of alternative (as compared to standard Supervisory Control and Data Acquisition [SCADA] systems) technical solutions for the establishment of real-time measurement and monitoring systems within the aggregators, should be allowed to reduce the upfront costs of aggregator integration. It should be applicable particularly for low-capacity service providing units/groups, where data exchange at the appropriate aggregation level may be allowed.

²⁹ Commission Regulation (EU) 2017/1485 establishing a guideline on electricity transmission system operation, Article 158(1)(e)
https://www.entsoe.eu/network_codes/sys-ops/.

Activation of real-time measurements and data exchange	BiH Grid Code
	<p>COMMENTS AND RECOMMENDATIONS</p> <p>Communication between the aggregator and the TSO control centers is, as a rule, active only during the service activation period, as well as during one billing period preceding and following the service activation period. Identical requirements regarding the duration of communication should apply to the offline data exchange, which should be recorded, archived and delivered to TSOs only at these time periods.</p> <p>In the case of a larger aggregators, the communication needs to be continuous and in accordance with the requirements for the respective conventional or renewable energy sources power plants.</p>

5. PREQUALIFICATION

The pre-qualification rules stipulate the basic technical, administrative and organizational requirements, as well as operational tests, the implementation of which verifies the compliance of the service provider's response with the prescribed requirements for products in the ancillary services market. During the pre-qualification process, the impact of the activation of flexibility services on the operating parameters of the power system is additionally assessed, and potential operational restrictions are defined by the relevant system operator to whose network the service provider's facility is connected.

Setting the pre-qualification requirements for ancillary services providers is an obligation defined by the requirements of the EU guideline on electricity balancing³⁰ and the guideline on electricity transmission system operation³¹.

In general, the pre-qualification process should be user-friendly, standardized as much as possible, with clearly defined roles and tasks of process participants, and with the minimum required number of steps adapted to the complexity of the product whose conformity is being assessed. The pre-qualification process should not be a barrier to the implementation of the aggregator concept, and to that end it should be in line with European best practices as much as possible. In this sense, network operators should be careful when prescribing pre-qualification requirements, in order to avoid disproportionate requirements that may prevent aggregators from participating in a particular market segment.

This chapter defines the recommendations for setting the rules and procedure for pre-qualification of aggregated resources to provide the aFRR and mFRR frequency regulation services that are commercially available to aggregators in BiH.

The recommendations are not given for the FCR frequency regulation services, considering that, in accordance with the BiH Grid Code and the BiH Market Rules, this ancillary service is provided free of charge by the generation facilities connected to the transmission network.

In addition, the recommendations are neither defined for the flexibility services provided in the wholesale market, taking into account that it is an unregulated electricity market where the terms and conditions of service provision are determined bilaterally between the flexibility customers and aggregators or according to the rules of participation in the organized day-ahead and intra-day markets.

The prequalification rules addressed in this chapter are generally applicable, regardless of the aggregator concept and applied implementation model.

³⁰ *Op. cit.*, fn. 21, Article 16

³¹ *Op. cit.*, fn. 29, Article 159

Table I: Prequalification

ISSUE	BiH REGULATIONS - RECOMMENDATIONS
Pre-qualification rules	<p data-bbox="448 348 691 380">Compliance testing</p> <p data-bbox="448 426 932 457">COMMENTS AND RECOMMENDATIONS</p> <p data-bbox="448 478 1421 659">The existing document “Compliance testing” should be divided into two parts. The first part would address the compliance testing of the power generating modules with the requirements for generators. The second part “Compliance tests of ancillary services providers,” would address the prequalification of ancillary services providers which are provided either on a commercial basis (aFRR and mFRR³² frequency regulation) or free of charge (capability to start without an external power source – “black start” and FCR).</p> <p data-bbox="448 684 1421 835">In order to create preconditions for the aggregator’s participation in the ancillary services market, as well as in order to timely harmonize regulations in BiH with System Operations Guidelines (SOGL) requirements, the prequalification rules need also to prescribe requirements for testing of the aggregated providers of aFRR and mFRR frequency regulation services.</p> <p data-bbox="448 861 1421 947">The requirements for prequalification of aggregators should be equal to the requirements for the conventional providers of ancillary services in terms of complying the technical requirements.</p> <p data-bbox="448 972 1421 1003">The prequalification rules for each of the frequency regulation services should define the:</p> <ul data-bbox="448 1026 1421 1757" style="list-style-type: none"> • Test cycle, which consists of several periods of standstill (reservation) and several periods of service activation. Duration of the periods of reservation and activation of services should correspond to the integer number of accounting periods in the balancing market, • Allowed response time for the respective service, which is the time from the receipt of the service activation order to the beginning of the generation/consumption change in relation to its stationary value, • Full activation time (FAT) for the respective service, during which the value of the reserve capacity that is the subject of prequalification must be reached at least once, • Permitted and acceptable level of deviation of active power response expressed in % of the reserve capacity subject to prequalification. Present requirements for response accuracy in BiH can be assessed as too strict (2.5% for aFRR, requirements not defined for mFRR) in relation to the European practice (e.g., Germany aFRR - 5% for an acceptable interval in which at least 95% of the values of active power response must lie within and 10% for the permissible interval in which up to 5% of the measured values can be located). The values of the permitted and acceptable intervals are relevant only for the pre-qualification procedure and do not affect the method of calculation of activated energy and the calculation of the imbalance of the service provider, • Requirements regarding the availability of reserve capacity (aFRR Article 158 SOGL), where it is necessary to consider the obligation to prescribe requirements for back-up capacity in case of unavailability or failure of one of the service providing units. The reserve capacity of the aggregator can be provided internally or externally on the basis of a contract with a third party,

³² The applicable compliance rules do not address the provision of the mFRR frequency regulation services.

