



ELECTRICITY TRANSMISSION SYSTEM SECURITY STANDARD (ETSSS)

Issue 1

Revision 1

30 January 2018

Issue and Revisions

Issue and Revision Record

1. Issue 1 Revision 0, March 2005
2. Issue 1 Revision 1, January 2018

Notes: Issue 1 Revision 1 is a major revision of the standard

Contents

1.	SCOPE, ROLE AND LAYOUT OF ETSSS	4
2.	POWER INFEED CONNECTION	7
	Introduction and Applicability.....	7
	Limits to Loss of Power Infeed Risks.....	7
	Power Infeed Connection Capacity Requirements	8
	Background Conditions	8
	Pre-Fault Planning Criteria	8
	Post-Fault Planning Criteria	9
3.	MAIN INTERCONNECTED TRANSMISSION SYSTEM	10
	Introduction and Applicability.....	10
	Background Conditions	10
	Pre-Fault Planning Criteria	10
	Post-Fault Planning Criteria.....	11
4.	DEMAND CONNECTION CRITERIA.....	12
	Introduction and Applicability.....	12
	Background Conditions	12
	Pre-Fault Planning Criteria	13
	Post-Fault Planning Criteria.....	13
5.	VOLTAGE AND VOLTAGE PERFORMANCE MARGINS.....	15
	Background Conditions	15
	Voltage Limits in Planning Timescales	15
	Voltage Limits in Operational Timescales	16
6.	OPERATION OF THE TRANSCO SYSTEM.....	19
	Operational Criteria	19
	Conditional Further Operational Criteria.....	20
	Post-fault Restoration of System Security	20
	Authorised variations from the Operational Criteria.....	20
7.	GLOSSARY AND DEFINITIONS	21
	Glossary	21
	Definitions.....	21

1. SCOPE, ROLE AND LAYOUT OF ETSSS

- 1.1 Pursuant to Condition 19 of the Transmission Licence, this document (the **Standard**) sets out criteria and methodologies which the Abu Dhabi Transmission & Dispatch Company (**TRANSCO**) shall use to plan, develop, operate and maintain the **TRANSCO System**.
- 1.2 Under its Licence obligations **TRANSCO** is required, from time to time, to update the security standard for its system. Future changes to this **Standard** will be made in accordance with **TRANSCO's** obligations. Implementation of these changes will require the approval of the **Bureau**.
- 1.3 The **Electricity Transmission Code** and the **Quality of Supply Standards** (to be adopted) should be read in conjunction with this document. The definitions presented in Section 7 of this **Standard** have been harmonised between the documents to the extent possible. Those terms which are in common with the **ETC** are identified within the Glossary and Definitions list by the symbol §. All defined terms in the text of the **Standard** are presented in emboldened font.
- 1.4 **Interconnections** are covered by separate agreements which will normally be consistent with this **Standard**.
- 1.5 Parts of the existing **TRANSCO System** may not be fully compliant with this **Standard** as they were approved prior to the revision of this **Standard**. Non-compliance resulting from this clause shall not, in itself, require derogation from the **Standard**. Where arrangements were non-compliant with the standards in force at the time when those arrangements were approved, this clause shall have no effect on their compliance status. Non-compliances resulting from arrangements approved prior to the **Standard** first coming into force in 2005 shall be the subject of consideration by the **Bureau**.
- 1.6 Where historic arrangements were not captured in formal agreements, **TRANSCO** and **USERS** should act in good faith to capture and set down in writing the understandings to the best recollection of the parties.
- 1.7 If any part of the **TRANSCO System** is found to have inadequate capability and does not fully comply with the requirements of this standard, **TRANSCO** shall urgently document the non-compliance and seek derogation from the **Bureau**.
- 1.8 If, whilst considering **Secured Events** defined in this **Standard**, equipment or systems not owned by **TRANSCO** are found to have inadequate capability, the relevant **User** will be notified by **TRANSCO** and reinforcement or alternative operation shall be undertaken by the **User**.
- 1.9 Whilst this **Standard** defines the minimum transmission capacity to satisfy the planning criteria, it does not follow that the transmission capacity should be reduced to meet only the criteria set out in this **Standard**.
- 1.10 Variations to standard connection designs may be requested by a **User** and may be permissible if they do not, other than in respect of the **User** requesting the variation, either immediately, or in the foreseeable future:
- (a) reduce the security of the **MITS** below the minimum planning criteria specified in Section 3 of this **Standard**; or

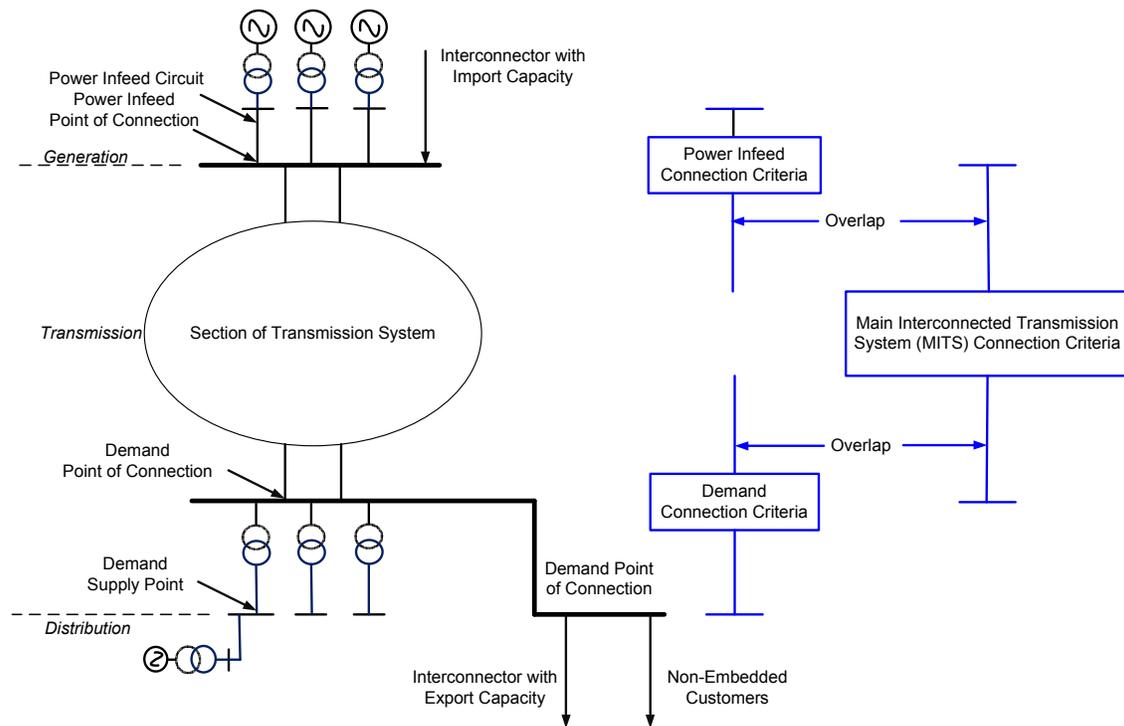
- (b) reduce the security and quality of supply of any other **User's** connection below the planning criteria set out in Section 2 or Section 4 of this **Standard**, unless specific agreements are reached with affected **Users**;
- (c) result in additional investment or operational costs to any other **User** or class of **User**; or
- (d) compromise **TRANSCO's** ability to meet other statutory obligations or **Licence** obligations.

