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CATEGORIZATION OF GENERATORS ACCORDING TO THE INSTALLED CAPACITY AND VOLTAGE LEVEL AT THE CONNECTION POINT IN BIH

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CONTENT

1.

2. INTRODUCTION

Component C 2.2.a of the USAID EPA Energy Policy Activity Project provides for the technical assistance to the transmission and distribution system operators in BiH in order to harmonize the BiH network rules with the requirements arising from the relevant EU network codes and applicable technical standards. The terms of reference for the Working Group established to develop Guidelines for network operators in BiH to amend relevant Grid Codes, which more precisely defines the USAID EPA technical assistance related to the BiH Transmission Grid Code and includes the development of guidelines for amendments to comply with the EU Network codes and guidelines related to the connection of generators, demands and high voltage DC facilities. In addition, the guidelines for amendments of distribution grid codes should include harmonization with the EU network codes that are relevant for the performance of electricity distribution activities.

The Network Code on Requirements for Generators, Commission Regulation (EU) 2016/631, (hereinafter referred to as RfG NC) is one of the most important documents from the package of EU network codes and guidelines, which are, by the decision of the Permanent High-Level Group of the Energy Community No. 2018/03/PHLG-EnC dated January 12, 2018, incorporated into the legal framework of the Energy Community. According to the Decision, the deadline for transposition of regulations into the national legislation is six months, while the deadline for full implementation is three years in relation to the deadline for transposition. The above means that the Energy Community Contracting Parties are obliged to fully apply the RFG NC by July 12, 2021, at the latest. The RfG NC is incorporated into the BiH regulatory framework by the decision of the State Electricity Regulatory Commission (SERC) on the transposition of the connection rules for the operation of networks of June 12, 2018[1]. In that Decision, SERC invited the Regulatory Commission for Energy in Federation of Bosnia and Herzegovina (FERC), Republika Srpska Energy Regulatory Commission (RSERC) and other relevant institutions to harmonize their relevant rules with the requirements given in the EU Commission regulations establishing requirements for grid connection, as listed in point 2 of the Decision.

Determination of the installed capacity thresholds for generator categorization purposes represents the basis for the implementation of the RfG NC. The selection of the maximum installed capacity threshold for certain classes of generators is performed by the relevant TSO with the approval of the regulator. The selection depends on: local conditions; voltage level at the connection point; application of generators of different technologies; types and capacities and their impact on the power system stability and operation; and analysis of the functional requirements with which generators of a certain type should comply.

[1] SERC, Decision on Transposition of Network Codes on Connection, No 05-14-1-97-3/18, 12 June 2018 http://www.derk.ba/DocumentsPDFs/Odluka-o-transpon-pravila-za-rad-mreza-u-vezi-prikljucivanja-en.pdf

3. DETERMINATION OF THE GENERATOR INSTALLED CAPACITY THRESHOLDS

According to the definition given in the RfG NC, “maximum capacity” or “Pmax” means the maximum continuous active power that a power-generating module can produce, less any demand associated solely with facilitating the operation of that power-generating module and not fed into the network as specified in the connection agreement or as agreed between the relevant system operator and the power-generating facility owner.

“Power-Generating module” is considered to be either a synchronous power-generating module or a Power Park Module.

"Power Park Module" (hereinafter referred to as "PPM") means a unit or ensemble of units generating electricity, which is either non-synchronously connected to the network or connected through power electronics, and that also has a single connection point to a transmission system, distribution system including closed distribution system, or HVDC system.

According to Article 5 of the RfG NC, the power-generating modules are classified into four types, depending on the voltage level at the connection point and the installed capacity. The RfG NC prescribes standard default values of the installed capacity and voltage levels for categorization of power-generating modules depending on the synchronous area.

According to the voltage level at the connection point, power-generating modules type A, B and C represent generators connected to a voltage level lower than 110 kV, while all generators connected to voltage levels of 110 kV and higher are categorized as type D generators.

Table 1. Maximum values of the installed capacity threshold by the power-generating module types[2]

Synchronous area	**Maximum capacity threshold for the power-generating module**		
	Type B	**Type C**	**Type D**
Continental Europe	1 MW	50 MW	75 MW
Great Britain	1 MW	50 MW	75 MW
Nordic	1.5 MW	10 MW	30 MW
Ireland and North Ireland	0.1 MW	5 MW	10 MW
Baltic	0.5 MW	10 MW	15 MW

[2] Commission Regulation (EU) 2016/631 of 14 April 2016 establishing a network code on requirements for grid connection of generators, Article 5, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=OJ:JOL_2016_112_R_0001.

The values specified in the RfG NC represent maximum values, whereby the relevant transmission system operator may prescribe different, lower values, with the obligation to uniformly apply the prescribed categorization by all system operators in a given country.

The values of the prescribed installed capacity thresholds for power-generating modules in the European Union member states are listed in the Table 2.

