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GRID CODE – PLANNING CODE

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Chapter 3: Planning Code

1 Introduction

- 1.1.1.1 This **planning code** specifies the technical and design criteria and procedures to be applied by the **TSMO** in the planning and development of the **transmission system**. **Users** of the **transmission system** in the planning and development of their own **systems** shall also take it into account.
- 1.1.1.2 This **planning code** defines the relationship and responsibilities of the **TSMO** and the **users**. The **users** comprise **generators** including **generators** connected at voltages below 110 kV, **demand customers** and **DSOs**.
- 1.1.1.3 This **planning code** facilitates the continuous development and refurbishment of the existing facilities and the construction of new ones. It enables investment in new **generation** and **network** facilities to be planned and developed in the most efficient manner.
- 1.1.1.4 Although generation planning is not the responsibility of the **TSMO**, the **TSMO** is in the best position to monitor the future generation and load balance. The **Planning Code** is therefore addressing monitoring of generation adequacy by the **TSMO** as well.

2 Objective

- 2.1.1.1 The objectives of this **planning code** are as detailed in the following paragraphs.
- 2.1.1.2 To promote discussion and exchange of information between the **TSMO** and the **users** regarding their present and future **system** developments and on proposed developments that may impact on the **transmission system**;
- 2.1.1.3 To provide a framework for the discussion of future developments taking into account the present **system** operation information.
- 2.1.1.4 To provide for the supply of information to enable the **TSMO** in producing the **transmission network development plan** and the generation adequacy plan and to plan and develop the **transmission system** so that it can be operated economically, securely and safely.
- 2.1.1.5 To facilitate the use of the **transmission system** by others and to specify a standard of supply to be provided.

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2.1.1.6 To define the flow and supply of information, in particular **system** planning data, between the **TSMO** and the **users** and to specify the relevant standards that are used.

2.1.1.7 To provide sufficient information for a **user** to assess opportunities for connection and to plan and develop their **system** such as to be compatible with the **transmission system**;

2.1.1.8 To specify the standards that will be used by the **TSMO** in the planning and development of the **transmission system**.

2.1.1.9 Reference is made in this **planning code** to the **TSMO** supplying information or advice to **users**. For the avoidance of doubt, unless the context otherwise requires, such information or advice will be furnished by the **TSMO** upon request by the **user** whether during the application for connection process or otherwise.

3 Scope

3.1.1.1 This **planning code** applies to the following:

- The **TSMO**;
- **Generators** with **generating units** connected to the **transmission system** and **generators** with **generating units** greater than 1MW connected to the **distribution system**;
- **DSOs**;
- **Demand customers** directly connected to the **transmission system**;

4 Transmission Planning Standards and Criteria

4.1.1.1 The **TSMO** shall apply in the planning and development of the system, the design of connections and in the **transmission network development plan**, system security and quality standards for planning and designing the transmission network. The relevant **planning standards** used by the **TSMO** are available on request.

4.1.1.2 The **transmission network** is generally planned and designed to meet the '**n -1**' **criterion**.

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- 4.1.1.3 **'n-1'** means that the **system** must be capable of meeting all the **user** requirements (both **generation** and **demand**) in the **event** of a loss of any single element of a multi-element group. This could be a single line, single transformer, single generating unit and in some cases a single busbar.
- 4.1.1.4 The security standards for planning criteria as applied by the **TSMO** provide for the conditions detailed in the following paragraphs.
- 4.1.1.5 Under all normal operating conditions the loss of a single overhead 400 kV or 220 kV line in the Kosovan **transmission system** or one other element will not lead to operating constraints and consequentially will not cause large loss of load;
- 4.1.1.6 Various arrangements may be prepared to ensure operational security in case of more serious outages, such as the loss of two elements of the **transmission system** or the loss of a busbar. The selection of measures to be applied will depend upon the comparative analysis of the technical and economic factors. Taking account of the following:
- The probability of the type of incident concerned;
 - The consequences of that type of incident;
 - The expense incurred in providing a permanent solution;
 - The cost of protective measures required to prevent the extension of an incident;

5 Transmission System Development Plan

5.1 General

The **transmission network development plan (TNDP)** is a document that describes the actual and predicted future changes, reinforcements, additions and removals to the **transmission network**. This document also shows the opportunities for future connections and indicates those parts of the **transmission network** most suited to new connections and to the transport of further quantities of electricity. This will assist in encouraging the promotion of competition and the development of the **transmission network** in a non-discriminatory manner. This plan is more fully described in paragraphs 5.2 to 5.5.