Should system conditions subsequently change, for example due to the proposed connection of a new **User**, such that either immediately or in the foreseeable future, the conditions set out in paragraph 1.10 are no longer satisfied, then suitable investments, procedures, and / or agreements shall be put in place such that this **Standard** continues to be satisfied.

1.11 The criteria and methodologies making up the Standard have been presented according to the functional parts of the **TRANSCO System** to which they primarily apply. These parts (shown in Figure 1.1) are:

- (a) **Power Infeed** connections supplying power to the **Main Interconnected Transmission System (MITS)**;
- (b) The **Main Interconnected Transmission System (MITS)**; and
- (c) **Demand Supply Points**.

Figure 1.1 Application of security criterion



- 1.12 The criteria used in this **Standard** are based upon the normal construction methods and equipment used in the electricity supply industry and in average environmental conditions. Where those approaches are departed from, e.g. by placing more than two circuits on any support structure, or where the environmental conditions pose a significantly increased risk, or there are other special factors, planners shall assess the security risks as an exceptional circumstance and act accordingly to meet the intent of this **Standard**.
- 1.13 Where a **User** and **TRANSCO** cannot agree on the interpretation of the **Standard** or upon the actions to be taken to achieve compliance, both parties shall refer the matter to the **Bureau** for determination.

2. POWER INFEEED CONNECTION

Introduction and Applicability

- 2.1 This Section presents the deterministic planning criteria relating to the connection of **Power Infeed** to the **TRANSCO System**. The criteria in this Section shall also apply to connections through which Power Infeed embedded within a User's network, exports power to the **TRANSCO System**.
- 2.2 For the avoidance of doubt, on-site station **Demand** of a **Power Infeed** will be subject to the criteria set out in Section 2 of this **Standard** and not the criteria set out in Section 4.
- 2.3 In those parts of the **TRANSCO System** where the criteria of Section 3 and/or Section 4 also apply, those criteria must also be met.
- 2.4 For the avoidance of doubt, an **Interconnection** shall be treated as the connection of a **Power Infeed** provided it is intended to import into the **TRANSCO System**; the size of which is set by the maximum import capacity allowed for the time being in the relevant **Interconnection Agreement**.
- 2.5 **Power Infeed Connections** shall satisfy the deterministic criteria set out in paragraphs 2.7 to 2.13. Variations to the design of connections, for example to reflect the particular characteristics of a **Power Station**, may be accommodated subject to the conditions detailed in paragraph 1.10.
- 2.6 The **Power Infeed Connection** planning criteria comprise two parts as follows:
- i. criteria which determine the maximum **Loss of Power Infeed** for a set of **Secured Events**, and
 - ii. criteria which determine transmission **Capacity** required to avoid unacceptable network conditions for a set of **Secured Events**

Limits to Loss of Power Infeed Risks

- 2.7 The **Loss of Power Infeed** resulting from a **Secured Event** shall be calculated as follows:
- (a) the sum of **Registered Capacities** of the **Generating Units** disconnected by the event, plus
 - (b) the planned import from any **External System** disconnected by the same event, less
 - (c) the forecast minimum **Demand** disconnected from the system by the same event.
- 2.8 **Power Infeed** connections shall be planned such that, starting with an **Intact System**, following the **Secured Events** of:
- (a) a **Fault Outage** of any single **Transmission Circuit**; or
 - (b) the planned outage of any single section of **Busbar**;
- there shall be no **Loss of Power Infeed**.

- 2.9 **Power Infeed** connections shall be planned such that, starting with an **Intact System**, following the **Secured Events** of:
- (a) a **Fault Outage** of any single **Power Infeed Circuit** or any single section of **Busbar**;
 - (b) the concurrent **Fault Outage** of any two **Transmission Circuits**, or any two **Power Infeed Circuits** on the same **Double Circuit Overhead Line**, or the **Fault Outage** of any circuit breaker;
 - (c) a **Fault Outage** of any single **Transmission Circuit** or single section of **Busbar**, during the planned outage of any other single **Transmission Circuit** or section of **Busbar**; or
 - (d) the **Fault Outage** of any single circuit breaker, during the planned outage of any single section of **Busbar**,

the **Loss of Power Infeed** shall not exceed the **Infeed Loss Risk**.

Power Infeed Connection Capacity Requirements

Background Conditions

- 2.10 The transmission capacity for a **Power Infeed** shall be planned against the following background conditions:
- (a) the **Active Power** output of the **Power Infeed** shall be set equal to its **Registered Capacity**, and with corresponding full leading or lagging **Reactive Power** output;
 - (b) conditions on the **TRANSCO System** shall be set to those which ought reasonably to be expected to arise in the course of a year of operation. Such conditions shall include forecast **Demand** cycle, transfers to and from **External Systems**, typical **Power Infeed** operating regimes and typical arranged transmission equipment outage patterns;
 - (c) for the purpose of assessment of system stability and voltage, the **Reactive Power** output shall be set to that which may reasonably be expected under the conditions described in paragraph 2.10(b).

