



USAID
OD AMERIČKOG NARODA



**ENERGY POLICY ACTIVITY PROJECT IN BOSNIA AND
HERZEGOVINA
(USAID EPA)**

**SIMPLIFIED CONNECTION PROCEDURE OF MICRO-
GENERATING PLANTS FOR SELF-CONSUMPTION
NEEDS**

The author's views expressed in this publication do not necessarily reflect the views of the United States Agency for International Development or the United States Government.

SIMPLIFIED CONNECTION PROCEDURE OF MICRO-GENERATING PLANTS FOR SELF-CONSUMPTION NEEDS

USAID Energy Policy Activity Project

December, 2020

CONTENT

1.	INTRODUCTION	5
2.	GENERAL REQUIREMENTS FOR POWER PLANT CONNECTION	7
3.	EXISTING CONNECTION PROCEDURES IN BIH	9
	A. FEDERATION OF BIH (FBIH)	9
	B. REPUBLIC OF SRPSKA	11
4.	CONNECTION REQUIREMENTS ACCORDING TO RFG NETWORK CODE AND TECHNICAL STANDARDS	14
5.	PRECONDITIONS FOR THE SIMPLIFIED CONNECTION PROCEDURE ESTABLISHMENT	16
	A. NECESSARY ASPECTS OF INTERACTION DURING THE CONNECTION PROCESS	16
	B. TECHNICAL AND FUNCTIONAL REQUIREMENTS	16
	C. CERTIFICATION OF THE INTERFACE UNIT AND MICROGENERATOR	17
	D. AUTHORIZED INSTALLER	18
6.	SIMPLIFIED CONNECTION PROCEDURE	19
	A. MICRO-GENERATING PLANTS QUALIFICATION	19
	B. PROPOSAL FOR THE SIMPLIFIED CONNECTION PROCEDURE	19
	C. MICRO-GENERATING PLANT CONSTRUCTION PROCESS INCLUDING THE SIMPLIFIED CONNECTION PROCEDURE	22
7.	ANNEX 1A – FLOWCHART ON EP HZHB POWER PLANTS CONNECTION	25
8.	ANNEX 1B - FLOWCHART ON MH ERS POWER PLANT CONNECTION	26
9.	ANNEX 2 –THE INTERFACE PROTECTION FUNCTIONS AND SETTINGS, MANDATORY FUNCTIONALITIES OF THE MICROGENERATING PLANT WITH RELEVANT OPERATIONAL PARAMETERS AND SETTINGS	30
10.	ANNEX 3 – APPLICATION FORM FOR CONNECTION PERMIT ISSUANCE AND CONNECTION CONTRACT AMENDMENTS	37

LIST OF ACRONYMS

BAS	National Standard of Bosnia and Herzegovina
CE	Conformité Européenne
DSO	Distribution System Operator
EMC	Electromagnetical compatibility
EN	European Standard
ENTSO-E	European Network of Transmission System Operators for Electricity
EPA	Energy policy activity
PV	Photovoltaic
RES	Renewable Energy Sources
RfG	Requirements for Generators

1. INTRODUCTION

USAID Energy Policy Activity (EPA) provides technical assistance to transmission and distribution system operators in BiH to harmonize their network rules with the requirements of the relevant EU electricity network codes and applicable technical standards. The technical assistance relevant to the distribution network rules also includes the specification of requirements for network connection and integration of the new categories of market participants. The consumers who produce electricity for their own needs (“prosumers”) represent one of the most important categories of new market participants and distribution network users. They are expected, by mass integration, to contribute to the energy transition goals and increase the share of electricity generation from renewable sources.

Due to the technology development and continuous reduction of investment costs of distributed generators, primarily solar photovoltaic (PV) power plants, the electricity generation for self-consumption needs has reached “Grid parity,” when it is price competitive with electricity purchase from the distribution network.

The aim of this paper is to define the basis for the establishment of a simplified connection procedure and to propose its elements in order to remove administrative barriers to the mass integration of low-capacity prosumers in BiH. In the standard technical literature, the simplified connection procedure is also called the “Inform and fit” connection procedure, which is defined¹ as a procedure of installing a micro-generating plant with prior notification to the DSO, with subsequent commissioning without the need to obtain a formal approval by the DSO.

This proposal of a simplified connection procedure is defined on the basis of:

- Analysis of the existing procedures in BiH for connection of the power plants to the distribution network (Chapter 3),
- Analysis of the relevant provisions and requirements of the ENTSO-E Network Code on Requirements for Grid Connection of Generators² (RfG Network Code) and technical standards (Chapter 4),
- Analysis of the necessary preconditions for the establishment of a simplified connection procedure for connecting the micro-generating plants (Chapter 5).

Based on the above-stated analyses, a proposal for a simplified connection procedure for the micro-generating plants and a proposal for the qualification of generators to which this procedure refers has been determined (Chapter 6).

This document contains three annexes, which complement the analysis and facilitate the application of a simplified connection procedure:

- Annex 1 – Flowchart of activities for connection of power plants in the jurisdiction area of:
 - EP HZHB.³
 - MH ERS.⁴

¹ BAS EN 50438, “Requirements for micro-generating plants to be connected in parallel with public low-voltage distribution networks”, Definition 3.11; The standard ceased to be valid with the entry into force of standard EN 50549-1.

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

³ Elektroprivreda Hrvatske Zajednice Herceg Bosne.

- Annex 2 - Proposals for interface protection functions and settings and mandatory functionalities of a micro-generating plant with relevant operational parameters and settings, and
- Annex 3 - Standard Application form for a connection permit issuance and connection contract amendments for the micro-generating plant for self-consumption needs.

2. GENERAL REQUIREMENTS FOR POWER PLANT CONNECTION

The rules and procedures for connection to the distribution network are generally tailored for the connection of power plants that have much higher capacity compared to the power plants that are installed for self-consumption needs. When impact on the distribution system is assessed, verification of certain connection criteria, as well as implementation of certain steps during the power plant connection and commissioning process, are essentially not necessary for the low-capacity generating plants intended for customers' own needs. Consequently, the standard connection procedure for this category of power plants can be simplified.

Connection of power plants intended for self-consumption needs according to the standard connection procedure, can be a significant administrative burden for low-capacity generators (in the order of several kW or a few tens of kW). Under given circumstances, complex connection procedures, combined with the disproportionate requirements related to the construction, supervision, testing and commissioning of the low-capacity power plants, can be an insurmountable barrier to their development, even under conditions of price competitiveness.

Power generating modules intended for self-consumption can generally be classified as Type A generators and less frequently as Type B generators. According to the RfG Network Code provisions, Type A generators are considered to be generators with an installed capacity in the range from 0.8 kW up to and including a maximum of 1 MW (default value), while Type B generators are considered to be within the range of 1 MW P_{inst} <math><50\text{MW}</math>, according to the default categorization.

The document "Categorization of generators according to the installed capacity and voltage level at the connection point," prepared as part of the USAID EPA project activities on harmonization of network rules in BiH, with the requirements of EU network codes and guidelines, proposes the following categorization of power generating modules in BiH.

Threshold value	A/B threshold	B/C threshold	C/D threshold
P_{inst}	500 kW	10 MW	20 MW

Technical and functional requirements for generators' connections to the low voltage distribution network are given by the standard BAS EN 50549-1 "Requirements for connection of power plant to distribution network - Part 1: Connection to low voltage distribution network - Power plants up to and including type B." This European and Bosnian-Herzegovinian technical standard applies for the connection of power plants with an installed capacity of more than 0.8 kW and less than the installed capacity threshold for the categorization of type B generators, as defined in accordance with the RfG Network Code. This Standard defines a micro-generating plant as a power plant whose nominal current does not exceed 16 A per phase (3.6 kW per phase, 10.8 kW three-phase). The micro-generating plant can consist of one or more generating units connected via the same connection point.

Article 17 of the Directive 2018/2001 on the promotion of the use of energy from renewable sources⁵ obliges Member States to establish a simplified grid connection procedure for the

⁵ Directive (EU) 2018/2001 of the European Parliament and of the Council from December 11, 2018 on the promotion of the use of energy from the renewable energy sources,

power plants with an installed capacity of up to 10.8 kW intended for self-consumption needs or the technologies classified as demonstration projects. This article also gives the countries the discretionary right to establish a simplified connection procedure for installations with a total installed capacity of up to 50 kW, provided that the stability, reliability and security of the network are maintained.

The connection of the micro-generating plant for self-consumption needs within the existing customers' facilities in principle does not create additional connection costs. The exception may be the installation of a bidirectional metering device at the connection point and a metering device for measuring the gross energy production (optional).

3. EXISTING CONNECTION PROCEDURES IN BIH

The procedure for connection of power plants to the distribution network in BiH is within the jurisdiction of the entity regulatory commissions and the relevant DSOs. Due to the different primary and secondary legislation, the relevant DSOs have established slightly different connection procedures of power plants. These procedures are analyzed in detail in this chapter.

General requirements for the connection of network users to the distribution network in BiH are defined by the entity laws on electricity. The connection procedures, together with mandatory elements of acts that have to be issued in the connection procedure, are defined by the general conditions for electricity supply adopted by the relevant regulatory commissions. In addition to these regulations, the legal and regulatory framework in the Republic of Srpska also contains a special rulebook that regulates in detail the connection of power plants to the distribution network. The regulatory framework in the Federation of BiH also contains a special Rulebook for micro-generating plants that use renewable energy sources (RES),⁶ with an installed capacity of up to 23 kW. Within the EPBiH area of competence, the connection of power plants to the distribution network is regulated in detail by an internal technical guidance document.