Table 2. Installed capacity thresholds for power-generating modules in the EU member states[3]

State	A/B threshold	B/C threshold	C/D threshold
Austria	250 kW	35 MW	50 MW
Belgium	1 MW	25 MW	75 MW[4]
Bulgaria	1 MW	5 MW	20 MW
Czech Republic	100 kW	30 MW	75 MW
Germany	135 kW	36 MW	45 MW
Denmark	125 kW	3 MW	25 MW
Estonia	0.5 MW	5 MW	15 MW
Spain	100 kW	5 MW	50 MW
Finland	1 MW	10 MW	30 MW
France	1 MW	18 MW	75 MW[5]
Great Britain	1 MW	10 MW	50 MW
Greece	1 MW	20 MW	75 MW
Croatia	500 kW	5 MW	10 MW
Hungary	200 kW	5 MW	25 MW
Ireland and North Ireland	100kW	5MW	10MW
Italy	11,08 kW	6 MW	10MW
Lithuania	250 kW	5 MW	15 MW
Luxembourg	135 kW	36 MW	45 MW
Latvia	0,5 MW	5 MW	15 MW

[3] ENTSO-E “Monitoring report on connection network codes implementation”, p. 6. https://eepublicdownloads.blob.core.windows.net/public-cdn-container/clean-documents/Network%20codes%20documents/CNC/Monitoring_report_on_connection_network_codes_implementation_191216.pdf.

[4] In Belgium, the TSO proposed an exemption for type D generation modules with a maximum power of less than 25 MW connected to a voltage level above 110 kV.

[5] FR: national legislation requires power-generating modules above a defined installed capacity to be connected at the voltage level of 110 kV

Netherlands	1 MW	50 MW	60 MW
Poland	200kW	10MW	75MW
Portugal	1 MW	10 MW	45 MW
Romania	1 MW	5 MW	20 MW
Sweden	1,5 MW	10 MW	30 MW
Slovenia	10 kW	5 MW	20 MW
Slovakia	100 kW	5 MW	20 MW

As stated in Table 2, a large number of countries belonging to the synchronous area of Continental Europe have decided to lower the installed capacity thresholds for the delimitation of power-generating modules of types A/B, B/C and C/D.

The practice in BiH's neighboring countries is similar, as these countries also decided to lower the thresholds of the installed capacity for categorization of generators in relation to the standard values given by the RfG NC.

Table 3. Installed capacity threshold values for generation modules in the countries of the region

State	A/B threshold	B/C threshold	C/D threshold
Croatia	500 kW	5 MW	10 MW
Serbia*	-	-	-
Macedonia*	-	-	-
Slovenia	10 kW	5 MW	20 MW

** Installed capacity thresholds not defined yet (as of August 18, 2020)*

4. RESPONSIBILITY FOR DETERMINATION OF THE INSTALLED CAPACITY THRESHOLDS

According to Article 5, Item 3 of the RfG NC, the proposed installed capacity thresholds for type B, C and D generators are subject to the approval of the relevant regulatory authority, and where applicable the member states. In defining the proposal, the relevant TSO will coordinate activities with the neighboring TSOs and DSOs and conduct a public hearing procedure in accordance with the Article 10 of the RfG NC.

According to Article 4 of the RfG NC, the requirements do not apply to the existing generators. In this case, the generator is considered to be existing if it is:

- already connected to the network on the day of the deadline for transposition of the RfG Network Rules (July 12, 2018), or
- The power-generating facility owner has concluded a binding contract for the purchase of the main generating equipment of the power plant within two years of the deadline for transposition of the RfG NC, i.e., by July 12, 2020. The power-generating facility owner is obliged to notify the relevant system

operator and relevant TSO about the conclusion of the contract by January 12, 2021.

The competent regulatory authority may, at the proposal of the system operator, decide on the implementation of part or all of the requirements of the RfG NC to the existing generators, provided that:

- The relevant system operator submits a technically justified proposal,
- There is a cost-benefit analysis in accordance with Articles 38 and 39 of the Grid Code, and
- The Regulatory Commission conducts a public hearing procedure.

5. FUNCTIONAL REQUIREMENTS FOR POWER-GENERATING MODULES

The main functional requirements for power-generating modules (generators), prescribed by the RfG NC, are listed in the Table 4, where the most important requirements that make a significant difference in the requirements for generators of a certain type compared to the previous type with a lower degree of functional requirements, are given in a bold format.

Table 4. Main functional requirements for generators

Basic functional requirements for generation modules			
Type A	**Type B**	**Type C**	**Type D**
Operating frequency range	Requirements for type A generators	Requirements for type B generators	Requirements for type C generators
Active power frequency response at over frequencies LFSMO-O	**Remote control (limitation) of active power generation**	Management of active power generation according to TSO requirements and control range	Stability at steady state voltage deviations
Rate of Change of Frequency withstand capability (ROCOF)	Control and protection schemes and settings	Active power frequency response at reduced frequencies LFSM-U	Reactive power generation requirements - *for type D synchronous generators*
Protection against loss of mains, based on the principle of frequency rate-of-change detection	**Real-time information exchange**	**Frequency sensitive mode (FSM)**	**Fault ride through (FRT) stability during symmetrical and asymmetrical short circuits in the network – for type D synchronous generators**
Stability of generation and permitted reduction of active power at reduced frequencies	Reactive power generation requirements - *for synchronous generators*	Real-time FSM monitoring	Reactive power generation requirements for type D PPMs
Automatic connection following an incidental disconnection	**Voltage regulation - *for synchronous generators***	Automatic shutdown in case of voltage deviation outside the prescribed ranges	**FRT stability during symmetrical and asymmetrical short circuits in the network – for type D PPMs**
Logical interface to cease generation after receiving an external signal	**Fault ride through (FRT) stability during symmetrical and asymmetrical short circuits in the network**	Active power change gradient	