Pre-Fault Planning Criteria

- 2.11 The transmission capacity for the connection of a **Power Infeed** shall be planned such that, for the background conditions described in paragraph 2.10, prior to any fault there shall not be any of the following:
- (a) equipment loadings exceeding the **Pre-fault Rating**; or
 - (b) voltages outside the **Pre-fault Voltage** limits or **Insufficient Voltage Performance Margins**; and
 - (c) **System Instability**.

Post-Fault Planning Criteria

2.12 The transmission capacity for the connection of a **Power Infeed** shall also be planned such that, for the background conditions described in paragraph 2.10, with no local outage and the **Fault Outage** of any of the following **Secured Events**:

- (a) a single **Transmission Circuit**, reactive compensator or other **Reactive Power** provider;
- (b) a single **Power Infeed Circuit**;
- (c) a single **Transmission Circuit** with the prior outage of another **Transmission Circuit**;
- (d) a section of **Busbar**; or
- (e) a single **Transmission Circuit** with the prior outage of a **Power Infeed Circuit**, reactive compensator or other **Reactive Power** provider;

there shall not be any of the following:

- (f) equipment loadings exceeding the **Post-Fault Ratings**; or
- (g) voltages outside the **Steady State** voltage limits (as stated in Section 5 of this **Standard**) or **Insufficient Voltage Performance Margins**; or
- (h) **System Instability**; or
- (i) **Loss of Supply Capacity** exceeding the levels permitted by the **Demand** connection criteria explained in Section 4 of this **Standard**.

2.13 Under **Intact System** or planned outage conditions with background conditions as described in paragraph 2.10 a fault on any circuit breaker shall not cause **Unacceptably High Voltage**.

3. MAIN INTERCONNECTED TRANSMISSION SYSTEM

Introduction and Applicability

- 3.1 This Section presents the minimum deterministic planning criteria for the **Main Interconnected Transmission System (MITS)**.
- 3.2 In those parts of the **TRANSCO System** where the criteria of Section 2 and/or Section 4 also apply, those criteria must also be met.
- 3.3 In planning the MITS, this standard is met if the design satisfies the minimum deterministic criteria detailed in the paragraphs 3.5 to 3.9.

Background Conditions

- 3.4 The **MITS** shall be planned against the following background conditions:
 - (a) the **TRANSCO System** shall be set to those conditions which ought reasonably to be foreseen to arise. This should include forecast **Demand** cycles, typical **Power Infeed** operating regimes, and typical planned outage patterns.
 - (b) power flows shall be set, based on an **Economic Despatch**, using assumptions which ought reasonably to be foreseen to arise. Scenario modelling shall be used as required to develop study cases of the **Power Infeed** outputs and transfers to and from **External Systems**. These study cases are termed the **Planned Transfer Conditions**.
 - (c) the expected availability of **Power Infeed** reactive capability shall be set to that to that which ought reasonably to be expected to arise. This shall take into account the variation of reactive capability with the **Active Power** output. In the absence of realistic data, the expected available capability shall not exceed 90% of the **Electricity Transmission Code** specified capability or 90% of assumed capability as appropriate.

Pre-Fault Planning Criteria

- 3.5 The minimum transmission capacity of the **TRANSCO System** shall be planned such that, for the background conditions described in paragraph 3.4 above, there shall not be:
 - (a) equipment loadings exceeding **Pre-Fault Rating**;
 - (b) voltages outside the **Pre-fault Voltage Limits**;
 - (c) **Insufficient Voltage Performance Margins**; or
 - (d) **System Instability**.
- 3.6 The minimum transmission capacity of the **MITS** shall also be planned such that, for the background conditions described in paragraph 3.4, the operational security criteria set out in Section 6 can be met.

Post-Fault Planning Criteria

- 3.7 The minimum transmission capacity of the **MITS** shall also be planned such that for the conditions described in paragraph 3.4 and for the **Secured Event** of a **Fault Outage** of any of the following:
- (a) a single **Transmission Circuit**, reactive compensator or other **Reactive Power** provider;
 - (b) a section of **Busbar**; or
 - (c) any single **Transmission Circuit** with the prior outage of another **Transmission Circuit, Power Infeed**, reactive compensator or other **Reactive Power** provider;
- there shall not be any of the following:
- (d) **Loss of Supply Capacity**, except as permitted by the Demand Connection criteria detailed in Table 4.1;
 - (e) **Unacceptable Overloading** of any **Primary Transmission Equipment**;
 - (f) **Unacceptable Voltage Conditions** or **Insufficient Voltage Performance Margins**(as stated in Section 5 of the Standard); or
 - (g) **System Instability**.
- 3.8 The minimum transmission capacity of the MITS shall also be planned such that, for the background conditions described in paragraph 3.4, a fault on any circuit breaker shall not cause unacceptably high voltage.
- 3.9 In addition to the above, the system shall be planned such that the operational switching does not cause **Unacceptable Voltage Conditions**.

4. DEMAND CONNECTION CRITERIA

Introduction and Applicability

- 4.1 This Section presents the minimum deterministic planning criteria for the connection of **Demand Groups** to the **TRANSCO System**.
- 4.2 In those parts of the **TRANSCO System** where the criteria of Section 2 and/or Section 3 also apply, those criteria must be met in addition to those of this Section.
- 4.3 The design of **Demand Connections** shall:
- (a) satisfy the minimum deterministic criteria detailed in paragraphs 4.5 to 4.7; or
 - (b) satisfy the connection design variation conditions set out in paragraph 1.10;