Generally speaking, regulations in BiH define procedures for connecting power plants to the distribution network, which does not depend on the installed capacity of the power plant and the purpose of electricity generation. In practice, this implies that the same procedure is applied for connection of low capacity (in the order of several kW) micro-generating plants for prosumers' self-consumption needs, as for the power plants whose installed capacity is of the order of several MW. From the low-capacity prosumers point of view, the implementation of the complete connection procedure is a disproportionate burden, the costs of which will significantly affect the total investment costs of the micro-generating plant, particularly taking into account the low-capacity prosumers' impact on the operation of the distribution system.

In the given context, it is worth mentioning that the new Law on Electricity of the Republika Srpska prescribes the DSO's obligation to establish a simplified procedure for the connection of the prosumer power plants.

A. FEDERATION OF BIH (FBIH)

The procedure for connection to the distribution network in FBiH is in the Law on Electricity, and specified in detail by the "General Conditions for the Delivery of Electricity",⁷ adopted by the Federation Regulatory Electricity Commission and applicable to all distribution system operators in the FBiH.

The General Conditions for the Delivery of Electricity stipulate that the power producer or investor is obliged to obtain the following documents during the connection process:

- Preliminary connection permit (Article 20 of the General Conditions) - issued at the request of the end customer/power producer or investor and represents a

⁶ Rulebook for Renewable Energy Micro-Plants ("Official Gazette of FBiH," No. 50/14 and 39/20), <https://www.ferk.ba/hr/index.php/akti-ferk-a/pravilnici/18768-obnovljivi-izvori-energije>.

⁷ General conditions for the delivery of electricity ("Official Gazette of FBiH", No. 89/14, 7/18 and 84/19), <https://www.ferk.ba/ba/index.php/akti-ferk-a/pravilnici/18555-opsti-uslovi-za-isporuku-elektricne-energije>.

confirmation that the planned facility can be connected to the distribution network in accordance with the network conditions and valid planning documents provided for that area,

- Connection permit (Article 21 of the General Conditions) - issued at the request of the end customer/power producer before connection to the distribution network,
- Contract on connection/increase/decrease of the connection capacity (Article 33 of the General Conditions) – concluded between the DSO and the connection permit holder in case of construction of a new connection or in cases from Article 18, paragraph (1) except point e) of these General Conditions,
- Contract on distribution network usage (Article 34 of the General Conditions) – concluded between the DSO and the end customer (it is not possible to regulate the usage of the distribution network through the supplier), and
- Temporary connection for testing or trial run operation (Article 54 of the General Conditions) – the DSO is obliged to allow the plant's temporary connection to the distribution network for testing or trial run operation, based on the request and written statement of the investor which is taking over the responsibility during temporary connection.

It is important to note that terms “micro-generating plant” and “generation for self-consumption” are not interrelated in the legal and regulatory framework in the FBiH.

The term micro-generating plant in the legal and regulatory framework of FBiH is used to define a power producer with a range of installed capacity of a power plant 2-23 kW, which uses any of the renewable energy sources (water, sun, wind, biomass ...) for electricity generation.

Article 3 (Definitions) of the Law on Electricity in the FBiH states under item 34 that “producer for self-consumption” means a natural or legal person who produces electricity for its own needs. Article 12, paragraph (4) of the same law stipulates that the production of electricity for self-consumption is not treated as an electricity activity. In this context, it is worth noting that the Law on Electricity does not address the delivery of generated surplus electricity to the grid at all. The implementation of the Law has led to the practice that the consumers with the power plants for their own needs are not allowed to inject the surplus energy in the grid.

Consequently, the consumer and generator that feed electricity to the grid, cannot be connected to the distribution network via the same connection point in the FBiH. As a result, currently, there is no possibility for the electricity prosumer to sell any surplus of generated electricity. The rule is that the generator must be registered separately as the end customer in case of using electricity from the distribution network for its own needs⁸.

The Distribution Grid Code of the Distribution System Operator (DSO) EP BiH, in Article 46 (“Additional conditions for the end customer who generates electricity for its own needs”) defines in more detail the criteria for using the power plant for self-consumption needs. Restrictions are given in paragraph (1), which specifies that the final customer must align the generation of electricity with its consumption and must not supply electricity to the distribution network. Paragraph (2) defines that during the power plant operation in the island mode, i.e., in the event of a power outage, the end customer must be disconnected from the distribution network.

The Rulebook for RES Micro-Generating Plants in the Federation of BiH regulates:

⁸ The solution for this issue is discussed infra, on p. 19.

- a) procedure for construction of RES micro-generating plants,
- b) conditions for connection of RES micro-generating plants to the distribution network, and
- c) metering and billing of electricity generated in the RES micro-generating plants.

According to the provisions of the Rulebook, a RES micro-generating plant is considered to be a power plant generating electricity from renewable energy sources, with an installed capacity between 2 kW and 23 kW. From the network connection point of view, the key provision is defined in Article 7, paragraph (1), which states “For metering of generated electricity to be delivered to the distribution network at the existing metering point where electricity consumption of the RES micro-generating plant owner is metered, a separate electricity meter shall be installed to separately register the generated electricity in a RES micro-generating plant.”

The micro-generating plant concept, as defined by the Rulebook, has its origins in Article 27 of the FBiH Law on Use of Renewable Energy Sources and Efficient Cogeneration⁹. The Article 27 para. (3) which stipulates that “A RES micro-generating plant must be located in the vicinity of or within an existing facility that already has an electricity meter. Its connection must be done at the existing metering point by installing a separate metering device which shall separately register the generation from RES micro-generating plants.” In addition, Article 27 stipulates that the owners of the RES micro-generating plants must be natural or legal persons, who must be electricity customers of one of the suppliers in the Federation BiH (Article 27, para. (1)), while paragraph (2) prescribes “For RES micro-generating plants, simplified procedures shall be applied, in accordance with the Rulebook for RES micro-generating plants, which will define the construction procedures, conditions for connection to the distribution network, method of measurement and billing of the generated electricity, and which shall be adopted by the Regulatory Commission in accordance with the deadlines defined in the Law on Electricity.”

The main shortcoming and inconsistency of the micro-generating plant concept, as defined by the Law on the Use of Renewable Energy Sources and Efficient Cogeneration, is reflected in the fact that the electricity generated in the micro-generating plant is not consumed directly for self-consumption needs, but is instead delivered to the network and purchased according to the rules that apply for privileged power producers using the same RES. Consequently, micro-generating plants, according to the concept established in the FBiH, cannot be considered as production for own needs.

A graphic representation of the existing connection procedure for power plants in FBiH in the EP HZHB area of competence, together with a proposal of steps that need to be eliminated in the connection procedure of micro-generating plants for self-consumption needs, is given in Annex 1a of this paper.

With regard to the connection costs, Article 51, para. (1) of the General Terms and Conditions¹⁰ prescribes:

- (1) End customers/generators that require changes to their connections and their metering points, as well as on any other part of the distribution network, and at the

⁹ Law on the Use of Renewable Energy Sources and Efficient Cogeneration (“Official Gazette of the Federation of BiH”, No. 70/13),

<https://fmeri.gov.ba/media/1061/zakon-o-koristenju-obnovljivih-izvora-energije.pdf>.

¹⁰ Op.cit. fn.7

same time, do not increase the connected power, shall cover the costs of executed changes for:

- a) separation of installations, and setting up a larger number of metering points,
- b) joining of installations, and setting up a smaller number of metering points, and
- c) any other requests (relocation, alteration from overhead to underground connection, relocation of parts of the distribution network and similar).

B. REPUBLIC OF SRPSKA

The procedure for power plants' connection to the distribution network under the competence of MH Elektroprivreda Republike Srpske is prescribed in detail by the "General Conditions for Delivery and Supply of Electricity"¹¹ and the "Rulebook on conditions for connecting power plants to the electricity distribution network of Republika Srpska"¹².

Item 9.1. of the Rulebook stipulates that during the planning, construction, connection and start of power plant operation, the generator must obtain the following documents and conclude the following contracts during the connection process:

- Connection permit (Article 14 of General Conditions) - A new connection permit shall be issued if at the request of the existing network user, the connection parameters are changed based on which the previous connection permit was issued,
- Connection contract to the distribution network (Article 42 of General Conditions) – It shall be concluded before the construction of the connection, at the request of network user to whom the connection permit was issued,
- Temporary connection for testing or trial run period (Article 34 of General Conditions) - The installation of end user/generator may be temporarily connected to the network at the request of investor for the installations testing purposes during the trial run period,
- Network access contract (Article 46 of General Conditions) –
 - The access to the network for tariff customers from the households category, shall be regulated by the supplier of tariff customers on the basis of the supply contract which contains the necessary provisions on the network access;
 - The access to the network for tariff customers from the category of non-household customers connected to 0.4 kV voltage level, medium voltage tariff customers, qualified customers and producers, might be provided on their behalf and for their account by their supplier, while the DSO is obliged to allow such a possibility, and
- Declaration on the connection (Article 35 of General Conditions) – DSO issues declaration on the power plant connection following the commissioning of the network user facilities; the Declaration contains parameters of the constructed connection.