	- for synchronous generators		
	Recovery of active power generation after fault elimination - *for synchronous generators*	**Black start capability**	
	Reactive power generation requirements for PPM (asynchronously connected generators)	Ability to switch to island mode	
	FRT stability during symmetrical and asymmetrical short circuits in the network – *for PPMs*	Ability to quickly resynchronize	
	Dynamic voltage support and fast fault current injection - *for PPMs*	Instrumentation	
	Recovery of active power generation after fault elimination for PPMs	**Simulation models**	
		Reactive power generation requirements - *for synchronous generators*	
		Reactive power generation requirements – *for PPMs*	
		Voltage regulation - *for PPMs*	

The main difference in functionalities between type A and type B generators is reflected in the obligation of type B generators to meet the requirements related to the fault ride through stability during symmetric and asymmetric short circuits in the power system, requirements for reactive power generation and voltage regulation for synchronous generators, as well as the obligation to establish a system of remote monitoring of the power plant, with the possibility of remote limitation of active power by the relevant system operator. When PPMs are considered, additional requirements are related to the injection of reactive current during voltage dips.

The main difference in functionalities between type B and C generators is reflected in the obligation of type C generators to meet the requirements prescribed for frequency sensitive mode of operation (participation in primary frequency control), capability to start a power plant without an external power source, and to meet the requirements related to the reactive power generation and voltage regulation.

The main difference in functionality between type C and D generators is reflected in the obligation of type D generators to meet specific requirements for reactive power generation and specific requirements for operating stability in the event of voltage drop during symmetric and asymmetric short circuits.

6. CRITERIA FOR SELECTION OF THE INSTALLED CAPACITY THRESHOLDS

Wider use of power-generating modules connected to the distribution network has led to the significant changes in the power flows, voltage conditions and short circuit power in the network.

A number of challenges have arisen from the security of distribution network operation and quality of electricity supply point of view, with a significant deterioration in a number of cases. In that sense, operation of a certain power-generating module can cause any of reactive energy to be consumed from the distribution network by generation modules,[6] increase in the number of outages in the network, increase of network losses or worsened voltage conditions, thus decreasing quality of supply. The owners operate the power-generating modules solely motivated by profit maximization, which can make it difficult for the DSO to run the distribution system. Additional increase in the number of power-generating modules in the future is expected to further complicate the current situation. In order to provide DSOs with the appropriate mechanisms to maintain both the safe operation of the system and quality of supply to customers, it is necessary to determine an appropriate threshold for classification of power-generating modules types A/B. The appropriate determination of A/B capacity threshold has to ensure monitoring, management and regulation of voltage and reactive power by the sufficient number and capacity of controllable future/new type B power-generating modules.

In addition to a significant increase in the number of power-generating modules in the distribution network, their additional intensive engagement is envisaged for the purpose of balancing, congestion management and frequency regulation,[7] in order to preserve the safety of power system operation under the conditions of high deployment of renewable energy sources with unstable and unpredictable electricity generation. Furthermore, power-generating modules connected to the distribution network will be expected to participate in the day-ahead and/or intraday electricity market in BiH (after the establishment of these markets), directly or through the balance responsible party or aggregators.[8] Therefore, it is necessary to ensure controllability of the active power generation of the sufficient number and capacity of future/new type C power-generating modules by the appropriate selection of power-generating module types B/C threshold.

The basic criteria for selecting the installed capacity threshold for the purposes of generator categorization may include:

- Compliance with the current network rules,
- Characteristics of the existing and future generation portfolio in the power system of a particular country,
- Increasing the integration of power plants using renewable energy sources, which are usually connected to the distribution voltage levels with increasing impact on the network operation and expected decrease in the share of conventional power plants connected to the transmission network,

[6] The generation modules were supposed to produce the necessary reactive energy .
[7] In BiH, only large generator units are currently used for these purposes.
[8] A new category of participants in the electricity market.

- Preservation of the achieved level of security of the electric power system, taking into account the expected changes in the structure of the generation portfolio in the electric power system,
- Characteristics of the transmission and distribution system in terms of voltage levels used, such as consumption density,
- Technological characteristics of modern power-generating modules,
- Requirements regarding voltage regulation and reactive power exchange at the TSO-DSO interface,
- Voltage level at the connection point (division A/B) - e.g., Germany generators on LV type A, generators on MV type B, and
- Increasing the portfolio available for direct (without the aggregator) provision of frequency regulation ancillary services (B/C division).

The functionalities of the generators that predominantly affect the fulfillment of the previously stated criteria are given in Table 5.

Table 5. Functionalities that determine the choice of installed capacity thresholds

Functionality	Division A/B	Division C/D
1.	Stability of generator operation at short circuits in the power system	Capabilities to participate in the frequency regulation
2.	Voltage regulation and control of the reactive power generation	Enabling remote control of active power generation
3.	Increasing monitoring and real-time data exchange with relatively low capacity generators in the power system	Availability of the power plant simulation model for power system operation simulation purposes
4.		Capabilities of reactive power generation and voltage regulation

7. STRUCTURE OF THE GENERATION PORTFOLIO IN BIH

The applicable network rules in Bosnia and Herzegovina define the division of generators into generators connected to the transmission voltage levels to which the provisions of the Grid Code apply and generators connected to the distribution voltage levels to which the provisions of relevant distribution network rules and connection regulations apply. It is important to emphasize that the current network rules in BiH generally do not define the categorization of generators, which is analogous to the categorization prescribed by the RfG NC, noting that the Rulebook on conditions of connection of power plants to the electricity distribution network of

Republika Srpska stipulates that, in relation to functional requirements, power plants are divided into power plants whose rated power is greater than 0.8 kW (type A) and power plants whose rated power is greater than 1 MW (type B).

