



# **Grid Code**

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## 2. Introduction

“Law on Transmission of Electric Power, Regulator and System Operator in Bosnia and Herzegovina” (“Official Gazette BiH” 7/02 and 13/03, 76/09 and 1/11, hereinafter called Law on Transmission of Electric Power), “Law on Establishment of Independent System Operator for Transmission System in Bosnia and Herzegovina” (“Official Gazette BiH” 35/04, hereinafter called Law on NOS) and “Law on Establishment of Company for Transmission of Electric Power in Bosnia and Herzegovina” (“Official Gazette BiH” 35/04, 76/09 and 20/14 hereinafter called Law on Elektroprijenos BiH) define the roles and responsibilities of the State Electricity Regulation Commission (referred to as SERC), Independent System Operator (referred to as NOSBiH) and Elektroprijenos BiH in the electric power system of Bosnia and Herzegovina.

Liability of NOSBiH to prepare and adopt a Grid Code arises from Article 5(3) of the Law on Transmission of Electric Power and Article 7(6) of the Law on NOS. The Grid Code:

- a) Defines minimum technical and operational requirements for the connection into a single electric power system of directly connected generation units, directly connected buyers to the transmission network and distribution systems within BiH.
- b) Determines operational procedures and the principles of the relations of NOSBiH with the Transmission Company and the users of the transmission system of BiH, both under normal and disrupted working conditions of the electric power system (EES).
- c) Aims at enabling development, maintenance, and management of the transmission system in accordance with the ENTSO-E rules and good European practices in this field.
- d) is linked to and harmonized with the Market Rules and relevant regulations which relate to the connection and exploitation of the BiH transmission system.
- e) In accordance with the foregoing laws, NOSBiH has an exclusive responsibility and authority to perform the following activities:
  - Supervision and management of the operations of the transmission system in Bosnia and Herzegovina of the 400, 220 and 110 kV voltage levels. Through special agreement NOSBiH may transfer functions of management to individual elements of transmission grid to Elektroprijenos BiH;
  - Management of the remote control and management equipment, which is necessary to manage the operations of the transmission system in real time;
  - Management of the equipment for the remote meter reading, which is necessary for the management of the balance market and settlement;
  - Issuance of orders to the balance responsible parties in order to implement the planned exchange program and eliminate balance errors;

- Adjustment and approval of the planned disconnections of the transmission network elements and generation facilities;
  - Approval and control of transit through the transmission network respecting technical constraints;
  - Communication, data exchange and coordination of all activities with neighboring system operators, ENTSO-E control block and ENSTO-E;
  - Drafting i.e. determination of the Indicative Generation Development Plan;
  - Checking, approval, direct revision and publishing Long-term Transmission System Development Plan;
  - Ancillary services procurement and system services providing.
- f) Each activity directly related to transformers 110/x kV is within the jurisdiction of Elektroprijenos BiH.
- g) NOSBiH and Elektroprijenos BiH shall cooperate and coordinate all the issues related to the implementation of the foregoing laws and this Grid Code as well as other issues related to efficient operations, maintenance, development and expansion of the transmission system.
- h) For technical requirements that are not explicitly defined by the Grid Code, NOSBiH may refer to the following international standards and recommendations:

- IEC (*Internacional Electrotechnical Commission*)
- EN (*European Standards*)
- CENELEC (*European Committee for International Standardisation*)
- ISO (*International Organization for Standardisation*)
- CIGRE (*Conference Inernationale des Grands Reseaux Electriques*)
- IEEE (*Institute of Electrical and Electronics Engineers*)
- ENTSO-E

## 3. Glossary and Definitions

### 3.1 Acronyms and Abbreviations

In the Grid Code, the following acronyms and abbreviations shall have the following meanings:

<b>AAC</b>	Already Allocated Capacity
<b>AMR</b>	Automated Meter Reading
<b>ARC</b>	Automatic Re-Connection
<b>ATC</b>	Available Transfer Capacity
<b>BAS</b>	The Institute for Standardization of Bosnia and Herzegovina
<b>BiH</b>	State of Bosnia and Herzegovina
<b>CAX</b>	Cross-border Exchange including netting
<b>CET</b>	Central European Time
<b>DC NOSBiH</b>	Dispatching Centre of NOSBiH
<b>DC OA</b>	Dispatching Centre of Elektroprijenos BiH Operational Area
<b>SERC</b>	State Electricity Regulation Commission
<b>EC</b>	European Commission
<b>EES</b>	Electrical Energy System
<b>ESS</b>	ETSO Scheduling System
<b>EN</b>	European Norm
<b>ENTSO-E</b>	European Network of Transmission System Operators for Electricity
<b>FRR</b>	Frequency Restoration Reserves
<b>FCR</b>	Frequency Containment Reserves
<b>HPP</b>	Hydro Power Plant
<b>IC</b>	Identification Code (at the metering point)
<b>IEC</b>	International Electrotechnical Commission

<b>NOSBiH</b>	Independent System Operator in Bosnia and Herzegovina
<b>NTC</b>	Net Transfer Capacity
<b>NES</b>	Non-manageable Energy Source
<b>VT</b>	Voltage Transformer
<b>BMT</b>	Billing Metering Point
<b>RR</b>	Replacement Reserve
<b>SCADA / EMS</b>	Supervisory Control and Data Acquisition/Energy Management System
<b>MV</b>	Medium Voltage
<b>CMT</b>	Current Meter Transformer
<b>SVC</b>	Static VAR Compensator
<b>TPP</b>	Thermal Power Plant
<b>TRM</b>	Transmission Reliability Margin
<b>TTC</b>	Total Transmission Capacity
<b>WPP</b>	Wind Power Plant
<b>HV</b>	High Voltage

### 3.2 Definitions

The following words and expressions in the Grid Code shall, unless otherwise required by the context, have the following meaning:

<b>Term</b>	<b>Meaning</b>
<b>Active Energy</b>	Measure of generation or consumption of active power of device integral in one particular time period. Expressed in kilowatthours (kWh), megawatt-hours (MWh) or gig watt-hours (GWh).
<b>Active Power</b>	Real component of apparent power, usually expressed in kilowatts (kW) or megawatts (MW).
<b>Automated Underfrequency Load Shedding</b>	Partial disconnection of consumption which is achieved by the effect of sub-frequency relays.

**Automated Recloser of a switch without manual intervention (automated) Reconnection of TL (APU)** after activation of its disconnect protection

**Black Start** Ability to start a generation unit without an outside supply source of own consumption.  
The procedure to return to normal state after partial or complete breakdown of the electric power system shall be initiated by NOSBiH or the unit upon the authorization given by NOSBiH.

**Directly Connected Consumer** Consumer whose connection points are on 110 kV voltage and higher.

**Dispatcher** Operational staff authorized for issuance of dispatching orders and instructions.

**Dispatching Instruction** Dispatching instruction of NOSBiH operational staff with an objective of coordination and harmonization of activities on increase of facility security, improvement of the regime which systems may put to the condition of decreased security and violations of exploitation parameters.

**Dispatching Centre of NOSBiH** Location from which the transmission network of BiH Control Area is being managed from

**Dispatching Order** Executive request from operational staff of authorized DC which relates to implementation of manipulations of commutation apparatuses in the facilities of transmission grid, usage of resources of ancillary services in accordance to valid agreements, enabling secure and stable functioning of EES facilities, as well as implementation of procedures in the phase of restoration of EES.

**Distributor** Distribution operator or Entity responsible for development, expansion, maintenance, operation and managing middle voltage and low voltage grids.

**Distribution Grid** The part of the grid which is used for distribution of electricity to the final users.

**Daily Schedule** Programme of generation, exchange and consumption of electric energy in precisely defined time intervals.

**Long-term Transmission Grid Development Plan** Long-term transmission grid development plan made by Elektroprijenos BiH

**Long-term Outages/ Disconnections** Planned disconnection lasting more than three (3) days.

**Study** Study of technical solution defining methods and conditions for connecting the user's facility to the transmission system.

**Power Plant** One or more generation units.

**Power Plant with a Possibility of Black Start** Power plant registered with NOSBiH as a plant which has at least one generation unit with a possibility of black start.

**Energy Balance of BiH** Document that contains plans of consumption, generation, procurement and delivery of electricity and power in BiH, estimation of losses in the transmission grid and estimation of needs for ancillary services. It is compiled for the period of one year with monthly dynamics.

**Elektroprijenos BiH** Company established in accordance with the Law on establishing a company for the transmission of electricity in BiH

**Energy Park** A group of generation units (wind power plants/solar power plants) which produce electricity with the following features:

- asynchronous connection to the grid or with power electronics devices and
- has one connection point in the transmission system, distribution or closed distribution system.

**Power Factor** Ratio of active power and apparent power

**Earth Fault Factor** The ratio between the effective value of voltage of a sound phase-to-earth during a fault and effective value of a phase-to-earth voltage when there is no fault.

This ratio must always be more than 1 and is a function of the ratio of the direct and zero reactance.

**Flicker** Disorder of human sight caused by changing the level of light of the light source. This occurs as a consequence of the change of level and frequency of the envelope of the supply voltage of the light source.

**Frequency** Number of cycles of alternating current in a second, expressed in Hertz (Hz).

**Main Meter** Metering instrument which measures the flows of active and reactive power at the metering point (point of receiving and/or delivery) in the transmission network.

**Annual Plan of Interruption** The Plan for disconnection of the power system elements due to an interruption approved by NOSBiH. It is consisted of the Plan for disconnection of the power system elements and the Plan for disconnection of elements at the User premises.

**Identification Code of the Metering Point (IC)** Single alphanumerical code for each metering point.

**IEC Standard** Standard approved by the International Electrotechnical Commission

**Indicative Generation Development Plan** Ten year Generation Development Plan is made by NOSBiH



**Interconnection Line** Line transformer through which electro-energy system of BIH is connected to electro-energy system of neighboring country

**Outage** Inadvertent transition of a grid element or a generating unit from operating state to a shut down

**User** Any natural or legal person or a group of legal persons who deliver and/or receive electricity and whose facilities are physically connected to the transmission system, as well as any natural or legal person or a group of legal persons whose facilities will be connected to the system.

**Short-term Interruption** Planned outage of the transmission grid elements which lasts for three days or less

**Safety Criterion (n-1)** Criterion which ensures that failure of a single network element in the transmission grid (line, interconnection line, grid transformer, generation unit) of a Control Area must not endanger normal operating.

This does not relate to failures at substations and to common cause failures.

**Licensed Party** Entity which holds a license in accordance with the rules of Regulatory Commissions

**Transmission reliability Margin (TRM)** Margin of a safe transmission which is introduced in order to have a necessary safe margin with the purpose of regulation and considering the lack of security with respect to the condition of the EES and scenario and to the precision of data and applied IT (Information Technology) methods and models.

Possibility of transmission is expressed together for all interconnected (connecting) lines between two adjacent interconnected control areas within a given timeframe, for both directions of transmission.

**Measures in Unforeseen Circumstances** Measures which are undertaken in the conditions of disrupted operation and which are defined by the Code of Measures in unexpected situations

**Metering Transformer** General name for current meter transformers and voltage meter transformers

**Dead zone of the Regulator** Deliberately set value at the turbine regulator inside of which there is no resulting change in the position of regulating valves in the regulatory system of speed/load

**Blueprints of the Location** Blueprints prepared for each connection location

**Voltage Meter Transformer** Transformer which is used with metering and/or protective instruments in which voltage in the secondary winding is within the prescribed error margin and is proportionate to the voltage and phase in the primary winding

**Net Transmission Capacity (NTC)** Represents best assessed margin of the possible transfer of power exchanged between two regulation areas. It is accorded with safety standards taking into consideration technical uncertainty of future conditions on the grid.

**Independent System Operator in BiH (NOSBiH)** Company established in accordance with the Law on Establishing Independent System Operator for the Transmission System in BiH

**Published Network Constraint** Constraint of the system determined and published by NOS BiH one (1) day before submitting the Daily Schedule

**User Unit** Generation/Consumption unit owned by the User which is through HV substation or directly connected to the transmission system

**Automatic Meter Reading** Database within NOSBiH jurisdiction where metering and calculating data are stored

**Defined Metering Point (DMP)** Actual physical or virtual location in which energy forms (energy/power) are calculated for the network user  
The metering point can be a physical meter (physical metering point) or a formula for calculating the physical meters (virtual metering point)

**Approved Daily Schedule** Daily schedule approved by NOSBiH which is applicable for a given day and is binding for the balance responsible party which submitted it.

**Maintenance of Voltage** System service to maintain the voltage within declared margins.

**Load** Power which the consumption instruments or the user receives from the transmission system.  
Load is not to be identified with consumption.

**Island** Part of the electric power system which is galvanically separated from the main *EES*.

**Plan of Rehabilitation of the Power System** Plan which is drafted and maintained by NOSBiH for the periods during which the overall electric power system of BiH or its parts has been disconnected from ENTSO-E System which will indicate the overall strategy of rehabilitation of the electric power system

**Plan of Protection** Plan which contains all technical and organizational measures for the prevention of expansion or deterioration of incidents in the *EES*.

**Planned Outage** Planned disconnection of a transmission element and/or the User's unit coordinated by NOSBiH.

**Capability Chart of Generation Unit Ancillary Service** Capability chart, which indicates the limits of operational capabilities of a generation unit in MW and MVAR under normal circumstances.  
All services, except generation and transmission of electric power,

provided to NOSBiH with the purpose of providing system services

**Auxiliary Power Supply** Independent source of electric power which can start a generation unit without an outside source of supply

**Disturbance** Unexpected event that may impair normal operations

**Disrupted Operation** Disrupted operation is marked by the state in which all customers are still supplied whereas:

- marginal values of voltage and frequency are not maintained anymore,
- and/or possible overload of generation and network units,
- (n-1)-safety criterion has not been met anymore.

**ENTSO-E Rules and Standards** Rules and Standards defined by ENTSO-E Operation Handbook and all other rules, standards or recommendations approved and published by ENTSO-E

**Transmission System** Elements of the electric power system used in the transmission of electric power and energy at voltage level of 110 kV and above

**Connection Point** A collection of lines, equipment and devices for transmission of electricity which are used to connect the user's facility directly or through HV substation to the transmission system

**Apparent Power** Product of voltage (in volts) and power (in amperes). Consists of real component (active power) and imaginary component (re-active power) often expressed in kilovolt-amperes (kVA) or megavolt – amperes (MVA)

**Ancillary Services Procedures** Accompanying document to the Market Rules  
Look at [www.nosbih.ba](http://www.nosbih.ba)

**Process of Frequency Restoration (secondary and tertiary regulation)** Centralized automated (secondary regulation, that is manual (tertiary regulation) function which regulates generation in the control area in order to maintain the control of exchange of electric power through interconnected transmission lines within the set constraints and bring the system frequency back to the set values in case of deviation.

**Process of Frequency Regulation (primary Regulation)** Maintains balance between generation and consumption in the network, using the turbine controller.

**Regulation)** It is an automated decentralized function of the turbine controller whose purpose is to adjust generator's output as a response to the frequency change in a synchronized zone.

**Generation Unit** A facility through which primary energy is converted to electric energy.

**Electric Power Generator** Entity with a license to generate electric power.

**Power System Breakdown** Power system breakdown can be partial or complete. Complete breakdown of the system means outage of all generation units from the transmission grid, no-voltage state of all plants and failure to supply all consumers, while partial breakdown of the system means outage of one part of the system having the same consequences at that part as after the complete breakdown.

**Available Transmission Capacity (ATC)** The amount of net transmission capacity (NTC) which is still available for commercial transactions, i.e. positive difference between NTC and the already allocated capacity (AAC)

**Unloading** Reduction of load in a controlled way by disconnecting the users

**Reactive Energy** Measure of generation or consumption of re-active power of a device integrated in a specific time period.

Expressed in kilovarhours (kVArh), megavar-hours (MVArh) or gigavar-hours (GVArh)

**Reactive Power** Re-active power is imaginary component of apparent power usually expressed in kilovars (kVAr) or megavars (MVAr)

Re-active power is that part of electric energy which creates and maintains electrical and magnetic fields of alternating current equipment

**Metering Register** Document which defines a way of calculating energy units.  
This register includes the data on the type and technical specifications of equipment, revision and calibration, specific data on the location, etc.

**Regulation of Frequency** Measures to be taken to maintain or restore the system frequency within the set parameters

**Regulation of Voltage** Measures to be taken to maintain the system voltage within a given range in different nodal points in the network

**Control/Regulation Block** One or more control areas which cooperate in matters of regulation of frequency and power of exchange within ENTSO-E

**Control / Regulation Area** Part of the interconnected ENTSO-E system (usually coincides with the territory of a company or state, physically delineated by the position of the metering points of the power exchanged with the remaining interconnected system), administered by an independent system operator, with real flows and controlled generation units connected within the control block.

The control area may be part of the control block which has its own sub-control in the hierarchy of the secondary regulation of frequency.

**Frequency Restoration Reserve (FRR)** Operating reserve activated with the purpose to restore frequency to the nominal value and power balance to the scheduled value of the synchronous area which is consisted of more regulation areas. It is used for secondary and tertiary regulation needs.

**Frequency Containment Reserve (FCR)** Operating reserve for constant prevention of frequency deviations from nominal value with the purpose of continuous maintenance of balancing power of the synchronous area.  
It is activated automatically for primary regulation needs.

**System Distruption Risk** Awareness of the risk of a large and serious disruption of the total transmission system or a part of the transmission grid according to which NOSBiH issues a warning to the users who might be in danger

**Metering System** All the components and instruments which are installed or which exist between each metering point and the database of readings. This also includes the metering installation, all supporting communication links, hardware and software necessary for the function of compiling the readings, as well as all the data processing equipment

**Supplier** Entity which holds a license to supply electric power to customers

**Central European Time (CET)** Official time in Bosnia and Herzegovina

**Static Stability** Ability of the system to maintain stable operation after small disturbance

**Statism** Amount of relative quasi-stationary frequency deviance on the grid and relative change of active output power from the generator caused by the action of primary regulator.  
This relation without dimension is often expressed in percentages

**Current Meter Transformer** Transformer used with metering and/or protective instruments in which current in the secondary winding is within the prescribed error margin, and is proportionate and in phase with the current in the primary winding

**Metering Point** Physical point where reception and delivery of electric power is metered

**Tests of Harmonization** Procedures determining compliance of the generation units with the Grid Code technical requirements ([www.nosbih.ba](http://www.nosbih.ba))

**Transient Stability** The ability of the power system to maintain synchronism following a major disturbance (in terms of its type, duration and the place where it occurs).  
The system is unstable if only one of its generation unit loses synchronism after such disturbance.

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**Contract on Connection** Contract between Elektroprijenos BiH and the transmission system user governing conditions for connection to the transmission system

**Total Transmission Capacity** Total amount of power exchangeable between the parts of the interconnection without jeopardizing the safety of the *EES* and of the interconnection

**Warning About System Constraints** Warning issued by NOSBiH that the system operates under aggravated conditions which may cause the constraint

**Already Allocated Capacity (AAC)** Total amount of allocated transmission rights, regardless if those are capacities or exchange programs, depending on the allocation methodology

**HV Substation** High voltage substation consisting of high voltage equipment and instruments serving for electricity transmission  
High voltage substation includes buses, HV field and/or metering fields of 110 kV voltage level or higher.

## 4. Transmission System Planning and Development Code

- (1) This Code includes compilation of Indicative Generation Development Plan, Long-term Transmission System Plan and Evaluation of the System stability, and is applied to NOSBiH, Elektroprijenos BiH, Distributors and Users.
- (2) This Code in detail describes the data used in the development planning process.

### 4.1. Indicative Generation Development Plan

- (1) NOSBiH is responsible for compilation of Indicative Generation Development Plan.
- (2) The purpose of Indicative Generation Development Plan is to provide information on announced constructing projects of new generation units in the transmission system. Indicative Generation Development Plan should firstly indicate the possibilities in terms of using own resources to satisfy Bosnia and Hercegovina's needs for electricity and power whereby taking into consideration the following planning elements:
  - Determination of needs for generation capacities to cover peak load of EES BiH in the transmission system
  - Determination of needs for generation capacities to satisfy electricity demand of distributors and buyers directly connected to the grid
  - Determination of needs for generation capacities with taking into consideration the approved values of maximum installed power from NES (wind power plants and solar power plants)
  - Required reserve of power and energy
  - Balance surplus and deficit
- (3) Indicative Generation Development Plan analyses the dynamics of realization of generation and consumption plans in the electric power sector in Bosnia and Herzegovina.
- (4) Indicative Generation Development Plan includes the period of ten (10) years. Determination of the Indicative Generation Development Plan is done on the basis of data delivered by Users. Update of Indicative Generation Development Plan is done every year.

- (5) Indicative Generation Development Plan contains:
- (a) Maximum and minimum power consumption in Bosnia and Herzegovina in the previous period and estimation of power demand for each of the year covered by the planning proces,
  - (b) Three scenarios of consumption growth for next 10 years (lower, basic and higher) on the basis of information on expected development of electricity consumption delivered by distributors and users upon their analyses,
  - (c) Size and structure of the generation capacities which are capable of supporting the energy and consumption in the planned period, number and structure of the generation capacities expected to be shut down most of the time during the year due to capital repairs,
  - (d) Current available generation capacities and those which will be built, reconstructed or permanently shut down in a planned period (type of power plant, installed capacity, scheduled annual generation, type of fuel, year of a start-up, beginning and completion of the reconstruction, year of closing down),
  - (e) The effects of construction of generating units used by NES,
  - (f) Overview of EES development plans at the regional level, including proposals related to construction of new interconnection lines and their impact on crossborder capacities.
- (6) Balancing of new generating units is done:
- For wind power plants and solar power plants:
    - in line with relevant Conditions for connection to the transmission system which were accepted by the Users, and
    - with relevant confirmation issued by the entity's authorized institution that the power plant operates within maximum power and that it is accepted as possible option for regulation of the system.
  - For other new generating facilities according to the Conditions for connection to the transmission system which were accepted by the User.
  - Potential additional balancing criteria are defined by the Indicative Generation Development Plan.
- (7) Dynamics of the compilation of Indicative Generation Development Plan for the period that shall start in year G:
- (a) NOSBiH shall publish announcement for data delivery at the beginning of November in G-2,
  - (b) Users shall deliver data to NOSBiH by the end of December in G-2,
  - (c) By the end of April in G-1 NOSBiH shall submit Indicative Generation Development Plan to SERC for approval,
- (8) Upon SERC's approval, NOSBiH shall publish Indicative Generation Development Plan on its web site.

#### **4.2. Long-term Transmission System Plan**

- (1) Elektroprijenos BiH is responsible for devising Long-term Transmission System Plan.
- (2) The purpose of Long-term Transmission System Plan is, according to Indicative Generation Development Plan (base scenario) and all relevant documents, to define appropriate support of existing facilities and building of new facilities in the transmission system as to ensure non-interruptible electricity transmission. This also enables timely provision of required assets and launching the procedures related to construction and reconstruction of transmission system elements. In the compilation process of Long-term Transmission System Plan Elektroprijenos BiH shall take into consideration development plans of the Distributor.
- (3) Elektroprijenos BiH shall compile the Long-term Transmission System Plan for next 10 years. The Plan shall be updated every year.
- (4) Elektroprijenos BiH is responsible for implementation of the Long-term Transmission System Plan.

#### **4.2.1. Criteria for Compilation of Long-term Transmission System Plan**

- (1) Transmission system must be planned to provide longterm safe and reliable transmission of electric power.
- (2) The starting points for compilation of Long-term Transmission System Plan are actual loads of the transmission system elements in regimes of maximum and minimum consumption at the transmission system. Long-term Transmission System Plan shall take into account a planned rise in consumption needs in the transmission system, engagement of generation capacities which are connected or will be connected (included balance generation capacities from Indicative Generation Development Plan) to the transmission system in a planned period as well as the system load forecasts at the regional level.
- (3) An integral part of the Long-term Transmission System Plan is also estimation of required financial assets respecting the economy criteria.

##### **4.2.1.1. Safety criterion (n-1)**

- (1) Safety criterion (n-1) is used in development planning of the transmission system at voltage level of 400 kV, 220 kV and 110 kV.
- (2) Implementation of safety criterion (n-1) in the planning process of the transmission system development shall provide a technical framework for determination of values on load of the transmission system elements and of voltage in nodes 110, 220 and 400 kV in relation to limit values. Consequences of multiple dicturbances which may occur in the transmission system shall not be taken into consideration.
- (3) Safety criterion (n-1) is met in the transmission system if, after a single outage of a system element: a line, a system transformer, an interconnection line and a generator connected to the transmission system:
  - there is no permanent deviations of threshold values of operating units in the transmission system,
  - there are no electricity supply interruptions.



- (4) Safety criterion (n-1) shall not be implemented in case of an outage of a two-system line or a multiple-system line.
- (5) In general case, the safety criterion (n-1) must be met at the border between the transmission and the distribution system. In case of a radial connection to the transmission system by one line or by one transformer 110/x kV, it is possible not to meet the safety criterion (n-1), only if supply from the middle voltage systems can be provided in full amount.
- (6) When planning a connection, with the User's consent it is possible to derogate from the safety criterion (n-1) whereby it is not allowed to make the connection in a way to form 'T connection' line.

#### **4.2.2 Compilation and Contents of Long-term Transmission System Plan**

- (1) NOSBiH shall make available to Elektroprijenos all the data related to operation of the transmission system necessary for development planning of the transmission system.
- (2) Distributers shall upon Elektroprijenos request deliver data necessary for development planning of the transmission system.
- (3) Standard data planning shall be ensured by new and existing Users for any significant modification on their network or operating mode.
- (4) Elektroprijenos BiH may request from the User other types of data required for compilation of Long-term Transmission System Plan which are not specified by item 4.4 and which shall be delivered by the User according to the specific request made by Elektroprijenos BiH.
- (5) When there is no change of the data for several years, instead of submitting the same data again, the User may send a written statement confirming that there was no change of the data in relation to previous period.
- (6) Dynamics of compilation of Long-term Transmission System Plan:
  - a) Long-term Transmission System Plan shall be delivered by Elektroprijenos BiH to NOSBiH for a review, approval, direct revision and publication.
  - b) NOSBiH shall organize an expert revision body to perform revision of Long-term Transmission System Plan. Depending on the results of the revision, Long-term Transmission System Plan may be returned to Elektroprijenos BiH for an upgrade. Long-term Transmission System Plan is submitted to SERC for an approval by 31 October.
  - c) Upon SERC's approval NOSBiH shall publish Long-term Transmission System Plan on its web site.
- (7) Long-term Transmission System Plan with current and planned data contains:
  - a) Maximum and minimum power of generation units,
  - b) Maximum and minimum active and reactive power of consumer junction points,
  - c) Assessment of connection of new generation and consumer capacities according to dynamics of their entry into operation,
  - d) Assessment of the load of the transmission network elements on the basis of the assessment of a maximum load of the transmission network using the safety criterion (n-1);
  - e) Assessment of the voltage conditions on the basis of the assessment of a maximum and minimum load of the transmission network,

- f) Proposals to construct new interconnection lines and their impact on the crossborder capacity values,
- g) Transmission system losses;
- h) Calculation of three phase and single phase short circuit currents for the first, the fifth and the tenth year in a planned period for each junction point. When potential short circuit current in HV substations in the transmission system is larger than 90% value of rated breaking short circuit current of the switching equipment, Elektroprijenos BiH must suggest appropriate measures.
- i) Need to boost the system and/or change the topological structure of the transmission system,
- j) Statistics on breakdowns and time of delays due to breakdowns and maintenance of high voltage lines and grid transformers in past five (5) years,
- k) Assessment of necessary investments for implementation of proposed plans.

### **4.3. Estimation of the Power System Stability**

- (1) NOSBiH makes estimation of the EES BiH at least once over period of 5 years. On the basis of appropriate analyses NOSBiH determines conditions that User must ensure in order to maintain the aimed level of stability reserve at minor disturbances.
- (2) Stability estimation is done for current state and for final year of the planned period arising from Long-term Transmission System Plan.
- (3) The transmission system must be planned as to ensure maintenance of stability at minor disturbances and maintenance of transient stability and appropriate voltage levels. With that purpose NOSBiH may demand from Elektroprijenos and the System User to harmonize their equipment characteristics and parametres, especially of the system related to the regulation of power and voltage of specific consumers devices and generation units which are significant in terms of the stability regulation and decrease of customer impact on the transmission system, including the impact on power quality.

### **4.4. Planning Data**

#### **(1) Preliminary Project Data**

- The data submitted by the User together with a request for connection to the transmission system shall be considered as preliminary project data until the Study is drafted. The preliminary project data shall contain only the standard planning data.

#### **(2) Executive Project Data**

- The Study on technical conditions for the connection shall define executive project data and they refer to connection of the User facility to the transmission system and to relevant parametres of the User facility.
- The executive project data together with other data related to the electric energy system available to NOSBiH and Elektroprijenos BiH shall form a basis for the EES planning. The executive project data may contain both the standard planning data and the detailed planning data.

- (3) For the process of the transmission system planning the User shall ensure two types of data: the standard ones which are obligatory (4.4.1) and the detailed planning data as may be requested by NOSBiH or Elektroprijenos BiH (4.4.2).

#### **4.4.1. Standard Planning Data**

(1) Planned Data on the User network

- A principal single-pole diagram of the user network (current and planned), location draft, topological and situational map
- Main parameters of the equipment and of energy transformers at voltage level of 110 kV and above
- For industrial grids connected to the voltage level 110kV and up, provide principal single-pole diagram of supply of large industrial consumers, power plants or compensation instruments (>5MVA)
- The year planned for connection to the transmission system.

(2) Data on consumption for User junction point at 110 kV and above

- Installed power of a network junction point
- Maximum and minimum active and reactive power for next 10 years
- Planned annual consumption of electric power for next 10 years
- Sensitivity of the individual User consumption to voltage and frequency variations of the transmission system
- Particulars on cyclic variations of consumption of active and reactive power (>5MVA/min)
- Gradient of change of active and reactive power -increase/decrease (>5MVA/min)

(3) Data on Generation Units and Power Plants

- Geographical location
- Principled single-pole diagram
- Primary power source
- Type of generation unit
- Type of turbine
- Number of generators and installed apparent power
- Nominal voltage of the generation unit (generator)
- Nominal power factor of the generation unit
- Maximum and minimum power on the busbar (MW)
- Available power on the busbar (MW)
- Planned annual generation

#### **4.4.2 Detailed Planning Data**

(1) Data on the User system

a) Main characteristics

- Detailed single-pole diagrams
- Type and arrangement of bus bars
- Characteristics of the power transformer, regulation selector switches and method of Regulation

- Disposition of the facility
  - Phase arrangement
  - Grounding system
  - Commutation instruments, metering transformers and metering appliances
  - Protection
  - Equipment for reactive power compensation: type of reactive power compensator, nominal voltage, regulation range and method of regulation
- b) Air ducts and cable lines
- Type, cross-section and length of the line; including the data on protection of the conductor for air ducts
  - Rated voltage (kV)
  - Direct reactance
  - Direct resistance
  - Direct susceptance
  - Zero reactance
  - Zero resistance
  - Zero susceptance.
- c) Transformers
- Rated power (MVA)
  - Rated voltage levels (kV);
  - Connection group;
  - Short circuit voltages  $u_{k12}$ ,  $u_{k13}$ ,  $u_{k23}$
  - power of active losses on winding resistance and magnetic field of the transformer reduced to primary
  - Idle motion current expressed in rated current percentages
  - Range of the regulation selector switches
  - Size of steps of the regulation selector switches
  - Type of regulation selector switches (loaded or in idle motion).
  - Data on switches and disconnectors: rated voltage (kV)
  - Rated breaking current of three phase short circuit (kA)
  - Rated breaking current of single phase short circuit (kA).

## (2) Protection Data

Full description including a possibility for adjustment of all protective instruments (relays) which are installed or will be installed at the User's facility

## (3) Grounding System

All the details on the grounding system of star-connection of transformer 110kV and more, including the impedance values of the grounding.

## (4) Estimates of the Transient Surge

At the request of NOSBiH or Elektroprijenos BiH, every User is required to submit the estimates of over-voltage within the domain of isolation coordination.

#### (5) Harmonics and Flickers

In studying the harmonics and flickers, NOSBiH shall assess the generation/growth of the harmonics and flickers at the transmission system on 110kV voltage and up. Upon a NOSBiH request, each User and Elektroprijenos BiH shall submit additional technical data.

#### (6) Voltage Changes

In studying the voltage, NOSBiH shall examine potential instability of voltage or coordination of voltage regulation. Upon NOSBiH request, each User and Elektroprijenos BiH shall submit additional data, as defined by NOSBiH.

#### (7) Data on consumption

The User shall submit:

- Data on current and planned consumption as given in 4.4.1;
- Data on possible reduction in consumption (MW and MVar), duration in hours, and a number of allowed reductions in a year

#### (8) Data on Generation Units and Power Plants

All power generation companies connected to transmission system shall deliver to NOSBiH all requested data ((9) – (14)) on their generation capacities, including data related to their supervision of the system and ancillary services supply.

#### (9) Own Consumption

It is necessary to submit for each generation unit basic data on its regular own consumption, i.e. needed active and reactive power for starting one generator (block), type and the power of the biggest consumer in the starting phase.

It is necessary to submit for each power plant a principled single-pole diagram of own consumption with a description of the main and auxiliary supply.

#### (10) Generation Unit Parameters

- Primary power source
- Type of power plant
- Type of turbine, producer
- Number of generators and installed apparent power, producer
- Rated voltage on clamps
- Rated power factor
- Installed active power (MW)
- Technical minimum (MW)
- Range of voltage regulation
- Nominal number of rotations
- Maximum and minimum number of rotations (frequency), time of operation on

border values

- Short circuit ratio
- Synchronic reactance (d and q-axes)
- Transient reactance (d and q-axes)
- Subtransient reactance d-axis
- Time constant of excitation winding  $T'_{do}$
- Time constant of dump winding d-axis  $T''_{do}$
- Time constant of dump winding q-axis  $T'_{qo}$
- Time constant of dump winding q-axis  $T''_{qo}$
- Time constant of direct short circuit current component of stator winding,  $T_a$
- Stator resistance
- Stator dissipative reactance
- Constant of inertia of rotating masses (MWs/MVA)
- Rated current of excitation
- Rated voltage of excitation
- Capability chart of the generator
- Saturation curve of magnetizing current.

#### (11) Block Transformer Parameters

- Rated power (MVA)
- Rated voltage levels
- Short circuit voltages  $u_{k12}, u_{k13}, u_{k23}$
- Power of active losses on winding resistance and magnetic field of the transformer reduced to primar
- Idle motion current expressed in rated current percentages
- Range of the regulation selector switch
- Size of steps of the regulation selector switch
- Type of regulation selector switch.

#### (12) Excitation Management System Parameters

- Type of excitation system and voltage regulator, producer
- Block diagram of the voltage regulation system
- Values of coefficients of the increase and time constants characteristic of a selected type of the regulator and the excitation system
- Rated voltage of excitation
- Lowest voltage of excitation
- Highest voltage of excitation
- Voltage change gradient of excitation (rising)
- Voltage change gradient of excitation (falling)
- Particulars on the curve of the excitation described in the block diagram (time responses)
- Dynamic characteristics of maximum excitation limiter
- Dynamic characteristics of under-excitation limiters
- Type and characteristics of a system stabilizer with a block diagram.

#### (13) Parameters of the Regulators of Turbines and Boilers

- Type of turbine regulator, producer
- Type of boiler regulator, producer (only for Thermal Power Plants)
- Detailed block diagram with defined coefficients of the increase, time constants and Limiters
- Time required for connection of the unit to the network
- Gradient of the power increase (MW/min.)
- Range of regulation in relation to the working point
- Dead zone of the regulator.

(14) Additional Data

By no derogation from the standard planning data and the detailed planning data, NOSBiH and Elektroprijenos BiH may request additional information from the User if they find that the data submitted are insufficient for development of comprehensive studies of the system.

## **5. The Code on Connection to the Transmission System**

- (1) This Code shall apply to NOSBiH, Elektroprijenos BiH and the Transmission System Users.
- (2) The connection procedure at the voltage level lower than 110 kV at undertakings of Elektroprijenos BiH shall be defined by the Regulations on the Connection and Detailed Rules for SN connection at undertakings of Elektroprijenos BiH ([www.elprenos.ba](http://www.elprenos.ba)).
- (3) This Code shall ensure that:
  - New and existing Users who are making changes of technical parameteres in their systems will not create negative effects on the transmission system or the entire EES, or other Users systems, and will not be subject of unacceptable effects of their own connection to the transmission system;
  - All Users connected to the transmission system are treated in a non-discriminatory manner.
- (4) This Code defines technical, constructive and operational conditions which must be satisfied by Users who will be connected to the transmission system of 110, 220 and 400kV and by current Users who are making changes of technical parameteres in their systems.
- (5) The procedures, rights and liabilities of NOSBiH, Elektroprijenos BiH and of the User in the realization procedure of a new User connection or in entering changes of current Users are defined in detail by the Regulation on the Connection to the transmission system ([www.derk.ba](http://www.derk.ba)).

## **5.1. Terms for Connection to the Transmission System**

- (1) The Terms for Connection shall be issued by Elektroprijenos BiH upon the User request and on the basis of a revised Study. Upon the User's acceptance of the Terms for Connection, Elektroprijenos BiH shall submit the Terms to NOSBiH.
- (2) The Study contains relevant analyses on whose grounds are defined the technical parameters of the Users connecting to the system and of currently connected Users who is changing the technical parameters of its system. Purpose of this Study is to avoid negative effects to the transmission system and EES in its entirety and to ensure normal operation of the User's facility.
- (3) The Study may contain many connection options whereas the cheapest and most technically suitable option is to be chosen. When compiling the Long-term Transmission System Plan Elektroprijenos BiH shall take into consideration the adopted option.
- (4) Each connection to the transmission system shall be performed in accordance with safety criterion (n-1) unless the User chooses another option.
- (5) If the connection of a new one or a remodeled facility of the existing Users requires expansion, strengthening or any technical change in the transmission network, it must be clearly defined and determined by the Study.

## **5.2. Agreement on Connection, Agreement on the Transmission System Usage and Management Agreement**

### **5.2.1. Agreement on Connection**

- (1) Terms and provisions defining the connection to the transmission system, shall be set forth in the Agreement on Connection which shall be concluded between the User and Elektroprijenos BiH. When creating the Agreement, Elektroprijenos BiH shall consult NOSBiH.
- (2) Elektroprijenos BiH shall submit a copy of the signed Agreement to NOSBiH.
- (3) Before entering the Agreement on Connection, the User shall provide to Elektroprijenos BiH up-to-date data pursuant to the Transmission System Planning and Development Code (4.4.1, and if necessary upon a request by Elektroprijenos BiH the data from 4.4.2).
- (4) The Agreement on Connection shall also define the requirements related to telecommunication, SCADA and the Code of Measures (Chapter 8).

### **5.2.2. Agreement on the Transmission System Usage**



- (1) The Agreement on the Transmission System Usage shall be concluded between Elektroprijenos BiH and the User/Supplier. The Agreement on the transmission system usage shall define legal, economy and technical requirements according to which the User/Supplier may use the transmission system owned by Elektroprijenos, for the electricity transmission.
- (2) The Agreement on the Transmission System Usage must be concluded for each single undertaking or more undertakings through which the electricity is delivered into the transmission system or by which the electricity is received from the transmission system.

### **5.2.3. Management Agreement**

- (1) Management Agreement shall be concluded between NOSBiH and the User. The Management Agreement shall define legal, economy and technical conditions according to which NOSBiH manages the User's instruments whose function is to transmit electricity.

### **5.3. Start up of HV Undertaking and of the User Connection**

- (1) The User shall inform Elektroprijenos BiH on completion of works at the HV undertaking and connection and shall submit a proposal for controlling the implemented works.
- (2) The controlling programme shall be approved by Elektroprijenos BiH and the User shall be informed on the control no later than seven days prior to the date set for the control.
- (3) After the control was carried on, Elektroprijenos BiH shall submit to NOSBiH and the User a minutes on the taken control and on readiness for start-up of HV undertaking and connection.
- (4) Acting upon the User's request, the Agreement on Connection and the minutes on the control from the previous item, Elektroprijenos BiH shall issue the Approval for connection of HV undertaking.
- (5) NOSBiH shall issue the compliance for starting-up of HV undertaking and the connection with prior delivery of the following documents:
  - Approval for connection of HV undertaking,
  - Protocol on protection set-up,
  - Management Agreement,
  - Report on set up communication and on the testing conducted for exchange of necessary measuring units with NOSBiH/Elektroprijenos BiH.

### **5.4 Start-up of the User Undertaking**

- (1) Each User must satisfy the technical requirements set forth in the Grid Code.
- (2) The procedure for issuance of certificate of compliance for starting-up the User undertaking shall consist of:
  - Certificate of compliance for a temporary operation and
  - Certificate of compliance for a permanent operation.

#### **5.4.1. Certificate of Compliance for a Temporary Operation**

- (1) With the certificate of compliance for a temporary operation, the User has the right to connect to the transmission system with the purpose of conducting a necessary functional testing, in accordance with the Grid Code and the Compliance tests.
- (2) Upon the User request, NOSBiH shall issue the Certificate of compliance for temporary operation:
  - a) For generating units on the basis of:
    - Approval for connection of HV undertaking,
    - Agreement on the use of the transmission system,
    - A Permit by the competent authority which covers the period of temporary operations,
    - The User statement on readiness of the undertaking for start-up and for synchronicity,
    - Protocol on protection set-up,
    - Management Agreement,
    - Report on set up communication and on the testing conducted for exchange of necessary measuring units with NOSBiH/Elektroprijenos BiH,
    - Programme of starting-up,
    - Mutually signed and certified Measuring Register.
  - b) For other undertakings on the basis of:
    - Approval for connection of HV undertaking,
    - Agreement on the Use of the Transmission System,
    - The User statement on readiness of the undertaking for start-up,
    - Protocol on protection set-up,
    - Management Agreement,
    - Report on set up communication and on the testing conducted for exchange of necessary measuring units with NOSBiH/Elektroprijenos BiH,
    - Programme of starting-up,
    - Mutually signed and certified Measuring Register.
- (3) During the validity period of the Certificate of compliance, the User must conduct all functional testings and analyses in accordance with the Compliance tests and submit the results to NOSBiH for an approval.
- (4) The Certificate of compliance for a temporary operation shall be issued for a period of twelve (12) months. NOSBiH shall submit a copy of the Certificate of compliance to relevant regulatory commissions and Elektroprijenos BiH along with the data from 4.4.2.
- (5) Renewal of the certificate of compliance shall be approved when, upon the User request, NOSBiH determines that the User has made significant improvement in ensuring full compliance with the requirements from the Compliance tests.

#### **5.4.2. Certificate of Compliance for a Permanent Operation**

- (1) Upon the User request, NOSBiH shall issue the Certificate of compliance for permanent operation on the basis of:
  - Compliance tests results verified by NOSBiH,
  - Exploitation permit,

- A licence for electricity generation issued by the relevant regulatory commission (only for generating units).
- (2) NOSBiH shall submit a copy of the Certificate of compliance for permanent operation to relevant regulatory commissions and Elektroprijenos BiH.

### **5.4.3. Compliance Tests**

- (1) The User must undertake the testing in accordance with Compliance tests:
- During the validity period of a certificate of compliance for temporary operation,
  - After repair or replacement of the equipment that could impact the compliance of the User's undertaking with the technical requirements of this Grid Code,
  - During the lifetime of the User undertaking, upon reasonable request made by NOSBiH.
- (2) Obligations and liabilities of NOSBiH and the User shall be defined by the Compliance Tests.
- (3) The User shall be responsible for safety of the staff and the undertaking during the testings.
- (4) NOSBiH shall have the right to participate in the testings at their location or from its remote Control centre.

### **5.5. Disconnection from the Transmission System**

- (1) Elektroprijenos BiH and NOSBiH, not to be held responsible whatsoever, shall have the right to disconnect the User from the transmission system on the basis of a written order issued by relevant institutions.
- (2) Elektroprijenos BiH and NOSBiH shall have the right to impose a temporary disconnection of the User from the transmission system without prior notice in the following cases:
- Prevention of threats to health and safety of people or equipment,
  - Accidents in power plants and substations,
  - If the User's operational staff fails to fill out the orders made by NOSBiH, unless the staff has done that for safety reasons, which are related to the staff or the undertaking or due to invalidity in a dispatching order or an instruction,
  - Other circumstances beyond of control of Elektroprijenos BiH and NOSBiH, which are not result of any intentional activity of the User or its violation of contract and are not subject to planning.
- (3) Elektroprijenos BiH and NOSBiH shall have the right and the liability to impose a temporary disconnection of the User from the transmission system, upon a written notice, in the following cases:
- Revocation of a license of the User,
  - Any change of technical conditions based on which the connection was made without consent by Elektroprijenos BiH and NOSBiH, if those changes would put at risk safety and quality of supply,
  - Planned repairs or reconstructions of Elektroprijenos BiH undertakings on the basis of harmonized plans of delay,
  - Failure of the User to execute the instructions for elimination of significant technical defects on the plant as well as safety-related instructions,
  - Detection of harmful or any other effects on metering points,
  - Denial of access with the purpose of reading and control at the metering points.

- Unfulfillment of financial liabilities towards NOSBiH and Elektroprijenos which are related to the Tariff for the services of Elektroprijenos BiH and NOSBiH and for ancillary services,
- non-existence of the supplier.

### **5.5.1. Reconnection**

- (1) Elektroprijenos and NOSBiH will ensure that the User's undertaking is reconnected to the transmission system after removing causes of its temporary disconnection.

### **5.5.2. Voluntary Disconnection**

- (1) The User may request permanent disconnection from the transmission system. Should they opt for permanent disconnection, unless otherwise agreed, they shall submit a written notice on disconnection to Elektroprijenos BiH and NOSBiH at least one (1) month before the disconnection date.
- (2) Elektroprijenos BiH/ NOSBiH shall carry out the procedure of disconnection and notify other users in case it finds that the disconnection procedures may have adverse effects on the connection conditions.

## **5.6. Telecommunication and SCADA**

### **5.6.1. Telecommunication**

- (1) Each User shall ensure appropriate telecommunication equipment necessary for communication between NOSBiH, Elektroprijenos BiH and the User (fax, phone, e-mail etc.), and an access to necessary devices and data required by NOSBiH, Elektroprijenos BiH and other Users, in a way defined by the Connection Agreement.
- (2) Each User shall be obliged to provide a Study on telecommunications defining connections of the Users's equipment and system to the telecommunication network of Elektroprijenos BiH, and the methods of data exchange. In creation of the Study on telecommunication and in choosing its telecommunication equipment, the User must ensure compatibility of the telecommunication equipment with existing equipment and to harmonize its choice with Elektroprijenos BiH and NOSBiH.
- (3) After the installation of the telecommunication equipment NOSBiH shall provide monitoring and additional configuration, and if this is not possible, the monitoring and additional configuration may be provided by Elektroprijenos BiH. In exceptional cases, with an approval of Elektroprijenos BiH and NOSBiH, the User may perform managing of the telecommunication equipment. Installed telecommunication equipment, connected to the telecommunication system of Elektroprijenos BiH, will be used for all required data exchanges (real time data, meters reading, protection etc.) and for remote managing, while the public telecommunication networks may be used only in extraordinary cases.

## **5.6.2. SCADA**

- (1) Elektroprijenos BiH and users shall be obliged to ensure appropriate metering installations and reliable communication as to provide that the requested data in real time are continuously entered into the data base of the authorized managing centres.
- (2) NOSBiH monitors and manages the work of EES BiH in real time. Real time data shall be directly sent to NOSBiH's SCADA/EMS equipment and to SCADA equipment at Elektroprijenos BiH through remote terminals from HV plants regardless of ownership. Collection of data from Users undertakings shall be done directly through Users SCADA/EMS equipment or through SCADA equipment of the authorized managing centre to NOSBiH SCADA/EMS equipment and to SCADA equipment at Elektroprijenos BiH, and Elektroprijenos BiH and the Users shall ensure a regular, timely and reliable method of transfer of all data required.
- (3) The following type of data are collected in real time:
  - Measurements (active and reactive power, voltage, frequency);
  - Signalization of switching devices (switchers, disconnectors, grounding units);
  - Positions of tap changers for power transformers of interest;
  - Alarm signals used for protective and managing equipment;
  - Wind speed and direction, pressure and temperature at the Energy parks locations
  - Other data, as appropriate.
- (4) The User shall be obliged to ensure technical possibility for remote control of HV switching devices which serve for electricity transfer.
- (5) Type of data and their exchange method in real time shall be defined by the Management Agreement.

## **5.7. Technical Requirements for the Connection**

- (1) NOSBiH and Elektroprijenos BiH shall provide technical, topological and operational standards in the connection point of the User. The User shall ensure that his undertakings and equipment are in compliance with the technical requirements.
- (2) Frequency, voltage, flickers and harmonic distortions under normal working conditions must meet the requirements of ENTSO-E, EN and BAS(EN) in terms of quality of electric power.

### **5.7.1. Frequency**

- (1) Nominal frequency is 50 Hz. Under normal working conditions and work, the standard range of frequency is  $50 \pm 0,05$  Hz, and maximum frequency deviation is  $\pm 0.2$  Hz.
- (2) Under disrupted working conditions, frequency may range from 47.5 to 49.8 Hz and from 50.2 to 51.5 Hz.

### 5.7.2. Voltage

(1) Range of voltage under normal conditions in the transmission system is:

Rated Voltage (kV)	Voltage Range (kV)	Voltage range (j.v.)
400	360-420	0.9 – 1.05
220	198-245	0.9 – 1.118
110	99-123	0.9 – 1.118

(2) Special provisions of the Connection Agreement with the User may allow, for a particular connection point, major or minor acceptable deviation of voltage from the voltage range as defined in item (1). Larger deviation of voltage from nominal value is allowed only in terms of compliance with procedures on isolation coordination.

### 5.7.3. Flickers

(1) Flicker values caused by the User, according to BAS IEC 61000-3-7:2002, for 95% of 1- minute voltage value over a week, not including into the statistics the flickers caused by voltage dips, must satisfy the following values:

- The short-term flicker severity must be lower than  $P_{st} = 0.8$ ;
- The long-term flicker severity must be lower than  $P_{lt} = 0.6$ .

### 5.7.4. Harmonic Distorsion

(1) The total harmonic distortion factor, THD(%), is a measurement of participation of sin members of the frequency which is a multiple of the frequency of the main harmonic:

$$THD(\%) = \frac{100}{U_1} \sqrt{\sum_{h=2}^{40} U_h^2}$$

where  $U_h$  is an effective (maximum) value of the  $h^{th}$  harmonic and  $U_1$  is effective (maximum) value of the main harmonic.

(2) The total harmonic distortion (THD) in EES must not exceed:

- 3% for 110 kV network, 1.5% for 220 kV and 400 kV network,
- THD for harmonics up to the 40<sup>th</sup> order must be lower than the limits set in IEC/TR 61000-3-6:2002.

### 5.7.5. Phase Asymmetry

- (1) Under normal working conditions, in accordance with IEC 61000-3-13, 95% of 10-minute voltage values, the maximum value of asymmetry of the phase voltage on the transmission system will be less than 2%, i.e. the negative component will be less than 2% of positive voltage component.

### 5.7.6. Reactive power

- (1) Distributors and directly connected buyers whose operations may affect the transmission system must meet the requirements related to reactive power exchange:
  - a) Distributors and directly connected buyers whose operations may affect the transmission system in stationary state shall maintain the range of reactive power under these conditions:
    - For buyers without their own generation, the range of power factor for taking over reactive power from the transmission system shall be from 0.9 up to 1, except in cases when the undertaking owner due to technical and economy benefits proposes differently and upon acceptance by NOSBiH/Elektroprijenos BiH, when it is possible to have different range through common analyses and by taking into account the conditions of connection to the transmission system in accordance with Directive 2009/72/EC.
    - For directly connected buyers with their own generation, the range of power factor shall not be larger than 0.9 for taking over reactive power from the transmission system, and 0.9 for delivery of reactive power into the transmission system, except in cases when the undertaking owner due to technical and economy benefits proposes differently and upon acceptance by NOSBiH/Elektroprijenos BiH, it is also possible to have different range through common analyses and by taking into account the conditions of connection to the transmission system in accordance with Directive 2009/72/EC.
    - For the distribution system connected to the transmission system the range of power factor shall not be larger than 0.9 for taking over reactive power from the transmission system, and 0.9 for delivery of reactive power into the transmission system, except in cases when the undertaking owner due to technical and economy benefits proposes differently and upon acceptance by NOSBiH/Elektroprijenos BiH it is possible to have another range.
  - b) The range of reactive power for directly connected buyers relates only to the point where electricity delivery and receipt is done, and for Distributors this range relates to the point where the distribution system is connected to the transmission system through the transformer.
- (2) NOSBiH/ Elektroprijenos BiH will have the right to require, by taking into consideration the access conditions to the transmission system in accordance with the Directive EC 2009/72, the directly connected system to have the possibility to actively control reactive power exchange as a part of a wider common concept for managing possibilities of reactive power due to benefits for the entire network. The method of this control will be agreed with the Distributor in order to ensure and justify safety

level of supply for both sides. The justification will contain the procedures plan which specifies steps and time frames for fulfillment of these requirements.

### **5.7.7. Protection**

#### **5.7.7.1. Protection Criteria**

- (1) Devices for protection from short circuits for all types of equipment (generators, transformers, busbars, HV lines) selectively remove all breakdowns in a fast and efficient manner. Protective relay systems in the transmission system are designed to provide reserve actions (if possible two protections on the same level of hierarchy), and equipped with main and reserve system for elimination of breakdown. Functioning of the protection may not cause premature outage due to overload or loss of synchronism. Speed and selectivity during a termination of HV line should be improved by the usage of signal connections between both sides of the HV line.
- (2) All Users are required to submit to Elektroprijenos BiH and NOSBiH for approval protection diagrams of their facilities and their settings due to up-date of the study for adjustment of protection devices on voltage level 110kV and up.

#### **5.7.7.2. Time of Protection Action**

- (1) At the request of the User for connection or during the change of conditions for connection, Elektroprijenos BiH shall submit the data on the time required for elimination of a fault or faults at the undertaking, including the recommended method of grounding the elements of the system.
- (2) The total time of basic degree required for the elimination of the fault, including the time from fault occurrence to complete interruption of the power flow, is:
  - For transmission lines 400 kV: up to 100 ms;
  - For transmission lines 220 kV: up to 100 ms;
  - For transmission lines 110 kV: 120 up to 140 ms.
- (3) The Users are required, in coordination with Elektroprijenos BiH, to set the times of response of their protections in a way to meet the requirement of selectivity. A diagram of coordination (selectivity) of protection of the transmission system and any change, shall be submitted to NOSBiH for the final approval. NOSBiH's approval will be based on the basis of results of analyses (transient stability, selectivity...).
- (4) Technique of the automated reconnection (APU) is applied in the EES of BiH, as follows:
  - In 400 kV network: single-pole APU with deenergization of up to 1s;
  - In 220 and 110 kV networks: single-pole and three-pole APU with deenergization of up to 1s.



### **5.7.8. Grounding**

- (1) The transmission system is an efficiently grounded system if a ground junction factor does not exceed 1.4.
- (2) At the system voltage of 110kV and higher, the windings of the generation unit transformers connected to transmission system must have the possibility of connection to the ground.

### **5.7.9. Levels of Short Circuit Currents**

- (1) The transmission system has been designed and functions in such a way to maintain the levels of short circuit currents below the following maximum values:
  - 40 kA on 400 kV system;
  - 40 kA on 220 kV system;
  - 31.5 kA on 110 kV system.
- (2) All the equipment which is part of the transmission system shall be designed in such a way to resist the mentioned values of the short circuit currents, unless otherwise contracted with Elektroprijenos BiH and NOSBiH.

### **5.7.10. Equipment and Instruments**

- (1) Current standards will be applied to all new and modified equipment and instruments. Equipment and instruments must be also in compliance with all additional requirements as defined by Elektroprijenos and NOSBiH, which must be met within technical specifications as a proof that main requirements of valid standards are fulfilled. Users must, as appropriate, supplement technical specifications in order to enable Elektroprijenos BiH and NOSBiH to meet their obligations.
- (2) The Users will make sure that the specification of the equipment and instruments at the network junction point are such as to enable the work within applicable technical and safety procedures as agreed on by the User and Elektroprijenos BiH/NOSBiH.
- (3) The Users will make sure that their equipment and instruments do not cause disruptions in the transmission system from the point of view of higher harmonics, voltage variations, asymmetry and alike.
- (4) All the elements of the transmission system, connected for the first time, must be new and attested, as well as to have adequate certificates in compliance with the relevant standards to confirm the quality.
- (5) All equipment and instruments in each undertaking of the User must be provided with updated and certified technical documentations which shall be available to Elektroprijenos BiH.

### **5.7.11. Subfrequency Relays**

- (1) Elektroprijenos BiH, Distributors and the Users are obliged to install adequate number of subfrequency relays. NOSBiH shall define the operational criteria for the action of subfrequency protection, load values as well as disconnection frequencies, whereas Elektroprijenos BiH, Distributors and the Users will implement this function in accordance with technical-technological characteristics of consumers.

#### 5.7.12. Collection and Exchange of Data in Real Time

- (1) Elektroprijenos BiH and the User shall timely inform NOSBiH about any changes of the transmission system topology at all voltage levels, or a change related to the type or technical characteristics of the installed equipment, especially of the metering equipment and its characteristics, and about changes related to previously defined data collected in real time.
- (2) Elektroprijenos BiH and the User shall timely inform NOSBiH on possible planned works on the equipment for remote monitoring and managing if those works will cause interruptions in communication or collection of data in real time which are performed by DC NOSBiH.
- (3) If all the technical possibilities are exhausted and if due to technical reasons it is not possible to make direct connection and collection of necessary data in real time from HV plant, Elektroprijenos BiH and/or the User shall commit themselves to forward the requested data, if they possess them, from their own managing centres to DC NOSBiH through inter-centre communication. If case of necessity expressed by Elektroprijenos BiH and/or the User, NOSBiH is obliged to submit the requested data to DC OP and/or to the User through the inter-centre communication from its system.

#### 5.8. Additional Technical Requirements for Generating Units

- (1) The new generating unit must remain operational within the frequency range and time intervals given in the following table:

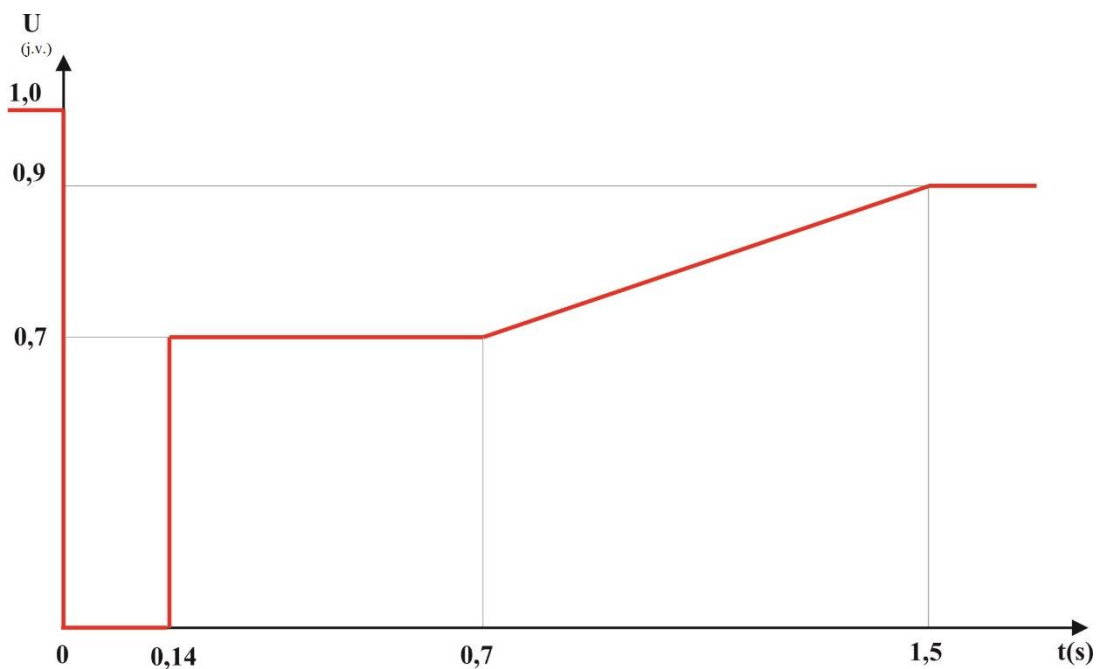
Frequency Range (Hz)	Period of work (min)
47.5 - 49	$30 < t < 60$
49 - 51	Without limitations
51 – 51.5	30

- (2) The generation unit must not generate active power, under normal working conditions, susceptible to the effects of voltage change.
- (3) Each generation unit must be capable of supplying power to the transmission system at every point of the operating diagram.
- (4) The new generating unit must remain operational within the voltage range and time intervals given in the following table:

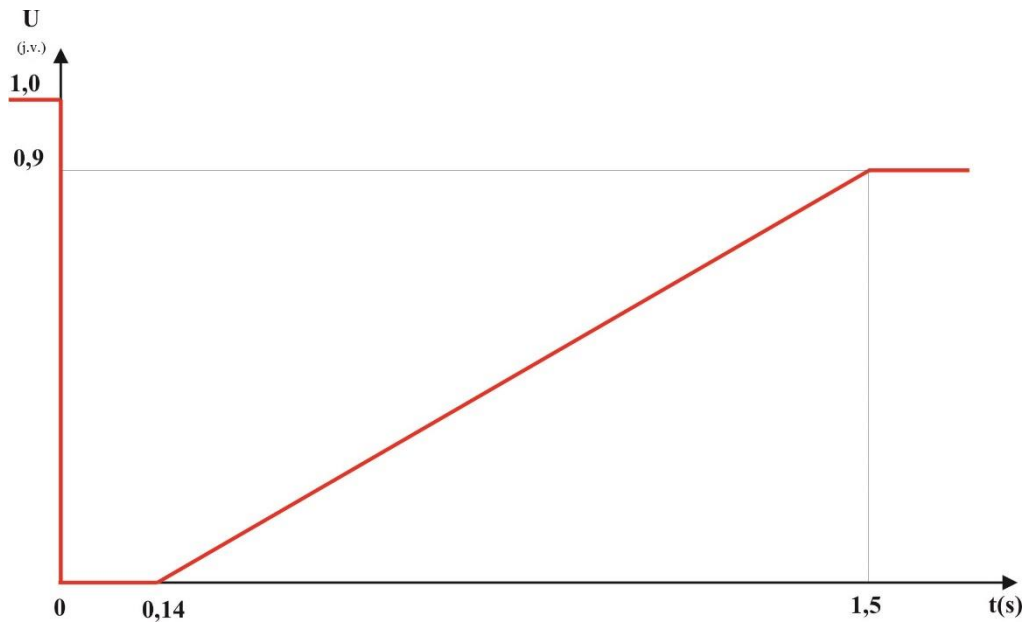
Voltage range	Voltage range	Period of work (min)
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for 110 and 220 kV	for 400 kV	
0.85 – 0.9	0.85 – 0.9	60
0.9 – 1.118	0.9 – 1.05	Without limitations
1.118 – 1.15	1.05 – 1.1	60

- (5) The generation unit which is connected to the transmission system in an isolated mode and still supplies the Consumer, must maintain frequency of the isolated system in accordance with the values and time constraints given in item (1).
- (6) All generation units must have the excitation system with an automated voltage regulator with continuous effect including power system stabilizers if they are, in the opinion of NOSBiH, necessary for systemic reasons which will be defined by the Terms for Connection.
- (7) The generation unit with an approved capability of the restart without the presence of voltage ("black start"), must be technically ready to provide this service if approved by NOSBiH.
- (8) New generation units must be capable to endure the breakdown condition ('Fault ride through' - 'FRT'), i.e. they must be capable to remain in the system and proceed with their stable work in case of voltage dips caused by a breakdown in the transmission system. Voltage-dependent curves for synchronous generators (9) and Energy parks (10), shown in images below, present the lower limit of voltage at the connection point during the voltage dip, as a function of time before, during and after the breakdown. Adjustment of time of undervoltage protection must be in accordance with the curve.
- (9) FRT curve for synchronous generators



- (10) FRT curve for Energy parks



(11) A new generation unit must remain operational and proceed with its stable work when voltage at the connection point during the breakdown remains above the lower limit except if the protection diagram for internal breakdowns demands disconnection of the generation unit from the transmission system.

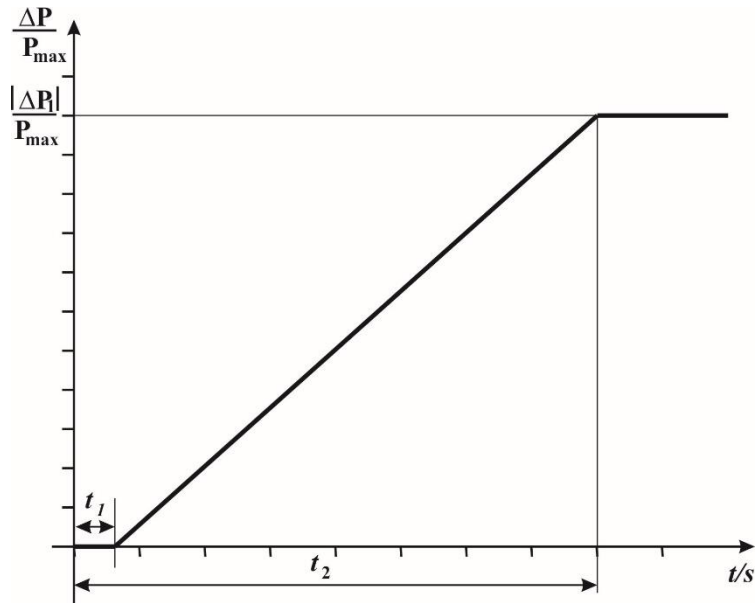
### 5.8.1. Frequency Regulation

- (1) Deviations from nominal frequency by more than 20 mHz are corrected by activating the primary frequency regulators and, if necessary, by activating the energy for frequency restore FRR.
- (2) Ensuring of tolerant frequency values in an isolated mode and in a disrupted (breakdown) operational conditions shall be determined by a plan of sub-frequency unloading.
- (3) As for the interconnected mode, in terms of frequency regulation NOSBiH must respect ENTSO-E conditions.

#### 5.8.1.1. Primary Regulation (The process of frequency regulation)

- (1) Each generation unit (turbo generators and hydro aggregates) connected to the transmission system, must be equipped with turbine regulators which have capability of automated regulation of the speed of rotation. A new generation unit must ensure capability of remote monitoring of the primary regulation status.

- (2) The statism of the regulator should be adjustable in the range of 3-4% for hydro generator, and 4-6% for turbo generators.
- (3) Each turbine regulator should have the possibility to adjust the deadband zone within the range of  $\pm 10$  mHz.
- (4) Response of active power of the generation unit during the process of frequency maintenance must be on or above the solid line shown in the following diagram:



Whereby:

- $P_{max}$  – is maximum output power of the generating unit as defined by the generation permit to which  $\Delta P$  refers to
- $\Delta P$  – is change of the generator's active power
- $t_1$  – is initial time delay
- $t_2$  – is time of full activation.

- (5) The generation unit must provide  $\Delta P$  of output active power by point  $\Delta P_1$  in accordance with the values defined in the following table:

Parameters	Range
Max.allowed initial time delay $t_1$ , unless otherwise indicated for technologies of the generators without inertia	2 s
Max.allowed full time of activation $t_2$ unless longer time is approved for the purpose of the system stability	30 s

- (6) Initial time delay of the activation ( $t_1$ ) must be as short as possible. If the initial time delay is longer than two seconds (2 s), the generation unit owner must explain the need for longer time by providing technical explanations.
- (7) The generation unit must be capable to ensure full response of active power within the time of up to 30 min having in mind the amount of active power and the primary source of the generation unit.
- (8) Accuracy of frequency measurements must be 10 mHz or better.

#### **5.8.1.2. Secondary Regulation (The process of automated frequency restoration)**

- (1) Each new hydrogenerator connected to the transmission system whose installed power  $P_n$  is over 20 MW, must be equipped with regulators that can provide secondary regulation service. The speed of active power change is from 1.5 – 2.5  $P_n$  per second.
- (2) Turbo generators which are capable to provide this service must ensure:
  - The speed of active power change from 1 – 2%  $P_n$  per minute, if coal is the generation fuel
  - And the speed of active power change of 8%  $P_n$  per minute, if gas or mazut are the generation fuels

#### **5.8.1.3. Tertiary Regulation (The process of manual frequency restoration)**

- (1) All generation units which participate in the process of providing tertiary regulation service must satisfy the following conditions:
  - Hydrogenerators must have the time of synchronization to the transmission system less than 15 minutes,
  - Turbo generators must have capability to increase/decrease generation of active power by a full range of regulation in less than 15 minutes.

#### **5.8.2. Technical Requirements for Energy Parks**

- (1) Energy parks connected to the transmission system must comply with the provisions of this Grid Code.
- (2) Due to possible large oscillation of generation, NOSBiH, at the points of their electricity reception/delivery in the transmission system, must provide monitoring of their output values in real time.

(3) Upon NOSBiH's request the energy park must have capability to work in any working position within its profile  $P-Q/P_{max}$  in a specific time period.

(4) The energy park must be capable to automatically ensure reactive power either by managing voltage, reactive power or power factor:

- In order to manage voltage, the Energy park must have capability to manage voltage at a connection point by exchanging reactive power with the system at setpoint voltage which covers the range of at least 0.95 – 1.05 r.j. in steps not bigger than 0.01 r.j. with inclination range 2-7% and steps not bigger than 0.5% of maximum reactive power. Setpoint voltage may be operational with or without deadband zone within the range 0-5% $U_n$ , with steps not bigger than 0.5%.

- In order to manage reactive power, the Energy park must have capability to set given values of reactive power at any place within reactive power range, with the setting of steps not bigger than 5 Mvar or 5% (depending on which of these two is smaller) of full reactive power, by controlling reactive power at the connection point with accuracy within  $\pm 5$  Mvar or  $\pm 5\%$  (depending on which of these two is smaller) of full reactive power.

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- In order to manage power factor, the Energy park must have capability to control power factor at the connection point within a defined range of reactive power.

(5) NOSBiH and the User shall mutually define which of the three methods of managing reactive power with appropriate settings ("setpoint") is to be chosen. The equipment must have capability for remote operability.

(6) In terms of managing the power oscillation damping, the Energy park must be capable to contribute to damping of power oscillation. The characteristics of managing voltage and reactive power of the Energy park should not have negative impact on damping of power oscillation.

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## **6. Operational Code**

(1) This Code shall apply to NOSBiH, Elektroprijenos BiH, Distributors and Users of the transmission system.

### **6.1. Planning**

#### **6.1.1. Projection of Consumption and Generation**

- (1) By the end of October in each year NOSBiH shall make annual Balance sheet for electric power in the transmission system which shall include detailed information on the monthly amounts for the next year. During the drafting of the Balance sheet NOSBiH shall coordinate the data with Users.
- (2) With the view of drafting the annual Balance sheet on the transmission system, the Users shall provide to NOSBiH, in a manner and time indicated, the following data:

- Each Distributor and directly connected buyer shall submit to NOSBiH, by end of September of each year, objective projections of minimum and maximum levels of power (MW, MVAR) (gross amount and amount taken from the transmission system) for each month of the following year;

- Each Distributor and directly connected buyer must submit to NOSBiH, by end of September of each year, objective projections of total consumption of electric power (MW, MVARh), as well as the amount of power a distributor or a user has planned to take from the transmission system for each month of the following year.

- Details from the previous paragraphs shall be delivered for each junction point of the Distributor or directly connected buyer.

- Each Distributor shall submit collective monthly data on planned generation of units connected to the distribution system.

- In their projections, each Distributor and directly connected buyer must indicate possible projected changes of power consumption, which might occur due to new projects which have been planned but not implemented yet.

- (3) With the view of drafting the annual Balance sheet on the transmission network, by the end of September in each year, each producer shall submit objective projections of electric power generation and of power for each HPP and RES, and for each generator in TPP, for each month of the following year.

- (4) NOSBiH shall make assessment of the value of loss for the transmission system on a monthly basis, as well as of the scope of reserves required for frequency restoration.

- (5) When determining the projections of the transmission system load, NOSBiH shall take into account the following factors:

- Historical consumption data and data from the User;
- Projections of transmission losses;
- Expected flows in interconnection lines;
- Other information by the User;
- Projected consumption of the pumped- storage units.

### **6.1.2. Planning of Outages/Shut-downs**

- (1) This section contains the procedures which enable NOSBiH to make evaluation of system safety and availability during specific time periods in accordance with ENTSO-E operational security standards.



### 6.1.2.1. Annual Plan of Outages

- (1) NOSBiH shall make the annual plan of outages in accordance with the data delivered by Elektroprijenos BiH (time periods of outages of the transmission system elements owned by it) and by the Users (time periods of outages of the transmission system elements and of the generation units owned by them). The annual plan of outages shall consist of precisely defined time periods for longterm outages and time periods for shortterm outages.
- (2) During the preparation of the annual plan, NOSBiH shall take measures to harmonize requirements for the planned disconnections of Elektroprijenos BiH and of the Users. In cases when the requests of Elektroprijenos BiH and/or of the Users cannot be met for legitimate reasons, additional consultations shall be made between NOSBiH, Elektroprijenos BiH and the User in order to make an adequate annual plan. In these circumstances, NOSBiH is authorized to make a final decision.
- (3) Chronology of harmonization of long-term plan of outages:
  - End of August: Elektroprijenos BiH and the Users shall submit to NOSBiH the first draft of the annual plan of outages for next year.
  - End of September: NOSBiH shall make a draft of the annual plan and submit it to Elektroprijenos BiH and the Users.
  - End of November: NOSBiH shall harmonize the draft of the annual plan with the plans of neighbouring system operators.
  - End of November: NOSBiH shall make the final annual plan of outages after it has been harmonized at the regional level.
- (4) Time period of a disconnection defined by the annual plan of outages may be modified by:
  - Timely notice of NOSBiH on the change of time of the beginning of disconnection in order to ensure reliable supply or operational safety of EES;
  - Agreement between NOSBiH and a party responsible for managing a generation unit in cases when those changes affect only that particular generation unit;
  - Agreement between NOSBiH and directly connected buyers in cases when such changes affect only that particular consumer;
  - Agreement between NOSBiH and Elektroprijenos BiH in cases when such changes affect only Elektroprijenos BiH;
  - Agreement between NOSBiH and the Distributor in cases when such changes affect only that particular Distributor;

- Agreement between the User and Elektroprijenos BiH, if approved by NOSBiH, with an assessment of the effect of such an arrangement on system conditions;
- Agreement between NOSBiH and regional coordinator, block coordinator and neighbouring system operators when the change of time of disconnection affects those systems.

#### **6.1.2.2. Monthly Plan of Outages**

- (1) Elektroprijenos BiH and the Users shall be obliged by the 20<sup>th</sup> in a month (M) to confirm the time of planned outages projected by the annual plan of outages for two (2) months ahead (M+2) or to propose eventual changes.
- (2) When creating the monthly plan of outages NOSBiH shall also define the time and duration of a planned outage.

#### **6.1.2.3. Disconnection Requests**

- (1) Elektroprijenos BiH and the Users shall ask NOSBiH for a written consent to carry out planned disconnections within the deadlines established by NOSBiH. Elektroprijenos BiH shall be obliged to ensure Users' compliance in case that a planned outage causes interruption in supply.

#### **6.1.2.4. Unplanned Outages**

- (1) When, due to unavoidable circumstances, Elektroprijenos BiH or the User need to carry out an unplanned disconnection, they must inform NOSBiH thereof and ask for approval.  
The request for approval must contain:
  - All the details on the equipment and instruments to be disconnected and possible effects;
  - The date and time of the beginning and end of the unplanned disconnection.
- (2) NOSBiH may request from Elektroprijenos BiH or Users to make changes related to the unplanned disconnection when NOSBiH determines that the disconnection may seriously affect power system security. If Elektroprijenos BiH or Users agree with a suggested alternative, NOSBiH must send a written notice with a new date and time of the unplanned disconnection.

#### **6.1.2.5. Outages**

- (1) In case that the User's undertaking or any of the transmission system elements are affected by a forced outage, NOSBiH must be informed about the incident as soon as possible. Elektroprijenos BiH or the User shall estimate possible duration of the outage and provide to NOSBiH all necessary details. If their estimations of the time and date of reconnecting to normal operating mode cannot be submitted together with the initial report on the disconnection, Elektroprijenos BiH or the User shall inform NOSBiH about the matter as soon as possible.

- (2) In case that a forced outage of transmission network elements results with failure to supply electricity to the Distributor/User, NOSBiH or Elektroprijenos BiH shall notify the respective Distributor/ User about the reasons for the outage and about preliminary estimations of outage duration.

### 6.1.3. Daily Schedules

- (1) Daily schedules are submitted electronically by a direct input of data into NOSBiH's EES platform in a defined format.
- (2) Entry and change of daily schedules are possible every day in accordance with the Instructions for daily schedules nominations ([www.nosbih.ba](http://www.nosbih.ba)).
- (3) Information on acceptance or rejection of a daily schedule may be seen at the user's ESS application.
- (4) Upon the expiry of submission deadline, NOSBiH shall verify the validity of each submitted daily schedule.
- (5) NOSBiH may declare invalid a final daily schedule or any of its parts in the following cases:
  - (a) if a daily schedule contains crossborder exchange with no crossborder capacity provided,
  - (b) if a daily schedule contains crossborder exchange which are not harmonized with neighbouring system operator,
  - (c) if a daily schedule contains crossborder exchange which are not harmonized within BiH Control Area,
  - (d) if a daily schedule contains internal exchange within published net constraints in BiH,
  - (e) if a daily schedule contains any data which is technically unacceptable or is illogical (eg. generation higher than technical maximum)
  - (f) if a daily schedule is not in balance.
- (6) In case that NOSBiH declares a final daily schedule or any of its parts invalid, NOSBiH shall inform thereof the party which nominated the schedule and provide reasons for such a decision.
- (7) If a daily schedule needs any correction, NOSBiH shall send the information on necessary correction which may be done within the defined correction cycles. If after the notice on necessary corrections and an end of the correction cycles, there was no corrected version of a daily schedule delivered, NOSBiH may adapt the submitted daily schedule in one of the following ways:
  - a) By reducing unbalanced values of nomination to lower value,
  - b) By elimination of unbalanced values of nomination.
- (8) Upon reception of last version of a daily schedule, NOSBiH shall also verify its validity.
- (9) A daily schedule shall be deemed to have been approved when the User receives by NOSBiH a confirmation of balance and a confirmation of harmonized exchanges.
- (10) Changes of an approved daily schedule are possible every day in accordance with the Instructions for daily schedules nominations ([www.nosbih.ba](http://www.nosbih.ba)).

#### **6.1.4. Short and Medium-Term Adequacy, D2CF models**

In line with the Procedures for critical network situations approved by ENTSO-E SOC (System Operation Committee) the Users are obliged to:

- regularly submit their 24 hour programme of generation and consumption for two days ahead (D-2) because of creation of 24 individual models for two days ahead (D2CF)
- regularly submit their 24 hour forecast of generation and consumption for next seven days for compilation of documents on available adequacy.

#### **6.1.5. Congestion Management**

- (1) NOSBiH shall calculate and publish available capacity values for each direction and each border separately. The Rules for allocation of cross border transmission capacities shall be published on NOSBiH web page.
- (2) NOSBiH shall calculate total transmission capacity (*TTC*) and harmonize it with neighbouring system operators with respect to safety criteria.
- (3) Net transmission capacity (*NTC*) is a positive difference between *TTC* and *TRM*

$$NTC = TTC - TRM$$

- (4) Available transmission capacity (*ATC*), before nomination of daily schedules related to the longterm rights to transmission capacity, is calculated by using the formula  $ATC = NTC - AAC$ , whereby *AAC* is the value of already allocated capacity, and it is followed by the formula  $ATC = NTC - CAX$ .
- (5) In case of congestion in the system, NOSBiH shall ensure updated values of *ATC*. NOSBiH shall identify all transmission lines and parts of the transmission system that could be affected by these congestions.
- (6) In order to ensure integrity and safety of EES, NOSBiH is authorized to partially or completely terminate all imports/exports which contribute to unexpected congestion in the system by giving a timely notice and afterwards a written explanation.
- (7) In case of internal congestion and with the purpose to ensure integrity and safety of EES, NOSBiH has the right to make redispatch of generation.

#### **6.2. Transmission System Management**

- (1) In order to make meaningful decisions related to safe and reliable operations of EES, NOSBiH must know, at any given time, the electric topological structure of the system as a whole as well as the overall status of the equipment in the system. NOSBiH must monitor

the electric process parameters of the system (voltages, power flows, power of plants' current generation, current consumption, deviation of power of exchange toward adjacent systems, regulation requirements, frequency, effects of power protection and alike), as well as keep the statistics of operational incidents. Supervision of the mentioned elements i.e. of the process sizes of EES is done by the system operator through SCADA system.

(2) NOSBiH must supervise all the works being performed in the system which affect its topology structure and transmission capabilities.

(3) NOSBiH is responsible for:

- (a) Managing operation of all high-voltage equipment in BiH of voltage level 110 kV and more whose function is to transfer electricity;
- (b) Issuing instructions in the managing process;
- (c) Balance market management;
- (d) Regulation of frequency and exchange power in the Control Area;
- (e) Voltage maintenance and;
- (f) Reenergization.

(4) NOSBiH carries out the above given functions by issuing dispatching orders for:

- Manipulation of commuting equipment in the transmission system;
- Engaging Ancillary services;
- Activating/shut-down and regulation of the equipment for reactive compensation (capacities/reactor/ SVC/ change of the position of a transformer switch);
- Redispatching with the purpose to eliminate congestion in the system.

(5) NOSBiH shall issue dispatch orders related to a change of the approved daily schedule only in case of danger for the system safety and/or engagement of ancillary services.

(6) NOSBiH must make sure that all dispatch instructions are kept in an appropriate form in accordance with provisions of the Law which regulates this area and internal acts of NOSBiH. Elektroprijenos BiH and every User may request access only to the information relating to their own equipment and instruments.

### **6.2.1. Frequency Maintenance**

1. NOSBiH shall maintain frequency in accordance with ENTSO-E Rules and the Market Rules by using FCR, FRR and RR.
2. Calculation of required amount of FRR shall be done in accordance with Ancillary Service Procedure.

#### **6.2.1.1. Primary Regulation (Process of frequency maintenance)**

1. In the interconnection, EES of BiH, as a single Control Area, must provide a set reserve of primary regulation at any time, in compliance with its share of generation in the total ENTSO-E generation.

2. The range of primary regulation has been defined by the value of active power in which the system that regulates the speed of the mechanism operates automatically in both directions in case of frequency deviation. That is the power which has to be provided in accordance with the coefficient of contribution set by ENSTO-E Standards.

#### **6.2.1.2. Secondary Regulation (Process of frequency restoration)**

(1) The objectives of frequency restoration are:

- Realization of the planned program of power exchange between BiH and neighbouring systems in the interconnection,
- Take over of frequency regulation from the activated FCR and its restoration,
- Returning the system frequency to the set value.

(2) The process of frequency restoration is an ancillary service at the level of EES with a minute response in order to maintain the desired power of exchange and frequency in the interconnection, i.e. only the frequency in an isolated mode of the Control Area or a part of EES. It is achieved through a system of regulation of the speed of generation units and active power group regulators of the power plant, if installed in the power plants with several generation units.

(3) Engagement of secondary regulation is done in accordance with Ancillary Service Procedure

#### **6.2.1.3. Tertiary Regulation (Manual engagement of FRR)**

- (1) Manual FRR is engaged by issuing a dispatch order or by activating software within 15 minutes.
- (2) In case that the required amount of reserve can not be provided in EES BiH, NOSBiH can provide it from other control areas in accordance with relevant agreements.

#### **6.2.2. Maintenance of Voltage and Delivery of Reactive Power**

- (1) In order to maintain security and integrity of the EES of BiH, NOSBiH manages the flows of reactive power in the transmission system as to maintain voltage within the margins defined in 5.7.2(1).
- (2) NOSBiH shall issue dispatch orders for managing available capacities and inductive reactive sources (generators, transmission lines, compensators etc.) and orders for changing the position of the regulation selector switch of 400 kV and 220 kV transformers in order to maintain the system voltage within the defined margins.

#### **6.2.3. Communication**

- (1) NOSBiH shall define the format and contents of dispatch order and instructions which shall be issued after consultation with Elektroprijenos BiH and Users.

- (2) The person who receives a dispatch order or instruction must repeat it so that the person issuing the order is sure that the order has been properly understood. The person who receives a dispatch order or instruction will implement it only after he/she has received the confirmation by the person who issued a dispatching order or instruction.
- (3) The User or Elektroprijenos BiH, with an appropriate explanation, may reject a dispatch order and instruction for safety reasons - related to the staff or equipment - or due to invalid dispatch instruction or order.
- (4) Under no circumstances may a valid dispatch order issued by NOSBiH to the User or Elektroprijenos BiH be ignored for commercial reasons.
- (5) In case of an unexpected problem during the implementation of the dispatch instruction or order which affects the safety of people and equipment, NOSBiH must be informed about the matter immediately.
- (6) In case of complete loss of communication, Elektroprijenos BiH and the User must work as responsible and reasonable operators.
- (7) In case of loss of communication, the power plant shall not be managed out of its safety margin i.e. the User must maintain the system frequency and the voltage levels within allowed limits.
- (8) In case of interruption in communication or broken communication, the affected parties shall take all necessary steps to reestablish any kind of communication as soon as possible.

## **7. Code of Measures in Unexpected Situations**

- (1) This Code shall apply to NOSBiH, Elektroprijenos BiH, Distributors and Users of the transmission system.
- (2) NOSBiH is responsible for implementation of the system safety measures in unexpected operating modes. Taking into account technical characteristics of the transmission system and the user, NOSBiH shall, in a specific document, define detailed measures and procedures for protecting the system from disruptions that may lead to partial or total breakdown, as well as the procedures for restoration of the system.

### **7.1. Protection Plan against Disruptions**

#### **7.1.1. Consumption Control**

- (1) Distributors and directly connected buyers shall comply with the measures of consumption restrictions which NOSBiH may take in order to maintain the security of the system and smooth supply of priority consumption.
- (2) When implementing the measures to reduce consumption NOSBiH shall have a non-discriminatory approach to electricity buyers in the transmission system and use them only after all other measures for maintenance of the system's security have been taken.

##### **7.1.1.1. Consumption Control Methods**

- (1) The consumption control includes:

- Voltage reduction initiated by NOSBiH

- Load reduction initiated by NOSBiH
- Automated subfrequency unloading
- Emergency manual unloading

(2) NOSBiH shall agree with Distributors and directly connected buyers all the details related to the controlled consumption unloading by voltage reduction and/or partial or complete disconnection of Users from the system.

#### **7.1.1.2. User Voltage Reduction**

- (1) In case of the threat of voltage collapse, NOSBiH, along with Elektroprijenos BiH, distributors and the system Users, shall activate the measures of voltage reduction at the consumers voltage supply levels of up to five percent (5%). In such cases, NOSBiH shall issue instructions to Elektroprijenos BiH to change the position of the regulation switch of the transformer at certain points of the system.
- (2) If the reactive resources are not adequate, NOSBiH shall issue an order to reduce consumption with the purpose to prevent voltage collapse.

#### **7.1.1.3. Load Reduction Initiated by NOSBiH**

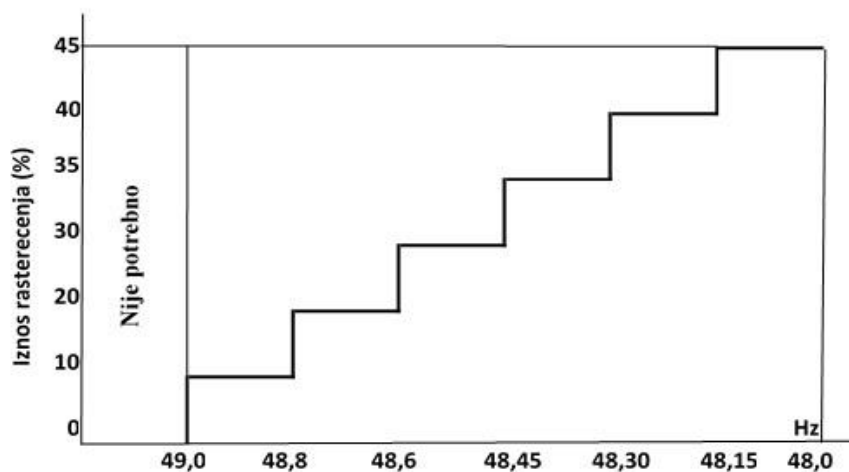
- (1) In case of disruptions in the EES in BiH which endanger security of the system and which have been estimated to last for a longer period of time, NOSBiH shall request load reduction. Under these circumstances, depending on the extent of the disruption, NOSBiH shall, in consultation with the Distributor, prepare a plan of load reduction for 45% of the consumption (divided in 6 steps, in 5% and 10%) in 35 kV, 20 kV and 10 kV distribution lines in each power transformer station of 110/x kV.

#### **7.1.1.4. Automated Subfrequency Unloading**

- (1) Distributors and buyers are obliged to prepare and implement the plans of subfrequency protection which contain a classification of consumers by degree of their priority, technological characteristics and power. Automated subfrequency unloading is achieved by using subfrequency relays which must have differential and time part. The total unloading of the system is 45% of nominal loading (in total) and is realized by operating sub frequency relays within the range from 49.0 up to 48.00 Hz. The plan of subfrequency unloading of the EES BiH must be in compliance with ENTSO-E General plan for automated sub frequency unloading which sets out the following:
  - a) Unloading of consumption is obligatory at 49.00 Hz, and gradual unloading of up to 45% of nominal loading (collectively) should be realized by operation of sub frequency relays within the range from 49.0 to 48.0 Hz.
  - b) At least 5% of total consumption should be unloaded at 49.0 Hz which should be compensated with loss of generation which is at this stage caused by decrease of frequency since the system's requests have not been met.
  - c) Under 49.0 Hz, the plan of unloading in steps should be supplemented by individual moderation of generation loss. The plan of sub frequency unloading should be adjusted as to compensate additional generation losses.
  - d) Frequency steps should be lower than or equal to 200 mHz (depending on the number of steps and the characteristics of sub frequency relays).



- e) For each step of automated sub frequency unloading it is allowed to disconnect no more than 10% of the load (depending on the number of steps and the characteristics of sub frequency relays) unless additional generation losses are taken into consideration.
- f) The maximum time-delay of disconnection should be 300 ms including a time response of the circuit breaker. No intentional time-delay should be added.
- g) Measurements of frequency for unloading should be maintained with a maximum measurement error of 30 mHz.
- h) Automatic disconnection of pumping stations should be activated below 49.8 Hz:
  - If  $49.2 \text{ Hz} < \text{frequency} < 49.8 \text{ Hz}$ , then delay is  $\leq 10 \text{ s}$ .
  - If frequency is  $\leq 49.2 \text{ Hz}$ , then delay is  $= 0 \text{ s}$ .
  - Below 49.2 Hz all pumping stations must be disconnected.



(2) The percentage of automated unloading is related to the peak power of the Distributor and directly connected buyer in the transmission system in previous year. Elektroprijenos BiH and each Distributor and directly connected buyer in the transmission system shall once a year inform NOSBiH on the location of a subfrequency relay as well as on the total expected reductions of consumption which is possible to achieve in each distribution system junction point.

#### 7.1.1.5. Automated Under Frequency Load Shedding

- (1) Automated under frequency load shedding should provide automated reduction of active power generation which is being injected into EES. In cooperation with other system operators NOSBiH shall define the following parameters for automated under frequency load shedding in the Defence Plan of EES:
  - (a) Frequency threshold for activation of the Plan;
  - (b) Reduction ratio of injected active power.

#### 7.1.1.6. Emergency Manual Unloading

(1) In order to prevent endangering of safety of the EES or any of its parts with a threat of a total or partial breakdown followed by overload of the transmission system elements, voltage reduction and/or frequency below the acceptable limit, NOSBiH may request, from the Distributor or Elektroprijenos BiH, an emergency manual disconnection of loads in certain parts of the system or in the entire plant. Elektroprijenos BiH and Distributors are responsible for the implementation of NOSBiH orders.

### **7.1.2. Resynchronization of Islands**

- (2) When parts of the system cease to be mutually synchronized but there is no total or partial interruption, NOSBiH shall issue instructions to certain Users to regulate their generation or consumption, as the case may be, to enable resynchronization. NOSBiH shall inform the Users on success or failure of the synchronization.

### **7.1.3. Multiple Incidents in the System**

- (1) Multiple incidents in the system, according to NOSBiH, Elektroprijenos BiH and the Users, may lead to or may have serious and/or many consequences for the entire system. When NOSBiH establishes that a multiple incident has occurred, it shall take all necessary steps as to prevent further disintegration of the system.

## **7.2. Operational Restoration of the System after Total Breakdown**

### **7.2.1 Plan of the Operational Restoration of the Electric Power System**

- (1) With support of Elektroprijenos BiH and the Users, NOSBiH is responsible for preparation and updating of the plan of restoration of the EES. This Plan shall introduce a framework strategy for restoration of the EES after the entire EES of BiH or some its parts were disconnected from the European system.
- (2) The objective of the plan of restoration of the EES is to provide guidelines for all parties included in the process of the EES restoration so that the power supply would be restored as soon as possible. The plan of the operational restoration of the EES should be flexible depending on black start possibility of the power plants and of the transmission facilities.
- (3) The framework strategy for rehabilitation of the EES, to be followed by the Users, shall be given in the Plan of restoration of the EES and shall define these steps:
- (a) Priority establishment of supply from the neighboring systems with the aim of perserving thermal parameters of thermal generators, priority consumption supply and faster rehabilitation of the system;
  - (b) Introduction of a certain number of isolated insular systems which rely on black start of power plants;
  - (c) Supply of local load from these power plants' *black start*;
  - (d) Synchronization, step by step, and interconnection of isolated EESs;
  - (e) Final and complete restoration of the normal operating mode of the entire EES, including connections to the neighboring systems.

#### **7.2.1.2. Updating the Power System Rehabilitation Plan**

- (1) In cooperation with Elektroprijenos BiH, NOSBiH is responsible for updating of the EES Rehabilitation Plan. This Plan shall be updated and revised every five (5) years.

(2) In the period between formal revisions, NOSBiH may, in cooperation with Elektroprijenos BiH, issue revised versions of the Rehabilitation Plan in order to harmonize it with changes of technical parameters which might affect changes of specific reconstruction procedures (new power plants, high-voltage lines, priority consumers).

### **7.2.1.3 Implementation of the EES Rehabilitation Plan**

(3) During the rehabilitation process of the EES, Elektroprijenos BiH and the Users must comply with NOSBiH's orders.

(4) After the process of the EES rehabilitation is done, NOSBiH shall inform Elektroprijenos BiH and the Users on normalization in the EES.

## **7.3. Training**

(1) NOSBiH has to make sure that its staff, which potentially may be included in the EES Rehabilitation Plan, are familiar with the plans and have adequate knowledge to implement, verify and adjust them.

(2) It is the liability of Elektroprijenos BiH and of the Users listed in the plans to provide adequate training for their employees to be included in the Defence Plans and the EES Rehabilitation Plan, as well as to make sure that those employees have adequate qualifications and experience.

## **8. Metering Code**

(1) This Code shall apply to NOSBiH, Elektroprijenos BiH, Distributors and Users of the transmission system.

(2) The Metering Code sets forth the rules, rights and liabilities related to measuring of electrical power and dispose of certain data.

(3) The data are stored in AMR system and in the calculation database and they present the basis for calculation of electricity flows in the EES of BiH (delivery, reception, peak power, ancillary services, imbalance...) for each settlement period.

(4) All system Users shall have adequate measurement readings to enable the registration and collection of data on the flows of active and reactive power every fifteen (15) minutes, and of data on peak power. NOSBiH shall collect the calculation metering data for the settlement and payment.

### **8.1. General Requirements**

(1) The main principles adopted in this Metering Code are as follows:

- a) Each metering point must have a metering installation;
- b) Every interconnection line must have a metering installation;
- c) Metering installations must

- be verified by the relevant institutions;
- be capable for remote reading;

- have possibility to measure active and reactive energy (kWh; kVArh) and peak power (kW);
- keep memorized data on measured values at least for last forty five (45) days;
- be timely synchronised;
- be entered into the Metering Registry.

d) All metering data shall be collected and stored in ARM system and then in the calculation database of readings at NOSBiH;

e) The party responsible for the measurement is also responsible for the inspection of the metering installations;

f) Elektroprijenos BiH shall perform the registration and shall update the Metering register as to enable the implementation of the Metering Code in terms of:

- creating new BMM (Billing metering point) and upgrading existing BMM and performing settlement of energy sizes in those BMM;
- creating new and upgrading existing metering installations and their characteristics;

g) All metering installations must be in compliance with the standards set forth in this Metering Code.

h) Metering data are used in the process of calculation of power flows, imbalance and ancillary services.

## **8.2. Defining of Metering Points and Measurement Parameters**

### **8.2.1. Defining of Metering Points**

- (1) Unless otherwise defined, Elektroprijenos BiH shall be responsible for the metering installations and for maintenance of the installations in line with the technical requirements for all the metering points at the interstate transmission lines and at the border lines with the Distributors, and for all the metering points between the Users and Elektroprijenos BiH located at Elektroprijenos BiH undertakings.
- (2) Unless otherwise defined, the Users shall be responsible for the metering installations and their installation and maintenance in line with the relevant technical requirements for all the metering points between the User and Elektroprijenos BiH located at the User's undertaking.
- (3) The responsible party must ensure that the metering installation is located in the metering point.
- (4) In cases when the metering installations can not be placed in the metering point (e.g. distant location) the compensation shall be ensured as to cover losses in the energy transformer and/or transmission line in order to satisfy total accuracy requirements.
- (5) Compensation may be done locally, with the metering equipment, or remotely, with a software. In both cases compensation must be approved by the parties involved. The agreed decision shall be delivered to NOSBiH. Final formula for compensation shall be kept at the Metering Registry along with the contractual clauses and parameters.

### **8.2.2. Metering Parameters**

(1) Each metering point must have a possibility of registration and remote reading of active and reactive power every fifteen (15) minutes, and of peak power.

(2) For each metering point the following readings are required:

- (a) Reception (kWh)
- (b) Delivery (kWh)
- (c) Reception (kVArh)
- (d) Delivery (kVArh)

3) During each fifteen (15) minute period, the following measurement of peak power shall be provided:

- (a) Reception (kW)
- (b) Delivery (kW)
- (c) Reception (kVAr)
- (d) Delivery (kVAr).

4) Certain types of readings may be omitted as agreed with NOSBiH.

#### 8.2.2.1. Metering Accuracy

(1) All power meters of active and reactive power must comply with Standards BAS EN 62052-11 (2016), BAS EN 62053-21 (2006), BAS EN 62053-22 (2006) and BAS EN 62053-23 (2007).

(2) Classes of metering installations accuracy are listed in the table below:

Type	Class of accuracy of metering equipment in a connection point	
	400 kV and 220 kV	110 kV
SMT	0.2 S	0.2
NMT	0.2	0.2
Meters of active energy	0.2	0.2
Meters of reactive energy	2	2

3) Total metering accuracy is presented in the following table:

Current as the percentage of rated current	Power Factor	Error margins for circuits on	
		400 kV and 220 kV	110 kV
Active energy			

20% up to 120%	1	$\pm 0.5\%$	$\pm 1.0\%$
5% up to 20%	1	$\pm 0.5\%$	$\pm 1.0\%$
1% up to 5%	1	$\pm 0.7\%$	$\pm 1.4\%$
20% up to 120%	0.5 behind to 0.8 ahead	$\pm 1.0\%$	$\pm 1.8\%$
Reactive energy			
10% up to 120%	0	$\pm 4.0\%$	$\pm 4.0\%$
10% do 120%	0.866 behind to 0.866 ahead	$\pm 5.0\%$	$\pm 5.0\%$

### 8.2.3.2 Metering Resolution

- (1) The resolution of power registration during the registration period will be 0.5 times  $k\%$  better than the registered power at the rated level. Factor  $k$  represents a meter accuracy class.

### 8.3. Metering Installation

- (1) The metering installation components consist of the following elements:

- (a) Metering transformers,
- (b) Meter,
- (c) Devices for data storing (registrator),
- (d) Communication system accorded to the communication system of Elektroprijenos BiH,
- (f) Clamped conductors.

- (2) Some components must be insured within the same part of equipment as well.
- (3) Metering installations must be protected from outside influences and from the system influences (supply interruption and similar).

#### 8.3.1. Metering Transformers

- (1) Current (CT) and voltage (VT) metering transformers must comply with valid standards.

#### 8.3.2. Meters

- (1) Active and reactive energy meters must have three systems and two systems and must satisfy the defined accuracy classes.
- (2) Each meter shall be marked by a unique name (EIC code) and this information along with the technical details and its specifications shall be available to Elektroprijenos BiH as to enter the meter into the Metering Register.

### **8.3.3. Data Storage**

- (1) Capacity of the device for storage of fifteen-minute data must be capable to store all the data metered in the period of at least forty five (45) days.
- (2) NOSBiH shall, in cooperation with Elektroprijenos BiH, define i.e. choose a format, protocol and timeframe for the remote data reading, in compliance with ENTSO-E Standards and the Market Rules requirements.
- (3) NOSBiH shall have the possibility to repeat remote collection of data at any moment throughout the period of data storage.
- (4) Metering installations shall be equipped with protection against losing the stored data.
- (5) The devices for storing the readings shall provide the following:
  - a) Incomplete values of power and consumption, those in which the interruption occurred and/or supply was restored for the data storage device, and the zero value of power and consumption caused by a power supply problem of the data storage devices, shall be marked so that the system for collection of readings could identify them.
  - b) Until supply is restored, clock, calendar and all the data shall be stored in the requested period.
  - (c) "Reading" of the data in any case shall not erase or modify the stored data readings.

### **8.3.4. Metering Installations Protection**

- (1) After the start-up, all metering installation equipment shall be sealed in accordance with an adequate procedure. A seal will be placed in a manner that the interior of the metering instrument cannot be accessed without breaking the seal.

### **8.3.5. Data Access**

- (1) Readings stored in the metering installation shall be protected against unauthorized local access or against remote electronic access by appropriate codes.
- (2) Elektroprijenos BiH shall ensure that NOSBiH has a "read" approach to the calculation data through the base where the metered data are located i.e. a direct access to BMP (Billing Metering Point) for interstate lines.
- (3) The Users shall ensure to NOSBiH and Elektroprijenos BiH a "read" approach to the data directly through the meter or through the base where the metered data are located, with NOSBiH's approval.
- (4) Elektroprijenos BiH shall ensure to the Users to have "read" approach to the data related to them.

## **8.4. Testing and Calibration of Metering Installations**

- (1) Metering installations must be calibrated and tested in accordance with the valid standards and regulations.
- (2) Elektroprijenos BiH shall approve startups of the metering installations.
- (3) Any change of parameters in existing metering installations must be approved by Elektroprijenos BiH.

### **8.4.1. Meters**

- (1) All meters must have:
  - a) Initial calibration – All meters shall be calibrated before they enter commercial use, in compliance with specifications requirements of the authorized institution and this Metering Code.
  - b) Periodical tests – All meters shall be tested regularly, calibrated periodically and replaced if necessary.
- (2) The testing and calibration is carried out in compliance with the appropriate standards and valid regulations on metering. The dates and results of all tests must be submitted to Elektroprijenos BiH. Special tests may be requested if necessary.

### **8.4.2 Metering Transformers**

- (1) New metering transformers must be calibrated before they enter commercial use.

### **8.4.3 Data Storage Devices**

- (1) New data storage devices must be tested before they enter commercial use.

## **8.5. Meter Errors**

- (1) In case that NOSBiH detects an error or an error is suspected, or if the User reports an error to NOSBiH, NOSBiH shall initiate the following procedure:
  - a) Inform the party responsible for metering within 24 hours.
  - b) When necessary order local collection of metering data
  - c) Order the party responsible for metering to inspect and remove the problem.
- (2) NOSBiH, Elektroprijenos BiH, the User and the Distributor shall agree between themselves on a method to correct the error.

## **8.6. Metering Register**

- (1) The purpose of the Metering Register is the registration of metering points by appropriate formulas for all the Distributors and Users connected to the transmission system, and the registration of appropriate metering points in interstate transmission lines.



- (2) Elektroprijenos BiH shall be responsible for setting up the Metering Register and its update, administration and accuracy.
- (3) Elektroprijenos BiH shall define a format for the submission of all necessary data (published on Elektroprijenos BiH web page) in the Metering Register. The format shall contain the following:
  - a) Data on the metering point (location, responsible party, identification codes, schemes, formulas for calculations of electricity acceptance/delivery and other relevant data);
  - b) Data on the metering installation equipment (manufacturer, type, serial number, production year, a class of the metering installation and calibration dates);
  - c) Information on communication.
- (4) The User shall be obliged to submit the documentation required for setting up the Metering Register to Elektroprijenos BiH.
- (5) Prior to the user's facility becoming operative, the Metering Register must be mutually signed and verified by Elektroprijenos BiH and the Distributor/User.
- (6) The signed and verified Metering Register shall be published by Elektroprijenos BiH on its web site. Elektroprijenos BiH shall approve an access to the Metering Register.
- (7) In case of any changes that may affect the measurement data i.e. the Metering Register, the User shall be obliged to submit them to Elektroprijenos BiH which shall inform NOSBiH thereof.

## **8.7. Settlement Database**

- (1) Settlement database shall contain: measured, calculated and otherwise collected data for each settlement period (15/60 min) which are used in the calculation of energy flows in the transmission system. This settlement shall include settlement of imbalance, ancillary services, delivery and reception of electricity etc.;
- (2) NOSBiH shall bear sole responsibility for setting up, update, maintenance and administration of the Settlement Database and shall also be responsible for the safety i.e. for protecting the settlement data;
- (3) Data on any metering point and on each settlement period (15/60 min) must be available to NOSBiH by 7:00 am at the latest in day D+1 for day D;
- (4) NOSBiH shall collect, confirm, process, secure and locate the data in the database in AMR system and in the Calculation database.
- (5) If the remote reading of data is prevented, NOSBiH and the party responsible for the relevant metering point shall organize the collection of relevant data by local reading.

If this is not possible either, NOSBiH shall use other methods (e.g. SCADA, load curves, equal allocation etc.) for the assessment of necessary data.

(6) The metering data shall include:

- a) Original, time dependent values of active and reactive power and energy, as collected from the metering installations;
- b) Values calculated based on the original data, as processed by NOSBiH;
- c) Assessed and modified or replaced data in case of incorrect or lost data;
- d) Data and values that will be used for the settlement.

(7) Metering system shall be set to the Central European Time (CET).

(8) All data shall be stored in the Measurement Database for at least one (1) year, i.e. stored in archive for five (5) years.

(9) NOSBiH shall be responsible for examining the validity of data and their replacement in case of errors or missing data. Elektroprijenos BiH, the Distributors and the Users shall be obliged to provide NOSBiH all information they have related to the validity of data and replacement of error data.

#### **8.7.1. Data Access and Collection of Data in the Settlement Database**

- (1) NOSBiH shall have access to measurement data in each metering point within the jurisdiction of Elektroprijenos BiH. Collection of data from all metering points shall be done through base-base i.e. directly from the metering points of interstate transmission lines.
- (2) The User shall provide that Elektroprijenos BiH and NOSBiH, in each metering point within its jurisdiction, may apply remote collection of data for the Settlement Database.

#### **8.7.2. Data Replacement**

- (1) If differences occur in the measurement data or if it becomes necessary to make data replacement, NOSBiH shall be responsible for the replacement of the data and shall develop a data replacement process and appropriate guidelines in consultation with other market participants.

#### **8.7.3. Data Access and Safety**

- (1) Upon written request of any of the Users, Elektroprijenos BiH shall provide data from the Metering Register which are requested for confirmation, testing, disputes, calibration or any other reason that Elektroprijenos finds acceptable. The information must be delivered electronically as soon as possible.
- (2) NOSBiH shall enable that, upon a written request, all Users and Elektroprijenos BiH may acquire relevant data from the Settlement Database.

## **9. General Terms and Conditions**

## **9.1. ENTSO-E Non-binding Guidelines**

### **9.1.1. Non-binding Guidelines for Implementation**

- (1) Non-binding Guidelines published by ENTSO-E explain technical issues, conditions and interdependencies to be considered in the process of compliance with this Regulation's requests on a national level.

### **9.1.2. Monitoring**

- 1) ENTSO-E shall monitor the implementation of Regulations for the Contracting parties whose OPSs are ENTSO-E members. The monitoring shall take into consideration the list of relevant information developed by the Agency for the Cooperation of Energy Regulators and it shall particularly deal with the following issues:

- a) Determination of all the differences in national implementation;
- b) Estimation if the choice of values and ranges in requests applied to the Users is still valid.

ENTSO-E shall inform the Energy Community Secretariat and the Energy Community Regulatory Board on its findings. The Energy Community Secretary and the Energy Community Regulatory Board shall make available all findings arising from the Regulations.

- 2) NOSBiH shall deliver the information necessary for performance of obligations from item 1 to the Energy Community Secretariat, the Energy Community Regulatory Board and ENTSO-E.
- 3) According to the request of the regulatory authority Distributors shall deliver to NOSBiH the information based on item 1 unless those information have already been obtained by the regulatory authorities, the Energy Community Secretariat, the Energy Community Regulatory Board or ENTSO-E within the scope of their duties, as to avoid sending the same information twice.
- 4) If ENTSO-E or the Energy Community Regulatory Board determines that it is necessary, based on market movements or experience obtained in the course of the Regulations' implementation, that certain areas subject to the Regulations should further harmonize with the Regulation's requests, it has to propose a draft amendment to the Regulations in accordance with Article 7, paragraph 1 of the Regulation (EC) 714/2009.

## **9.2. Amendments to the Grid Code**

- (1) NOSBiH shall, in accordance with the Law on NOS, establish a Technical Committee for amendments to the Grid Code. NOSBiH shall consult the Committee in order to provide a possibility for market participants to give comments on proposed amendments. The Committee meetings shall be open to the public.
- (2) Work of the Technical Committee shall be performed in accordance with the Book of Rules of the Committee.

(3) NOSBiH shall form a working group for amendments to the Grid Code and ensure its continuous work. The group shall consist of employees of NOSBiH and Elektroprijenos BiH (hereinafter referred to as 'the Working group').

(4) The Working group shall:

- a) Monitor and review the Grid Code and its implementation;
- b) Consider all proposals for amendments to the Grid Code which the Regulatory Commissions, Elektroprijenos BiH or any other User may submit to NOSBiH;
- c) Provide clear and justified proposals for amendments to the Grid Code;
- d) Issue guidelines for the Grid Code and its implementation and interpretation based on a legitimate request from any User.

(5) The working group shall submit its opinion on all proposals for amendment to the Grid Code.

(6) All proposed amendments to the Grid Code must be reviewed by the Technical Committee. NOSBiH's final proposal for amendments to the Grid Code shall be submitted to SERC for an approval. This shall be accompanied by the amendment explanation and the minutes from the technical committee meeting.

### **9.3. Interpretation of the Grid Code**

(1) In case that the User requires an additional interpretation of the intention and implementation of any section of the Grid Code, it may request such an interpretation from NOSBiH. NOSBiH shall provide the User with the interpretation of a given section and make publicly available both the request and the interpretation.

(2) In case that the User finds the interpretation given by NOSBiH incomplete, it may ask for an additional explanation by NOSBiH.

### **9.4. Illegality and Partial Invalidity**

(1) If any of the provisions of this Grid Code shall become illegal or partially invalid, for any legal or statutory reason, the remaining provisions of the Grid Code shall not be affected thereby.

### **9.5. Dispute Settlement**

(1) If a dispute arises regarding the rules and procedures under the Grid Code, the parties shall attempt in good faith to resolve a dispute in relation to the issues discussed in this Grid Code.

(2) If the parties fail to reach an amicable settlement, the dispute shall be settled in accordance with the law, legal acts and rules.

## 9.6. The Procedure of Making Exceptions

(1) If the User, the Distributor or Elektroprijenos BiH is not or will not be able to comply with a provision of the Grid Code, it will inform NOSBiH on the matter. NOSBiH, Elektroprijenos BiH and the User must act in the following manner in case of such non-compliance.

(2) When the disagreement relates to:

a) The equipment and/or instrument connected to the transmission system and is caused exclusively or mainly by the modification of the Grid Code,

b) The equipment and/or instrument which is connected, approved for connection or whose connection to the transmission system is requested,

c) The equipment and/or instrument which is a part or is planned to be a part, of the transmission system,

d) the User's or the Distributor's belief that it would be unreasonable (including the price and technical considerations) to request a correction of such a disagreement or to allow a certain period of time for it to be corrected, then the User/the Distributor will file a request to SERC to immediately make an exception from such a provision in compliance with the requirements of the following section, while NOSBiH shall be given a copy of this request.

(3) The request for making an exception from the provision of the Grid Code shall contain:

a) Issuance number and the date of the Grid Code provision which is the subject of disagreement or for which the disagreement is related;

b) Identification of the equipment and/or instrument for which the exception is being made and, if relevant, nature and duration of the exception;

c) Identification of a provision which the User cannot, or will not be able to, comply with;

d) Reason for non-compliance and

e) New compliance date.

(4) After reception of a request for exception, SERC shall consider it pursuant to the relevant law and the rules.

(5) An exception from any provision of the Grid Code shall be enabled by NOSBiH and it shall contain:

a) Issuance number and the date of the Grid Code provision to which the request is related to;

b) Identification of the Grid Code provision to which the exception relates to;

c) Identification of the equipment and/or instrument that the exception relates to and, if necessary, nature and extent of the exception, including the provisions of the modified approvals;

d) Reason of disapprovals for which the exception is requested;

e) The date by which the exception ceases if the agreement is reached, or by which the making of exception expires.

- (6) In accordance with this section and within the allowed limits of exception making, the User and the Distributor shall be free from the obligation to comply with the applicable provision of the Grid Code and shall not be responsible for its failure to comply, but shall have to comply with all the modified provisions as defined above in the making of exceptions.
- (7) NOSBiH shall keep the register of all the exceptions that were made, providing the name of the person at whose request the exception was made, a relevant provision of the Grid Code and the period of exception and, at the request of any User, to provide a copy of this register of exceptions.

### **9.7. Unforeseen Circumstances**

- (1) In case of circumstances that have not been foreseen by the provisions of the Grid Code, NOSBiH shall, to the extent possible under such circumstances, consult all the Users concerned in order to reach an agreement on adequate measures. If NOSBiH and the Users cannot reach an agreement on the measures to be taken, NOSBiH shall independently make a decision on how to proceed. Each User must comply with all the instructions issued by NOSBiH. The working group must inform the Technical Committee on all unforeseen circumstances and relevant decisions.

### **9.8. Transitional and Final Provisions**

- (1) This Grid Code shall enter into force on the day of SERC's adoption of the decision on the Grid Code approval and shall apply from the eight day after SERC's decision has been published in the Official Gazette of BiH.