The flowchart of the activities on the connection of power plants under the MH ERS jurisdiction, together with the proposal of steps that need to be eliminated in the connection

¹¹ General Conditions for Delivery and Supply of Electricity ("Official Gazette of RS," No 90/12 and 81/19)

<https://reers.ba/pravila-i-propisi/podzakonska-akta-regulatora/?pismo=lat>.

¹² Rulebook on conditions for connecting power plants to the electricity distribution network of Republika Srpska, March 2014, http://ers.ba/wp-content/uploads/2019/07/pravilnik_prikljucenje.pdf.

procedure of the micro-generating plants for self-consumption needs, is given in the Annex 1b.

According to the existing procedure, the interaction between the power producer and the DSO during the connection process takes place in five steps, with the additional final issuance of the Declaration on the Connection by the DSO:

1. Application for issuance of the connection permit,
2. Request for preparation of the connection's main design and conclusion of the connection contract,
3. Conclusion of the network access contract,
4. Request for temporary connection for testing under real operating conditions, and
5. Request for permanent connection of the power plant.

When connection costs are considered, Article 21, paragraph (3) of the Rulebook on the methodology for determining the fee for connection to the distribution network¹³, stipulates that the power producer pays the true connection costs and the true costs of necessary network upgrades.

The Article 100, para. (1) of the new Electricity Law in Republic of Srpska¹⁴ stipulates that the DSO, with the consent of the Regulatory Commission, adopts rules for connecting network users' facilities to the distribution network. The same Article, in paragraph (2), prescribes that the connection rules shall also establish a simplified connection procedure for the prosumer's generation facilities. The Law on Electricity was adopted in July 2020, and entered into force on January 1, 2021, with the obligation to adopt and harmonize bylaws within one year from the date of entry into force.

The law stipulates that an investor who intends to connect its facilities to the distribution network, in the standard connection procedure, has the obligation to obtain:

- A connection permit (Article 90),
- A connection contract (Article 91), and
- A declaration on the connection and metering points (Article 95).

¹³ Rulebook on the methodology for determining the fee for connection to the distribution network ("Official Gazette No. 123/08), https://reers.ba/wp-content/uploads/2019/05/Pravilnik_Prikljucak_na_DistMrezu_sa_Obrascem_zajtjeva_cir.pdf.

¹⁴ Law on Electricity of Republic of Srpska, ("Official Gazette of the Republika Srpska," No. 68/2020)

4. CONNECTION REQUIREMENTS ACCORDING TO RFG NETWORK CODE AND TECHNICAL STANDARDS

This chapter analyzes the basic requirements for connection of micro-generating plants given in the RfG Network Code¹⁵ and technical standard EN 50549-1 “Requirements for connection of power plants to the distribution network - Part 1: Connection to low voltage distribution network - Power plants up to type B.”

Article 30, paragraph (1) of the RfG Network Rules, prescribes:

1. The operational notification procedure for connection of each new type A power-generating module shall consist of submitting an installation document. The power-generating facility owner shall ensure that the required information is filled in on an installation document obtained from the relevant system operator and submitted to the system operator. Separate installation documents shall be provided for each power-generating module within the power-generating facility.

The same article in paragraph (2) prescribes:

The relevant system operator shall specify the content of the installation document, which shall have at least the following information:

- (a) location at which the connection is made;
- (b) date of the connection;
- (c) maximum capacity of the installation in kW;
- (d) type of primary energy source;
- (e) classification of the power-generating module as an emerging technology according to Title VI of this Regulation;
- (f) reference to equipment certificates issued by an authorized certifier used for equipment that is in the site installation;
- (g) as regards equipment used, for which an equipment certificate has not been received, information shall be provided as directed by the relevant system operator; and
- (h) the contact details of the power-generating facility owner and the installer and their signatures.

Technical standard EN 50549-1 prescribes in detail the technical and functional requirements for the connection of power plants to the low-voltage distribution network. By its entry into force in 2019, this standard superseded the standard EN 50438, which had previously prescribed the terms and conditions of connection of micro-generating plants to the distribution network.

Notwithstanding the fact that Standard EN 50438 has ceased to apply, especially under conditions where some specific issues were not readdressed by Standard EN 50549-1, certain principles informally continue to be applied for the connection of micro-generating plants. The provisions of standard EN 50438 have evolved over time to be considered to be good engineering practice, as they have proven to be very practical. Therefore, they have been incorporated in some solutions presented in this document.

In this regard, it is important to note that Standard EN 50549-1 does not explicitly address the existence of the “Inform and fit”¹⁶ connection procedure. The procedure, however, is

¹⁵ *Op. cit.*, Fn. 2.

defined by Standard EN 50438, where its application was not mandatory. In accordance with information in Annex C of the Standard EN 50438, the application of this procedure envisaged that a prosumer has to submit only one notification form to the relevant DSO, without the obligation to obtain a formal approval for the connection and commissioning of the micro-generating plant.

Standard EN 50438, Chapter 6, further stated that a micro-generating plant may be connected to the grid and put into operation if the following conditions are met:

- Micro-generators (including interface protection) meets the requirements of Standard EN 50438 and the other applicable standards,
- The manufacturer has provided installation instructions in accordance with Standard 50438 and national and regional requirements,
- Unauthorized access to the protection device and change of settings is prevented,
- In the absence of product standards, the micro-generator is type-tested against the connection requirements given by this Standard,
- The installation was performed by the installers who have recognized and approved qualification for the fuels used, general electrical installations and who are particularly qualified for the installation of micro-generating plants, and
- The installer has provided a single-line diagram of the power-generating plant, showing the circuit breaker, protection and inverter.

Unless otherwise prescribed by the national legislation or regulations, prior approval of the DSO is required for connection to the network and commissioning.

¹⁶ Phrase used in technical literature, meaning that the network user only has to inform the DSO about the intended connection of specific facilities. No formal approval or permission by the DSO is foreseen, unless the facility is technically non-compliant.

5. PRECONDITIONS FOR THE SIMPLIFIED CONNECTION PROCEDURE ESTABLISHMENT

The simplified connection procedure for micro-generating plants should ensure an appropriate balance between the administrative burden and connection costs from the prosumer's point of view, and the implementation of the proportionately necessary activities and provision of the necessary information, as observed from the DSOs' and suppliers' point of view.

A. NECESSARY ASPECTS OF INTERACTION DURING THE CONNECTION PROCESS

In order to define the possibilities and restrictions for simplification of the standard connection procedures, the minimum necessary aspects of interaction between the prosumer who installs the micro-generating plant and the DSO and the supplier are given below. These aspects are related to the timely submission of information and harmonization of necessary contracts.

The DSO must be timely informed about the intended construction of a micro-generating plant for self-consumption needs (with and without delivery of electricity to the grid) in order to:

- maintain the security of the distribution system,
- check whether the existing metering device meets the requirements for electricity metering in both directions,
- determine the obligation and conditions for the installation of a metering device for measuring gross electricity generation,
- check the impact of the micro-generating plant on the operation of the distribution network and the existence of any restrictions related to the connection of the micro-generating plant,
- harmonize the provisions of the connection contract and charge the costs of the existing connection changes,
- carry out the necessary changes on the connection and metering points, and
- update the database of metering devices and to register the status of the billing registers on the metering device.

The DSO must be timely informed about the planned connection and commissioning of the micro-generating plant in order to:

- organize the on-site presence during the first connection,
- harmonize the provisions of the network access contract,
- plan the operation of the distribution network, and
- register the status of the generation facility and exchange the data with the TSO.

The supplier must be timely informed about the planned connection and commissioning of the micro-generating power plant in order to:

- harmonize the provisions of the supply contract with the changed supply conditions, which include the electricity takeover from the prosumer,
- harmonize the provisions of the network access contract if the customer's network access is regulated indirectly through the supplier,
- plan the electricity procurement and sales, and

- avoid the occurrence of imbalances in the supplier's portfolio.

B. TECHNICAL AND FUNCTIONAL REQUIREMENTS

As a prerequisite for the establishment and application of the simplified connection procedure, the DSO has to define and publish in advance the requirements related to:

- the obligation of the micro-generating plant to possess a certificate of conformity (interface unit and microgenerator) with the requirements of standard EN 50549-1, thus avoiding on-site operational tests during the commissioning of the micro-generating plant (except, exceptionally, at the special request of the DSO),
- the settings of the interface protection (overvoltage, undervoltage, over frequency, underfrequency, loss of mains protection) which are applicable in accordance with the provisions of the DSO Distribution Network Rules,
- the mandatory functionalities of micro-generating plants and relevant operational parameters and settings, in accordance with the provisions of the DSO Distribution Network Rules, and
- the switching and disconnection devices at the connection point of the micro-generating plant.

The proposal for the mandatory functions and settings of interface protection, as well as an overview of mandatory functionalities of the micro-generating plant with the relevant operational parameters and settings, are given in the Annex 2.

C. CERTIFICATION OF THE INTERFACE UNIT AND MICROGENERATOR

The simplified connection procedure can be applied only to micro-generating plants that have a certificate of type testing and conformity of the interface unit and microgenerator with the requirements of the Standard EN 50549-1. The certificates have to be submitted with the application for the issuance of a connection permit. The requirements for certification and compliance of microgenerators with the standard EN 50549-1 are applicable to electricity storage devices too.