Structure of the generation portfolio in Bosnia and Herzegovina, as of June 1, 2020, is shown in Table 6.

Table 6. Generation portfolio in BiH on June 1, 2020

Generation module type	**Synchronous generators**		**Asynchronously connected power plants**		**TOTAL**	
Rated capacity	Number of generators	Pn (MW)	Number of plants (PPMs)	Pn (MW)	Number	Pn (MW)
0,8 kW < P ≤ 150 kW	14	1.1	295	20.5	**309**	**21.6**
150 kW < P ≤ 250 kW	24	5.6	24	5.6	**48**	**11.2**
250 kW < P ≤ 500 kW	48	19.7	4	1.3	**52**	**21.0**
500 kW < P ≤ 1 MW	33	23.9	3	2.9	**36**	**26.8**
1 MW < P ≤ 2,5 MW	26	37.1	0	0.0	**26**	**37.1**
2,5 MW < P ≤ 5 MW	26	95.8	0	0	**26**	**95.8**
5 MW < P ≤ 10 MW	4	38.0	0	0	**4**	**38.0**
10 MW < P ≤ 20 MW	2	30,6	0	0	**2**	**30.6**
20 MW < P ≤ 75 MW	23	977,0	2	86.6	**25**	**1063.6**
P>75 MW	18	3489.0	0	0	**18**	**3489.0**
UKUPNO	**218**	**4717.8**	**328**	**116.9**	**546**	**4834.6**

The structure of the generation portfolio in the BiH power system on June 1, 2020, from the aspect of the total number of generators according to the applied installed capacity ranges, is given in Figure 1.

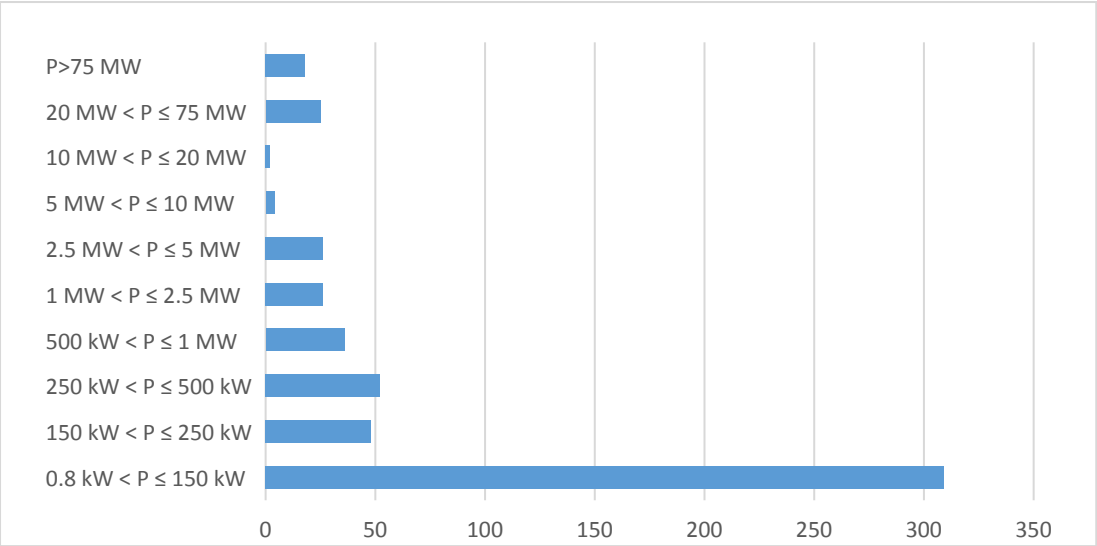

Figure 1. Number of generators/PPMs in the BIH power system on June 1, 2020

The structure of the generation portfolio in the BIH power system on June 1, 2020, from the aspect of the total installed capacity of the generators according to the applied installed capacity ranges, is given in Figure 2.