	<ul style="list-style-type: none"> • Requirements regarding the technical capabilities of ancillary services providers (e.g., control and telecommunication infrastructure, real-time measurements, remote exchange of data and measurements), • Manner of conducting tests of the aggregator control system, which refers to the correct registration and delivery of real time data, reception and execution of the TSO's orders, the system resilience to failures and application of "back-up" solutions, • Manner of conducting communication tests between TSOs, aggregators and individual service providing units, and • Conditions for re-qualification (change in the composition of the service providing group, change in the availability or characteristics of the equipment that affects the qualification of the service provider, expiration of a period of five years, at the legitimate request of the TSO). <p>The method should be defined for determination of the aggregator's available reserve capacity that is the subject of prequalification. The average active power value achieved during the testing period is recommended to be used for these purposes, given the expected volatility of the aggregator response due to the participation of a larger number of smaller aggregated resources.</p> <p>The available reserve capacity can be defined as the difference between the realized average active power values during the service activation period and the average active power values during the standstill (reservation) period. Power values during the power change period should not be taken into account when determining the available reserve capacity.</p> <p>Deviations of the power response outside the permitted range should be a basis for the pre-qualification test to be considered unsuccessful.</p> <p>Aggregators should maintain an up-to-date list of service providing units (DERs), which must be available for inspection by the TSO. The list should contain basic technical data on the service providing units, such as available capacity, type of DER, location, standard load profile.</p>
<p>Pre-qualification procedure and data submission</p>	<p>Compliance tests of ancillary services providers</p>
	<p>COMMENTS AND RECOMMENDATIONS</p> <p>Present compliance tests of ancillary services providers are tailored to the requirements for conventional service providers and are not fully applicable to the aggregator prequalification process.</p> <p>The procedural rules of the aggregator prequalification process should be prescribed as an integral part of the prequalification rules of the aggregated services providers, which would further define the:</p> <ul style="list-style-type: none"> • Conditions in which the ancillary services provider independently conducts tests with/without informing the TSO, • Minimum threshold of the aggregator installed capacity when the TSO must be informed about the planned prequalification tests, • Deadlines for submission of notifications on the implementation of the pre-qualification tests and testing plan, • Obligation to submit data on the aggregator structure and applied communication technologies, • The right of the TSO to supervise the pre-qualification process,

	<ul style="list-style-type: none"> • Manner of submitting applications, information and documents for prequalification assessment, • Deadlines for resolving applications and evaluating the results of the prequalification tests, and • The right of the TSOs to conduct control tests in order to verify results of tests performed by the service providers. <p>Furthermore, the TSO should prescribe in advance the content of the application forms and standard technical data about the service providing units to be submitted in the pre-qualification process.</p> <p>The aggregation rules need to define whether the total capacity for the aFRR frequency regulation services must be provided by the service providing units in operation or alternatively the part of the capacity can be provided by the units that are out of operation at the time of receiving the service activation signal. When a share of the aFRR reserve capacity can be provided by the out of operation units (quick start units) as well, the minimum share of reserves that must be provided by service providing units in operation needs to be defined.</p>
<p>Changes in aggregator composition</p>	<p>Compliance tests of ancillary services providers</p>
	<p>COMMENTS AND RECOMMENDATIONS</p> <p>An integral part of the pre-qualification rules for aggregators should be the rules of subsequent adding/removing the service providing units from the group.</p> <p>The pre-qualification of aggregated resources should be performed at the portfolio level, given that the pre-qualification at the level of individual service providers can be a barrier to the aggregator participation in the market, due to the potential costs, complexity and duration of the process.</p> <p>Where a change in the aggregator composition occurs, with an increase in available reserve capacity, it is recommended not to perform a new prequalification procedure if the additional available capacity is lower in a certain percentage (e.g., 5%) than previously determined reserve capacity.</p> <p>If the additional available reserve capacity exceeds the given percentage, the re-qualification procedure may be performed for additional service providing units only or for the portfolio as a whole.</p> <p>If added service providing units are of the same type as the units previously pre-qualified for the provision of ancillary services, instead of conducting a new pre-qualification procedure, the aggregator may submit documentation confirming the equality of the characteristics of the added service units.</p> <p>In case of removal of a certain number of services providing units, an analogous procedure as for the case of increasing the available reserve capacity should be performed, whereby compliance tests may prescribe a different value of the reserve capacity change when no re-qualification procedure is required in relation to the process of adding new service providing units.</p>

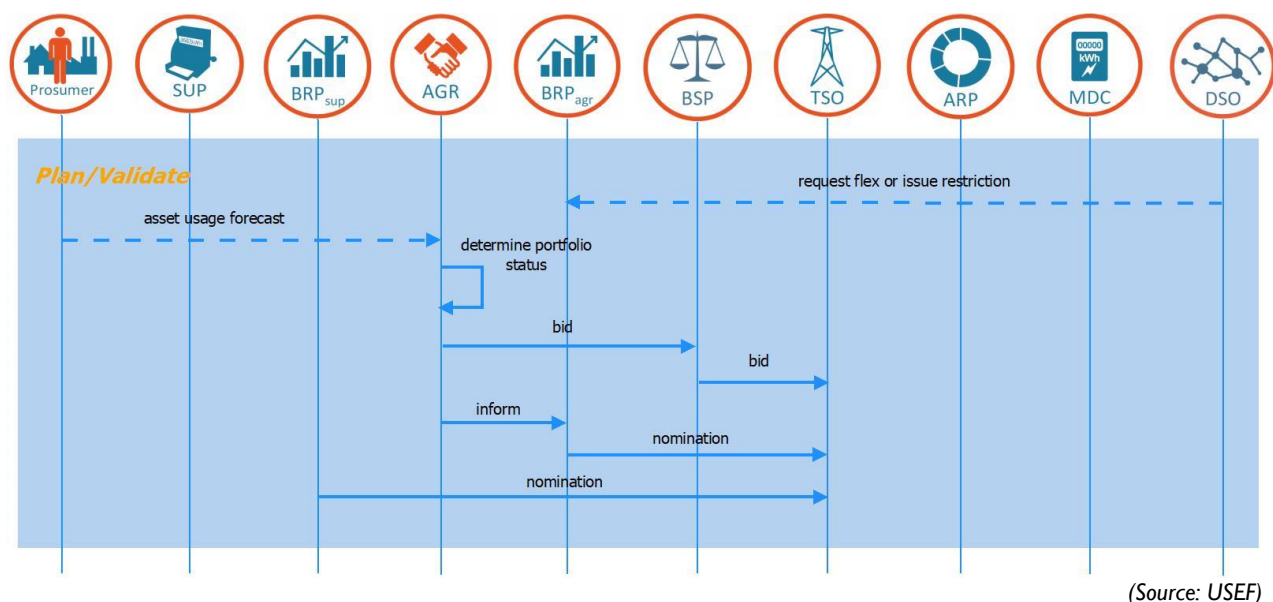
Service providers with limited energy storage capacities	Compliance tests of ancillary services providers
	<p>COMMENTS AND RECOMMENDATIONS</p> <p>Service providers with limited energy storage capacities are providers that cannot provide reserve capacity services at the required time periods without the application of additional energy storage management measures.</p> <p>The compliance tests should define, as a criterion for categorization, a threshold corresponding to the 60 minutes time period of providing services with capacity commercially offered in the market, or 15 minutes of providing services with capacity that is subject to prequalification.</p> <p>An integral part of the prequalification procedure for this category of service providers should be the verification of useful energy capacity. During the determination of useful energy capacity, the application of energy storage management measures is not allowed.</p> <p>TSO should prescribe the rules of registration and submission of stationary data related to the energy capacity of aggregators and individual service providing units/groups that have limited energy storage capacity.</p> <p>For the FRR frequency regulation services, the service provider is obliged to verify that the service providing unit/group always has useful energy capacity that depends on the volume of FRR reserve capacity and that allows the service delivery in the minimum duration prescribed by the TSO. Additionally, the service provider must verify that it has developed the energy storage management measures that enable the continuous and secure provision of services for the duration prescribed by TSO.</p>
Specific requirements for downward regulation services	Market rules
	<p>COMMENTS AND RECOMMENDATIONS</p> <p>Special conditions should be envisaged for the negative frequency regulation services (generation reduction or consumption increase), to prohibit the provision of services through an increase in electricity consumption that has no technological purpose or a reduction in electricity generation that includes unused burning of primary fuel.</p>
Costs and duration of the prequalification procedure	Compliance tests of ancillary services providers
	<p>COMMENTS AND RECOMMENDATIONS</p> <p>Procedures for ancillary services stipulate that the costs of testing the technical compliance of facilities to provide ancillary services are borne by each party separately,</p>