The certificate shall be accompanied by a report on the tests performed that contains information on the model and type of the tested microgenerator, test conditions and registered test results.

In addition to the test certificate, the microgenerator must possess the CE mark, or other equivalent proof of compliance with the relevant European directives, authorizing its use.

Certification tests of the interface unit and microgenerator should be performed as the type tests,¹⁷ whereby the equipment supplier shall guarantee that each individual device of this type complies with the requirements of the Standard EN 50549-1 and specific requirements specified in the DSO Distribution Network Rules.

The testing of the interface unit and the microgenerator must be carried out by or under the supervision of an authorized testing laboratory.

The interface unit of a micro-generating plant is a technological unit consisting of the switching, disconnection and protection devices through which the microgenerator is connected to the prosumer's internal installations and through which the automatic disconnection from the network is performed when fault occurs. The interface unit can be

¹⁷ Certification tests are conducted by an accredited certification body in Bosnia and Herzegovina or abroad.

integrated with an inverter in the micro-generating plants that is connected to the distribution network via an inverter.

The interface unit of the micro-generating plants must meet the following certification requirements:

- The settings of the protection devices during the test are in accordance with the DSO requirements,
- Operational tests of all elements of interface protection were performed,
- Testing methodology is in accordance with EN 50549-1 (testing of PV inverters is performed according to the requirements of the standard EN 62116,¹⁸ other inverters used with other technologies are tested according to the requirements of standard EN 50549-1), and
- After a successful test, a certificate of conformity is issued, which the equipment seller delivers to the buyer.

A microgenerator must meet the following certification requirements:

- The settings of the operating parameters during the test are in accordance with the requirements of the DSO,
- Operational tests of all functionalities required by standard EN 50549-1 are performed – operating voltage and frequency range, production of active power at the frequency reduction, immunity to fast frequency changes, reduction of active power at the frequency increase, capability of reactive power production (for products that are intended for mass market, implementation of all operating modes is recommended), power plant operation in case of short circuit in the network (Type A optional, depending on the DSO requirements), electromagnetic compatibility in accordance with the standards EN 61000,¹⁹ connection to the network and generator synchronization, production interruption after receiving an external control signal,
- Test methodology in accordance with the EN 50549-1, and
- After a successful test, a certificate of conformity is issued, which the equipment seller delivers to the buyer.

When the interface unit is integrated with the inverter, the prosumer submits a single certificate of type testing and conformity for the micro-generating plant as a whole.

D. AUTHORIZED INSTALLER

All micro-generating plants must be installed and connected to the grid by the authorized equipment installers who are qualified to perform the low voltage installation works.

Registration and qualification of equipment installers and persons authorized to perform low voltage installations works is implemented in accordance with the regulations adopted by the entity ministries and institutions of the Brcko District in charge of electricity.

A qualified installer has an additional obligation in the connection process, related to the preparation of a report/certificate on the completion of works regarding installation and connection of the micro-generating plant, which is submitted to the DSO and the end customer.

¹⁸ EN 62116 - Grid-connected photovoltaic inverters - Test procedure for measures to prevent island operation.

¹⁹ EN 61000 – Electromagnetical compatibility EMC

6. SIMPLIFIED CONNECTION PROCEDURE

A. MICRO-GENERATING PLANTS QUALIFICATION

As stated in the introductory chapter of this paper, Article 17 of Directive 2018/2001 regarding promotion of the use of RES energy sources obliges Member States to establish a simplified procedure for connection to the electricity distribution network of the micro-generating plants with an installed capacity of up to 10.8 kW. The Directive also permits the Member States to increase the installed capacity threshold to a maximum of 50 kW.

In addition to the installed capacity, other qualification criteria are related to the purpose of electricity generation, electricity generation technology, the existence of a certificate of conformity of the micro-generating plant with the requirements of the technical standard governing network connection, and the existence of the CE marking or other equivalent evidence that confirms the quality of the equipment.

In this regard, the proposal for the qualification of power plants to which the simplified connection procedure applies is:

- Installed capacity of the micro-generating plant - up to 10.8 kW three-phase or up to 3.6 kW per phase,
- Purpose of generation - For self-consumption needs within the existing facility of the end customer,
- Electricity generation technology - All renewable energy technologies, and
- Compliance with technical requirements
 - Certificate of conformity with EN 50549-1 issued by an authorized testing laboratory.
 - CE mark or other equivalent proof of compliance with the relevant European directives and standards applicable in BiH.

The simplified connection procedure shall also be applied when several microgenerators are connected at the same connection point, whose total installed capacity does not exceed the threshold of 10.8 kW for three phase equipment or 3.6 kW per phase.

The simplified connection procedure shall also be applied when microgenerators and electricity storage devices are connected via the same connection point to the distribution network, whose sum of installed capacities does not exceed 10.8 kW for three phases equipment or 3.6 kW per phase.

The simplified connection procedure does not apply for the connection of new customers whose facilities are equipped with micro-generating plants, regardless of the installed capacity of the micro-generating plant. Under these conditions, the standard connection procedure is applied, which is prescribed for the customers of the relevant consumption category, with the obligation to submit a certificate of the micro-generating plant conformity.

Taking into account the aforementioned eligibility criteria for micro-generating plants, it is necessary to amend the primary and secondary legislation in the Federation of BiH in order to harmonize the concept of micro-generating plants and generation for self-consumption needs, which are currently defined by the Law on Electricity and the Law on Renewable Energy Sources and Efficient Cogeneration in the Federation of BiH. They should be harmonized with the standard concept of the prosumers who have the right to generate electricity for their own needs, to store it, as well as to deliver the energy surplus to the network.

B. PROPOSAL FOR THE SIMPLIFIED CONNECTION PROCEDURE

The proposal for the simplified connection procedure determined on the basis of the above criteria, analysis of the necessary aspects of interaction between prosumer and DSO, as well as the analysis of processes and documents that are part of the standard connection procedure, but which are not necessary for the connection of micro-generating plants, contains the following steps:

1. The prosumer submits a request for the connection permit issuance and the connection contract amendments,
2. The DSO issues a connection permit and a proposal for amendments of the connection contract,
3. The prosumer concludes the connection contract and pays the connection fee,
4. The DSO performs installation of metering devices and other changes on the connection (if necessary),
5. The qualified installer submits to the DSO a signed and stamped report/certificate that the installation of the micro-generating plant was performed in accordance with the applicable technical and safety regulations and standards and that the settings of the electrical protection was performed in accordance with the DSO requirements, and that the plant is ready for connection and commissioning,
6. A qualified installer in the presence of a DSO representatives performs the first connection and commissioning of the micro-generating plant, performs the basic functional tests of the parallel operation of the micro-generating plant with the network (operational start-up, synchronization, disconnection under normal conditions, tripping by the loss-of-mains interface protection), and
7. The DSO prepares and submits a declaration on the connection containing the data on the installed micro-generating plant for the self-consumption needs (applicable in the case of MH ERS).

A graphical representation of the simplified connection procedure is shown in Figure 1.

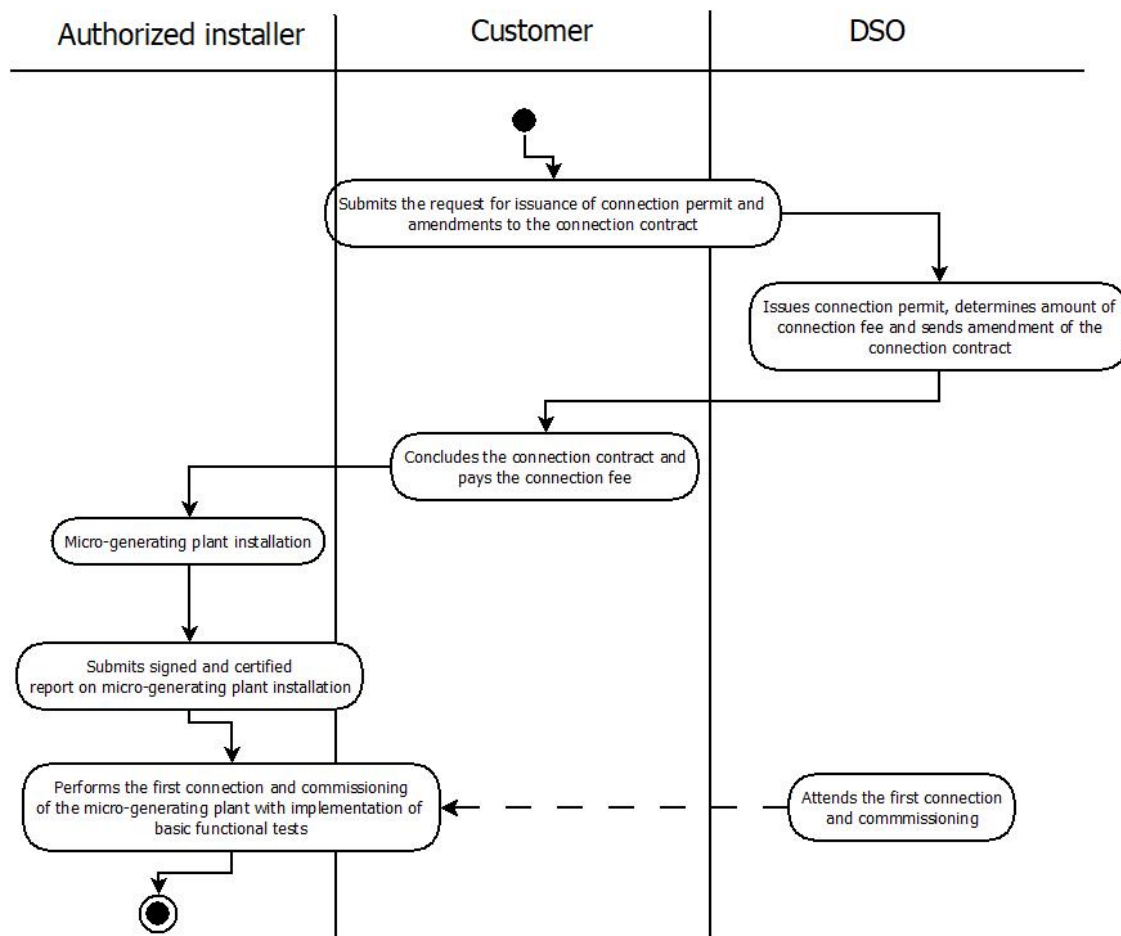


Figure 1: Simplified micro-generating plant connection procedure

From the prosumer’s point of view, the change of the connection procedure reduces the obligations in the connection process to the:

1. Submission of application for the connection permit issuance and the connection contract amendments, and
2. Signing the connection contract and payment of the connection fee.