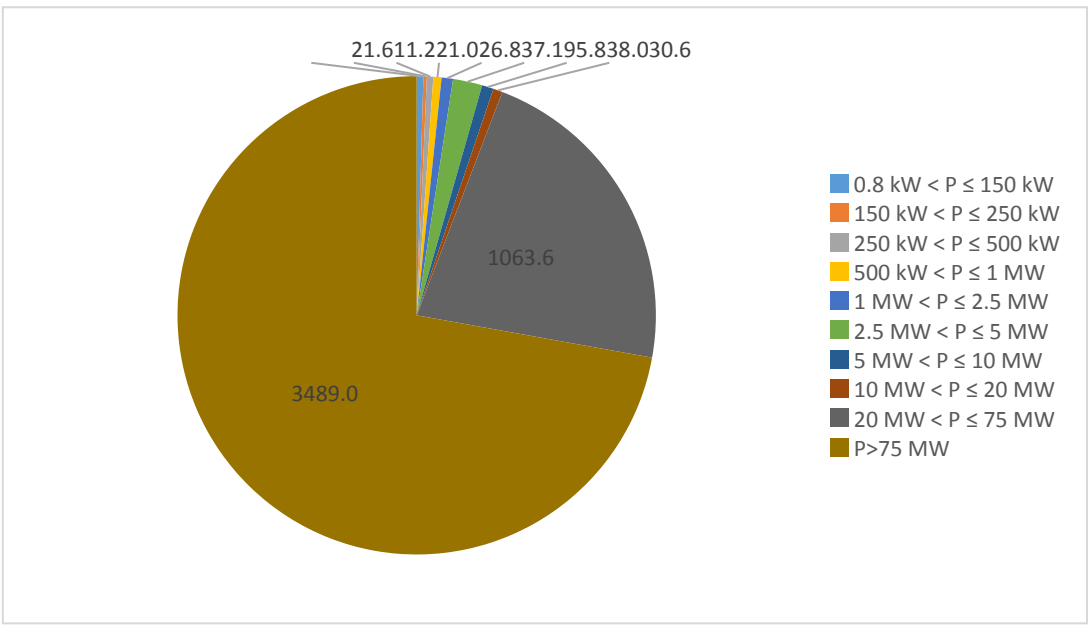

Figure 2. Total installed capacity of generators in the BiH power system on June 1, 2020 (MW)

Installed capacity of the transmission connected power plants on June 1, 2020 is 4,629.5 MW, while the installed capacity of power plants at the distribution level is 2051 MW,[9] which is 4.2% in relation to the total installed capacity of power plants in the BiH power system.

The structure of the generation portfolio at the distribution level is shown in Figure 3.

[9] Data for HPP Jajce 2 are not contained in the dataset related to the power plants connected to the distribution network due to the specific connection arrangement of this HPP; relevant data are contained in the dataset related to the transmission connected power plants.

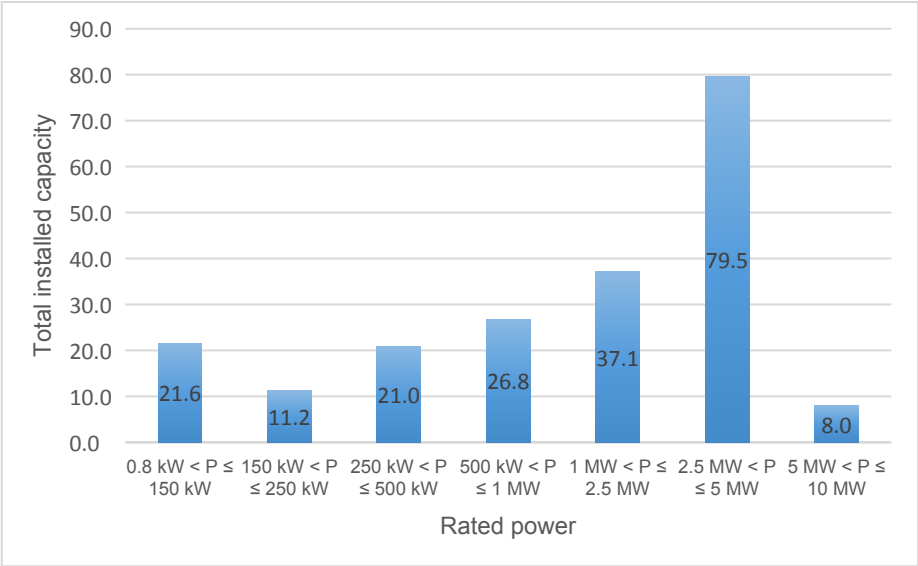

Figure 3. The structure of the generation portfolio at the distribution level in the BiH power system on June 1, 2020 (in MW)

If, for the sake of illustration, the existing generators in the BiH power system were categorized into types A and B by applying the maximum value of the installed capacity threshold of 1 MW,[10] generators having installed capacity of 80.5 MW would be categorized into type A, and generators having installed capacity of 124.6 MW into type B.

The planned generation portfolio in Bosnia and Herzegovina in 2023, obtained by analyzing data on power plants whose connections are expected in the next three years, and for which on June 1, 2020, the connection permits were issued and the connection agreements were concluded, is given in following tables and graphs.

Table 7. Planned generation portfolio in BiH in 2023

Generation module type	**Synchronous generators**		**Asynchronously connected power plants**		**TOTAL**	
Rated capacity	Number of generators	Pn (MW)	Number of plants (PPMs)	Pn (MW)	Number	Pn (MW)
0.8 kW < P ≤ 150 kW	21	2.1	352	24.2	**373**	**26.2**
150 kW < P ≤ 250 kW	26	6.0	26	6.1	**52**	**12.1**
250 kW < P ≤ 500 kW	55	22.1	4	1.3	**59**	**23.4**
500 kW < P ≤ 1 MW	49	35.8	5	4.7	**54**	**40.5**
1 MW < P ≤ 2.5 MW	36	51.9			**36**	**51.9**
2.5 MW < P ≤ 5 MW	27	99.3			**27**	**99.3**
5 MW < P ≤ 10 MW	4	38.0			**4**	**38.0**
10 MW < P ≤ 20 MW	5	80.2			**5**	**80.2**
20 MW < P ≤ 75 MW	23	977.0	3	134.6	**26**	**1111.6**

[10] Maximum threshold value of 1 MW as given by the RfG NC.