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5.2 Transmission System Development Plan

5.2.1.1 Each year the **TSMO** shall prepare and issue the detailed **transmission development plan (TDP)** for the next 10 years.

5.2.1.2 The **TNDP** shall conform to the planning standards of the **TSMO** but shall avoid unnecessary duplication of facilities and avoid the imposition of unreasonable cost.

5.3 Contents of the TNDP

5.3.1.1 The following are the key items that will be contained in the **TNDP** with both present and forecast data being included:

- Circuit capacities;
- Power flows;
- Supply point loadings;
- Short circuit levels for each transmission node;
- Transmission losses;
- System capabilities – zonal;
- Commentary on opportunities to connect;
- Planned system reinforcements and/or changes in topology;
- Network configuration:

5.3.1.2 The **TSMO** shall prepare a **TNDP** that is transparent to all **parties**. Included in the plan should be the procedures used in its preparation. As a minimum this should include base case data used for system analysis, analysis procedures and results etc.

5.3.1.3 If a **user** considers that the information provided in the **TNDP** does not contain sufficient detail for their particular needs, then the **user** can request additional information from the **TSMO**. In determining what additional information shall be provided, the **TSMO** shall comply with the requirements of its **transmission licence**. The **TSMO** shall have the right to charge **users** for the provision of system data additional to that required by the **TNDP**.

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5.3.1.4 The **TNDP** shall include information on transmission related projects where this information is available and is not subject to confidentiality restrictions. This will include details of the project including progress against plan.

5.3.2 Energy Law Requirement

5.3.2.1 Every two years the **TSMO** shall prepare and issue to the **ministry** the information required to meet the requirements of Article 6 of the Law on Energy.

5.4 TSMO Responsibilities

5.4.1.1 The **TSMO** shall be responsible for the preparation of the **TNDP** but the **TSMO** shall take into consideration the needs of the other parties involved. The draft version of the **TNDP** shall be submitted to the **regulator** by the end of October for consideration and review. The comments from the **regulator** will be submitted by the end of November and once agreement is reached between the regulator and the **TSMO**, the **TSMO** shall prepare the final version of the **TNDP** and submit it to the **regulator** for final approval.

5.4.1.2 Ultimately the **TSMO** shall be held accountable for the quality of the planning activities and planning results included in the **TNDP**.

5.5 Issue of the Transmission Network Development Plans

5.5.1.1 The **TSMO** will submit the final **TNDP** to the **Regulator** for consideration and approval and will also make the unapproved plan available to **transmission system users**. Once approved the **TSMO** will then issue the **TNDP** to all **users** of the **transmission system** by the end of December in each calendar even year.

6 Technical and Planning Data

6.1 General

6.1.1.1 The **TSMO** in order to carry out its obligations under its **transmission licence** requires information and data from all **users** of the **transmission system** and will also provide data to **transmission system users** and others for the reasons given in the following paragraphs.

6.1.1.2 To enable the **TNDP** to be prepared standard planning data and detailed planning data as listed in this **planning code** shall be submitted by each **user** to the **TSMO**.

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This data shall be submitted at an agreed time each year and shall cover each of the 10 following years. If from the date of one submission to another, there is no change in the data to be submitted, instead of resubmitting the data, a **user** may submit a written statement confirming that there has been no change from the data submitted previously.

6.1.1.2.1 Where planning data is included in Appendix B of the relevant **Connection Agreement**, then the **User** may confirm that the data in that Appendix is correct.

6.1.1.3 Any **user** requiring a new or modified **Connection Agreement** shall submit to the **TSMO** the preliminary project data as per paragraph 8 with the connection application, and shall submit the standard planning data as per paragraph 11 and the detailed planning data as per paragraph 12 to timescales that shall be specified in the **Connection Agreement**.

6.1.1.4 To enable **users** to model the **transmission network** in relation to short circuit current contributions - the **TSMO** shall submit to **users** the **network** data as per paragraph 7 of this **planning code**. This data will be submitted at an agreed time each year.