The prosumer would be obliged to enclose the following documentation with the application for the connection permit issuance:

- The certificate of conformity of microgenerator,
- The certificate of conformity of interface unit,
- The proof of CE marking or other equivalent proof of compliance with the relevant European directives and standards for power generating facilities,
- Construction permit or Locational (Urban-technical) conditions - if applicable,
- Single line diagram of the micro-generating plant connection, and
- Layout of the prosumer’s facilities with the indicated location of the micro-generating plant.

Works on the micro-generating plant installation cannot be performed without the valid connection permit and the connection contract concluded.

An overview of the unnecessary procedural steps and the documents that don't need to be obtained when connecting a micro-generating plant for self-consumption needs, is given by

the example of the standard connection procedure under the EP HZHB and MH ERS jurisdiction area.²⁰

C. MICRO-GENERATING PLANT CONSTRUCTION PROCESS INCLUDING THE SIMPLIFIED CONNECTION PROCEDURE

A graphical representation of the micro-generating plant overall construction process, which also includes a simplified connection procedure, is given in Figure 2, where the steps representing the key elements of the simplified connection procedure are specifically indicated (shaded in red).

²⁰ A graphic presentation of activities that do not need to be carried out is given in Annex 1 of the document.

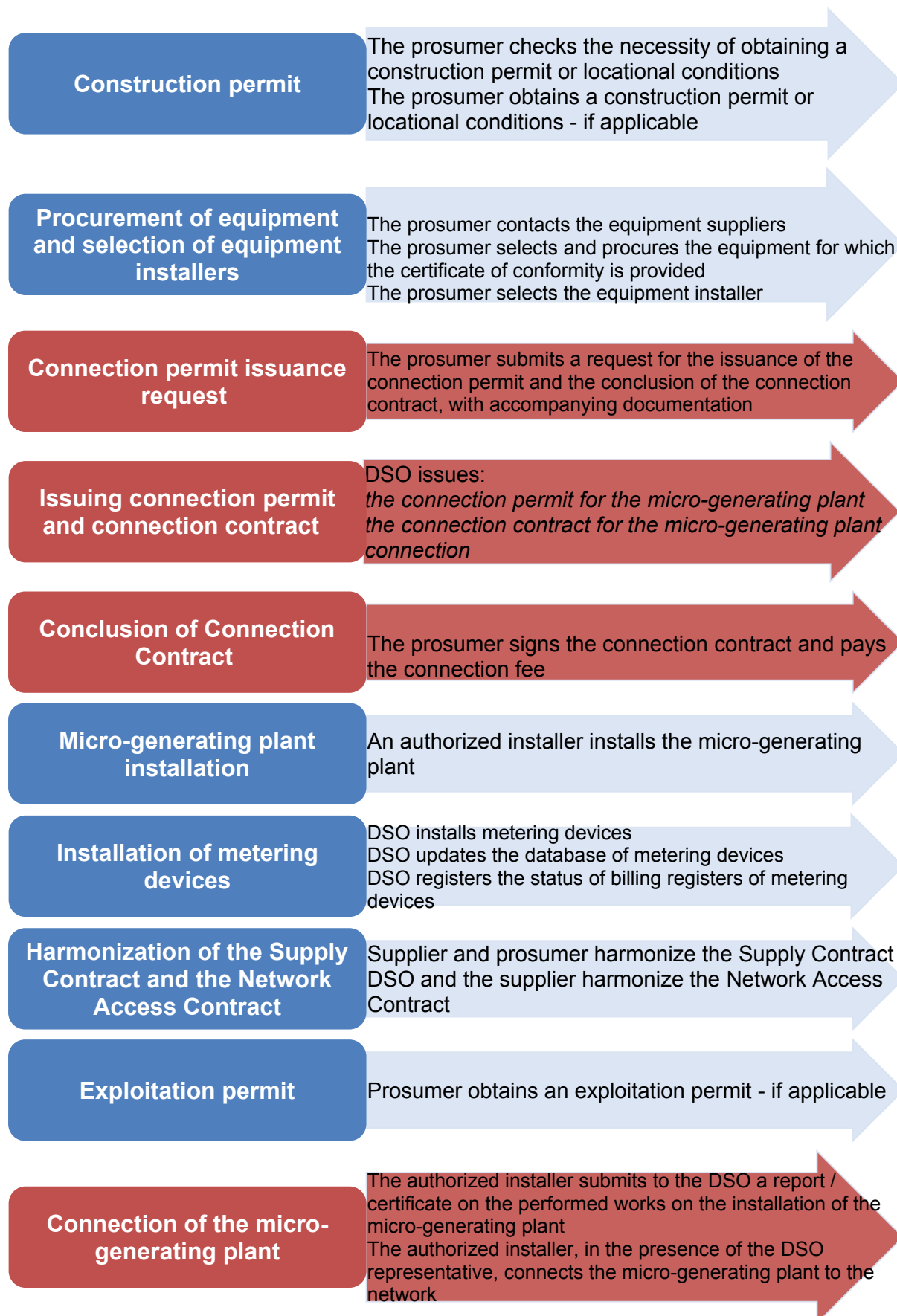


Figure 2: The micro-generating plant construction process with a simplified connection procedure

The flowchart diagram of activities on the construction of the micro-generating plant, with the indication of the entities participating in the connection procedure and their tasks, is given in Figure 3.

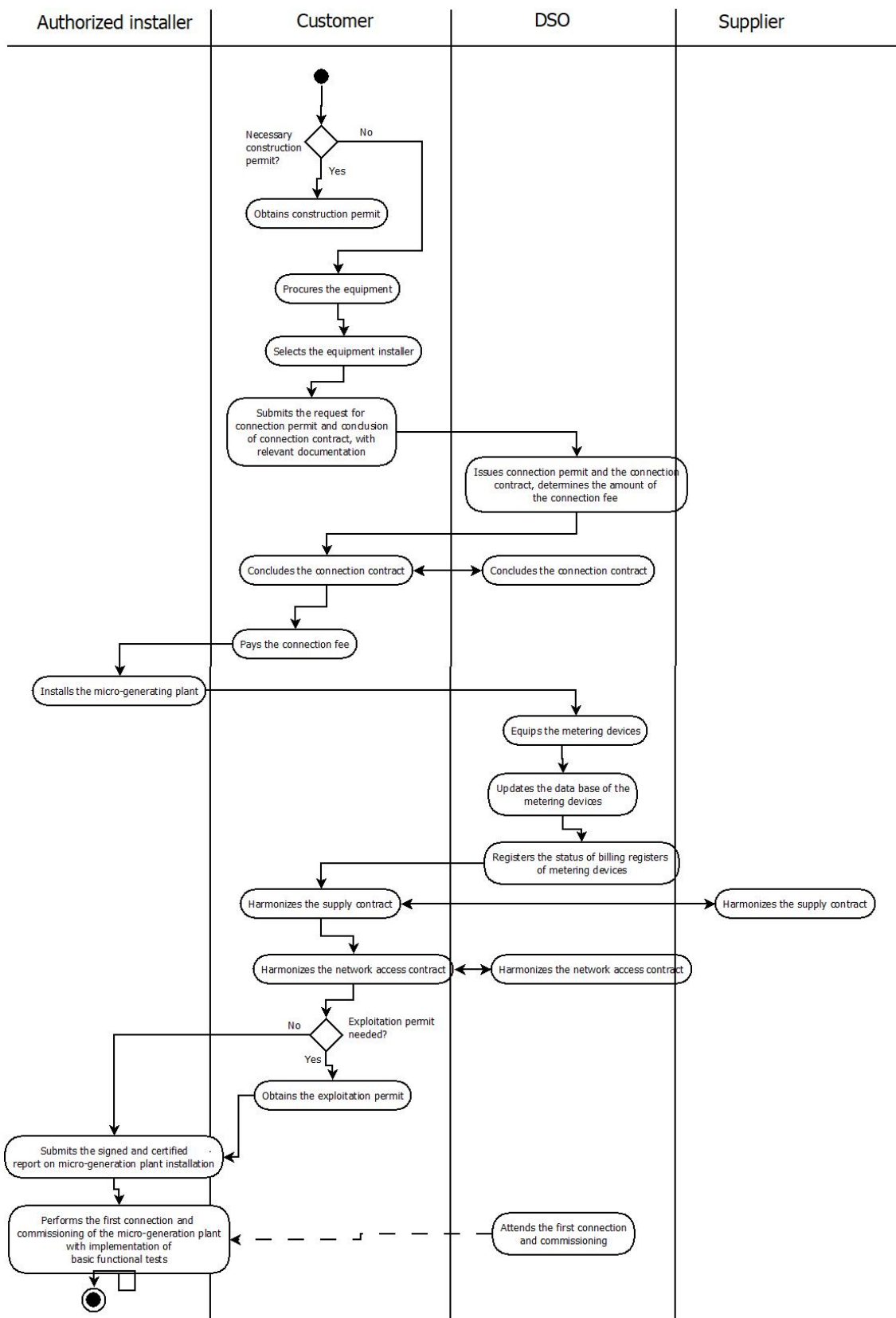
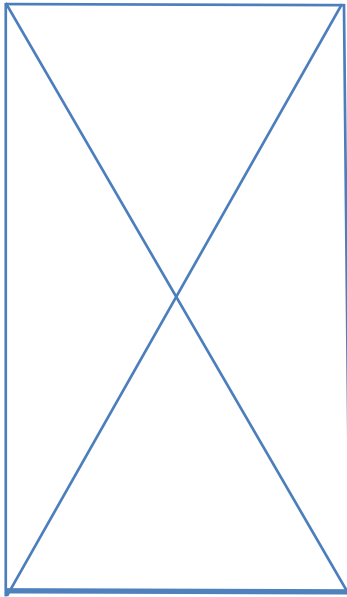