Background Conditions

- 4.4 The connection of a particular **Demand Group** shall be assessed to determine whether the **TRANSCO System** meets the criteria set out in paragraphs 4.5 to 4.7 under the following background conditions and making the following allowances:
- (a) when there are no arranged outages, the **Demand** of the **Demand Group** shall be set equal to **Group Demand**;
 - (b) when there is a planned outage local to the **Demand Group**, the **Demand** of the **Demand Group** shall be set equal to the **Maintenance Period Demand**;
 - (c) the security contribution of small embedded (less than 1MW) **Power Infeed** facilities is implicitly accounted for in the **Group Demand** and need not be considered separately;
 - (d) embedded **Power Infeed** in excess of 1MW shall be considered separately for their impact on **Group Demand**. The relief given to a **Demand Group** depends on a number of factors:
 - (i) the nature of the **Power Infeed** to be available;
 - (ii) the incentive for the **Power Infeed** to be available and run on request; and
 - (iii) the information, command and control arrangements available with the **Power Infeed**.
 - (e) Transfer of **Demand** from one **Demand Group** to another (declared by **Distribution Companies** pursuant to the **Electricity Transmission Code**), shall be considered, taking account of any restrictions both on the timescales needed to achieve the transfer and any limitation on the duration of the transfer. In circumstances where **TRANSCO** agrees with a **Distribution Company** to plan to make use of the transfer capacity referred to in this paragraph, to relieve the conditions on another **Demand Group**, **TRANSCO** shall plan to maintain that capacity availability in all appropriate parts of the **TRANSCO System**.

Pre-Fault Planning Criteria

- 4.5 The transmission capacity for the connection of a **Demand Group** shall be planned such that, for the background conditions described in paragraph 4.4 under **Intact System** conditions, there shall not be any of the following:
- (a) equipment loadings exceeding the **Pre-fault Rating**;
 - (b) voltages outside the **Pre-Fault Voltage Limits**;
 - (c) **Insufficient Voltage Performance Margins**; or
 - (d) **System Instability**.
- 4.6 The transmission capacity for the connection of a **Demand Group** shall also be planned such that for the background conditions described in paragraph 4.4, and for the planned outage of a single **Transmission Circuit** or a single section of high voltage **Busbar**, there shall not be any of the following:
- (a) **Loss of Supply Capacity**,
 - (b) **Unacceptable Overloading** of any **Primary Transmission Equipment**;
 - (c) voltages outside the **Pre-Fault Voltage Limits**;
 - (d) **Insufficient Voltage Performance Margins**; or
 - (e) **System Instability**.

Post-Fault Planning Criteria

- 4.7 The transmission capacity for the connection of a **Demand Group** shall also be planned such that for the background conditions described in paragraph 4.4, with the planned outage of a single **Transmission Circuit** and the **Secured Event** of a **Fault Outage** on the **TRANSCO System** of:
- (a) a single **Transmission Circuit**; or
 - (b) a single **Power Infeed** or a **DC Converter**;
- there shall not be any of the following:
- (c) a **Loss of Supply Capacity** such that the provisions set out in Table 4.1 are not met;
 - (d) **Unacceptable Overloading** of any **Primary Transmission Equipment** in excess of **Post-Fault Ratings**;
 - (e) **Unacceptable Voltage Conditions**;
 - (f) **Insufficient Voltage Performance Margins**; or
 - (g) **System Instability**.

Table 4.1 Minimum planning supply capacity following secured events

Group Demand (MVA)	Initial System Conditions	
	Intact System	With Single Planned Outage
In excess of 500 MVA	Immediately Group Demand	Immediately Maintenance Period Demand
120 – 500 MVA	Immediately NOTE 1 Group Demand	Immediately NOTE 1 Maintenance Period Demand
40 – 120 MVA	Immediately NOTE 1 Group Demand	5 minutes NOTE 2 Maintenance Period Demand
Up to 40 MVA	Immediately NOTE 2 Group Demand	5 minutes NOTE 3 Maintenance Period Demand

- Notes:
- [1] A Loss of Supply not exceeding 5 minutes may be acceptable if this leads to significant economies..
 - [2] A Loss of Supply not exceeding 3 hours may be acceptable at certain sites if this leads to significant economies and has the prior approval of the Bureau following consultation with all stakeholders.
 - [3] A Loss of Supply not exceeding 6 hours may be acceptable at certain sites if this leads to significant economies and has the prior approval of the Bureau following consultation with all stakeholders.

5. VOLTAGE AND VOLTAGE PERFORMANCE MARGINS

Background Conditions

- 5.1 The **Group Demands** used in planning timescales for calculation of the voltage performance margins, are to be 5% higher than the estimated **Group Demand** in the forecast peak **Demand** figures. The **Group Demand** used for voltage calculations in other timescales is to be the estimated **Group Demand**.

Voltage Limits in Planning Timescales

- 5.2 The **Pre-Fault Voltage Limits** and targets on the **TRANSCO System** are as shown in Table 5.1.

Table 5.1 Pre-fault voltage limits in planning timescales

Voltage limits on the transmission network		
Nominal voltage	Minimum voltage	Maximum voltage
400kV	380 kV (95%) Note 1	420 kV (105%) Note 1
220kV	209 kV (95%) Note 1	231 kV (105%) Note 1
132kV	125 kV (95%) Note 1	139 kV (105%) Note 1
Customer Connection Points at 33kV and below will be maintained at +/- 6% of the nominal voltage		

Notes: [1] It is permissible to relax these to the limits specified in Table 5.3 if:
 (i) following a secured event, the voltage limits specified in Table 5.3 can be achieved, and
 (ii) there is judged to be sufficient certainty of meeting the operational voltage limits specified in Table 5.5

- 5.3 A voltage condition is unacceptable in planning timescales if after either:
- (a) a **Secured Event**; or
 - (b) operational switching;
- and the affected **Site** remains directly connected to the **TRANSCO System**, any of the following conditions apply:
- (c) the voltage step change at an interface between the **TRANSCO System** and a **Customer** exceeds that specified in Table 5.2; or
 - (d) there is any inability following such an event to achieve a **Steady State** voltage as specified in Table 5.3 at **TRANSCO System** substations or connection **Sites** with **Customers** using manual and/or automatic facilities available, including the switching in or out of relevant equipment.
- 5.4 The **Steady State** voltages are to be achieved without widespread generation transformer re-tapping or post fault adjustment of SVC set points to increase the reactive power output or to avoid exceeding the available reactive capability of generation or SVCs. In particular, following a secured event, the target voltages at Customer

Connection Points should be achieved after the operation of local reactive switching and auto switching schemes, and after the operation of transformer tap changers.