	<p>which is the standard applied solutions. An identical requirement needs to be defined by the “Compliance tests of ancillary services providers”.</p> <p>Under the given conditions, the aggregator bears its own pre-qualification costs, while the TSO/DSO bears the costs of its staff engaged in supervising the implementation of pre-qualification tests and analysis of documentation to evaluate the fulfillment of the prequalification criteria.</p> <p>The deadlines for the prequalification process need to be harmonized with the requirements of Article 159, paragraphs 3 and 4 of the SOGL (TSO is obliged to check the completeness of the application within eight weeks, evaluate the submitted documentation and confirm whether the applicant meets the pre-qualification requirements within three months of receiving the complete application).</p>
<p>TSO-DSO cooperation in the pre-qualification process</p>	<p>Compliance tests of ancillary services providers</p>
	<p>COMMENTS AND RECOMMENDATIONS</p> <p>The TSO should be obliged to inform the DSO on the implementation of the prequalification of the service providing units/groups that are connected to the distribution network.</p>

6. PLANNING AND ACTIVATION OF THE FLEXIBILITY SERVICES

This chapter addresses the issues related to the operational planning of flexibility services, the baseline methodology, services activation and the exchange of information between the market participants. A schematic representation of interactions between the market participants during the planning and nomination phase of flexibility services is given in Figure 5³³.

Figure 5: Interaction between participants during the planning and nomination phase (contractual model).



Since the activated flexibility cannot be measured directly, it is necessary to define the methodology to determine the baseline that represents the estimated production or consumption of electricity that would be achieved without activating the flexibility services.

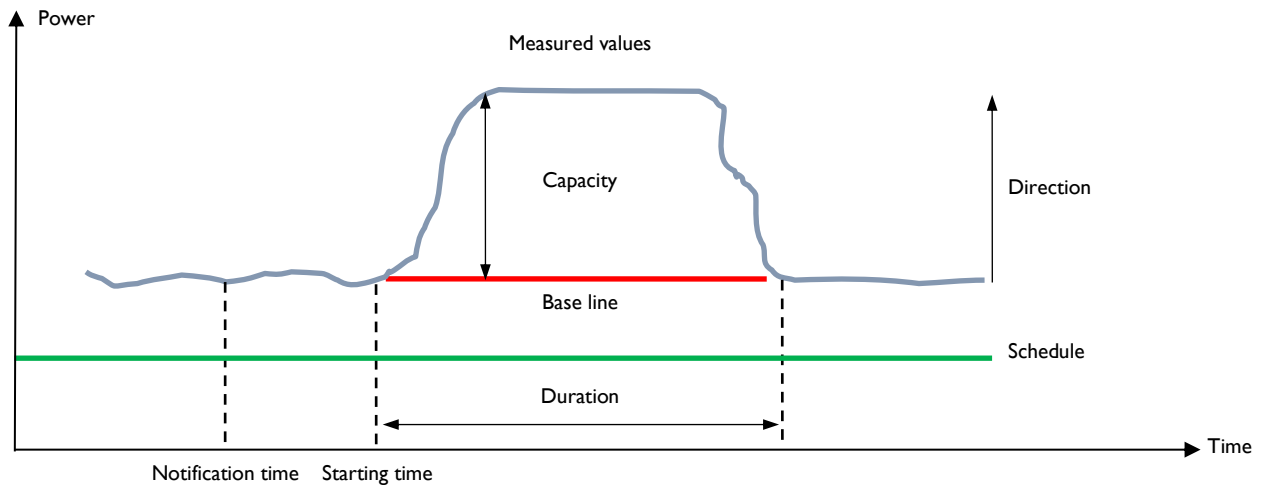
The activated flexibility might be provided within time intervals that are shorter than the actual billing interval of 60 minutes. Therefore, the daily schedule of the aggregator units is not suitable to determine whether the flexibility service has been provided or not. Additionally, the flexibility unit generation/consumption may in general be different from that specified in the daily schedule.³⁴ The baseline diagram (baseline) is therefore used as a basis for quantification of the activated reserve and determination of the amount of energy that is subject of the transaction between the aggregator and the supplier. Activated flexibility for a given billing interval is determined as the difference between the measured value of generation/consumption and the respective baseline.

An illustrative example of a base diagram with activated flexibility service is given in Figure 6.

³³ *Op. cit.*, fn. 4, p.20.