Figure 3. Flowchart diagram of the micro-generating plant construction process, including simplified connection procedure

7. ANNEX 1A – FLOWCHART ON EP HZHB POWER PLANTS CONNECTION

The flowchart diagram for the connection of the power plants to the distribution network under EP HZHB jurisdiction, which includes the procedure for connecting micro-generating plants,²¹ is shown graphically below.

Activities that do not need to be performed when applying the simplified connection procedure for micro-generating plants are marked in beige on the chart and by crossed out text.²²



²¹ Flowchart developed as part of the activities of the USAID EPA Network Rules Working Group.

²² The flowchart does not cover the branch that refers to power plants whose installed capacity exceeds 23 kW, since these are power plants that do not belong to the category of micro-generating plants.

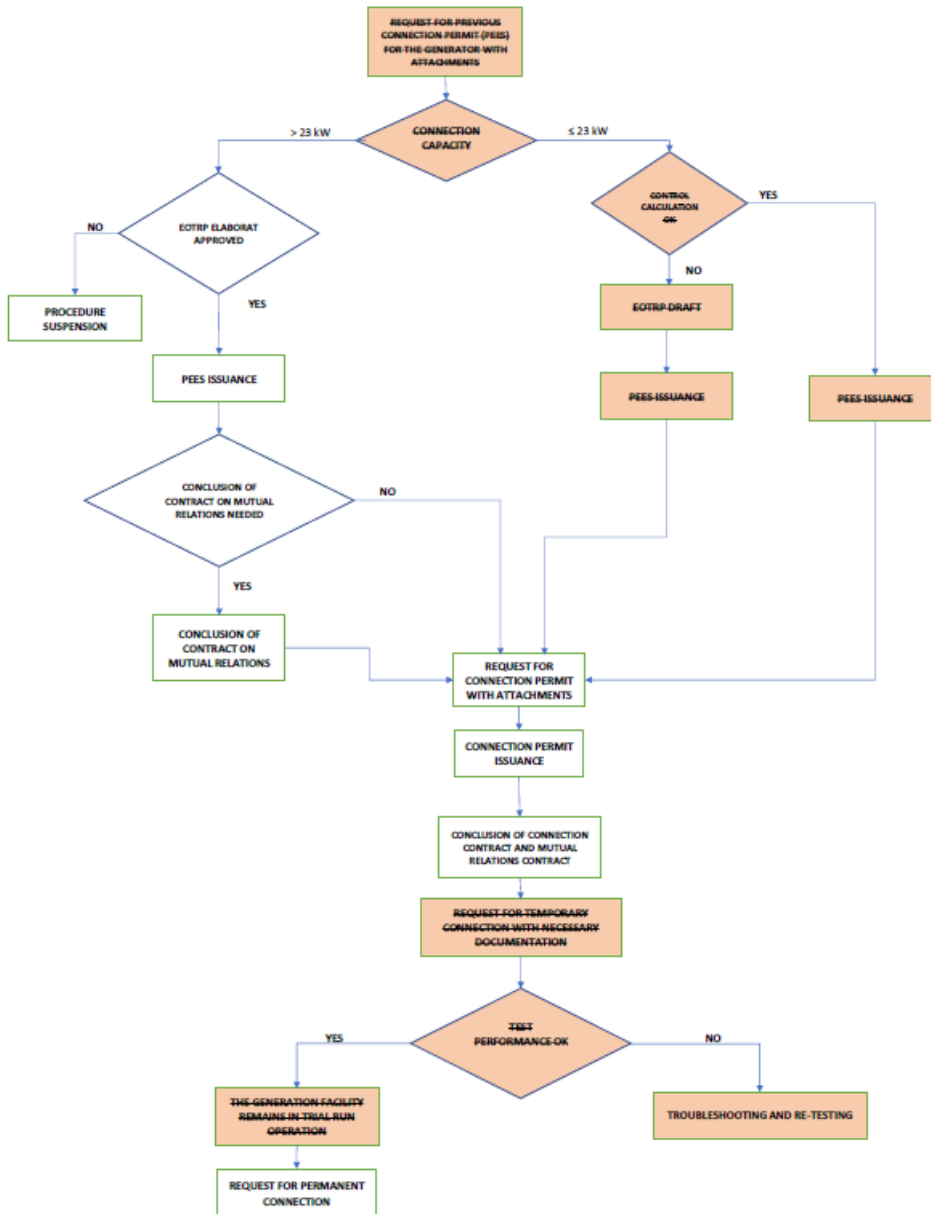


Figure 2: Existing flowchart diagram for EP HZHB connection procedure

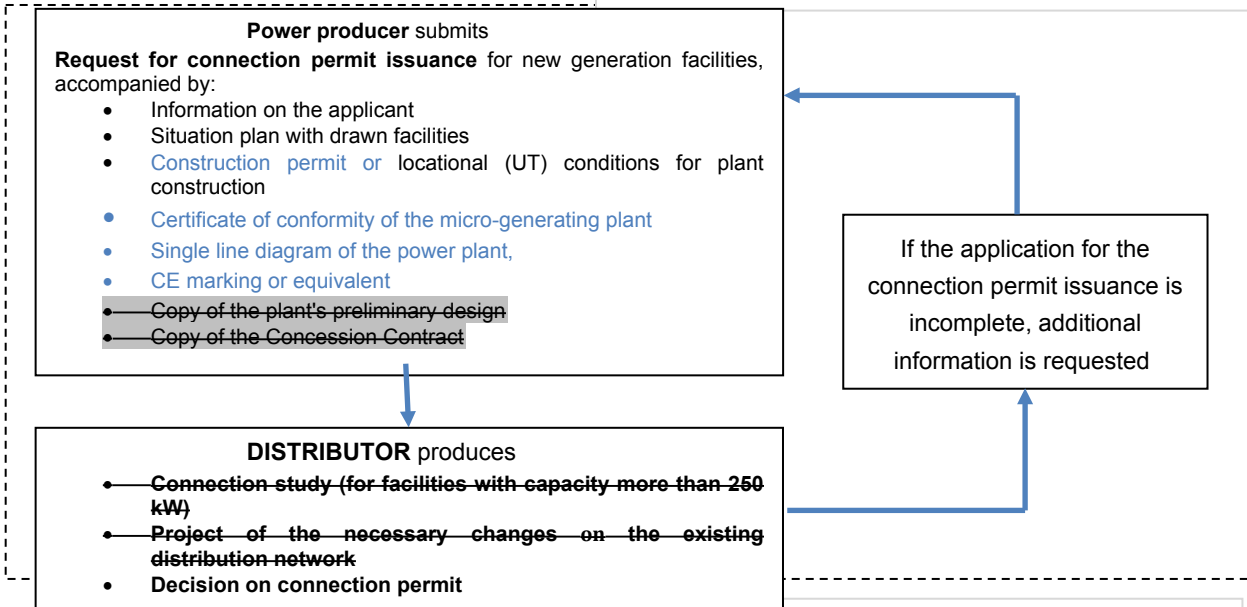
8. ANNEX 1B - FLOWCHART ON MH ERS POWER PLANT CONNECTION

The flowchart diagram for the connection of power plants to the distribution network under MH ERS jurisdiction, which includes the procedure for connecting micro-generating plants,²³ is shown graphically.