P>75 MW	18	3489.0			**18**	**3489.0**
UKUPNO	**264**	**4801.5**	**390**	**170.8**	**654**	**4972.3**

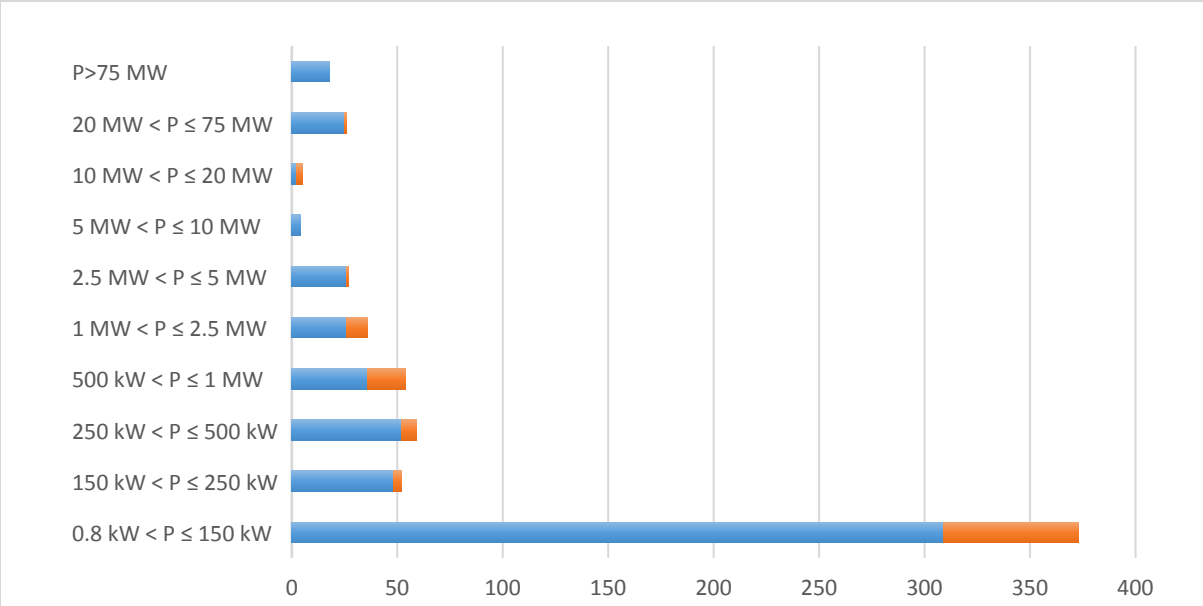

Figure 4. Planned number of generators/PPMs in the BIH power system in 2023

The below figure shows the structure of the planned generation portfolio in BiH in 2023 from the aspect of the installed capacity of generators/PPMs.

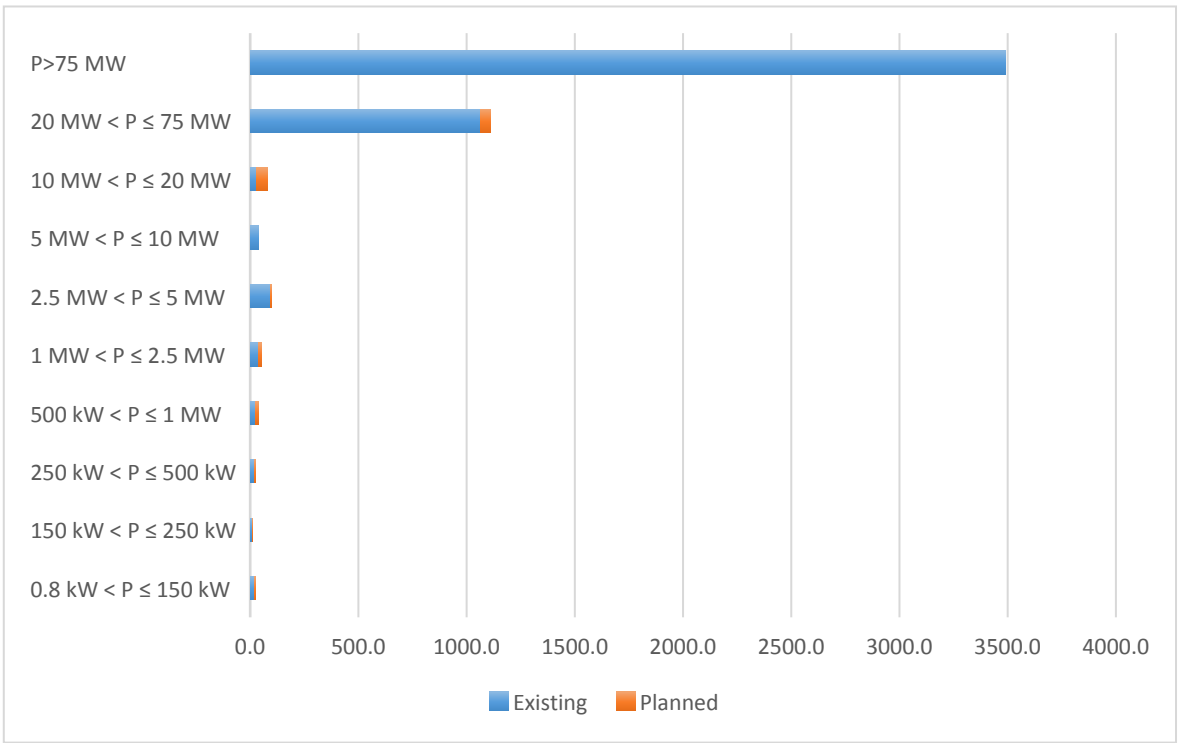

Figure 5. Planned installed capacity of generators in the BiH power system in 2023 (in MW)

The expected structure of the generation portfolio at the distribution level in 2023, from the aspect of the installed capacity of generators/PPMs, is shown in Figure 6.