7 System Data (provided by the TSMO to users)

7.1.1.1 To allow **users** to model the **transmission network**, the **TSMO** shall provide the following data to **users**:

- Maximum and minimum symmetrical 3 - phase short circuit current infeed at the instant of fault;
- Maximum and minimum symmetrical 3 - phase short circuit current infeed after the sub-transient fault current contribution has substantially decayed;
- Maximum and minimum single phase short circuit current infeed at the instant of fault;
- The zero sequence source resistance and reactance values at the point of connection consistent with the maximum infeed;
- The pre fault voltage magnitude at which the maximum fault currents were calculated;

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- The positive sequence x/r ratio at the instant of fault;
- The negative sequence resistance and reactance values of the **transmission system** seen from the point of connection;
- The corresponding zero sequence impedance values;
- Since the equivalent will be produced for the 400, 220 and 110 kV parts of the **transmission system**, the **TSMO** will provide the appropriate transformer data.

8 Preliminary Project Planning Data (Provided by Users to the TSMO)

8.1.1.1 Each **generator** with reference to a **connection application** that it submits to the **TSMO** for a new or the modification of an existing **connection**, must provide the following information to facilitate the assessment:

8.2 Connection Application (Generating Unit Data)

- name and type of plant;
- preferred site location (listing any alternatives);
- power transfer capability of whole plant (maximum MW and/or MVA);
- expected energy production (MWh per month);
- expected **demand** of auxiliary **system**;
- plant type and configuration;
- nature of any disturbing load;
- technology of proposed **generating units**;
- when plant is to be in service;
- minimum stable **generation** MW;

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- **generating unit's** rated MVA, MW, direct axis transient reactance, SCR¹, inertia constant;
- step up transformer's rated MVA and positive sequence reactance (at max/min taps);
- details of the exciter type and category, for example whether it is a rotating exciter or a static exciter:

9 Generation Adequacy Planning

9.1 Generation Planning Standards and Criteria

9.1.1.1 A secure and reliable supply of electricity is an absolute essential for Kosovo and its people, for the future growth and development of the economy and for national security and independence. In order to achieve these aims it is essential that there is sufficient generation capacity to meet both short term and long term demand forecasts. These are key criteria of generation system planning.

9.1.1.2 In the generation planning process in Kosovo the following issues shall be taken into account:

- Required reserve ratio – available **generation** capacity to peak load ratio in accordance with the UCTE methodology;
- Probability of maximum **generation** loss (planned and unplanned outages);
- Maximum forecast energy deficit;
- Other standards and criteria:

9.2 Generation Adequacy Plan

9.2.1 General

9.2.1.1 The objectives of this generation adequacy plan (GAP) are as follows:

¹ SCR – Short Circuit Ratio

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- To provide, in the short term, an overview of generation adequacy and more generally of supply reliability;
- To provide, in the medium to long term, information of the amount of new generation or demand side reductions that are required:

9.2.1.2 This information provides early warning signals to all **parties** and indicates business opportunities for **market participants**.

9.2.1.3 The **transmission network development plan (TNDP)** shall be consistent with the generation adequacy plan (GAP).

9.2.2 Contents of the Generation Adequacy Plan

9.2.2.1 The generation adequacy plan (GAP) should cover a period of 10 years and address every year of this period individually. The plan should basically compare whether expected **demand** can be met by the available **generation** options within the required reliability standards and should also define the opportunities for **generation** expansion projects. The plan addresses the reliance on imports separately.

9.2.2.2 The following are the key items that will be contained in the generation adequacy plan (GAP) with both present data and forecast data being included:

- Current and future system peak generation availability and load demand for power and energy for Kosovo in general and per power nodes;
- Expected developments in electricity consumption (by category such as households, commercial, industrial, agricultural etc) based on several economic scenarios (low growth, normal growth, high growth);
- Impact of daily and seasonal load curves;
- Impact of developments in energy saving and demand side management options;
- Current and future installed **generation** capacity (type of plant, installed capacity, fuel type, year of commissioning, year of decommissioning);
- Impact of developments in small power plants (eg solar energy);
- Impact of import and export opportunities;

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- Impact of possible system constraints;
- Impact of different scenarios, e.g. fuel price scenarios, demand growth scenarios;
- Choice of primary sources with care for suitable diversification for fuels (and possibly attention for the promotion of renewable resources and environmental conditions):

9.2.3 System Security Assessment

9.2.3.1 The GAP should indicate with what reliability the expected power and capacity **demand** can be supplied with the available **generation** and imports options.