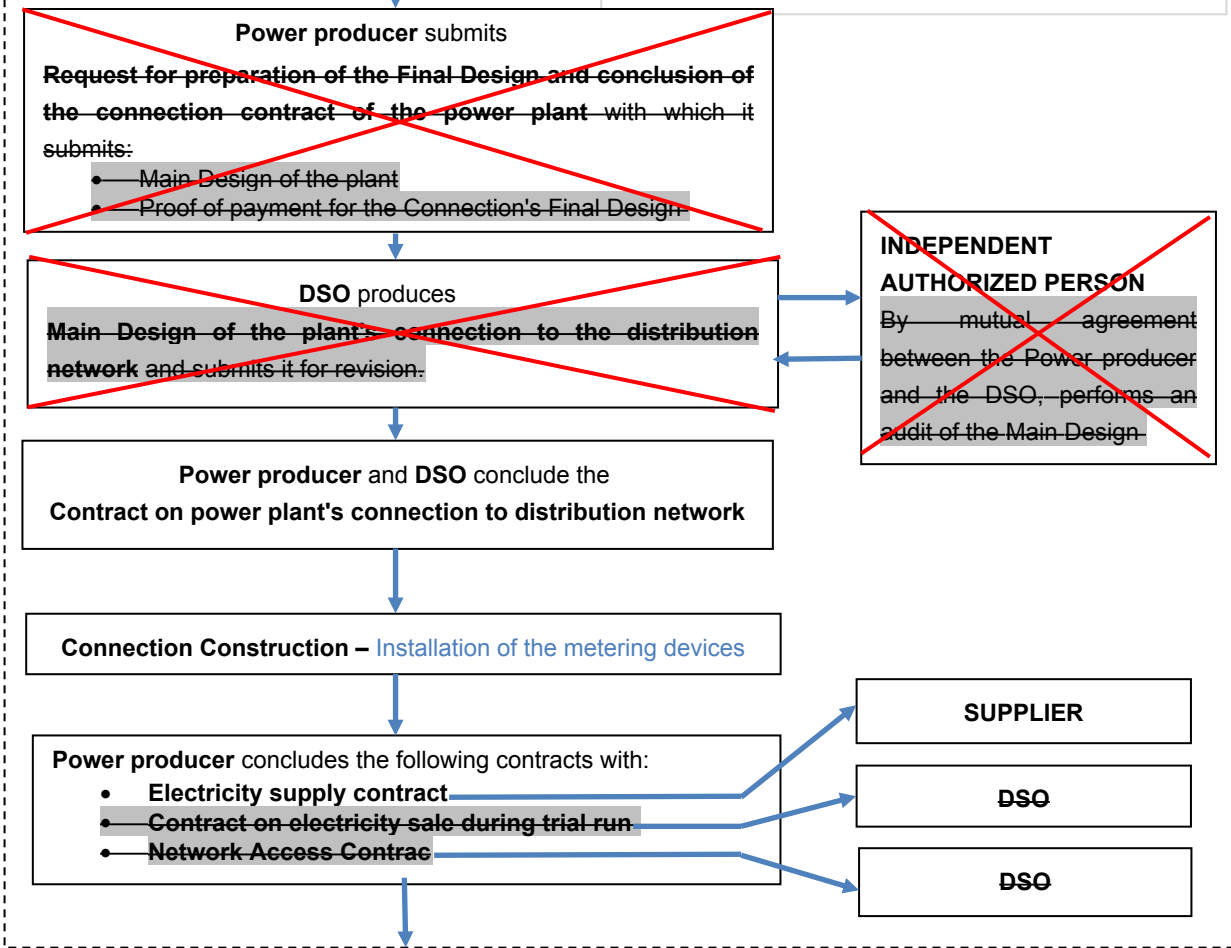
Activities that do not need to be performed when applying the simplified connection procedure for micro-generating plants are marked in red on the chart and by crossed out text, whereas the added items that did not exist within the existing flowchart for the standard connection procedure are colored in blue.

²³ Rulebook on conditions for connection of power plants to the electricity distribution network of Republika Srpska, Annex V - Flowchart of activities for connection of power plants.

1. OBTAINING CONSTRUCTION PERMIT



2. CONNECTION CONSTRUCTION



~~3. FUNCTIONAL TESTS TRIAL RUN PERIOD~~

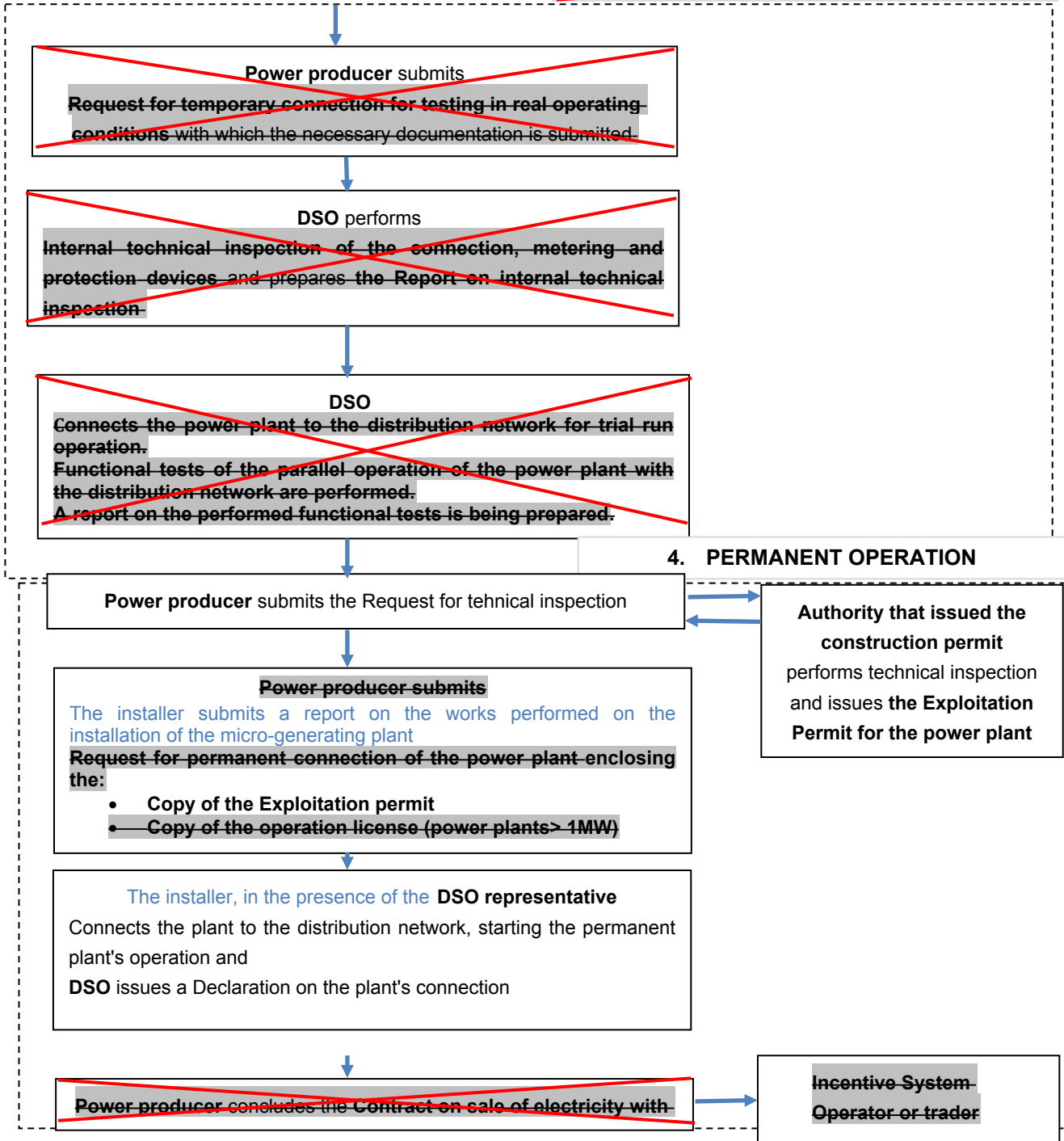


Figure 2: Existing flowchart diagram for MH ERS connection process

Procedures that do not need to be implemented and documents that are unnecessary when connecting a micro-generating plant for self-consumption needs in the area under MH ERS jurisdiction, are:

1. Network connection approval phase:
 - a. Preparation of the Connection Study (for facilities larger than 250 kW) - obligation of the DSO, and
 - b. Preparation of the Project of necessary upgrades of the existing distribution network - obligation of the DSO.
2. Connection construction phase:
 - a. Submission of a request for the preparation of the Connection Main Design and conclusion of the connection contract - **obligation of the prosumer**
 - b. Preparation of the Main Design of the power plant connection to the distribution network - obligation of the DSO
 - c. Conclusion of the contract on the sale of electricity during the trial run period between the DSO and the **prosumer**, and
 - d. Conclusion of the network access contract between the DSO and the **prosumer**.
3. Functional tests - trial run operation phase:
 - a. Submission of the Request for temporary connection for testing under the real operating conditions - **obligation of the prosumer**,
 - b. Carrying out the Internal technical inspection of the connection, metering and protection devices - obligation of the DSO,
 - c. Preparation of the Report on internal technical inspection - obligation of the DSO,
 - d. Conducting functional tests of parallel operation of the power plant with the distribution network - **obligation of the prosumer**,
 - e. Preparation of the Report on performed functional tests - **obligation of the prosumer**,
4. Permanent operation phase:
 - a. Submission of the Request for permanent connection of the power plant - **obligation of the prosumer**.

9.