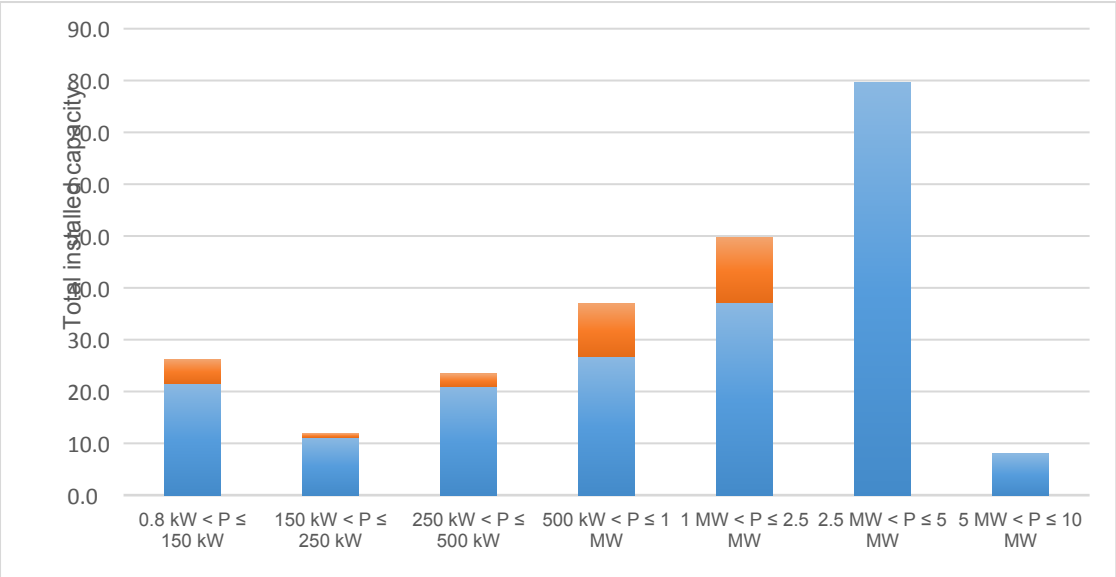

Figure 6. Planned structure of the generation portfolio at the distribution level in the BiH power system in 2023 (in MW)

By analyzing the data shown in Figures 5 and 6, it can be concluded that, compared to the situation in 2020, in the next three years no significant change in the structure of the BiH generation portfolio is expected. If we pay special attention to the planned structure of the generation portfolio at the distribution level, we can see a significant increase in the planned total installed capacity of power plants in the ranges of 500 kW <P ≤ 1 MW and 1 MW <P ≤ 2.5 MW.

An indicative overview of the generation portfolio of variable renewable sources in the BiH power system in 2035, envisaged by the BiH Framework Energy Strategy[11] according to the type of energy sources, is given in Table 8.

Table 8. Generation mix of variable renewable sources in the BiH power system in 2035

Scenario	Higher value (MW)	Median (MW)
Solar	116.24	111.8
Biomass / biogas	43.59	51.6
Wind	944.45	352.6
Small HPP	348.72	344
Total	**1453.0**	**860.0**

The data shown in Table 8 are indicative and in no case can be considered fully relevant in terms of the expected participation of certain types of renewable sources in the generation mix of the BiH power system in 2035, especially bearing in mind that in the period after the BiH Framework Energy Strategy had been adopted, there have been significant changes in the conditions related to:

- Launching an initiative to adopt a moratorium on the construction of small HPPs in the Federation BiH,

[11] BiH Framework Energy Strategy, p.108, http://www.mvteo.gov.ba/data/Home/Dokumenti/Energetika/Okvirna_energetska_strategija_Bosne_i_Hercegovine_do_2035._HR_FINALNA.PDF.

- Planned change of the RES support system concept, with the application from 2021, and
- Significant reduction in prices of generation technologies, especially solar PV technology.

8. CATEGORIZATION PROPOSAL

The proposal for categorization of type A/B generators is based on the objectives related to:

- Increasing the visibility and controllability of the power plants connected to the distribution voltage levels,
- Increasing the robustness of the generation portfolio at distribution voltage levels and increasing the security of the power system,
- Improving the performances of the generation portfolio at distribution voltage levels from the aspect of the reactive power generation and participation in the voltage regulation, and
- Increasing the base of potential ancillary services providers through aggregation and virtual power plants.

The proposal for categorization of type B / C generators is based on the objectives related to:

- Increasing the contribution to the frequency regulation of generators connected to the distribution voltage levels,
- Preservation of the power system security of operation in periods of high participation of the renewable sources in the total generation of electricity,
- Increasing the base of potential direct providers of ancillary services for the TSO's needs.