- 5.5 The voltage step change limits must be applied with load response taken into account.

Table 5.2 The voltage step change limits in planning timescales

Type of Event	Voltage Fall	Voltage Rise
Following a Secured Event :	-6% Note 1,2	+6%
Following operational switching at intervals of more than 10 minutes:	-3%	+3%
Following operational switching at intervals of 10 minutes or less:	In accordance with figure 5.1	In accordance with figure 5.1

Notes: [1] It is permissible to relax this to -12% if the fault includes a double circuit overhead line.
[2] It is permissible to relax this to -12% if the fault includes the loss of a section of busbar.

Table 5.3 The steady state voltage limits in planning timescales following any secured event

Voltage limits on the transmission network		
Nominal voltage	Minimum voltage	Maximum voltage
400kV	360 kV (90%) Note 1	420 kV(105%) Note 1,2
220kV	198 kV (90%) Note 1	242 kV (110%) Note 1
132kV	119 kV (90%) Note 1	145 kV (110%) Note 1
Customer Connection Points at 33kV and below will be maintained at +/- 6% of the nominal voltage		

Notes: [1] For voltages above <95% or >105% there must be sufficient certainty of meeting the operational voltage limits specified in Table 5.5
[2] It is permissible to relax this to 440kV (110%) for no longer than 15 minutes following a major system fault.

Voltage Limits in Operational Timescales

- 5.6 Where possible, the **Steady State** pre-fault voltage on the **TRANSCO System** will be no lower than 95% of nominal. The target operational voltages at **Customer Connection Points** should be as agreed with the relevant **Customer**.

- 5.7 A voltage condition is unacceptable in operational timescales if after either:

- (a) a **Secured Event**; or
- (b) operational switching;

and the affected **Site** remains directly connected to the **TRANSCO System**, any of the following conditions apply:

- (c) the voltage step change at an interface between the **TRANSCO System** and a **Customer** exceeds that specified in Table 5.4; or

- (d) there is any inability following such an event to achieve a **Steady State** voltage as specified in Table 5.5 at **TRANSCO System** substations or connection **Sites** with **Customers** using manual and/or automatic facilities available, including the switching in or out of relevant equipment.

Table 5.4 The voltage step change limits in operational timescales

Type of Event	Voltage Fall	Voltage Rise
Following a Secured Event:	-6% Note 1,2	+6%
Following operational switching at intervals of more than 10 minutes:	-3%	+3%
Following operational switching at intervals of 10 minutes or less:	In accordance with figure 5.1	In accordance with figure 5.1

Notes: [1] It is permissible to relax this to -12% if the fault includes a double circuit overhead line.
 [2] It is permissible to relax this to -12% if the fault includes the loss of a section of busbar.

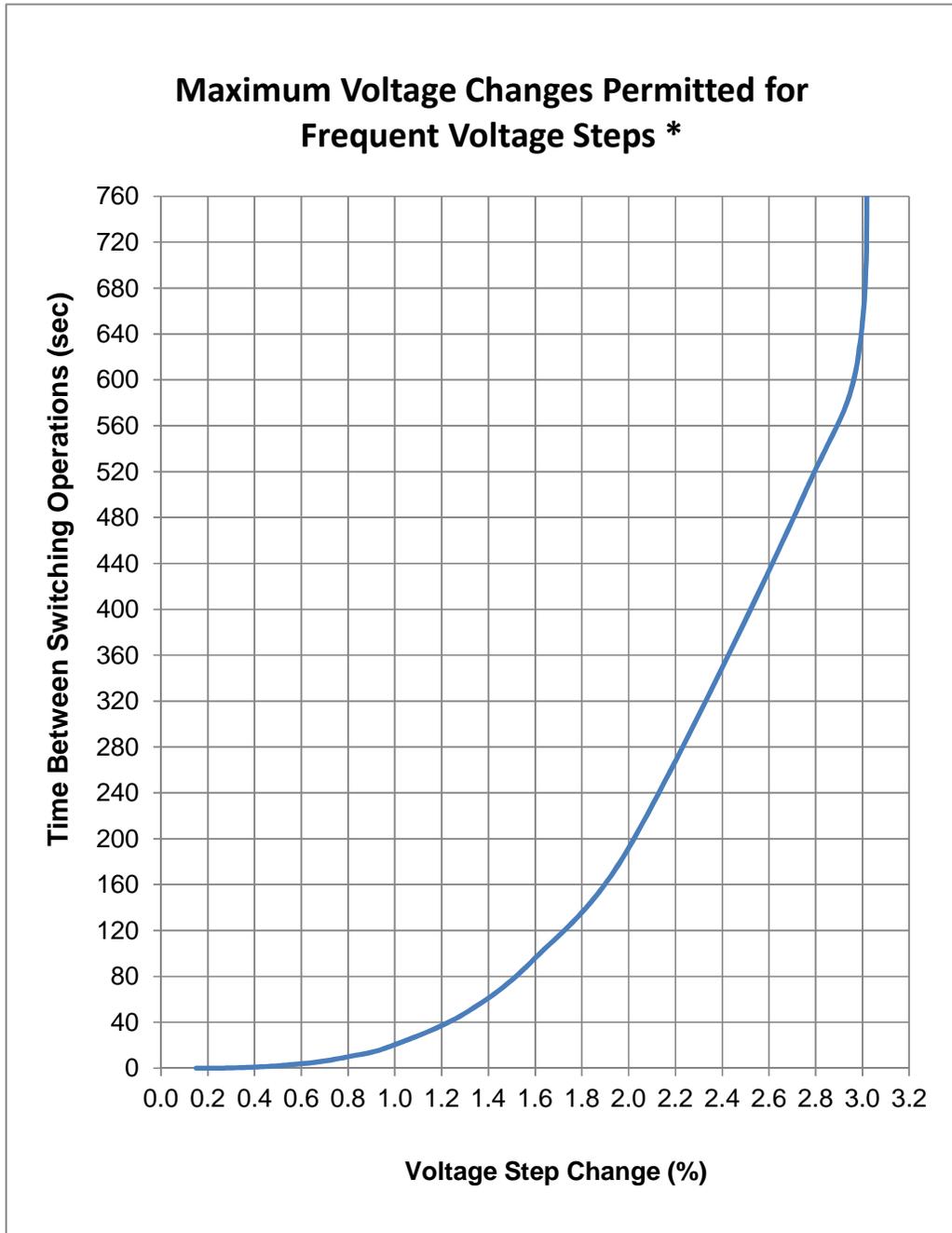
Table 5.5 The steady state voltage limits in operational timescales

Voltage limits on the transmission network		
Nominal voltage	Minimum voltage	Maximum voltage
400kV	360 kV (90%)	420kV (105%) Note 1
220kV	198 kV (90%)	242 kV (110%)
132kV	119 kV (90%)	145 kV (110%)
Customer Connection Points at 33kV and below will be maintained at +/- 6% of the nominal voltage		

Notes: [1] It is permissible to relax this to 440kV (+110%) for no longer than 15 minutes following a major system fault.