³⁴ An example is the FCR service, where the current capacity before the reserve activation (i.e., significant changes in the system frequency) is taken into account when evaluating the service provided, but not the daily schedule for that billing interval.

Figure 6: Quantification of the activated reserve using a baseline diagram.



(Source³⁵)

The flexibility activation in Figure 6 is determined by the difference between the blue line (measured value) and the red line. The figure shows also the green line representing the daily schedule, which is unusable for determination of the activated flexibility.

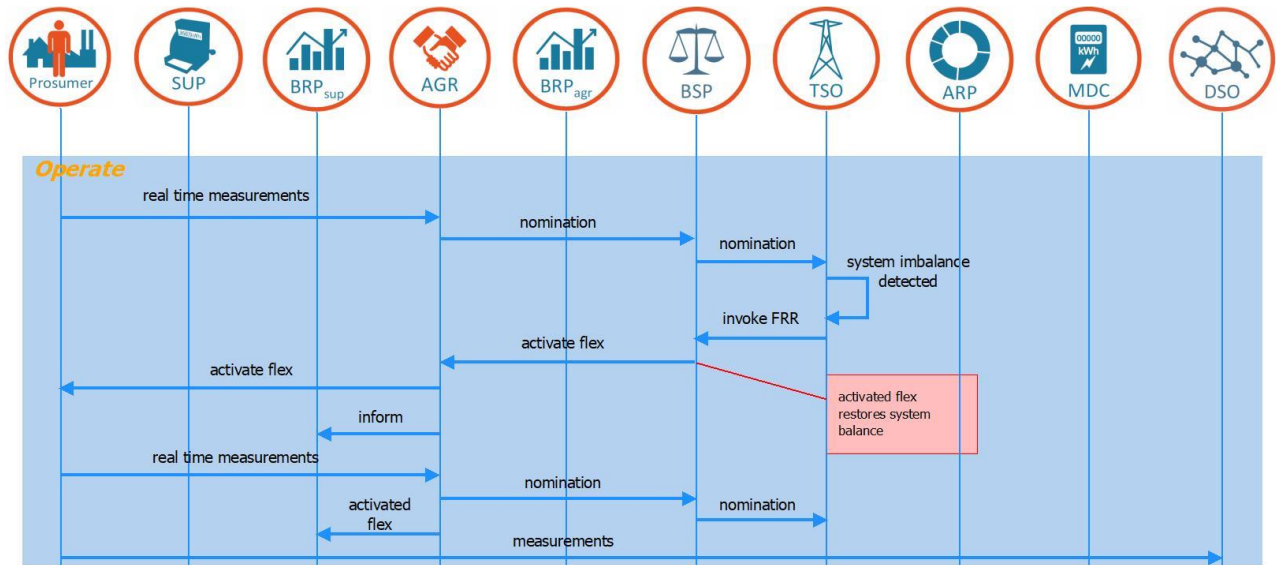
For each of the products on the wholesale and the ancillary services markets, the methodology for determination of the baseline and the nomination periodicity needs to be defined. Adequate baseline methodology is a key prerequisite for establishing a flexibility services market; thereby, the methodology needs to meet the requirements related to the accuracy, reasonable complexity that does not require excessive implementation costs, transparency and impartiality in relation to the market participants.

A schematic representation of interactions between market participants during the flexibility services activation phase is given in Figure 7³⁶.

³⁵ Simone Minniti, Niyam Haque, Phuong Nguyen and Guus Pemen, “Local Markets for Flexibility Trading: Key Stages and Enablers”, 2018, p.4, <https://www.mdpi.com/1996-1073/11/11/3074/htm>.

³⁶ *Op. cit.*, fn. 4, p. 20.

Figure 7: Interaction between participants during the activation phase (contractual model).



(Source USEF)

The recommendations defined in this chapter are generally applicable, regardless of the adopted aggregator concept and the selected implementation model.

Table 2: Planning and activation of flexibility services

ISSUE	BiH REGULATIONS - RECOMMENDATIONS
Baseline	<p>Market Rules</p> <p>COMMENTS AND RECOMMENDATIONS</p> <p>Since the activated flexibility cannot be directly measured, the Market Rules need to define a baseline that represents the generation or consumption of electricity that would be achieved without activation of the flexibility services.</p> <p>The baseline should be used as the basis for the calculation of activated flexibility services, transfer of energy and allocation and calculation of imbalances.</p> <p>The baseline methodology and the nomination periodicity should be defined for each of the products on the wholesale and the ancillary services markets.</p>
Daily schedule and baseline submission rules for aggregators	<p>Market Rules</p> <p>COMMENTS AND RECOMMENDATIONS</p> <p>It should be defined whether the aggregator submits to the flexibility customer a daily schedule and a baseline at the portfolio level or at the level of the individual DERs, and whether there are different rules depending on the type of services provided.</p>

	<p>The submission of the baselines is recommended to be performed at the portfolio level, since this level of details meets the needs of the flexibility customer.</p> <p>The baseline determined at the portfolio level should be based on the baselines of individual service providing units/groups, thus creating preconditions for disaggregation and identification of the flexibility service providers, correct quantification of delivered services, and a calculation of imbalances and transferred energy.</p> <p>An exception to the obligation of making the baseline at the level of the individual service providing units/groups can be applied in a situation where the service provider demonstrates that determination of the baseline at the level of one or more service providing units (power generating modules and power plants) is not possible, provided that these facilities are connected to the same segment of the distribution network and have the same electricity generation technology.</p> <p>The obligation to submit the locational information of the service providing units/groups that are nominated should be considered, regarding the impact the service activation has on the operating parameters of the electricity system. The process of locational information submission should be considered as well.</p>
<p>Baseline methodology, responsibility for establishment of the baseline methodology</p>	<p>Market Rules</p>
	<p>COMMENTS AND RECOMMENDATIONS</p> <p>The baseline methodology depends on the type of the market product</p> <p>The responsibility to establish the baseline methodology for the ancillary services should be delegated to the flexibility customer (TSO or DSO), The baseline methodology may be subject to the regulatory approval. It is recommended that the competent regulatory commission approves the baseline methodology.</p> <p>The baseline methodology for products on the wholesale market should be determined by the regulator, taking into account that these are the services for a larger number of users on the unregulated market.</p> <p>Depending on the type of product, the baseline methodology can be defined as follows³⁷:</p> <ul style="list-style-type: none"> • aFRR services - a methodology based on the “rolling” nomination of aggregators for the next ISP. The basis for nomination is the present power level determined by the real-time measurements, which is extrapolated to the next ISP, thus preventing gaming by resources that have variable output power. The time resolution, time window, and periodicity of nomination updates should be adjusted to the specific characteristics of the aFRR products. Nominations should be performed at the portfolio level, where data must be available at the level of individual service providing units. • mFRR service - a methodology identical to the methodology for aFRR service, with the specificity that the duration of the nomination should be equal to the full duration of the service providing period (depending on the characteristics of the product). The baseline should be frozen at the moment when the activation signal of the TSO is received.

³⁷ *Op. cit.*, fn. 4, p. 54-58.

	<ul style="list-style-type: none"> • Intra-day market - the methodology depends on the time planning horizon and the GCT. For GCTs above three hours, the methodology corresponds to the methodology for the day-ahead market, while for shorter GCTs it corresponds to the methodology for mFRR frequency regulation services. • Day-ahead market - nominations at the ISP level, for the periods covered by the bid. Nominations should be performed at the portfolio level, where data must be available at the level of individual service providing units in order to prevent potential “gaming”. Otherwise, the aggregator could "activate" in real time those units that would regularly change its operating point at a given moment even without activating flexibility services. The baseline should be frozen before the day-ahead market clearing. <p>The flexibility customer can check the quality of the nomination in periods when the services are not activated.</p> <p>The entity responsible for the creation and submission of the baselines should be explicitly defined. Available options are an aggregator or supplier (or their balancing responsible parties). As a rule, responsibility should be assigned to the aggregator, since the allocation of responsibility also implies responsibility for the accuracy of baseline planning. In addition, suppliers by default perform planning and nominations at the portfolio-level and assigning responsibilities to create a baseline diagram would be an additional administrative burden for them.</p> <p>In order to ensure satisfactory accuracy of the baseline diagram for the wholesale market services, the maximum number of activations may be limited, as in the case of the service providing units that are activated on a daily basis it is difficult to distinguish flexibility behavior from the “normal” behavior.</p>
Baseline submission at the individual service providing units/groups	Market rules
	<p>COMMENTS AND RECOMMENDATIONS</p> <p>The installed capacity threshold of individual service providing units/groups for which the submission of individual baselines is mandatory should be prescribed.</p>
Rules for the simultaneous provision of flexibility services	Market rules
	<p>COMMENTS AND RECOMMENDATIONS</p> <p>Aggregators may be allowed to provide several services at the same time, with the obligation to divide the portfolio into segments that provide a particular service.</p> <p>Under these conditions, the rules should be defined for the aggregator’s imbalance allocation in case of simultaneous provision of a multiple service. The imbalance due to the activation of multiple flexibility services needs to be allocated to one of the services provided, depending on the combination of services provided by the aggregator.</p> <p>The simultaneous provision of multiple reserve capacity services by the same service providing unit is not recommended.</p>

Activation of services	Market rules
	<p data-bbox="451 300 932 327">COMMENTS AND RECOMMENDATIONS</p> <p data-bbox="451 352 1333 443">The existing rules in BiH for ancillary services activation are general in nature and tailored to the activation of conventional service providers connected to the transmission network.</p> <p data-bbox="451 468 1385 558">An important feature of the existing system is the activation of aFRR frequency regulation services on a “pro rata” basis, which in principle represents a barrier to the entry of new market participants.</p> <p data-bbox="451 583 1403 735">It is recommended that, in parallel with the general harmonization of the BiH regulatory framework for aFRR frequency regulation services with the requirements of the EU guideline on electricity balancing, including the changes in the methodology of aFRR balancing energy pricing, it should be prescribed that activation of aFRR frequency regulation services is performed based on a merit order list.</p> <p data-bbox="451 760 1390 877">The obligations of the aggregator to inform the supplier about the intended/performed activation of flexibility services should be prescribed, particularly when the real-time measurements are provided from the activated unit’s delivery point, to avoid counter balancing activities by the supplier.</p> <p data-bbox="451 903 1406 1115">The manner of informing the DSO about the intended/performed activation of flexibility services in its distribution area should be defined as well. The DSO should be entitled to limit and terminate flexibility activation if it leads to the violation of grid parameters or causes the system instability. Furthermore, an obligation of the DSO should be prescribed to provide information on the occurrence of local constraints in parts of the distribution network (e.g., due to faults, planned outages), which may affect flexibility services providers in their respective area.</p>

7. VALIDATION, BILLING AND PAYMENT OF FLEXIBILITY SERVICES

This chapter defines recommendations related to the exchange of billing data, quantification of delivered flexibility services, quality of services, remuneration for delivered services, calculation of imbalances during the flexibility services activation period, determination of quantities and prices of transferred energy between the independent aggregator and supplier and the financial transactions between the participants in the flexibility market.

When the exchange of billing data is addressed, it is important to emphasize that Article 17.3 of EU Directive 2019/944 requires Member States to prescribe non-discriminatory and transparent rules and procedures for the exchange of data between market participants engaged in aggregation and other electricity undertakings, in order to ensure easy access on equal and non-discriminatory terms while fully protecting commercially sensitive information and customers' personal data.

The provisions of this chapter with regards to:

- Balancing responsibility of the aggregator during the services activation period,
- Imbalance settlement due to the activation of flexibility services,
- Energy settlement,
- Price determination methodology for the activated energy that is transferred between aggregator and supplier, and
- Rules of payments between supplier and aggregator,

are relevant only to the concept of the independent aggregator.

Activation of flexibility services by an independent aggregator causes an imbalance in the supplier's portfolio. When flexibility services are activated, the supplier takes over/delivers the changed volume of electricity from/to the activated DERs as compared to the contracted volume in the wholesale market.

