GRID CODE – CONNECTIONS CODE

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Chapter 4: Connections Code

1 Introduction

1.1.1.1 The terms and conditions on which **connection** to the **transmission system** is granted will be set out in a commercial agreement, on reasonable terms, entered into by the **user** and the **transmission system and market operator (TSMO)**. This is called the **connection agreement** (**CA**) and is a specific contractual agreement between the **TSMO** and the **user** for each individual **connection point** of the **transmission system**. Where a single **user** has multiple **connections** on a single site then only a single **CA** is required.

1.1.1.2 The **TSMO** by entering into a **CA** with a particular **user** must ensure that the quantity and quality of service that it agrees to provide to the relevant **user** are not less than could be provided if the **transmission system** was planned, designed and operated in accordance with the criteria set out within this **connections code**, except if specifically varied by the relevant **CA**.

1.1.1.3 **Users** by entering into a **CA** with the **TSMO** must ensure that they abide by the rules, procedures, technical specifications and equipment requirements as outlined in this **grid code**, except if specifically varied by the relevant **CA**.

2 Objective

2.1.1.1 The **connections code** is designed to ensure that:

- There are appropriate procedures for connection of, new or refurbished, **user**'s **plant and apparatus** and that the basic rules for connection treat all **users** in a non-discriminatory fashion and in accordance with all statutory and licence obligations;

- The minimum technical, design and operational criteria specified in this connections code are designed so that a new or modified connection to the **transmission system** shall:

  - Not suffer **system** conditions beyond those defined in this **connections code**

  - Nor impose the same on the **transmission system** or on the **system** of any other connected **user**:

3 Scope

3.1.1.1 This **connections code** shall apply to all **parties** to the **transmission system**. This covers all those whose current or prospective activities place them in one of the following categories:

- **Generators** connected to the **transmission system**;
- The **TSMO**;
- **Distribution system operators** (**DSO**s);
- **Demand customers**;
- **Suppliers**;

4 Non-Compliance

4.1.1.1 It is acknowledged that some existing **plant and/or apparatus** will, in part or in whole, be unable to comply with some of the minimum standards specified in this **connections code**, either because the plant was designed to different standards or because of deterioration against design specification. In order to continue to operate a **derogation** must be sought and granted. For any equipment that met the prevailing standards at the time of installation and still meets these standards the granting of a **derogation** should be automatic. All other cases should be identified and considered on a case by case basis. The procedure for applying for and for granting **derogations** is given in the **general conditions code**.

5 Connection Procedure

5.1 The Connection Offer

5.1.1.1 The **TSMO** must offer to enter into a **CA** with various categories of **Users** with reference to the following:

- new connection sites;
- existing connection sites;
- modifications at a connection site:

5.2 Connection Agreements

5.2.1 General

5.2.1.1 All **users** are subject to the same requirements for **connection** and by entering into a **CA** with the **TSMO** they must ensure that they abide by the rules, procedures, technical specifications and equipment requirements as outlined in this **connections code** except if specifically varied by the relevant **CA**.

5.2.1.2 The **connection agreement (CA)** must contain the specific conditions that have been agreed to for connection and access to the **transmission network**. Data and records exchanged must be part of the **CA** and must include but are not limited to those detailed in paragraph 5.2.2 of this **connections code**.

5.2.2 CA Specific Conditions

5.2.2.1 The **CA** must contain the specific conditions that have been agreed to for connection and access to the **transmission network** and data and records exchanged must be part of the **CA** and, if applicable, must include but are not limited to some or all of the following:

- Details of the **connection point** (ownership, configuration, list of associated assets, associated plant identification and nomenclature, fault levels, short circuit infeeds, impedances, switchgear ratings, nominal voltages, protection equipment type/fault clearance time/settings of relays, intertripping schemes, special automatic features etc);
- Busbar protection schemes and settings;
- System splitting or islanding schemes that impact on a **generator**'s plant;
- Frequency and voltage sensitive **generating unit** protection settings;
- Registered capacity and the power transfer capability of associated **generating units**;
- The agreed authorised demand that may be supplied to the **User**;
- Details of the metering installation and metering arrangements and adjustments for losses where the actual metering equipment differs from the **Connection Point**;
- Details on requirements for CTs, VTs, contacts for protection, metering, interlocking etc;

- Testing intervals for associated protection systems;
- Agreed protocols for maintenance co-ordination;
- Operational diagrams;
- Site drawings;
- Any site specific special conditions, derogations, exemptions etc;
- Any specific priority, operational conditions and/or switching arrangements required for security reasons;
- Any other data in text or diagram form that will be deemed necessary by both **parties**:

5.2.2.2 The actual information required from each **user** or potential **user** of the **transmission system** shall depend on the type and capacity of the proposed connection.

5.2.2.3 The standard of service to be provided at each **connection point** must be included in the relevant **CA**, and will include a power transfer capacity such that in the satisfactory operating state, the power system must be capable of providing the highest reasonably expected requirement for power transfer at any time, with appropriate recognition of diversity between individual peak requirements and the necessity to withstand credible contingency **events**.

5.2.2.4 During the most critical single element outage the power transfer capacity may be either:

- zero;
- a nominated proportion of the normal power transfer capacity;
- the normal power transfer capacity;

5.2.2.5 A **CA** may state the expected proportion of time that the normal capability will not be achieved, taking account of specific design, locational and seasonal influences that may affect performance and the random nature of element outages.

5.2.3 Connection Arrangements

5.2.3.1 The design of connections between the **transmission system** and **users** shall be in accordance with the principles set out in this **connections code**, subject to any modification agreed by the **TSMO**.

5.2.3.2 During the 'application for connection' process the **TSMO** will agree with the **user** the voltage level to which a **user** will be connected in accordance with its normal practice for the type of load to be supplied. The **TSMO** may on occasion specify a different connection voltage from normal in order to avoid potential disturbance caused by the **user's** apparatus to other **users** of the **transmission system** or for other technical reasons or may agree alternative methods for minimising the effects of disturbing loads.

5.2.3.3 If in the reasonable opinion of the **TSMO** an application for connection would be more appropriately made to the distribution system then the **TSMO** shall refer the application with the reasons for their decision to the appropriate **DSO**.

5.2.3.4 Before entering into a **CA** it will be necessary for the **TSMO** to be reasonably satisfied that the **user**'s **system** at the boundary with the **transmission system** will comply with all appropriate requirements of this **connection code** and with the principles contained in the relevant statutory regulations or relevant other standards as appropriate.

5.3 Connection Application & Approval Procedure

5.3.1 Timescales

5.3.1.1 Timescales set for review of Connection Application, are to be implemented as defined in paragraph 4.5 of Transmission Connection Charging Methodology.

5.3.2 Connection Application

5.3.2.1 For a new **connection point** or a modification to an existing **connection point**, each **user** must submit a formal **connection application** to the **TSMO**, advising it of the type, magnitude, timing and all other relevant information. This information is required to enable the **TSMO** to assess the application, including the power transfer capability that the **system** interconnection facilities should provide. It applies to both applicants for **connection** that need to be supplied with electric energy (**demand users**) or to applicants who wish to export the generated electric energy for sale (**generation user**). A **DSO** who requires a **connection** to the **transmission system** is a **user**.

5.3.2.2 During the initial phase the **user** will submit the standard planning data and the preliminary project planning data as specified in the **planning code**. Although this data will be treated by the **TSMO** as confidential data it may be shared with other **system operators** if this is necessary to progress the application.

5.3.2.3 Where the design or technical details submitted in the application to connect do not satisfy the requirements specified by the **TSMO** and are not in accordance with the provisions of this **connections code** then the **user** must inform the **TSMO** when submitting the application.

5.3.2.4 Prior to the formal application being submitted the **user** may have undertaken a feasibility study with the **TSMO** as outlined in the **planning code**. This is an optional exercise and the initial meeting will be provided as a free service by the **TSMO**. However if the **user** requests the **TSMO** to carry out more detailed or additional work then the **TSMO** may make a reasonable charge in order to cover the costs of the work.

5.3.3 Offer to Connect

5.3.3.1 The **TSMO** must, in response to a submitted application to connect, provide the applicant with a completed offer within the timescales laid down in the Transmission Connection Charging Methodology.

5.3.3.2 When the **TSMO** provides the Connection Offer, **TSMO** must use its reasonable endeavours to advise the **user** of all risks and obligations in respect of the proposed connection, associated with any planning and environmental legislation.

5.3.3.3 The **TSMO** shall require that **users** provide any additional information in relation to the application to connect that reasonably is required to assess the technical performance and costs involved in the offer.

5.3.3.4 In order to maintain levels of service and quality of the power system, the **TSMO** may consult with other network operators in order to determine the following:

- the performance requirements for the equipment to be connected;
- the extent and cost of reinforcements that may be required to other parts of the **transmission network**;
- the possible material effect of this new connection on the **transmission network** power transfer capability:

5.3.3.5 If the application to connect indicates, or the **TSMO** has reasonable grounds to believe, that the facilities proposed to be connected will cause distortion of the

waveform, fluctuation in voltage or unbalance between the three phases of the voltage at this or another **connection point**, then the **TSMO** must notify the **user** of the reduced levels of such distorting effects that must be achieved before connection can occur. The **TSMO** must also provide to the **user** all information that is reasonably required to allow the latter to design the facility to achieve these levels.

5.3.3.6 The **TSMO** in preparing the offer to connect must include provisions for remote control equipment and remote monitoring equipment required for **system** operation as specified in paragraph 7.3.6 of this **connections code**.

5.3.3.7 **Generators** must supply to the **TSMO** the data required for the remote monitoring of their **generating units**.

5.3.3.8 The offer to connect must contain the proposed terms and conditions for **connection** to the **transmission system** in relation only to the connection assets and associated equipment **plant and apparatus** that are the responsibility of the **user**. The **TSMO** has the responsibility in relation to alterations and/or extension works required to the rest of the core **transmission network**.

5.3.3.9 The offer to connect must be fair and reasonable and must be consistent with the safe and reliable operation of the **transmission system**.

5.3.3.10 The offer may contain more than one option for connection to the **transmission system** and/or at different levels of service and with different terms and conditions.

5.3.3.11 Both the **TSMO** and the **user** are entitled to negotiate in respect of the provision of the **connection** and any other matters relevant to the provision of the **connection** and if negotiations occur then such negotiations must be conducted in good faith.

5.3.3.12 For complex connections due to the size, nature, location or timing of the proposal, the **TSMO** may decide that additional more extensive **system** studies are required in order to evaluate more fully the impact of the proposed **user** development on the **transmission system**. Where the **TSMO** judges that such studies are necessary, the connection offer may indicate the areas that require more detailed analysis. Before such additional studies are carried out, the **user** shall indicate whether it wishes the **TSMO** to undertake the work necessary to proceed to make a revised connection offer. The **TSMO** may carry out these additional studies itself or employ a competent consultant to perform the studies and in either case it may recover the reasonable cost of these studies from the **user**.

5.3.4 Finalizations of Connection Agreements

5.3.4.1 If a **user** wishes to accept an offer to connect, then the **user** must take the following steps:

- Inform the **TSMO**, in writing, that he accepts the offer within the time period stated in the offer which in any case must be no less than 30 days, after which it automatically lapses;
- Within 30 days enter into a **CA** with the **TSMO**;
- Within 30 days after signing the **CA**, the **user** must provide detailed planning data as specified in the **planning code**. The **TSMO** can now treat all data as non-confidential and it can be used without restriction in the **transmission development plan** and by the **DSO**-s in the development of their detailed plans:

5.3.4.2 The provision of the connection, by the **TSMO** as detailed above, may be made subject to gaining any environmental and planning approvals for any necessary alterations or extension works to the **transmission system**. The **CA** may assign responsibility to the **user** for obtaining the approvals needed for environmental and planning work subject to the provisions of the Energy Law and Instructions from MEM)

5.3.4.3 The data and information included in a **CA** must be prepared, given and used in good faith and must be treated as confidential information. It must be protected from disclosure and must not be made available to a third party, except for the purpose of enabling the **TSMO** to carry out **system** studies and planning. It will also be used to enable the **TSMO** to assess the effect of the proposed facility on the performance of the power **system** and to determine the extent of any **ancillary services** that have to be provided at that **connection point**.

6 Ownership – Commercial Boundaries

6.1 General

6.1.1.1 The division of ownership of **TSMO** plant assets, **plant and apparatus** and associated equipment shall be at the commercial boundary as specified in the following paragraphs. The commercial boundary will in all cases be the **connection point** and will conform to the guideline of physical and commercial boundaries between **transmission system** and other **users** issued by the **regulator**. The equipment

required to connect the **user** to the **transmission network** is designated as the **network** interconnection facilities.

6.1.1.2 The **TSMO** will with the **user**'s agreement prepare a responsibility schedule and an operational diagram showing the agreed ownership boundary. The **TSMO** and the **user** will retain copies of these documents. Changes in the boundary arrangements proposed by either **party** must be agreed in advance and will be recorded on the appropriate operational diagrams after agreement by the **regulator**.

6.1.1.3 The electric power supply between the **parties** shall be, in principle, a three-phase voltage of a value detailed in the **CA** of the connection site at a nominal frequency of 50Hz.

6.1.1.4 The commercial boundary between the **user** and the **TSMO** is as specified in paragraphs 6.2 to 6.4 below notwithstanding the exceptions detailed in paragraph 6.5.

6.2 Power Plants

6.2.1.1 For **power plants** the commercial boundary will be as set out in the **connection agreement** and taking into account the principles of Guideline of boundaries issued by the **regulator** and the principles of connection envisaged in the Rule on General Condition of Energy Supply.

6.3 Distribution

6.3.1.1 For the transfer of electrical energy between the **transmission system** and **distribution systems** the commercial boundary will be at the high voltage side bushing of the step-down transformer.

6.4 Users without Generation

6.4.1.1 For **users** taking only **demand** who is directly connected to the **transmission network** then the commercial boundary will be as agreed in the **CA**.

6.5 Specific Conditions

6.5.1.1 The general rules above will be followed but each case will be dependent upon the site specific conditions, switchyard layout, type of **user** installation, etc. However in every case the **connection point** and the commercial boundary will be described in the **CA** and this will be fully supported, where necessary, with the relevant diagrams.

6.6 Ownership and Operation

6.6.1.1 The **user** owns all the electrical equipment, **plant and apparatus** on the **user** side of the **connection point** and is responsible for the safe operation and maintenance of those assets according to Kosovan Laws, this **grid code** and specifically the provisions of the **CA**.

6.6.1.2 The **user**'s assets at the connection site, the **system** interconnection facilities and the metering and communication facilities and all associated **plant and apparatus** to which these rules relate, will be listed in detail in the **CA**.

6.6.1.3 The **TSMO** owns all the electrical equipment – **plant and apparatus** – on the **transmission network** side of the **connection point**. The **TSMO** will own, operate and maintain the HV substation at the connection site and all other connection assets which may be required for connection to the **transmission network**, according to the 'Rule on General Condition of Energy Supply', this **grid code** and the provisions of the **CA**.

6.7 Costs

6.7.1.1 The **TSMO** shall develop the connection charging methodology and procedures in full compliance with the general principles of connection charging methodology as set out in the 'Rule on General Conditions of Energy Supply'

7 Connection Conditions

7.1 General

7.1.1.1 The connection conditions specify the minimum technical, design and operational criteria which must be complied with by the **users**, connected to the **transmission network** and also the criteria with which the **TSMO** must comply in relation to the part of the **transmission network** at each **connection point** with the **users**.

7.1.1.2 All equipment at the ownership boundary shall meet the design principles contained within this **grid code**. Connections for entry to and exit from the **transmission network** shall incorporate a means of disconnection of the **user**'s installation from the **transmission network** by the **TSMO**.

7.1.1.3 The **regulator** can issue directions relieving the **TSMO** or the **users** from compliance to the above provisions. This will be specifically detailed in the relevant **CA**, under the schedule 'specific site derogations'. Any other special terms or conditions that apply to a specific connection site will be also included in this schedule.

7.2 Requirements on the TSMO

7.2.1.1 The **TSMO** shall own and maintain the **transmission network** and shall operate it in accordance with their operating procedures and **UCTE** requirements. This shall be carried out in accordance with the **Electricity Standards Code** for the Kosovan **power system**, any other relevant documents in use at the time for the planning, operation and security of the **transmission system**, the **grid code**, all internal procedures of the **TSMO** and the terms of all applicable Kosovan Laws. The list of relevant documentation and standards is contained within the **standard documents**.

7.2.1.2 The **TSMO** shall ensure that the function of **system** operation is performed and that the **transmission system** complies with the following technical, design and operational criteria at the **connection points** with the **users**.

7.2.2 System Frequency

7.2.2.1 The frequency of the **transmission network** shall be nominally 50 Hz and shall be controlled within the limits as detailed in the frequency control standards in the **frequency control code** (within the **balancing code**).

7.2.2.2 **User**'s plant must meet the requirements of the **frequency control standards** unless specifically detailed otherwise in the **CA**.

7.2.3 System Voltage

7.2.3.1 The voltage on the **transmission network** will normally remain within the limits detailed in the **voltage control code** (within the **balancing code**).

7.2.3.2 It should be noted that under fault conditions, the voltage may collapse transiently to zero at the point of fault until the fault is cleared.

7.2.4 Voltage Waveform Quality

- All **plant and apparatus** connected to the **transmission network** and all **users**' facilities shall be capable of withstanding the following distortions of the voltage waveforms in respect of harmonic content, phase unbalance and voltage fluctuation:

- Total harmonic distortion of 2%;

- Under normal operating and planned outage conditions, the maximum negative phase sequence component of the phase voltage on the **transmission system** shall not exceed 1% for 99.5% of the time. Infrequent short duration peaks are permitted to a maximum value of 2% for phase unbalance.

- Voltage fluctuation at the **connection point** shall not exceed the levels stated in the **voltage control code** (within the **balancing code**);

- Voltage flicker at each **connection point** with a fluctuating load directly connected to the **transmission system** shall not exceed:

  - at 400kV and 220 kV, a short term flicker severity (Pst) of 0.8 Unit and a long term flicker severity (Plt) of 0.6 Unit;

  - at 110 kV and below, a short term flicker severity (Pst) of 1.0 Unit and a long term flicker severity (Plt) of 0.8 Unit:

7.3 General Requirements for All Users

7.3.1.1 Each **user** shall operate and maintain the **plant and apparatus** in its site and design new connected equipment or proposed modifications, in accordance with its statutory obligations under licence, the technical parameters of the connection site set forth in the **CA**, the prevailing Kosovan standards and procedures as referenced in the **standard documents**, good electricity industry practice and the terms of all applicable Kosovan Laws.

7.3.1.2 The **user** shall comply with all the provisions of this **grid code** and the prevailing standards, procedures and specifications for the security, planning, operation and maintenance of its site and the system interconnection facilities. **generators** must operate and maintain each of their **power plants** to ensure their sound technical operation in order to, as far as possible, guarantee the safety of the working staff and comply with the environmental laws and quotas.

7.3.1.3 **Users** shall own, operate and maintain the network interconnection facilities involved in the connection to the **transmission network** as well as the back-up and auxiliary facilities operating directly with them, in accordance with this **connections code**.

7.3.1.4 Each **generator**'s facilities must have the performance requirements as detailed in paragraphs 7.3 and 7.4.

7.3.1.5 **Users** without **generation** that take only **demand** must have the performance requirements as detailed in this paragraph 7.3.

7.3.2 Active Energy Demand

7.3.2.1 **Active energy demand** shall not exceed the maximum permitted loading of any of the elements of the power line or the supply substation owned by the **TSMO**.

7.3.2.2 **Users** are obliged to accept and execute instructions and to implement the load shedding schedule in case of a serious or potentially serious fall in the electricity system frequency. Any load shedding will either be instructed by the **TSMO** on the basis of a pre-arranged rota or will be automatically invoked by underfrequency load shedding. The requirements will be specified in the **CA** and the actual implementation details will be the responsibility of the **DSO**.

7.3.3 Reactive Energy Demand

7.3.3.1 A **user** shall consume electric energy with a power factor of greater than 0.9 unless otherwise agreed in the **CA**. The readings from the commercial **metering installation** at the **connection point** shall be used to determine the actual power factor.

7.3.3.2 A **User** shall provide the **TSMO** with information on any reactive compensation plant directly or indirectly connected to the **transmission network**.