- 5.8 Developments established in the planning timeframe should have regard to the frequency of operational switching as agreed with the system operator and following the “flicker “ guidance derived from the UK Engineering Recommendation P28 as summarised in Figure 5.1.

Figure 5.1 Maximum voltage step change permitted for operational switching



Source: Derived from UK Energy Networks Association Engineering Recommendation P28 1989, Figure 4.

6. OPERATION OF THE TRANSCO SYSTEM

Operational Criteria

6.1 The **TRANSCO System** shall be operated under **Prevailing System Conditions** so that for the **Secured Event** of a **Fault Outage** on the **TRANSCO System** of any of the following:

- (a) a single **Transmission Circuit**, reactive compensator or other **Reactive Power** provider; or
- (b) a single **Power Infeed Circuit**; or
- (c) a loss of **Power Infeed** not exceeding the **Infeed Loss Risk**; or
- (d) a section of **Busbar**,

there shall not be any of the following:

- (e) a **Loss of Supply Capacity** except as specified in Table 6.1;
- (f) **Unacceptable Frequency** conditions;
- (g) **Unacceptable Overloading** of any **Primary Transmission Equipment**;
- (h) **Unacceptable Voltage Conditions**; or
- (i) **System Instability**.

6.2 For a **Secured Event** on the **TRANSCO System** involving connections to more than one **Demand Group**, the permitted **Loss of Supply Capacity** for that **Secured Event** is to be assessed on the basis of the size of the sum of the **Demand Groups**.

Table 6.1 Maximum permitted loss of supply capacity following a secured event

Group Demand (MVA)	Initial System Conditions	
	Intact System	With Single Planned Outage
In excess of 500 MVA	Immediately Group Demand	Immediately Maintenance Period Demand
120 – 500 MVA	Immediately NOTE 1 Group Demand	Immediately NOTE 1 Maintenance Period Demand
40 – 120 MVA	Immediately NOTE 1 Group Demand	5 minutes NOTE 2 Maintenance Period Demand
Up to 40 MVA	Immediately NOTE 2 Group Demand	5 minutes NOTE 3 Maintenance Period Demand

Notes: [1] A Loss of Supply not exceeding 5 minutes may be acceptable if this leads to significant economies..
 [2] A Loss of Supply not exceeding 3 hours may be acceptable at certain sites if this leads to significant economies and has the prior approval of the Bureau following consultation with all stakeholders.
 [3] A Loss of Supply not exceeding 6 hours may be acceptable at certain sites if this leads to significant economies and has the prior approval of the Bureau following consultation with all stakeholders.

Conditional Further Operational Criteria

- 6.3 During periods of major system risk, **TRANSCO** operational control may implement measures to mitigate the consequences of this risk.
- 6.4 If other actions cannot resolve overloading, it is acceptable to utilise short-term post-fault actions to avoid **Unacceptable Overloading of Primary Transmission Equipment** which may include a requirement for **Demand** reduction ; however, this will not be used as a method of increasing reserve to cover abnormal post-fault generation reduction. Where possible these post-fault actions shall be notified to the appropriate **User**.

Post-fault Restoration of System Security

- 6.5 Following the occurrence of a **Secured Event** on the **TRANSCO System**, measures shall be taken to re-secure the system to the above operational criteria as soon as reasonably practicable. To this end, it is permissible to put operational measures in place pre-fault, to facilitate the speedy restoration of system security.

Authorised variations from the Operational Criteria

- 6.6 Exceptions to the criteria in paragraphs 6.1 to 6.5 may be required where variations to the connection designs have been agreed between **TRANSCO** and the **User** and approved by the **Bureau**.
- 6.7 The principles of these operational criteria shall be applied at all times except in special circumstances where, to preserve overall system integrity, **TRANSCO** may need to act, or give instructions to act, outside the criteria. Such actions shall only take place following consultation with the appropriate party.

7. GLOSSARY AND DEFINITIONS

Glossary

DISCO	Distribution Company
ETC	The TRANSCO Electricity Transmission Code
ETSSS	This TRANSCO Electricity Transmission System Security Standard, as altered or amended from time to time and to be construed as including any approved instruction, rules or guidance issued pursuant to that Standard. This document refers to itself as The Standard.
MITs	Main Interconnected Transmission System
MVA	Megavolt-Amperes - See definition for Apparent Power
MW	Megawatts - See definition for Active Power
MVA_r	Megavolt-Amperes reactive - See definition for Reactive Power
SVC	Static Var Compensator
WFPS	Wind Farm Power Station

Definitions

Notes: § denotes a definition from the Electricity Transmission Code (ETC).