9.2.3.2 The GAP should contain information on **generation** surpluses or shortages.

9.2.3.3 The method to be used for determining generation adequacy should be developed by the **TSMO** and agreed with the **Regulator**.

9.2.4 Opportunities for Generation Expansion Projects

9.2.4.1 The GAP should define the opportunities for **generation** expansion projects. Such information should include the total required capacity per year to meet reliability standards and the prospects for new equipment commissioning, type of power plant, preferred fuel type.

9.2.5 TSMO Responsibilities

9.2.5.1 The **TSMO** in its role of **System Operator** shall be responsible for the preparation of the GAP but the **TSMO** shall take into consideration the opinion of the other parties involved. The **TSMO** will be responsible for the issue of the final version of the GAP. Any of the other parties may conduct independent assessments to evaluate alternatives.

9.2.5.2 The **TSMO** shall be held accountable for the quality of the GAP but the **TSMO** has no obligation to make sure that any investments in **generation** expansion projects are actually carried out. In the event of the **TSMO** being unable to operate the **system** to the required standards as a direct result of shortages in available **generation** then the **TSMO** will take the necessary operational measures to secure the **system**.

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9.2.6 Issue and Publication of the Generation Adequacy Plan (GAP)

9.2.6.1 The **TSMO** shall issue the draft GAP to the **Regulator** each two years by the end of September, or even earlier if the connection of new generators in the electrical system occurs before the period defined above. The **Regulator** will provide its comments by the end of October and the final version of the GAP, incorporating the comments received from the **Regulator**, will be issued by the **TSMO** to all parties and posted on its website by the end of November.

9.2.7 Data for GAP

9.2.7.1 In preparing the GAP the **TSMO** will use the planning data of **users** as submitted by **users** for the development of the **TNDP** as per paragraph (i.e. in the **planning code**) of this **planning code** and any information that it deems necessary. In taking this action the **TSMO** will follow the requirements of information confidentiality as per section 10 of this **planning code**.

10 Confidentiality of Information

10.1.1.1 Much of the data included in the GAP and the **TNDP** will be provided by independent commercial organisations who will be the users (or potential users) of the **transmission system**. The data will be commercially sensitive and in view of this, the user demand or **generating unit** information will be listed in the plans and will be used to produce the forecast power flows only if a **connection agreement (CA)** has been signed between the **TSMO** and the **user**. Speculative new projects, potential closure of existing plants or other developments that may have been discussed with the relevant user will not be included in the plans without the explicit agreement of the user or where the impact of omitting the information would adversely affect the accuracy of the plans.

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11 Appendix 1 – Standard Planning Data (Provided by Users to the TSMO)

11.1 Demand and Active Energy Data

11.1.1 General

11.1.1.1 Each of the following **demand users** directly connected to the **transmission system** shall provide to the **TSMO** with their **demand** data.

11.2 Demand and Active Energy Data

11.2.1 User's Total Demand and Active Energy Data

11.2.1.1 The following requirements are applicable to all **users** directly connected to the **transmission system**. **Demand** of **power plants** directly connected to the **transmission system** will be supplied by the **generator** under paragraph 12.2.1.

11.2.1.2 All **users** shall provide the **TSMO** with its **demand** data (**active power** and **reactive power**) and its **active energy** requirements with reference to its system (each summated over all **connection points**). In assembling its **demand** and **active energy** requirement forecasts, each **user** must endeavour to avoid duplication with other **users**. Forecasts of the total demand of **users** (**active power**) and **active energy** are required for the following:

- Peak **demand** day on the system of each **user** that in the opinion of the **user** could reasonably be imposed on the **transmission system**;
- Day of peak **demand** on the national electricity **system** (**active power**) which for planning purposes will be specified by the **TSMO**;
- Day of the **TSMO**'s minimum demand (**active power**) which for planning purposes will be specified by the **TSMO**;
- The annual **active energy** requirements for each of the **connection points** of the **user**, subdivided into the following categories of customer:
 - domestic, farms, commercial, industrial, traction, public lighting and **user** system losses:

11.2.1.3 All forecast **demand** of the **users** of the electricity **system** shall:

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- Be such that the profiles comprise average **active power** levels in MW for each time marked [one] hour throughout the day;
- Take into consideration energy output produced by embedded **power plants** and electric installations;
- Based on average conditions expected for weather:

11.2.2 Connection Point Demand

11.2.2.1 Forecast demand (**active power**) and power factor to be met at each **connection point** are required for the following:

- The maximum **demand (active power)** at the **connection point** that in the opinion of the **user** could reasonably be imposed on the **system** of the **TSMO**;
- The **demand** at the time of peak **demand** on the **transmission system** as specified by the **TSMO**;
- The **demand** at the time of minimum **demand** on the **transmission system** as specified by the **TSMO**;

11.2.2.2 All forecast **demand** as specified above shall relate to each **connection point** and be in the form of:

- One set of **demand** data where the **user's system** is connected to the **transmission system** via a busbar arrangement that is not normally operated in separate sections;
- Separate sets of **demand** data where the **user's system** is connected to the **transmission system** via a busbar arrangement that is or expected to be operated in separate sections:

11.2.2.3 All of the above forecast **demand** shall:

- Be that remaining after any deductions reasonably considered by the **user** to take into account the output profile of all embedded **generating units** and such deductions should be separately stated;
- Based on average weather conditions, unless specified differently;

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11.2.2.4 So that the **TSMO** is able to assess the impact on their **transmission system** of the diversified **demand** at various periods throughout the year, each **user** shall provide additional forecast **demand** at times to be specified by the **TSMO**. The **TSMO** shall not make such a request for additional data more than once in any calendar year.

11.2.3 General Demand Data

11.2.3.1 The information in the following paragraphs may be required and should be supplied when requested by the **TSMO**.

11.2.3.2 Details of any individual loads that have characteristics significantly different from the typical range of Domestic, Commercial or Industrial loads supplied.

11.2.3.3 The sensitivity of the **demand (active power and reactive power)**, to variations in voltage and frequency on the **transmission system** at the time of peak **demand**;

11.2.3.4 The average and maximum unbalance of voltages by phases that the **user** would expect its **demand** to impose on the **transmission system**.

11.2.3.5 The maximum harmonic content that the **user** would expect its **demand** to impose on the **transmission system**.

11.2.3.6 Details of all loads that may cause **demand** fluctuations greater than [1]MW at a point of common coupling.

11.3 Generating Unit Data

11.3.1 General

11.3.1.1 Each **Generator** with **generating units** connected to the **transmission system**, each **generator** with **generating units** of greater than [5]MW connected to the **distribution system** and any other unit considered by the **TSMO** to be important shall provide the **TSMO** with the following current and forecast data each year relevant to the particular plant:

- The point of **connection** to the **transmission system** in terms of geographical and electrical location and system voltage;
- Number of **generating units** to which this data applies and type of equipment;
- Registered capacity in MW;

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- Rated terminal voltage (kV);
- Rated power factor – minimum leading and lagging;
- Net dependable output on a weekly and daily basis in MW;
- System Constrained Capacity (MW) for embedded **generating units**;
- Minimum technical **generation** output in MW;
- Maximum technical **generation** output in MW;
- The **generation unit** performance chart at the **generating unit's** stator terminals;
- The **generating unit's** rated MVA, MW, direct axis transient reactance, SCR, inertia constant; (overlap with the previous section!)
- Details of the exciter type and category, (eg whether rotating or static);
- The expected running regime (eg base load, medium load or peak load or reserve plant) at each **power plant** and type of **generating unit** (eg steam unit, hydro etc);
- Forecast **generation** profile of **active power** for independent **generating units** directly connected to the **transmission system**. Such profile is required in respect of each **connection point** for peak day **demand** at the **connection point**, minimum day **demand** at the **connection point**, typical weekday and Saturday and Sunday **demand** at the **connection point** for each month of each year;
- Details of the ability of its **generating units** to start and operate without connection to an external power supply and to update this information in the event of any change to this ability:

11.3.2 Generating Unit Step-up Transformer

- 11.3.2.1 The following **generating unit step-up transformer** parameters shall be provided:
- The step up transformer's rated MVA and positive sequence reactance (at maximum, minimum and nominal taps);

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- Number of Steps and Step size if applicable.

11.4 User's System Data

11.4.1 General

11.4.1.1 Each **user** connected directly to the **transmission system** via an existing **connection point** shall provide, each year, the **TSMO** with data on its **user** system that relates to the connection site.

11.4.1.2 When providing this information the **user** must reflect the effect at the **connection point** of any third party embedded within its own **user** system as follows:

- **User's** system layout, single line diagram which includes;
 - Busbar layouts;
 - Electrical circuitry (overhead lines, underground cables, transformers, etc);
 - Earthing arrangements;
 - Switching facilities;
 - Operating voltages;
 - Numbering and nomenclature;
 - System of auxiliary supply.

11.4.2 Reactive Compensation Equipment

11.4.2.1 For all reactive compensation equipment connected to the **user** system other than power factor correction equipment associated directly with customer's **plant and apparatus**, the following information is required:

- Type of equipment (i.e. fixed or variable);
- Capacitive and/or inductive rating or its operating range in MVA_r;
- Details of any automatic control logic to enable operating characteristics to be determined;

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- The point of connection to the **user's** system in terms of electrical location and system voltage;

11.4.3 Short Circuit Contribution to Transmission System

11.4.3.1 To allow the **TSMO** to model a **user system** with **generating units** and/or motor loads connected to it, a **user** is required to provide data, calculated in accordance with good industry practice.

11.4.3.2 The data should be provided for the condition of maximum short circuit infeed from that **user** system with all **generating units** synchronised to that **user** system. The **user** must ensure that the pre-fault system conditions reflect a credible system operating arrangement.

11.4.3.3 The following data regarding the short circuit contribution to the **transmission system** is required:

- symmetrical three phase short circuit current infeed at the instant of fault;
- symmetrical three phase short circuit current after the sub-transient fault current contribution has substantially decayed;
- the zero sequence source resistance and reactance values of the **user's** system as seen from the **connection point** consistent with the maximum infeed above;
- the positive sequence X/R ratio at the instant of fault;
- the pre-fault voltage magnitude at which the maximum fault currents were calculated;
- the negative sequence resistance and reactance values of the **user's** system seen from the **connection point**;

11.4.4 Switchgear Data

11.4.4.1 The following information is required with respect to switchgear on the connecting circuits including those at **power plants**;

- Rated voltage (kV);
- Operating voltage (kV);

- Rated short circuit breaking current 3 - phase (kA);
- Rated short circuit breaking current 1 - phase (kA);
- Rated load breaking current 3 - phase (kA);
- Rated load breaking current 1 - phase (kA);
- Rated peak short circuit making current 3 - phase (kA);
- Rated peak short circuit making current 1 - phase (kA);
- Breaker Response Time.

11.4.4.2 This information is to be included in Appendix B of the Relevant **Connection Agreement**.

11.4.5 User System Data

11.4.5.1 For transformers between the **transmission system** and the **user** system the following data shall be provided for each transformer:

- Rated MVA;
- Rated Voltage Ratio;
- Winding arrangement and vector group;
- Positive sequence resistance and reactance (max, min and nominal tap);
- If requested by the **TSMO**, zero sequence reactance;
- Tap changer range and step size;
- Tap changer type: on load or off circuit;
- **Earthing** method: Direct, through resistance or reactance; and
- Impedance if not directly earthed.

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11.4.6 Connecting Circuits data

11.4.6.1 Where the **User's** part of the circuits connecting the **User** system to the **transmission system** are longer than 100 m in length, the **User** shall supply the following data:

- Rated voltage (kV)
- Operating Voltage (kV)
- Positive phase sequence resistance, reactance and susceptance
- Where specifically requested by the **TSMO**, zero phase sequence resistance, reactance and susceptance.

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12 Appendix 2 – Detailed Planning Data (provided by Users to the TSMO)

12.1 Data of all system users

12.1.1.1 The following data must be provided:

- single line diagram (showing connections - using a defined format);
- rated parameters of connections;
- point of connection and voltage;
- **demand** (active power and reactive power) and active energy profiles;
- **generation** profiles;
- harmonic content;
- **demand** sensitivity/fluctuations;
- **demand** management data;
- **demand** transfer capability;
- reactive compensation equipment;
- protection data;
- equipment technical data (as specified in paragraph 12.2.12);
- remote data and data transmission requirements (as specified in paragraph 12.2.12);
- transient over voltage data:

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12.2 Generating Unit Data

12.2.1 Energy Demand for In-House Needs

12.2.1.1 For each **generating unit** that has an associated **unit transformer**, the value of the **demand** supplied through **this unit transformer** when the **generating unit** is at rated MW output is to be provided.

12.2.1.2 Where the **power plant** has associated **demand** additional to the unit-supplied **demand** that is supplied from the **transmission system** through the station (or starting) transformer, the **generator** shall supply forecasts for each **station transformer** of:

- The maximum **demand** that in the opinion of the **generator** could reasonably be imposed on the **transmission system**;
- The **demand** at the time of the peak **transmission system demand**;
- The **demand** at the time of minimum **transmission system demand**:

12.2.2 Synchronous Machine and associated Control system Data

12.2.2.1 The following **generating unit** and **power plant** data shall be supplied:

12.2.3 Power Plant Technical Data

12.2.3.1 From the connection point to the transmission system (text, diagram)

- Nominal voltage at the **connection point** – kV;
- Total rated capacity – MW;
- Largest common mode failure:

12.2.3.2 At the **Connection Point**:

- the maximum 3 phase short circuit infeed calculated - kA (symmetrical, asymmetrical);
- the minimum zero sequence impedance - % on 100 MVA base;
- the minimum negative sequence impedance - % on 100 MVA base:

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12.2.4 Generating Unit Parameters

- Rated terminal volts (kV);
- Rated MVA;
- Rated MW;
- Minimum and maximum generation (MW);
- Auxiliary load (MW);
- Short circuit ratio;
- Direct axis synchronous reactance;
- Direct axis transient reactance;
- Direct axis sub-transient reactance;
- Direct axis short-circuit transient time constant.
- Direct axis short-circuit sub-transient time constant;
- Quadrature axis synchronous reactance;
- Quadrature axis sub-transient reactance;
- Quadrature axis short-circuit sub-transient time constant;
- Stator time constant;
- Stator leakage reactance;
- Armature winding direct-current resistance;
- Turbo-generator inertia constant (MW/MVA);
- Rated field current (A) at rated MW and MVA_r output and at rated terminal voltage;

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- Field current (amps) open circuit saturation curve for generating unit terminal voltages ranging from 50% to 120% of rated value in 10% steps as derived from appropriate manufacturers test certificates.

12.2.5 Genset and Station Transformer

12.2.5.1 The following data must be provided:

- Number and arrangement of windings;
- Rated MVA for each winding;
- Rated Voltage ratio;
- Positive, negative and zero sequence impedances for each winding;
- Vector group;
- Grounding arrangement;
- Saturation curve;

12.2.5.2 Tap Changer Details

- Tapped winding - text diagram;
- Tap changer range;
- Tap changer step size;
- Tap changer type;
- Tap change cycle time:

12.2.6 Generating Unit Reactive Capability (Performance Chart)

12.2.6.1 The following data must be provided:

- lagging **reactive power** at rated MW;
- lagging **reactive power** at minimum MW;

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- lagging reactive short time capability at rated MW, terminal voltage and speed;
- leading **reactive power** at rated MW:

12.2.7 Excitation System

12.2.7.1 The excitation system transfer function block diagram showing gains, time constants, limits, rates of change etc of individual elements including details of:

- rated field voltage at rated MVA and power factor and rated terminal volts and speed;
- maximum field voltage;
- minimum field voltage;
- maximum rate of change of field voltage (rising and falling);
- generating unit and exciter saturation characteristics 50 - 120% (Diagram);
- dynamic characteristics of over and under excitation limiter (block diagram);

12.2.8 Governor and Associated Prime Mover Parameters

12.2.8.1 The following governor parameters must be provided for all **generating units**.

12.2.8.2 A governor block diagram system transfer function block diagram showing gains, time constants, limits, rates of change etc of individual elements including details of:

- Filters;
- Converters;
- Overall average gain (MW/Hz):

12.2.8.3 The following prime mover parameters must be provided for steam turbine units.

12.2.8.4 The prime mover system transfer function block diagram showing gains, time constants, limits, rates of change etc of individual elements and controllers with parameters expressed in terms of the **generating unit** rated MW including details of:

- Boilers;

- HP turbine;
 - HP turbine power fraction;
 - HP steam extraction range (expressed in terms of the boiler rated output);
 - HP steam extraction valves;
- LP turbine;
 - LP turbine power fraction.

12.2.8.5 The following prime mover parameters must be provided for gas turbine units.

12.2.8.6 The prime mover system transfer function block diagram showing gains, time constants, limits, rates of change etc of individual elements and controllers including details of:

- Inlet guide vanes;
- Compressor;
- Fuel valve;
- Combustion chamber;
- Power turbine:

12.2.9 Generating Unit Load Controller

12.2.9.1 The following data must be provided:

- maximum, minimum and normal droop - %;
- maximum, minimum and normal frequency deadband - Hz;
- MW deadband;
- **automatic generation control (AGC)** capability:

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12.2.10 Governor and Generating Unit Response Capability

12.2.10.1 The following data must be provided:

- Sustained response to frequency change - MW/Hz;
- Non - sustained response to frequency change - MW/Hz;
- Rate of loading following shutdown (**generating unit** and **power plant**);
- Block load following synchronising;
- Rate of de-loading from normal rated MW;
- Regulating range;
- Governor time constant (in seconds);
- Load rejection capability while still synchronised and able to supply load;
- Details of governor system described in block diagram form showing transfer functions of individual elements and measurement units - diagram;
- Fraction of power produced by each stage in a multi - stage steam turbine (HP, IP, LP per unit of max power);

12.2.11 Generating Unit Setting Data

12.2.11.1 The settings of the following protections:

- loss of field;
- under/over excitation;
- differential;
- negative phase sequence:

12.2.12 Equipment Technical Data

12.2.12.1 The following data must be provided:

- insulation co-ordination data;

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- rated lightning impulse withstand voltage – kV;
- rated short duration power frequency withstand voltage – kV;
- circuit maximum current;
- rated short time withstand current;
- ambient conditions under which above current applies;
- **earthing** method and rated current;
- insulation pollution performance:
- Remote data and data transmission arrangements;
- System configuration and single line diagrams;
- Protection data for protection relevant to the connection point;
 - Reach of all protections on transmission lines or cables - % on 100 MVA base;
 - Number of protections on each item;
 - Total fault clearing times for near and remote faults;
 - Line re-closure sequence details;
- Time delay settings of all transformer tap changers;
- Reactive compensation - location, rating, inductance, resistance and details:

12.3 Users System Data

12.3.1 General

12.3.1.1 Each **user**, whether connected directly via an existing **connection point** to the **transmission system** or seeking such a direct connection, shall provide the **TSMO** with data on its **user** system which relates to the connection site containing the **connection point** both current and forecast.

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12.3.2 Interconnecting Transformers

12.3.2.1 For transformers between the **transmission system** and the **user** system the following data shall be provided for each transformer:

- Rated MVA;
- Rated Voltage Ratio;
- Winding arrangement and vector group;
- Positive sequence resistance and reactance (max, min and nominal tap);
- Zero sequence reactance;
- Tap changer range and step size;
- Tap changer type: on load or off circuit;
- **Earthing** method: Direct, resistance or reactance.

12.3.3 Transient Over-voltage Assessment Data

12.3.3.1 When undertaking insulation co-ordination studies the **TSMO** will require to conduct transient over-voltage assessments. When requested by the **TSMO** each **user** is required to submit data with respect to the **connection point** as follows:

- Busbar layout, including dimensions and geometry together with electrical parameters of any associated current transformers, voltage transformers, wall bushings, and support insulators;
- Physical and electrical parameters of lines, cables, transformers, reactors and shunt compensator equipment connected at that busbar or by lines or cables to that busbar. This information is for the purpose of calculating surge impedances;
- Specification details of all apparatus connected directly or by lines and cables to the busbar including the basic Insulation Levels;
- Characteristics of over-voltage protection at the busbar and at the termination of lines and cables connected at the busbar;

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12.3.3.2 The following **generating unit** or **power plant** transformer data is required:

- Three or five limb cores or single phase units to be specified;
- Operating peak flux density at nominal voltage.

12.3.4 User Protection Data

12.3.4.1 The following information is required which relates only to protection equipment that can trip or intertrip or close any **connection point** circuit breaker:

- A full description, including estimated settings, for all relays and protection systems installed or to be installed on the **user** system;
- A full description of any auto-reclosing facilities installed or to be installed on the **user** system, including type and time delays;
- A full description, including estimated settings, for all relays and protection systems or to be installed on the **generating unit**, genset transformer, station transformer and their associated connections;
- For **generating units** having (or intended to have) a circuit breaker at the **generating unit** terminal voltage, clearance times for electrical faults within the **generating unit** zone;
- The fault clearance time for electrical faults on any part of the **user** system directly connected to the **transmission system**:

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. Transmission Development Plan (TDP)
2. Generation Adequacy Plan (GAP)

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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	