7.3.4 User Load Fluctuations

7.3.4.1 A **user** shall provide the required measures to maintain a relatively constant power during consumption of electric energy under normal operation. The speed of change in the actual power during consumption of electric energy expressed in % of the maximum load per minute shall not exceed 10 % of Pmax.

7.3.4.2 In the event of this not being technically achievable for a particular site then this will be stated in the **CA**. The **TSMO** shall stipulate a special regulating service that will have to be performed.

7.3.5 Harmonic Distortions and Phase Unbalance (Voltage Asymmetry)

7.3.5.1 In the **event** of problems arising with the quality of electric energy at a **connection point** and the reason not being immediately determined then mutual measurements shall be taken. The measurement results shall determine the cause of the quality deviations and the appropriate action needed to eliminate them.

7.3.5.2 The harmonic components and three-phase voltage asymmetry shall not exceed the figures specified in paragraph 7.2.4.

7.3.6 Protection and Control

7.3.6.1 General

7.3.6.2 Each **connection** between a **user** and the **transmission network** must be controlled by a circuit breaker capable of interrupting the maximum short circuit current at the **connection point**. The **transmission development plan** gives values of short circuit current and the rating of the transmission circuit breakers at existing and committed **connection points** for future years.

7.3.6.3 The scope and arrangement of the relay protections of **generating units**, step-up transformers, busbars and power lines owned by the **generator** shall at least be in compliance with the requirements of the relevant Kosovan Standards as referenced in the **standard documents**.

7.3.6.4 The setting of the relay protections against faults in the **transmission network**, owned by the **generator** but external to the **generating units** and step-up transformers, with respect to impedance, current and time shall be co-ordinated with the **TSMO**.

7.3.6.5 The technical requirements for low frequency relays, covering frequency settings, measurement period settings, operating time, facility stages, output contacts and voltage supply requirements will be as specified by the **TSMO**.

7.3.6.6 The principle applied is that all power lines shall be protected by at least one protection designed for all types of faults. The normal arrangements at the different voltage levels are as follows:

- for power lines of 400kV two high speed main protections and one backup protection are provided:
- for power lines of 110kV and 220kV main and backup protections are provided. Backup protection may be provided remotely;

7.3.6.7 The combination, type and functions of the relay protections shall be agreed between the **generator** and the **TSMO**.

7.3.6.8 The fault clearance times for faults on a **user**'s equipment directly connected to the **transmission network**, from fault inception to the circuit arc extinction shall not be greater than the following:

- 90 ms at 400 kV;
- 100 ms at 220 kV;
- 140 ms at 110 kV;

7.3.6.9 In the **event** that the above fault clearance times are not met as a result of failure of the main protection systems to operate, the **users** shall provide back-up protection. The **TSMO** will also provide back-up protection and these back-up protections will be co-ordinated so as to provide discrimination. Back-up protection shall operate to give a fault clearance time of no greater than 500 ms at voltages of 110 kV and above.

7.3.6.10 Where no **TSMO** circuit breaker is installed at the **user**'s connection voltage, the **user** must provide the **TSMO** with the means of tripping all its circuit breakers necessary to isolate faults or system abnormalities on the **transmission network**. In these circumstances, for faults on the **user**'s facilities, the **user** shall also trip higher voltage **TSMO** circuit breakers.

7.3.6.11 **Users** should also be aware that the protection arrangements on some **networks** may cause disconnection of one phase or two phases only of a three phase supply for certain types of fault.

7.3.6.12 No busbar **protection**, circuit-breaker fail **protection** relays, AC or DC wiring (other than power supplies or dc **tripping** associated with the **user's plant** and **apparatus**) shall be worked upon or altered, by or on behalf of, a **user** in the absence of a representative of, or written authority from, the **TSMO**.

7.3.7 Breaker Fail Protection

7.3.7.1 In order to mitigate failures in the event of a circuit breaker fault involved in the **connection** between a **user's system** and the **transmission network**, breaker fail protection shall be used for the automatic trip of all circuit breakers adjacent to the faulty circuit breaker.

7.3.7.2 The decision as to whether or not to have breaker fail protection shall be agreed with the **TSMO** taking into account **system** stability and other relevant factors.

7.3.7.3 Installation, commissioning and maintenance of breaker fail protection shall be a responsibility of the owner of the relevant site.

7.3.8 Automatic Reclosing

7.3.8.1 Where automatic reclosure of **TSMO** circuit breakers is required following faults on the **user**'s **system**, automatic switching equipment shall be provided in accordance with the requirements specified in the corresponding **CA**.

7.3.8.2 The type of automatic reclosing - single phase, three-phase, multi-phase, control of synchronism or no voltage - for power lines connecting the **user** site with the **transmission network** shall be co-ordinated between the **user** and the **TSMO** based on the relevant studies.

7.3.8.3 The **TSMO** will on request provide details of the auto-reclosing or sequential switching features in order that the **user** may take this into account in the design of the **user system**, including protection arrangements.

7.3.9 Protection Settings

7.3.9.1 Protection and Relay Settings will be co-ordinated for existing, new and/or modified connections and subsequently updated across the **connection point**, as outlined in each **CA**, to ensure effective disconnection of faulty equipment. All data that is reasonably required must be recorded in timescales of the corresponding **CA** and updated by both **parties** in the event of any data changes. This information must include as a minimum:

- The fault levels and fault infeeds assumed at the time the protection settings were agreed;
- Protection equipment type, fault clearance time, relay settings;
- Differential protection setting for the **generating unit**/step up transformer unit/short distance lines;
- **Generating unit** protection setting;
- Busbar protection;
- Frequency and voltage sensitive **generating unit** protection settings;
- Any site-specific special automatic facilities;
- Operation and safety diagrams;
- Site drawings

7.3.10 Protection Communications

7.3.10.1 Communications for acceleration of relay protection signals and remote tripping of circuit breakers shall be the subject of design and agreement between the **user** and the **TSMO**.

7.3.10.2 For power lines connecting a **power plant** to the **transmission system** two independent channels – independent from each other and at least one independent from the line to be protected – must be provided for relay protections installed at both ends of the connecting power line and the time for transmission of signals shall not be longer than 20 ms. These channels can be used, if required, for the remote switching out of adjacent switchgear under the action of the breaker fail protection.

7.3.10.3 **PLC** or some other form of communications media can be used to provide these facilities. The supply and installation of the communications equipment shall be a

responsibility of the owner of the switchgear on which it is required to be fitted. In the **event** of rented communication facilities being used the responsibility for the costs shall be detailed in the **CA**.

7.3.11 Synchronising Device

7.3.11.1 All electrical connections to the transmission switchgear rated at 110 kV and higher must be equipped with check synchronising systems.

7.3.11.2 All synchronous **generating units** must be equipped with precision automatic synchronising **systems.**

7.3.12 Frequency Protection

7.3.12.1 **Generating units** of thermal power plants of above the capacity determined by the UCTE formula must be equipped with a system to separate the unit including the supply of house-load system from the network in case of frequency excursions due to emergency conditions.