Active Power	<p>§ The product of voltage and the in-phase component of alternating current measured in units of watts and standard multiples thereof, i.e.</p> <p>1000 Watts = 1 kW 1000 kW = 1 MW 1000 MW = 1 GW 1000 GW = 1 TW.</p>
Apparent Power	<p>§ The product of voltage and of alternating current measured in units of volt-amperes and standard multiples thereof, i.e.</p> <p>1000 VA = 1 kVA 1000 kVA = 1 MVA</p>
Bureau	The Regulation and Supervision Bureau for Abu Dhabi (RSB).
Busbar	The physical connection which couples two or more Transmission Circuits electrically.
Connection Agreement	§ The agreement for connection envisaged in Condition 14 Paragraph 2 of the Transmission Licence. The full title of the document is the connection, Use of System and Interface Agreement.
Connection Point	The physical boundary between the TRANSCO System and that owned by a User, as identified in the connection, Use of System and Interface Agreement.
Customer	§ A Person to whom electricity is provided.
Demand	The electrical Apparent Power and Reactive Power drawn by a User or, as the case may be, a group of Users.
Demand Group	A Site or group of Sites that collectively take power from TRANSCO's System
Demand Supply Point	A point of supply from the TRANSCO System to a User. In the case of the DISCO's, the Demand Supply Point is the transformer low voltage bushing between the TRANSCO System and the Distribution System, or the nearest point to this on the low voltage side of the transformer, which can be used as a point of disconnection or earthing. In the case of other Users, the Demand Supply Point is defined as the Connection Point recorded in the relevant Connection Agreement.
Distribution Company (DISCO)	A User of TRANSCO's System who holds a distribution Licence.

Distribution System	§ .The system consisting of electric lines which are owned or operated by a DISCO and used for the distribution of electricity.
Double Circuit Overhead Line	An overhead transmission line which consists of two or more circuits sharing the same towers for at least one span. For the avoidance of doubt, a single circuit could form parts of more than one Double Circuit Overhead Line.
Economic Despatch	The despatch of Power Infeed facilities by TRANSCO to produce energy at the lowest cost for the Single Buyer i.e. ADWEC and to reliably serve consumers, recognising any operational limits of generation and transmission facilities.
Electricity Transmission Code (ETC)	§ The document referred to in Condition 3 of the Transmission Licence.
External System	Any transmission system or private network containing demand and generation, sometime referred to as self-supply sites, that connects with the TRANSCO system and is owned and/or operated by a Person other than TRANSCO.
Fault Outage	An outage of one or more items of Primary Transmission Equipment and/or Plant initiated by automatic action unplanned at that time, which may or may not involve the passage of fault current.
Frequency	The number of alternating current cycles per second (expressed in Hertz) at which the TRANSCO System is running.
Generating Unit	<p>Other than in the case of Wind Farm Power Stations (WFPS) or solar Power Stations, means a turbine generator within a Power Station, together with all Plant and apparatus at that Power Station up to the high voltage bushings at the generator transformer, which relate exclusively to the operation of that turbine generator (which in the case of a steam turbine will include the boiler and heat exchanger and in the case of a gas turbine will include the gas generator/combustion turbine).</p> <p>In the case of wind generation, a WFPS is a generating unit and comprises one or more wind turbine generators that are controlled together, including all Plant and apparatus and any step-up transformer which relates exclusively to the operation of those wind turbine generators.</p> <p>In the case of solar Power Stations, a solar generating unit is a group of devices which are controlled together to collect or concentrate the sun's rays within a solar Power Station, together with all Plant and apparatus and any step-up transformer which relates exclusively to the operation of that part of the solar Power Station.</p> <p>Generating Units could be synchronous or non-synchronous.</p>
Generator	A Person who generates electricity under Licence in Abu Dhabi Emirate.
Group Demand	The forecast maximum Demand for a single Demand Supply Point or a number of connected Demand Supply Points, provided in accordance with the requirements of the Electricity Transmission Code by the DISCOs or other directly connected Customers.
Infeed	The quantity of electric power entering the TRANSCO System (or part of the system) from any source or, as the case may require, the sum of power entering from a number of sources.
Infeed Loss Risk	<p>Is a value set by TRANSCO from time to time to ensure that no Secured Event can result in a Frequency deviation below 49.5Hz; and when the System is connected to other systems no Secured Event on the TRANSCO System would cause a Frequency deviation greater than allowed in the relevant Interconnection Agreement.</p> <p>For the purposes of system design the maximum Power Infeed Loss Risk considered by TRANSCO is 1400MW</p> <p>For the purpose of system operation TRANSCO must use an appropriate value of Infeed Loss Risk given the prevailing network conditions.</p>

Insufficient Voltage Performance Margins	In all timescales and in particular the post-fault periods (i.e. before, during and after the automatic controls take place), there are Insufficient Voltage Performance Margins when any of the following occurs: i) voltage collapse; ii) over-sensitivity of system voltage; or iii) unavoidable exceedance of the reactive capability of generating units such that accessible reactive reserves are exhausted; under any of the following conditions: a 5% increase in Demand above the Annual Peak Demand figures; the unavailability of any single reactive compensator or other Reactive Power provider; or the loss of any one automatic switching system or any automatic voltage control system for on-load tap changing.
Intact System	This is the TRANSCO System with no System outages, whether planned or unplanned.
Interconnection	The arrangements, including any Transmission Circuit, whether owned by TRANSCO or not, which link an External System to the TRANSCO System, and Interconnector and Interconnected shall be construed accordingly.
Interconnection Agreement	An agreement made between TRANSCO and an External System Operator and/or other relevant Person for the Interconnection relating to the operation of that Interconnection.
Licence	§ Any licence granted to TRANSCO or a User, under Article 82 of the 'Law'
Loss Of Power Infeed	Power Infeed from any source that is disconnected from the System by a Secured Event, less the Demand disconnected from the System by the same Secured Event.
Loss of Supply Capacity	The reduction in the supply capacity at a Demand Supply Point as a result of TRANSCO's failure to maintain the potential to provide the supply capacity in full.
Main Interconnected Transmission System (MITS)	The 400kV, 220kV and 132kV elements of the TRANSCO System except for Power Infeed Circuits; Demand Connections and Interconnections between the TRANSCO System and External Systems.
Maintenance Period	The period of the year, typically from November to April, during which maintenance of Transmission equipment is normally undertaken.
Maintenance Period Demand	The Demand level experienced at a Demand Supply Point and is the maximum Demand level expected during the normal maintenance period. This level is such that the period in which maintenance could be undertaken is not unduly limited. Unless better data are available this should be 50% of the Group Demand.
Megawatt (MW)	See definition for Active Power
Planned Transfer Conditions	The meaning is set out in paragraph 3.4(b) of this Standard.
Plant	§ Fixed and moveable items used in the generation and/or supply and/or Transmission of electricity and/or water.
Post-Fault Rating	The maximum continuous rating appropriate to the climatic or other conditions which may be applied in a fault situation until pre-fault requirements can be restored. Normally this would be for a period well within 24 hours.
Power Infeed	Any source of Active Power supplied to the system.
Power Infeed Circuit	The sole electrical Connection between one or more Power Infeeds and the Main Interconnected Transmission System i.e. a radial circuit which if removed would disconnect the power infeed.
Power Station	§ An installation comprising one or more Generating Units in common ownership which may reasonably be considered as being managed as one Power Station.

Pre-Fault Ratings	The specified pre-fault capability of Transmission equipment. Due allowance shall be made for specific conditions (for example, ambient /seasonal temperature), agreed time-dependent loading cycles of equipment and any additional relevant procedures.
Pre-Fault Voltage Limits	These limits are set down in Table 5.1 of this Standard for the planning timeframe.
Prevailing System Conditions	These are conditions on the TRANSCO System prevailing at any given time and will therefore normally include planned outages and unplanned outages.
Primary Transmission Equipment	The high voltage equipment comprising the TRANSCO System.
Quality of Supply Standards	A set of standards approved and adopted by TRANSCO, based upon international best practice, which apply to Users of the ETC and, to the extent identified in this ETSSS, to TRANSCO for the maintenance of the quality of the voltage waveform in TRANSCO's Licensed area.
Reactive Power	§ The product of voltage and current and the sine of the phase angle between them measured in units of volt-amperes reactive or VAR and standard multiples thereof, i.e. 1000 VAR = 1 kVAR 1000 kVAR = 1 MVAR
Registered Capacity	For a Generation Unit the registered capacity is the full load capacity as declared by the Generator in their PWPA, less the MW consumed by the Generating Unit when producing full Load (the resultant figure being expressed in whole MW).
Secured Event	A contingency which shall not result in the remaining TRANSCO System being in breach of the security criteria. Secured Events are individually specified in this Standard. It is recognised that more onerous unsecured Events may occur and that additional operational measures within the requirements of the Electricity Transmission Code may be utilised to maintain overall TRANSCO System integrity.
Site	A User electricity station or a TRANSCO electricity station as the case may be.
Standard (The)	This Electricity Transmission System Security Standard.
Steady State	A condition of a power system in which all automatic and manual corrective actions have taken place and all of the operating quantities that characterise it can be considered constant for the purpose of analysis.
System Instability	System Instability means either angular instability as described in i) to iii) below or voltage instability as described in iv) below : poor damping - where electromechanical oscillations of Generating Units are such that the resultant peak deviations in machine rotor angle and/ or speed at the end of a 20 second period remain in excess of 15% of the initial peak deviations. poor damping between interconnected systems, where the damping ratio for the electrical flow oscillation between the systems less than 0.05. pole slipping - where one or more synchronous Generating Units lose synchronism with the remainder of the system; or voltage collapse - whether progressive, fast or slow, voltage decrease or increase develops such that it can lead to partial or overall system blackout.
Thermal Rating	The maximum Apparent Power flow (MVA) which may be permitted to flow on a circuit under specific conditions (for example, ambient/ seasonal temperature). For the purpose of the planning criteria in this document the following ratings apply:- Circuit-breakers: continuous rating Transformers: the appropriate Cyclic Rating based on a 24-hour load cycle. Underground cables: the appropriate Cyclic Rating based on a 24-hour load cycle Overhead Lines: continuous seasonal rating. For operational purposes appropriate equipment short term ratings may be applied during post-fault conditions.
TRANSCO	§ The Abu Dhabi Transmission and Despatch Company
TRANSCO System	The network, or as the case may require, any part of the network, owned or operated by TRANSCO.

Transmission Circuit	Part of the TRANSCO System controlled by a circuit breaker which includes, for example, transformers, reactors, cables and overhead lines and other circuit breakers, but excludes Busbars and Generation Circuits.
Unacceptable Frequency Conditions	The System Frequency will be controlled within the limits of 49.9 Hz and 50.1 Hz under normal Steady State conditions and within the limits of 50.5 Hz and 49.5 Hz under exceptional Steady State circumstances. Conditions outside these bands are unacceptable for Secured Events.
Unacceptable Overloading	The overloading of any Primary Transmission Equipment beyond its specified time related capability. Due allowance shall be made for specific conditions (e.g. ambient/seasonal temperature), pre fault loading, agreed time-dependant loading cycles of equipment and any additional relevant procedures.
Unacceptable Voltage Conditions	Voltage conditions failing to meet the limits as set down in Table 5.1, 5.2, 5.3 and Figure 5.1 of this Standard for the planning timeframe, and Tables 5.4 and 5.5 for the operating timeframe.
User	A Person to whom a Connection to the TRANSCO System is provided.

Managing Director
TRANSCO



مكتب المدير العام
Office of the Director General

Ref: 2113/AQM/18/2015

Date: 15 February 2018

Dear Managing Director,

Subject: Electricity Transmission System Security Standard (ETSSS), Issue 1, Revision 1, 30 January 2018.

Thank you for your letter reference TRANSCO/AMD/PNDD/2857 dated 30 January 2018, submitting the revised ETSSS for Bureau approval.

The Bureau is pleased to see that TRANSCO has discussed and agreed a way forward with the relevant stakeholders on all comments received during our consultation, and amended the ETSSS accordingly.

Having reviewed the document, the Bureau now approves the Electricity Transmission System Security Standard (ETSSS), Issue 1, Revision 1, 30 January 2018. Please ensure that new revision is promptly supplied to all relevant stakeholders and made available on TRANSCO's website.

Yours sincerely,


SAIF SA'EEED AL QUBAISI
Director General



TRANSCO-MD				
<input type="checkbox"/> URGENT <input type="checkbox"/> TOP URGENT				
18 Feb 2018				
Respond To MD By: _____				
Dept.	Action	Feedback	Info	Support
Advisor				
NSD			✓	
AMD	✓			
PROJ			✓	
HR&A				
FIN				
SUP				
BPP				
HSE				
LDC				
File				