The proposal for categorization of type C/D is based on the objectives related to:

- Equal treatment of the power plants with higher installed capacity in terms of mandatory functional requirements regardless of the voltage level at the connection point (MV busbars in substation 110/x kV or 110 kV and more),
- Compliance with the applicable requirements for ancillary services providers prescribed by the BiH Grid Code.

In order to monitor the development of the generation portfolio in the power system and the corresponding changes in the characteristics and performance of the system, it is necessary to periodically review the prescribed thresholds of the installed capacity and categorization of generators. The key reasons that may lead to the need to change the installed capacity thresholds are related to the increase of integration of the renewable sources and the share of distributed generators in the generation portfolio, while at the same time decommissioning and reducing the share of conventional generators at the transmission level.

Change of the installed capacity thresholds and categorization of the generators is possible after a period of at least three years from the adoption of the previous categorization.

It should be borne in mind that the categorization of generators is not only applicable to the RfG NC, but also to the Network Code on Electricity Emergency and Restoration and the Guideline on Electricity Transmission System Operation, in the

areas related to the categorization of significant system users and respective requirements.

Table 9 shows the structure of the existing generation portfolio at the distribution level in case of application of the following installed capacity thresholds combinations:

- Type A/B – Options 500 kW or 1 MW
- Type B/C – Options 5 MW or 10 MW

Table 9. The existing generation portfolio at the distribution level for different combinations of the installed capacity thresholds

Installed capacity threshold - Variant		Type A	Type B	Type C
A/B 500kW B/C 5 MW	Number	409	84	1
	Pn (MW)	53.7	143.4	8.0
A/B 500kW B/C 10 MW	Number	409	85	0
	Pn (MW)	53.7	151.4	0.0
A/B 1 MW B/C 5 MW	Number	445	48	1
	Pn (MW)	80.5	116.6	8.0
A/B 1 MW B/C 10 MW	Number	445	49	0
	Pn (MW)	80.5	124.6	0.0

To illustrate, hypothetically, if the generator connection requirements specified in the RfG NC were applied retroactively to the existing generators, with lowering the installed capacity threshold for categorization of type A/B generators from a default value of 1 MW to 500 kW, an additional portfolio of controllable generators with installed capacity of 26.8 MW as of June 1, 2020, would be created. The data is for illustration purposes only; and it is important to emphasize that the prescribed requirements in the forthcoming period will be applied only to generators that are not considered as existing, according to Article 4 of the RfG NC.

In order to make a decision on the proposal of the installed capacity thresholds, it is necessary to keep in mind that in the medium term no significant change in the structure of the generation portfolio in BiH is expected in regards to the situation on June 1, 2020.

The proposal for the installed capacity thresholds for power-generating modules in Bosnia and Herzegovina, determined on the basis of the previously stated criteria and objectives and the analysis of the current structure and future generation portfolio in BiH, is given in Table 10.

Table 10. Proposed installed capacity thresholds for power-generating modules in BiH

Threshold value	A/B threshold	B/C threshold	C/D threshold
Pn	500 kW	10 MW	20 MW

The categorization of synchronous generators does not depend on the plant's total installed capacity.

9. CATEGORIZATION DEROGATIONS

According to the default categorization of generators, generators whose installed capacity correspond to the installed capacity of type A and B generators and are connected to a voltage level of 110 kV and above, are treated as type D generators as determined by the voltage level at the connection point. If default categorization given by the RfG NC is applied, requirements that include complex technical functionalities typical for high-capacity generators connected to the transmission voltage levels would also be obligatory for the relatively low-capacity generators that may be part of industrial plants or part of larger power plants. However, implementation of complex technical functionalities impose requirements on the low-capacity generators that are disproportionate to their impact and importance in the power system operation. This results in different requirements for low-capacity generators connected to the transmission voltage levels than the exact same type of low-capacity generators that are connected to the distribution voltage levels. Furthermore, it represents the inequitable imposition of disproportionate costs on power producers that do not have significant impact on power system operation.

The appropriate and necessary solution for this dichotomy in generation categorization is to submit a request for a derogation for power-generating modules described above, which are connected to voltage levels of 110 kV and higher but whose installed capacity corresponds to the power ranges prescribed for power-generating modules type A and B. In particular, the derogation should be requested that exempts these generators from the obligation to meet the functional requirements for type D generators in relation to the Type A and Type B generators respectively and be remain in place for the technical lifetime of the power-generating module.[12]

[12] RfG NC, Recital (29) and Articles 61-63. The method of implementing the derogation should be in line with the modalities provided in the RfG NC, which states in recital (29) that system operators should be able to propose derogations for certain classes of power-generating modules, which are submitted for approval to the competent regulatory authority or other authority where applicable in the Contracting parties. Competences for granting exemptions are prescribed by Article 60 of the RfG NC, which states that the regulatory authority may, upon receipt of a request from a power-generating facility owner, relevant system operator or relevant TSO, grant a derogation relating to one or more provisions of these Rules for new and existing power-generating modules in accordance with Articles 61-63. Article 63 of the RfG NC prescribes in detail the procedure for granting a derogation on the request of the system operator. The regulatory authority, in the case of granting a derogation, must specify the derogation's duration in its decision. Article 64 of the RfG Network Code prescribes the obligation of the regulatory authority to maintain a register of granted derogations.