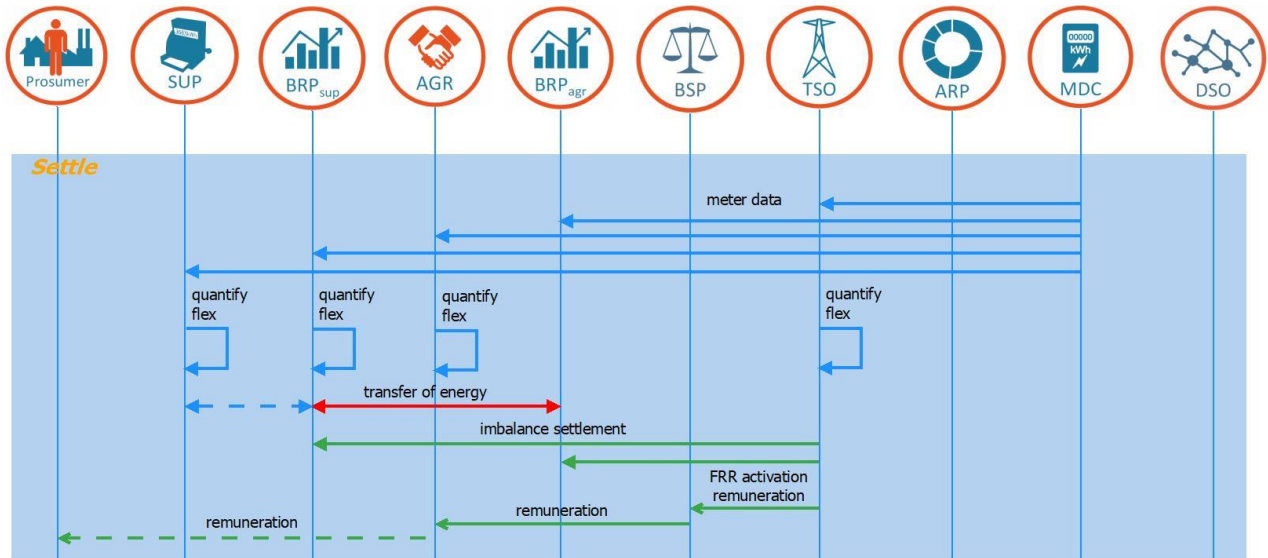
In order to avoid negative impact on the electricity supplier, the energy settlement (energy transfer) and correction of supplier's balancing perimeter should be performed for the period of the flexibility services activation by an independent aggregator.

Energy settlement and correction of the balancing perimeter are additionally complicated by the fact that independent aggregators sell aggregate products, while the settlement needs to be performed at the level of disaggregated individual service providers.

A schematic representation of the interactions between flexibility market participants during the flexibility services settlement phase is depicted in Figure 8³⁸.

³⁸ *Op. cit.*, fn. 4, p.21.

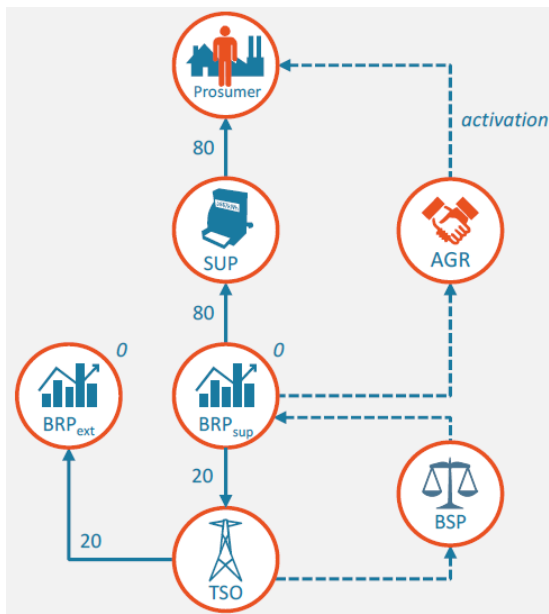
Figure 8: Interaction between participants during the settlement phase (contractual model).



(Source: USEF)

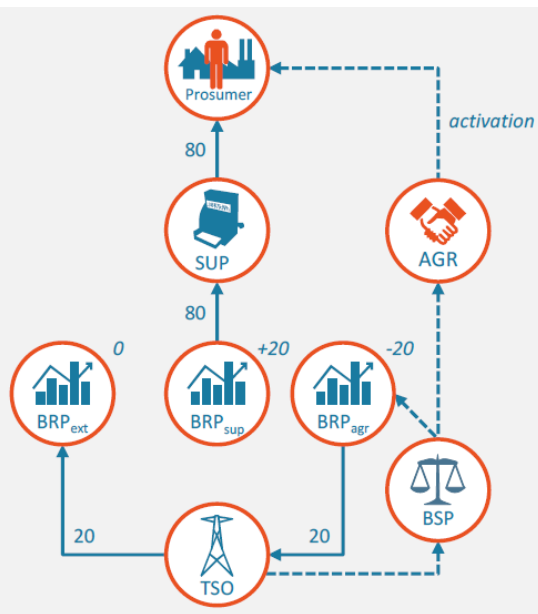
Indicative views of energy flows and commercial transactions when flexibility services are activated by an integrated and an independent aggregator (contractual model) for the TSO's needs are depicted in Figures 9 and 10.

Figure 9: Energy flows and commercial transactions – Integrated aggregator



(Source³⁹)

Figure 10: Energy flows and commercial transactions – Independent aggregator



(Source⁴⁰)

³⁹ Op. cit., fn. 4, p. 31.

⁴⁰ Op. cit., fn. 4, p. 36.

Both views are given for the case of activation of flexibility services through reduction of the service provider’s consumption from 100 to 80 units (which corresponds to the upward regulation services), while the difference of 20 activated units was delivered to the TSO in the balancing services market.

Energy and commercial flows in presented cases are given in Table 6.

Table 3: Energy flows and commercial transactions of an integrated and an independent aggregator

Transaction type	Integrated model	Independent aggregator (contractual model)
Energy transaction in the balancing market	The aggregator/supplier delivers 20 nominated units through BRP _{SUP} for the TSO needs.	The aggregator delivers 20 nominated units for the TSO needs through BRP _{AGR} .
Energy transaction between the aggregator and supplier	Integrated subjects ⁴¹ – without transaction.	By the activation of the flexibility services, the aggregator “takes over” the energy sourced by the supplier. The transaction is performed through BRP _{SUP} and BRP _{AGR} . The quantification of the transaction is the difference between the measured consumption and the baseline value.
BRP_{SUP} perimeter correction due to the activation of flexibility services	Integrated subjects – no correction performed.	The BRP _{SUP} perimeter is corrected for the number of energy units corresponding to the activated flexibility services. In the shown case, the perimeter correction is performed indirectly through the energy transfer between the BRP _{SUP} and BRP _{AGR} .
Imbalance settlement	BRP _{SUP} is the balancing party that is responsible for the overall imbalance, which includes customer consumption and flexibility services.	BRP _{AGR} is responsible for the imbalance given as the difference between the nominated energy transaction for the TSO needs (20 units) and the volume of activated flexibility services. BRP _{SUP} is balancing responsible during the services activation period for the deviations of the nominated procurement (100 units) compared to actual consumption and activated flexibility services.

⁴¹ An integrated subject is a supplier performing both the energy supply and the aggregation activities.

Table 4: Validation, billing and payment of flexibility services

ISSUE	BiH REGULATIONS - RECOMMENDATIONS
Data exchange and delivery rules	FBiH – RS – Brcko District Electricity Laws Market Rules
	<p>COMMENTS AND RECOMMENDATIONS</p> <p>Generally speaking, the supplier and its balance responsible party may need to have specific data related to the contracting and activation of flexibility services by an independent aggregator. On the other hand, specific information relating to aggregators and individual service providers may have the character of commercially sensitive information.</p> <p>The supplier’s BRP should have data on activated flexibility services at the ISP level. Additionally, the supplier may request information on customers who have concluded contracts with the aggregator, to determine whether there has been a breach of the supply contract provisions. Information on the concluded contract with the aggregator can be submitted by the generator/customer or by the aggregator.</p> <p>In the case of larger generators/customers, the supplier may need real-time data on activated flexibility services, in order to avoid the application of counter-balancing measures (especially for users with real-time measurement) and to apply measures to reduce the negative consequences of the “rebound” effect. For smaller generators/customers, data on activation can be provided at an aggregated level.</p> <p>In order to alleviate negative effects on suppliers, the aggregator should additionally be obliged to submit the data regarding the expected duration and magnitude of the “rebound” effect, given by the DER’s types.</p> <p>The relevant system operator to whose network the service providing unit is connected, should be informed by the aggregator about the technical aspects of the flexibility contract which are relevant for network operations (available capacity, rate-of-change of active power, type of flexibility services).</p>
Validation and exchange of billing data	Market Rules Distribution Grid Codes EP BiH – MH ERS – EP HZHB – Brcko District
	<p>COMMENTS AND RECOMMENDATIONS</p> <p>The relevant system operator to whose network the service provider’s facilities are connected to, should be responsible for the validation of metering data, which are used for the quantification of transferred energy and correction of the balancing positions of the supplier and its BRP. This obligation should also apply to the generation/consumption submetering, if it is being applied.</p> <p>The relevant system operator should be in charge of delivering the metering data to the aggregator, supplier, and TSO as the flexibility customer or as the allocation responsible party (ARP).</p> <p>Open, interoperable standard protocols need to be applied for the billing data exchanges. The flexibility customer (TSO, DSO, participant in the wholesale market) is, as a rule, responsible for prescribing the format, content and frequency of billing data exchange.</p>

Quantification of the delivered services	Market Rules or Procedures for Ancillary Services Distribution Grid Codes EP BiH – MH ERS – EP HZHB – Brcko District
	<p>COMMENTS AND RECOMMENDATIONS</p> <p>Responsibilities for quantification of delivered flexibility services could be assigned either to the metering operator (DSO or TSO, depending on the connection point of the service provider) or to the flexibility customer (network operator or supplier and aggregator when services are provided on the wholesale market).</p> <p>The quantification of delivered services should be performed by network operators who are flexibility customers (TSO or DSO), and by the TSO where the services are provided for portfolio optimization between different BRPs in the wholesale electricity market.</p> <p>Quantification of delivered flexibility services should be based on respective baseline values and metering data from the main metering device or generation/consumption submetering device.</p> <p>The delivered flexibility should be calculated as the difference between the total generation/consumption and the corresponding baseline value of generation/consumption during the settlement period. The values at the aggregator level should be determined as the sum of individual values of activated generation/consumption.</p> <p>Activated energy of ancillary services during the power change period (during activation and deactivation of services) is calculated as an integral part of the total activated balancing energy.</p>
Quality of performed services	Procedures for Ancillary Services
	<p>COMMENTS AND RECOMMENDATIONS</p> <p>ISO BiH Procedures for ancillary services prescribe requirements related to measuring the quality of secondary and tertiary regulation services. The quality of the secondary regulation services is based on the application of the signals “Unit blocked” or “Unit off remote control,” and the signal “Unit Not Following.”</p> <p>An analysis of the applicability of these signals to assess the quality of the aFRR frequency regulation services provided by the aggregator should be performed. If necessary, new criteria should be defined on a basis of the actual generation/consumption during the service activation period.</p>
Billing aggregator – an individual service provider	FBiH – RS – Brcko District Electricity Laws
	<p>COMMENTS AND RECOMMENDATIONS</p> <p>The aggregator should be obliged to inform individual service providers about the performed flexibility services in a way that is simple, unambiguous and allows precise separation of flexibility services from other transactions between the aggregator/supplier and individual service provider.</p>

Imbalance settlement due to flexibility services activation	Market rules
	<p>COMMENTS AND RECOMMENDATIONS</p> <p>Activation of flexibility services by an independent aggregator causes an imbalance in the supplier's portfolio that needs to be corrected in order to avoid a negative impact on the supplier and its balance responsible party.</p> <p>For the contractual aggregator implementation model, correction of imbalances in the supplier's portfolio due to the activation of flexibility services is performed implicitly through the transfer of energy between the aggregator and the supplier.</p> <p>The aggregator should have balancing responsibility for the difference between the activated flexibility and the nominated energy transaction in the wholesale or ancillary services market. During the service activation period, the balancing responsibility of the supplier is determined for the nominated baseline.</p>
Energy settlement	Market rules
	<p>COMMENTS AND RECOMMENDATIONS</p> <p>The energy sourced by the supplier but sold by the independent aggregator on the flexibility market (positive regulation service) should be exchanged between them, in order to avoid a negative impact of the flexibility services activation on the supplier and its balancing responsible party. For negative regulation services, the energy purchased by the independent aggregator on the flexibility services market needs to be transferred from the aggregator to the supplier.</p> <p>The quantification of activated energy should be based on the values of the baseline and registered quantities on the metering devices of the service providing units/groups for each ISP.</p> <p>For the contractual implementation model, the transfer of energy and compensation are performed bilaterally between the aggregator and the supplier.</p>
Methodology for determining the value of activated energy between aggregators and suppliers	Market rules
	<p>COMMENTS AND RECOMMENDATIONS</p> <p>The methodology for determining the value of activated energy should be the same for all DER's categories. The energy price must be known in advance in relation to the time of aggregator's bids submission and activation of services.</p> <p>The value of activated energy is standardly differentiated depending on the type of services and the market segment in which the aggregator operates. The price of energy can be further differentiated depending on the time of procurement of flexibility services. The basic division separates services where flexibility is provided in the long run (e.g.,</p>

	<p>strategic reserves, “hedging” in the wholesale market) and services where flexibility is traded in the short term, including intraday trading.</p> <p>The price of energy should reflect the suppliers’ sourcing costs at the time of procurement, which can be variable. The energy prices should be expressed with the highest possible time resolution, preferably at the ISP level or the billing unit on the day-ahead market.</p> <p>For the flexibility services delivered on the balancing market, the energy price should be determined based on publicly available data on the day-ahead market in BiH (when applicable) or on the day-ahead markets in the surrounding countries. The data on suppliers’ electricity purchase costs should not be used for these purposes, since this information has the confidential character.</p> <p>For the flexibility services delivered on the day-ahead market, the energy price should be determined based on a mix of prices at the bilateral market and a day-ahead market applied to the standard electricity supply mix of the average supplier.</p> <p>For the flexibility services delivered on the intra-day market, the energy price should be determined based on day-ahead market prices for the respective billing period. The intraday market pricing methodology can be further differentiated depending on whether the bidding period is up to three hours ahead of the real time, or 3-24 h when the conditions are more like the day-ahead market conditions.</p>
<p>Settlement rules supplier – aggregator – service provider</p>	<p>Market rules</p>
	<p>COMMENTS AND RECOMMENDATIONS</p> <p>For the contractual aggregator implementation model, the rules of billing and payment between the aggregator and the supplier should be prescribed for the transfer of energy due the activation of flexibility services. The terms of billing and payment should be an integral part of the standardized contract between the aggregator and the supplier.</p> <p>The method of settlement between aggregators and individual service providers are not subject to regulation. These aspects should be arranged on a bilateral basis between the aggregator and the service provider by applying the market principles. Multiple payment methods between the aggregator and the service provider are applicable, such as a fixed annual fee, a fee depending on the amount of activated energy or number of hours in which the service is available, or a fee expressed as a percentage of the aggregator’s earnings.</p>
<p>Dispute resolution</p>	<p>Law on Transmission, Regulator and Operator of the Electricity System in BiH</p>
	<p>COMMENTS AND RECOMMENDATIONS</p> <p>A settlement mechanism needs to be established for disputes between the market participants engaged in aggregation and other market participants, including their liability for imbalances.</p> <p>The competence for dispute settlements related to the participation of aggregators in the wholesale and ancillary services markets should be assigned to the State Electricity Regulatory Commission (SERC).</p>

8. TRANSPARENCY AND DATA PUBLICATION

This chapter addresses the general rules for publication and protection of commercially confidential information, publication of data on the ancillary services market in BiH, and the basic principles of communication and data exchange between the independent aggregator and supplier.

The basic principle for defining the rules of data publication and availability is that any subject should be authorized to access the information it needs in order to perform its tasks.

A special aspect of the rules for publishing and protection of the confidentiality of commercially sensitive data relates to the use of data on the contracted energy price between the supplier and the individual service provider (the energy sourcing price within the supplier's portfolio).

Table 5: Transparency and data publication

ISSUE	BiH REGULATIONS - RECOMMENDATIOIS
Ancillary services market data publication	Market Rules
	<p>COMMENTS AND RECOMMENDATIONS</p> <p>BiH market rules and accompanying documents provide a formal framework for timely publication of the data on the functioning of the balancing market, and a structured analytical presentation by type of ancillary services, with the protection of confidential and commercially sensitive data.</p>
Publication of data in the communication between aggregators, suppliers and balancing responsible parties	Market Rules
	<p>COMMENTS AND RECOMMENDATIONS</p> <p>From the aspects of protection of commercially sensitive data, non-distortion of competition and equal treatment of the market participants, special attention should be paid to the issues related to the:</p> <ul style="list-style-type: none"> • The right to access metering data of the individual generators and electricity customers, • Provision of information to the supplier about the contract concluded between the aggregator and the service provider with whom the supplier has valid electricity purchase/supply contract, • The way the supplier and its BRP are informed about the activation of flexibility services within their portfolio, and • Method of delivery and publication of data regarding the supplier's energy component price, for the purpose of energy settlement with an independent aggregator.

Considering the analysis and recommendations given in this document, the above stated issues should be addressed as follows:

- The generator and the customer must have access to their own data on electricity generation and consumption at the appropriate granularity level, which are necessary for the comparison of different offers and for the selection of aggregation services providers. Metering and any other data relating to the customer/generator is the ownership of that subject and their delivery to third parties is permitted only upon the prior consent of the subject to which the data relates.
 - The supplier should be informed about the conclusion of a contract between the aggregator and the service provider with whom the supplier has concluded an electricity purchase/supply contract. The individual service provider should have the obligation to provide such information. Under given conditions, the supplier must not be disadvantaged by the prospective treatment of this information as commercially sensitive.
 - The supplier should be informed about the activation of flexibility services within its portfolio, in order to avoid the negative effects of the counterbalancing and to take measures to alleviate the consequences of the rebound effect. The aggregator should have the obligation to provide this information. The information should be provided at the individual level for network users whose installed capacity is above the prescribed threshold, and at the portfolio level for other users. In this situation, the supplier should not be put at a disadvantage due to the prospective labeling of the information about the performed activation of services as commercially sensitive.
 - Considering the proposed implementation model of independent aggregator and the methodology for determination of the transferred energy price, the supplier's energy component price is not applied to determine the value of transferred energy during the energy settlement process between the independent aggregator and the supplier.
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