7.3.12.2 The system for separation of units from the network must provide for adjustment of frequency within the range of 47.5 to 50 Hz and in terms of time within the range of zero to three seconds.

7.3.13 Protection Dependability

7.3.13.1 The target performance for the system fault dependability index shall be not less than 99%. This is the measure of the ability of the protection to operate to initiate successful tripping of circuit breakers that are associated with the faulty item of apparatus.

7.3.14 Fault Recording Facilities

7.3.14.1 Where fault recording facilities are required by the **TSMO** their technical requirements should conform to the fault analysis facility standards that are produced and revised by **TSMO**.

7.3.15 Earthing

7.3.15.1 For the **transmission system** direct earthing is normally used but in all cases the earthing of all **users plant and apparatus** and provision of an earthing system shall as a minimum requirement be in accordance with the recommendations contained in the "Guide for Safety in Alternating Current Substations", ANSI/IEEE No. 80, 1986."

7.3.16 Fault Level Considerations

7.3.16.1 The short circuit rating of the **user**'s equipment at the **connection point** shall be not less than the design fault level of the **transmission system** to which it is connected.

7.3.17 System Monitoring

7.3.17.1 The **user** should provide such voltage, current, frequency, **active power** and **reactive power**, transformer tap position outputs and status points from his system as are considered reasonable by the **TSMO** to ensure adequate system monitoring. The telemetry RTU (or equivalent) in such a situation will be provided, installed and maintained by the **TSMO**. Under the requirements of this **connections code** all new **generating units** and **power plants**, including **generating units** with an output of 5MW and greater connected to the **distribution system**, will need to provide real time information including MW to the **TSMO** for monitoring purposes.

7.3.18 Communications

7.3.18.1 Where required by the **TSMO** in order to ensure the monitoring and control of the **transmission system** communications between **users** and the **TSMO** shall be established in accordance with the relevant **CA**. These communications shall include some or all of the provisions detailed in the following:

- Primary speech facility;
- Backup or emergency speech facility using communication channels and power supplies completely independent from the primary facility;
- Facsimile machine;
- Telemetry for system monitoring as per paragraph 7.3.17;
- Electronic data link;
- Email;
- Main and backup metering links as required by the **metering code**;

7.3.18.2 The actual requirements in each particular case will be detailed in the **CA**.

7.3.19 Site Related Conditions

7.3.19.1 The **TSMO** and the **user** for each **connection point** shall agree connection site responsibility schedules that will include the following:

- Ownership, control, operation and maintenance details at the **connection point**;
- Operational diagram - to a defined format;
- Site common drawings - to a defined format;
- Schedule of HV **plant and apparatus**;
- Schedule of telecommunication and telemetry equipment;
- **Metering installation** details;
- Site access arrangements;
- Protection information;
- Interlocking schemes;
- Information for carrying out work on protection;
- Maintenance arrangements
- Safety management responsibilities:

7.3.20 Plant and Apparatus Identification

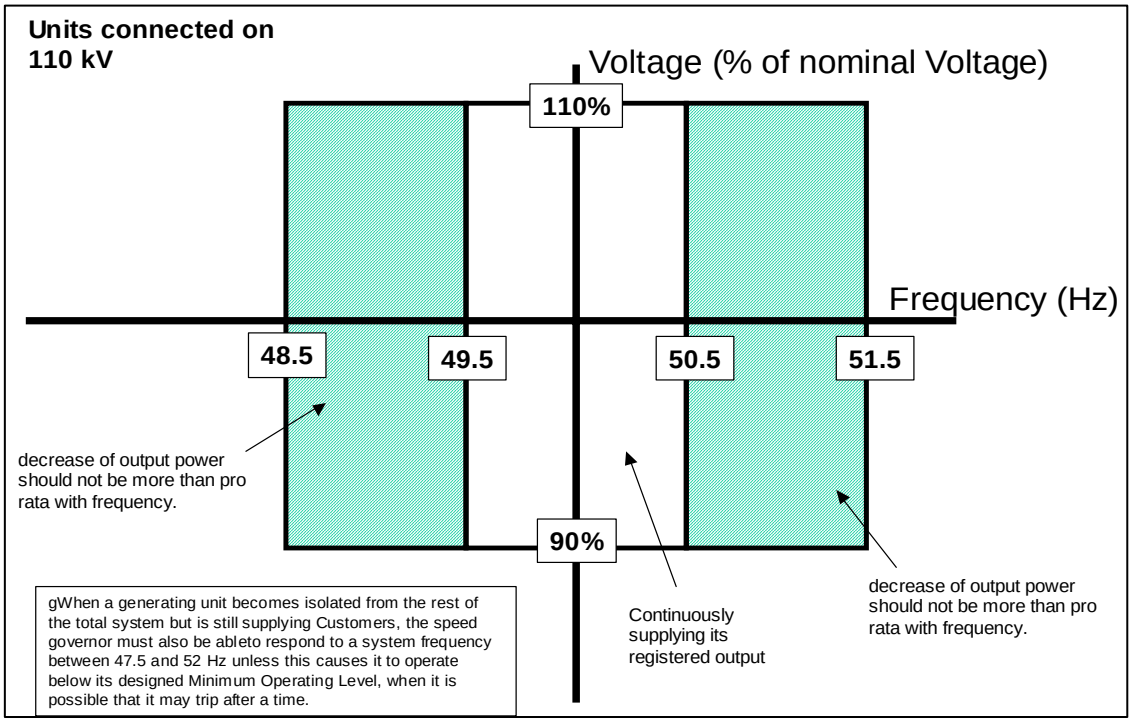
7.3.20.1 The **TSMO** and the relevant **user** will follow the requirements of the plant and apparatus identification code (within the **operations code**).

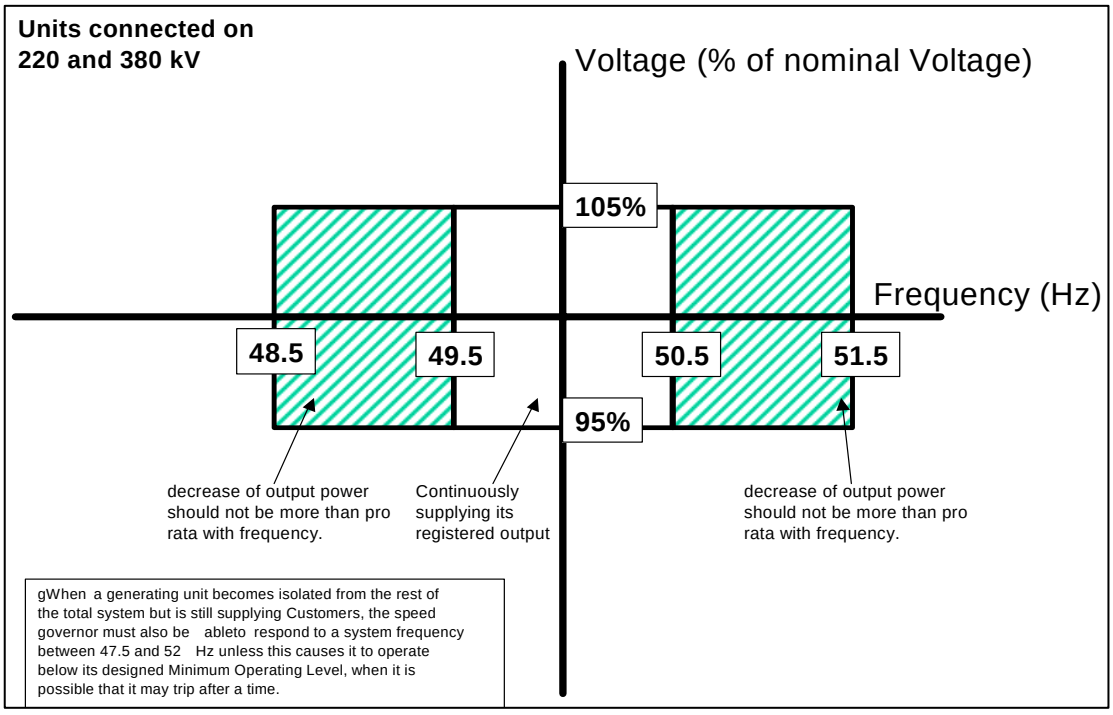
7.4 Additional Requirements for Generators

7.4.1 General

7.4.1.1 **Generators** shall operate and maintain their **generating unit's** voltage control facilities, their **generating unit's** frequency control facilities and the reactive power control of the network interconnection facilities, in strict adherence to this **grid code** and instructions received from the **TSMO** for the operation and security of the **transmission network**.

7.4.1.2 Each **generating unit** must be capable of continuously supplying its registered output within the system frequency range 50 ± 0.5 Hz. Any decrease of output power occurring in the frequency range 48.5 to 51.5 Hz, should not be more than pro rata with frequency.





7.4.1.3 Each **generating unit** directly connected to the **transmission system** should not have its **active power** output affected by voltage changes in the normal operating range specified in the **voltage control code**.

7.4.1.4 Each **generating unit** must, as a minimum, be capable of supplying rated **active power** output (MW) at any point between the limits 0.85 power factor lagging and 0.95 power factor leading at the **generating unit** terminals. Each asynchronous

generating unit must be compensated so as to supply reactive power output at the **connection point** such that the power factor is between 0.9 lag and 0.95 lead.

7.4.1.5 The **reactive power** output under steady state conditions should be fully available within the voltage range of ± 5% at 400, 220 and 110 kV

7.4.1.6 The supply generated must have balanced phase voltages with harmonic distortion of no greater than 2%.

7.4.1.7 Each **generating unit** and the **power plant** in which is located must be capable of continuous uninterrupted operation during the occurrence of the following.

- Overspeed up to 110%;
- Unbalanced load 5 – 10%;
- Exciter response ratio more than 0.5%;
- Negative phase sequence current up to 5%.

7.4.2 Active Power Control

7.4.2.1 All synchronous gas turbines and hydro **generating units** of capacity over 1 MW and turbo **generating units** of over 5 MW must be equipped with turbine speed and active power automatic control systems.

7.4.2.2 The speed governor of each **generating unit** must be capable of operating within the generating unit's technical limits and in a frequency range defined in paragraph 7.4.1.2.

7.4.2.3 The speed governor in co-ordination with other control devices must control the **generating unit** active power output with stability over the entire operating range of the **generating unit** and must be able to maintain the set active power of the **generating unit** with accuracy as follows:

- For units of up to 20 MW- not less than ± 2% of rated power;
- For units above 20 MW - not less than ± 1% of rated power.

7.4.2.4 Turbine speed governors must be capable of equalising the speed (frequency) of the synchronous set with the frequency of the **transmission system** prior to connection of the **generating unit** in parallel with an accuracy of at least ± 0.1%.

7.4.2.5 Automatic speed and power control systems for turbines rated over 10 MW shall be transformed from 'power control' mode to 'speed control' mode by rejection of the nominal load of the turbine by the action of the overspeed protection.

7.4.2.6 Turbine automatic speed control systems must provide for limitation and protection against overspeed of the synchronous set and adjustment within a range as follows:

- For steam turbines - 104 to 112% of their nominal value;
- For hydro and gas turbines - 104 to 130% of their nominal value.

7.4.2.7 Each **generating unit** with a registered capacity of at least 10 MW must be fitted with suitable equipment to receive LFC signals from the associated **TSMO** control feature. The **TSMO** will determine the selection and use of this function to ensure the overall Kosovan **power system** meets the requirements of the UCTE rules and standards as set out under the **frequency control code** (within the **balancing code**).

7.4.2.8 The LFC system signalling criteria are as follows:

- Accuracy 0.5 to 1.5% for **active power** measurement;
- Accuracy 1.5 mHz for frequency measurement;
- Regulation update time no more than two seconds;
- Associated with the above the **TSMO SCADA**/EMS system will continuously display the active power output, higher and lower operating limits and run up/ run down rates.

7.4.2.9 Where a **generating unit** becomes isolated from the rest of the total system but is still supplying Customers, the speed governor must also be able to respond to a system frequency between 47.5 and 52 Hz unless this causes it to operate below its designed minimum operating level, when it is possible that it may trip after a time.

7.4.2.10 All gensets with a registered capacity of 10 MW or more must have the capability to provide **primary control** (with the response timing and duration set out in the **frequency control code)** subject to the following minimum requirements:

- The control band of the speed governor must be at least +/-2% of the **generating unit**'s registered capacity, and must be adjustable on instruction by the **TSMO**;
- The speed governor must be capable of being adjusted, on instruction by the **TSMO**, so that it operates with an overall speed droop of between 3% and 4%,

in case of hydro **generating units**, and between 4% and 6% in the case of thermal **generating units;**

- The speed governor insensitivity shall be no greater than +10 mHz;

7.4.2.11 All **generating units** with a registered capacity of at least 10 MW must have the capability to provide **secondary control**, with the response timing and duration set out in the **frequency control code** (within the **balancing code**).

7.4.3 Blackstart and Island Operation

7.4.3.1 Hydro **power plants** with a generating unit of registered capacity of at least 10 MW shall, if stipulated by the **TSMO**, provide a **black start** capability. All **generating units** with an approved **black start** capability will be made available under the terms of an **ancillary services agreement**, and meet the operational requirements set out in the **contingency planning code.**

7.4.3.2 Turbine speed governors of **generating units** involved in system restoration after major system failures (hydro and gas turbines) shall be able to operate with an isolated load (island mode) in which case regulation will take place after altering the droop characteristic to insensitive mode. Transition of regulation modes shall take place as required by the prevailing operational circumstances:

- by criteria built into the governor - upper and lower limit of frequency, rate of change in frequency or loading;
- by the power plant operator using a control switch;
- remotely - by means of a telesignal from the dispatch centre dependent on the condition of the switchgear.

7.4.3.3 Turbine speed governors of units involved in the power system restoration after major system failures shall be able to start rotating initially and reach synchronous speed and be loaded in the absence of an external ac supply.

7.4.4 Excitation Systems

7.4.4.1 Each **generating unit** must be capable of contributing to voltage control by continuous modulation of **reactive power** supplied to the **transmission network.**

7.4.4.2 Each **generating unit** must be fitted with a continuously acting automatic excitation control system that may include stabilisers, to provide constant terminal voltage of the **generating unit,** without instability over the entire operating range of the **generating unit**.

7.4.4.3 The output voltage limits of **generating units** must not cause excessive voltage excursions in excess of ±10% of nominal. The voltage regulating equipment shall be able to maintain the output voltage level of the associated **generating unit**.

7.4.4.4 The excitation system must provide for increase (forcing) in the excitation current and voltage of a synchronous **generating unit** as a factor at nominal load as follows:

- hydro **generating units** up to 25 MVA - min factor (ratio) 1.5 - min time 10 s;
- hydro **generating units** above 25 MVA - min factor 1.8 - min time 20 s;
- turbo **generating units** of up to 25 MVA - min factor 1.8 - min time 10 s;
- turbo generating units above 25 MVA - min factor 2.0 - min time 30 s.

7.4.4.5 The forcing parameters must be achieved at a **generating unit** terminal voltage within the range of 80% to 120% of the nominal voltage and at a frequency range of 47.5 Hz to 52 Hz.

7.4.4.6 The speed of change in the exciting voltage of the synchronous **generating unit** shall not be lower than 2 relative units/sec using as reference the exciting voltage under nominal load of the synchronous **generating unit**.

7.4.4.7 All synchronous **generating units** of capacity over 1 MVA must be equipped with an automatic voltage regulator (AVR).

7.4.4.8 **AVR**s shall be capable of maintaining the voltage at the **generating unit** terminals with an accuracy as follows:

- for **generating units** of up to 25 MVA - not less than ± 1% of rated voltage;
- for **generating units** above 25 MVA - not less than ± 0.5% of rated voltage.

7.4.4.9 **AVR**s must compensate for any drops in the voltage of the Unit Transformer as well as provide a stable distribution of **reactive power** between the synchronous **generating units** connected to common busbars.

7.4.4.10 **AVR**s must provide for limitation of the following:

- Minimum excitation;
- Rotor maximum current;
- Synchronous generating unit stator maximum reactive current.

7.4.4.11 The excitation systems of generating units involved in the restoration of the transmission network after severe system incidents, shall be able to regulate the excitation of the generating unit in the absence of an external ac supply.

7.4.5 Loss of Synchronism Protection

7.4.5.1 Synchronous units, which are registered by the manufacturer to be capable of asynchronous operation (with or without excitation), shall be tested for stability at the point of their **connection** to the **transmission network.**

7.4.5.2 In the cases when asynchronous operation is not permitted in terms of stability, the **generating units** must be equipped with protection against asynchronous operation if they become disconnected from the **network**.

7.4.6 Plant Subject to Central Dispatch

7.4.6.1 All eligible **generating units** must be fitted with LFC and a power system stabiliser. The requirements for these will be as determined by the **TSMO**.

8 Ancillary Service Requirements

8.1.1.1 This **connections code** contains requirements on **generating units** to have a capability for certain **ancillary services** that are needed for system reasons. The basic mandatory provisions for frequency control and voltage and reactive power control, are as set out in section 7.4. The provision and procurement of ancillary services to enable the **TSMO** to manage the control of the Kosovan **power system** will be as set out in the associated **ancillary services agreement** and **market rules**. The types of **ancillary services** are covered in the **frequency control code**, the **voltage control code** and the **contingency planning code**.

9 Inspection and Testing

9.1 Rights of the TSMO

9.1.1.1 The **TSMO** has the right to request inspection and testing of a **user**'s facilities connected to the **transmission system**. The inspection shall be carried out in order to:

- Ensure compliance with the technical provisions and standards as detailed in the **grid code** and the site specific conditions as laid out in the **CA** - the **TSMO** will only issue the final notification for a newly connected **user** to begin commercial

operation after satisfactory test results have confirmed full compliance with the specifications;

- Assess compliance with operational obligations or an **ancillary services agreement**;
- Investigate any possible past or potential threat to power system security;
- Determine analytical parameters for modelling purposes or to assess the performance of the relevant **generating unit** as specified in the **CA**;
- Conduct any periodic familiarisation or training associated with the operational requirements of the facility:

9.2 Costs of Inspection

9.2.1.1 The costs of an inspection carried out under paragraph 9.1 must be borne by the **TSMO**. However if testing demonstrates a significant deviation by the **user** from the data provided and/or non-compliance to the required technical specifications as outlined in this **connection code**, the costs of the inspection will be met by the **user**.

9.3 Inspection Notice

9.3.1.1 The **TSMO** must give at least one month's notice to the respective **user**. This notice will give the time of commencement of the inspection, its expected duration and the name of the responsible person who will conduct the inspection. It will also include the reason for the inspection and the nature of the suspected non-compliance. **Users** in response must grant them full access to the site and the necessary support to carry out the inspection.

9.4 Inspection Conditions

9.4.1.1 The **TSMO** must observe the site conditions and cause no damage to the facility. They can only interfere with the operation of the facility to the extent reasonably necessary and approved by the **user** to carry out the agreed inspection.

9.4.1.2 The **TSMO** may attach test equipment or monitoring equipment to plant owned by the **user** or request the latter to attach such test equipment. In carrying out monitoring the **TSMO** must not cause the performance of the monitored plant to be constrained in any way.

9.5 Ongoing Compliance

9.5.1.1 Each **generator** must provide evidence to the **TSMO** that each of its **generating units** complies with the technical requirements of paragraph 7.4, this **connection code** and the provisions of the relevant **CA**.

9.5.1.2 Each **generator** and other **users** must negotiate in good faith with the **TSMO** to agree on a compliance monitoring programme, including an agreed method, for all of its plant to confirm ongoing compliance with the applicable technical requirements of paragraph 7.4, this **connection code** and the relevant **CA**.

9.5.1.3 The **TSMO** must provide to the **user** all the test results and such details of the analytic parameters of the model derived from the tests, as may reasonably be requested by the **user**.

9.5.1.4 If a performance test or monitoring of in-service performance demonstrates that a **user** is not complying with one or more technical requirements then the **user** must:

- Promptly notify the **TSMO**;
- Promptly advise the **TSMO** of the remedial steps it proposes to take and the timetable for such remedial work;
- Diligently undertake such remedial work and report it at monthly intervals to the **TSMO**;
- Conduct further tests or monitoring on completion of the remedial work to confirm compliance:

9.5.1.5 If the **TSMO** holds the reasonable opinion that there is or could be a threat to power **system** security or quality of supply, then they may direct the relevant **user** to operate the relevant **generating unit** at a particular generated output or in a particular mode or to disconnect his load from the system. The **user** will only be reconnected when he has submitted evidence reasonably satisfactory to the **TSMO** that his plant is now compliant.

9.6 Protection Testing

9.6.1.1 Each **user** must co-operate with the **TSMO** in testing the operation of equipment forming part of the protection **system** relating to a **connection point** at which that **user** is connected to the **transmission system** and the **TSMO** must conduct these tests as follows:

- Prior to the plant at the relevant **connection point** being placed in service;
- At intervals specified in the **connection agreement**:

9.7 Record Keeping

9.7.1.1 Each **user** must maintain records for 6 years for each of their connection sites for all items of primary plant, setting out details of the results of all technical performance and monitoring conducted under the provisions of this paragraph 8. The costs of conducting all such tests are to be borne by the **users**.

10 Access

10.1 General

10.1.1.1 A **user** shall grant to the **TSMO** all necessary permanent rights of way within his own site that are required for the construction, equipping, replacement, decommissioning, operation, testing, inspection and maintenance of the system interconnection facilities, in accordance with the prevailing current Kosovan standards and procedures for HV system operation and maintenance. The list of relevant documentation and standards is included in the **standard documents**.

11 Commissioning

11.1 General

11.1.1.1 Each **user** must ensure that all of its new or replacement equipment is inspected and tested to demonstrate that it complies with the **CA** and any other relevant Kosovan standards and specifications as referenced in the **standard documents**, prior to or within an agreed time after being connected.

11.1.1.2 **Users** must produce test certificates in relation to the above, on demand by the **TSMO** showing that the equipment has passed the tests and complies with the standards.

11.1.1.3 The **TSMO** has the right to witness commissioning tests relating to new or replacement equipment that could reasonably be expected to alter the performance of the power system or to confirm the accurate metering of energy. The **TSMO** has the right to witness commissioning tests relating to new or replacement equipment for connections to the **transmission system** and for all eligible **users**.

11.1.1.4 The electricity facilities for connection of a **user's plant and apparatus** shall be energised to the property borderline by the **TSMO** within seven days following the confirmation by the **user** that all tests that can be completed have been carried out successfully. The **user** can energise its facilities up to the property borderline on its own responsibility by meeting the technical requirements for security, quality and safety.

11.1.1.5 Connection of a **power plant** to the **transmission system** shall take place in two stages agreed between the respective **parties** as follows:

- Firstly the system interconnection facilities shall be energised by the **TSMO** for the purpose of conducting individual and/or complex tests and 72 hour tests on such facilities;

- Secondly the **user** shall commence operation of its plant in parallel with the **transmission system**:

11.2 User Responsibilities

11.2.1.1 A **user** seeking to connect to the **transmission system** must co-operate with the **TSMO** to develop procedures to ensure that commissioning of the connected facilities is carried out in a manner that:

- Does not adversely affect other **users** or power system security or quality of supply;

- Minimises the threat of damage to any other participant's equipment;

11.2.1.2 Not less than four months prior to the proposed commencement of commissioning of any new or replacement equipment that could reasonably be expected to alter the performance of the power system, **users** must submit to the **TSMO** sufficient design information to allow critical assessment including analytical modelling of the effects of the new or replacement equipment on the performance of the power system.

11.2.1.3 The **TSMO** may propose alternative parameters for the equipment and they must negotiate with the relevant **user** settings that are acceptable to them both.

12 Disconnection and Reconnection

12.1 Voluntary Disconnection

12.1.1.1 **Users** are entitled to require voluntary permanent disconnection of their equipment from the **transmission system**. If a **generator** decides to permanently disconnect its equipment then unless agreed otherwise and specified in the relevant **CA**, he must give the **TSMO** notice in writing of its intention at least six months before the commencement day for the disconnection;

12.1.1.2 The **user** must bear all the costs directly attributable to the voluntary disconnection and decommissioning.

12.1.1.3 The **TSMO** will undertake the decommissioning procedures and will notify other **users** in the event that it believes the terms and conditions of the relevant **CA-**s could be affected by procedures for disconnection;

12.1.1.4 **Users** taking only **demand** can disconnect their plant from the **transmission system** at any time under the following circumstances:

- Permanently using the an agreed disconnection procedure;
- Temporarily by agreement with the **TSMO** for **demand** control;
- Under the terms of an **ancillary services agreement**:

12.2 Involuntary Disconnection

12.2.1 Generators

12.2.1.1 The **TSMO** may decide to disconnect a **generator's** facilities from the **transmission system** due to any of the following circumstances:

- Pursuant to orders issued with the necessary level of authority;
- During an emergency;
- In accordance with Kosovan Laws;
- In accordance with the provisions of the relevant **CA**;
- In the event of a system incident causing the tripping of the **generating unit**:

12.2.1.2 In all cases of disconnection the **TSMO** must undertake a review and then provide a report to the relevant **generator** advising of the circumstances requiring such action.

12.2.1.3 Generally there will be no compensation to **generators** for lost revenue due to involuntary disconnection without advance notice in most circumstances. Examples of such circumstances are as follows:

- Prevention of imminent danger to the health and security of people or facilities;
- Accident in the **power plant** or the connection facilities;
- Non-fulfilment by the plant operating staff of an order given by the **TSMO**;
- Other circumstances beyond the control of the **TSMO** not resulting from any intentional action or violation of the contract on their part and not subject to planning:

12.2.1.4 The **TSMO** will compile a report that will be submitted to the **regulator** who will decide if further action is required.

12.2.2 Demand Users

12.2.2.1 **Demand users** shall be subject to the requirements of the **grid code** in particular to the **demand control code** (within the **operations code**) and the **contingency planning code** (within the **operations code**) with respect to the following:

- Mandatory **demand** reduction;
- **Underfrequency load shedding**:

12.3 Obligation to Reconnect

12.3.1.1 The **TSMO** must ensure that a **generator's** facilities are reconnected to the **transmission system** at a reasonable cost to the **generator** as soon as practicable if:

- The **TSMO** reasonably satisfied that the emergency that caused the **generator** to be disconnected no longer exists;
- The **TSMO** is reasonably satisfied that there no longer exists a reason for the disconnection under the **grid code** or Kosovan Laws or the relevant **CA**;
- A breach of the **CA**, giving rise to disconnection, has been remedied and the **generator** has taken all necessary steps to prevent the reoccurrence of the breach and has delivered binding undertakings to the **TSMO** that the breach will not re-occur:

13 Resources and Documents

13.1 Resources

Nr.	Name of Document
1.	Law on Electricity
2.	Transmission System Operator License
3.	
4.	

13.2 Documents and forms

1. Connection Agreements

13.3 Revision Information

Version	Date	Description	Preservation time
1.1	27.01.2007	Edition 1, Revision 1	1 year
2.0	14.01.2008	Edition 2	2 years
2.1	10.09.2010	Edition 2, Revision 1	