10. ANNEX 2 –THE INTERFACE PROTECTION FUNCTIONS AND FUNCTIONALITIES OF THE MICROGENERATING PLANT WITH RE PARAMETERS AND SETTINGS

Interface protection (4.9.3.)²⁴

Function	Parameter	Setting's range / setting's step	Default values as per EN 50549-1 standard
Undervoltage protection stage 1 U <	Threshold	(0.2-1) Un / 0.01Un	-
	Operate time	(0.1-100) s / 0.1s	-
Undervoltage protection stage 2 U <<	Application is not mandatory for microgenerators		
Overvoltage protection stage 1 U >	Threshold	(1.0-1.2)Un / 0.01Un	-
	Operate time	(0.1-100)s / 0.1s	-
Overvoltage protection stage 2 U >> ²⁵	Threshold	(1.0-1.3)Un / 0.01Un	-
	Operate time	(0.1-5)s / 0.05s	-
Overvoltage protection 10 min mean value	Threshold	(1.0-1.15)Un / 0.01Un	-
	Operate time	3s without the option to change settings	-
Underfrequency protection stage 1 f <	Threshold	(47.0-50.0) Hz / 0.1 Hz	-
	Operate time	(0.1-100) s / 0.1s	-
Underfrequency protection stage 2 f <<	Threshold	(47.0-50.0) Hz / 0.1 Hz	-
	Operate time	(0.1-5) s / 0.05s	-
Over frequency protection stage 1 f >	Threshold	(50.0-52.0) Hz / 0.1 Hz	-
	Operate time	(0.1-100) s / 0.1s	-
Over frequency protection stage 2 f >>	Threshold	(50.0-52.0) Hz / 0.1 Hz	-
	Operate time	(0.1-5) s / 0.05s	-
Loss of mains protection (according to DSO requirements) ²⁶	Threshold	-	-
	Operate time	-	-

²⁴ References are given to the relevant provisions of technical standard EN 50 549-1 Annex C.

²⁵ The second level of overvoltage, underfrequency and overfrequency protection can be deactivated, depending on the

²⁶ The protection function is not intended for microgenerators for own needs.

Functional requests

Function	Parameter	Setting's range / setting's step	Default values as per EN 50549-1 standard	Proposal setting for
Operating frequency range (4.4.2.)	47.0 – 47.5 Hz	0 – 20 s	0 s	0 s
	47.5 – 48.5 Hz	30 – 90 min	30 min	30 min
	48.5 – 49.0 Hz	30 – 90 min	30 min	30 min
	49.0 – 51.0 Hz	Not adjustable	Unlimited	Unlimited
	51.0 – 51.5 Hz	30 – 90 min	30 min	30 min
	51.5 – 52 Hz	0 – 15 min	0 s	0 s
Minimal requirement for active power delivery at underfrequency (4.4.3)	Reduction threshold	49 Hz – 49.5 Hz	49.5 Hz	49.5 Hz
	Maximum reduction rate	2 – 10 % PM/Hz	10 % PM/Hz	10 % PM/Hz
Continuous operating voltage range (4.4.4.)	Upper limit	Not configurable	110% Un	110% Un
	Lower limit	Not configurable	85% Un	85% Un
Rate of change of frequency immunity (ROCOF) (4.5.2)	Non-synchronous generating technology	Not defined	2 Hz/s	2 Hz/s
	Synchronous generating technology	Not defined	1 Hz/s	1 Hz/s
Under voltage ride through capability (UVRT) (4.5.3.)	Type A generators	Application is not mandatory for type A generators		
Over voltage ride through	Microgenerators	Application is not mandatory for microgenerators		

capability (OVRT) (4.5.4.)				
Power response to overfrequency (LFSSM-O) (4.6.1.)	Frequency threshold f1	50.2 Hz – 52 Hz	50.2 Hz	50.2 Hz
	Droop	2 % – 12 %	5%	5%
	Reference power	PM Pmax	Pmax for synchronous generators and EESS PM for other non-synchronous technology	Pmax for synchronous generators and EESS PM for other non-synchronous technology
	Intentional delay	0 – 2 s	0 s	0 s
	Deactivation threshold f _{stop}	50 Hz – f1	Off	Off
	Deactivation time t _{stop}	0 – 600 s	-	-
	Acceptance of staged disconnection	YES/NO	YES	YES
Power response to underfrequency (LFSSM-U) (4.6.2.)	Type A generators	Application is not mandatory for type A generators		
	Electricity storage devices - EESS	Mandatory application for electricity storage devices		
	Frequency threshold f1	49.8 Hz – 46 Hz	49.8 Hz	49.8 Hz
	Droop	2 % – 12 %	5%	5%
	Power reference	PM Pmax	Pmax	Pmax

	Intentional delay	0 – 2 s	0 s	0 s
Reactive power capability (4.7.2.2.)	Power factor range overexcited	0.9 - 1	0.9	0.9
	Power factor range underexcited	0.9 - 1	0.9	0.9
Reactive power control modes (4.7.2.3.)	Enabled control modes	Q setp. Q(U) cos ϕ setp. cos ϕ (P)	Q setp.	Q setp.
Reactive power setpoint control modes (4.7.2.3.2.)	Q setpoint and excitation	0 – 48 % PD	0	0
	setpoint and excitation	1 – 0.9	1	1
Voltage-related control modes (4.7.2.3.3.)	Characteristic curve	-	-	-
	Time constant	3s – 60 s	10 s	10 s
	Min	0.0 - 1	0.9	0.9
	Active power at which the control mode is activated	0 % - 20 %	Off	Off
	Active power at which the control mode is deactivated	0 % - 20 %	Off	Off
Power-related control modes	Characteristic curve	-	-	-

(4.7.2.3.4.)				
Zero current mode for converter generating technologies (4.7.4.2.2.)	Type A generators	Application is not mandatory for type A generators		
Electromagnetic compatibility (4.8)	Higher harmonic current emissions	In accordance with the EN 61000-3-2		
	Voltage fluctuations and flickers	In accordance with the EN 61000-3-3		
Automatic reconnection after tripping (4.10.2.)	Lower frequency	47.0Hz – 50.0Hz	49.5 Hz	49.5 Hz
	Upper frequency	50.0Hz – 52.0Hz	50.2 Hz	50.2 Hz
	Lower voltage	50% – 100%Un	85% Un	85% Un
	Upper voltage	100% – 120% Un	110% Un	110% Un
	Observation time	10s – 600s	60s	60s
	Active power increase gradient	6% – 3000% Pmax/min	10% Pmax/min	10% Pmax/min
Starting to generate electrical power (4.10.3.)	Lower frequency	47.0Hz – 50.0Hz	49.5 Hz	49.5 Hz
	Upper frequency	50.0Hz – 52.0Hz	50.1 Hz	50.1 Hz
	Lower voltage	50% – 100%Un	85% Un	85% Un
	Upper voltage	100% – 120% Un	110% Un	110% Un
	Observation time	10s – 600s	60s	60s
	Active power increase gradient	6% – 3000% Pmax/min	Off	Off

Ceasing active power generation (4.11.1.)	Remote operation of logic interface	YES / NO	NO	NO
--	-------------------------------------	----------	----	----

11.

12. ANNEX 3 – APPLICATION FORM FOR CONNECTION PERMIT ISSUANCE AND CONNECTION CONTRACT AMENDMENTS

Information on applicant:

(Owner/investor)

(Address)

(DSO name)

(the name of the DSO's local branch)

Address:

Request

for the connection permit issuance and the connection contract amendments of the micro-generating plant for self-consumption needs

1. General information about prosumer

1.1	Information	Name and Surname / Name	
-----	-------------	-------------------------	--

		Address	
		ID number	
		Phone	
		E-mail	
1.2	Information about equipment installer	Name	
		Address	
		Certificate/License number	
		Contact person	
		Phone	
		Fax	
		E-mail	
1.3.	Information about micro-generating plant	Type of primary energy source	
		Plant's Address	
		Total number of micro generators	
		EESS device installed (YES/NO)	
		Connection type (single-phase/three-phase)	
		Installed capacity of micro-generating plant (kW)	
		Estimated annual production (kWh)	
		Rated power capacity and energy capacity of EESS (kW/ kWh)	
		Estimated date of connection to the network and start of operation	

2. Information about microgenerators

	Ordinal number of the generator	1	2
2.1.	Type of primary energy source		
2.2.	Single-phase/three-phase connection		

2.3.	Rated power (kW)		
2.4.	Manufacturer		
2.5.	Model		
2.6.	Serial number		
2.7.	Certificate of conformity with EN 50549-1 (YES/NO)		

3. Interface unit data (if the interface unit is an independent functional unit)

	Ordinal number of the generator	1	2
3.1.	Manufacturer		
3.2.	Model		
3.3.	Serial number		
3.4.	Certificate of conformity with EN 50549-1 (YES/NO)		

4. Attached documentation:

- Certificate of conformity of the microgenerator with the standard EN 50549-1
- Certificate of conformity of the interface with the standard EN 50549-1 - if the interface unit is an independent functional unit
- Proof of possession of the CE mark or other equivalent proof of conformity with relevant European directives and standards
- Construction permit or Locational (Urban-technical) conditions - if applicable
- Single line diagram of the micro-generating plant connection
- Layout of the prosumer's facilities indicating location of the micro-generating plant
- Proof of the fee payment for connection permit issuance

Applicant's signature

Place:
Date: