



THE ELECTRICITY TRANSMISSION CODE

Version 2

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THE ELECTRICITY TRANSMISSION CODE

CONTENTS

PREFACE	1
CHAPTER 1 - GLOSSARY AND DEFINITIONS (GD)	4
CHAPTER 2 - PLANNING CODE	39
1. INTRODUCTION	39
2. OBJECTIVE	39
3. SCOPE.....	40
4. PLANNING PROCEDURES	40
5. PLANNING DATA STATUS	43
6. PLANNING STANDARDS.....	44
APPENDIX A - STANDARD PLANNING DATA	45
1. DEMAND AND ACTIVE ENERGY DATA.....	45
2. GENERATING UNIT DATA	47
3. USER SYSTEM DATA.....	49
APPENDIX B - DETAILED PLANNING DATA	52
4. GENERATING UNIT DATA	52
5. USERS SYSTEM DATA.....	59
APPENDIX C - NETWORK DATA	62
6. SYSTEM MODEL	62
7. SHORT CIRCUIT CALCULATIONS.....	62
CHAPTER 3 - CONNECTION CONDITIONS	63
1. INTRODUCTION	63
2. OBJECTIVE	63
3. SCOPE.....	63
4. PROCEDURE	63
5. CONNECTION.....	63
6. TECHNICAL, DESIGN AND OPERATIONAL CRITERIA	65
7. SITE RELATED CONDITIONS.....	80
8. ANCILLARY SERVICES	84
APPENDIX A - FORMAT, PRINCIPLES AND BASIC PROCEDURE TO BE USED IN THE PREPARATION OF SITE RESPONSIBILITY SCHEDULES	85
9. PRINCIPLES	85
10. ALTERATIONS TO EXISTING SITE RESPONSIBILITY SCHEDULES	86
11. RESPONSIBLE MANAGERS.....	86
ATTACHMENT TO APPENDIX A - PROFORMA FOR SITE RESPONSIBILITY SCHEDULE	87
APPENDIX B - SYMBOLS FOR OPERATION DIAGRAMS	88
APPENDIX C - APPARATUS TO BE INCLUDED ON OPERATION DIAGRAMS	89
12. BASIC PRINCIPLES	89
13. APPARATUS TO BE SHOWN ON OPERATION DIAGRAM	89
APPENDIX D - SCADA OUTSTATION INTERFACING	91
14. INTRODUCTION	91
15. GENERAL REQUIREMENTS	91
APPENDIX E - TECHNICAL REQUIREMENTS FOR UNDER FREQUENCY RELAYS FOR THE AUTOMATIC DISCONNECTION OF SUPPLIES AT LOW FREQUENCY	93

16.	UNDER FREQUENCY RELAYS.....	93
	APPENDIX F - HARMONIC DISTORTION ON THE TRANSMISSION SYSTEM	95
	PLANNING LEVELS AND COMPATIBILITY LEVELS	95
	CHAPTER 4 - OPERATING CODE “A”	97
1.	INTRODUCTION	97
2.	SCOPE	97
3.	DEMAND FORECASTS	97
4.	OPERATIONAL PLANNING AND DATA PROVISION	101
5.	OPERATING MARGIN	114
6.	DEMAND CONTROL	119
	APPENDIX A.....	126
	1) - SYNCHRONOUS GENERATOR PERFORMANCE CHART	126
	2) - WIND AND PHOTOVOLTAIC POWER FARM PERFORMANCE CHART	120
	APPENDIX B - GENERATION PLANNING PARAMETERS	128
7.	STEAM TURBINE GENERATING UNITS.....	128
8.	GAS TURBINE GENERATING UNITS.....	128
9.	COMBINED CYCLE GAS TURBINE (CCGT) MODULES.....	128
10.	POWER FARMS	128
	APPENDIX C - OPERATING MARGIN DATA REQUIREMENTS	130
11.	PRIMARY RESPONSE CHARACTERISTICS	130
12.	PRIMARY CONTROLLER DROOP CHARACTERISTIC AND DEAD BAND	131
13.	PRIMARY CONTROLLER DEAD BAND.....	131
	APPENDIX D - EMERGENCY MANUAL DEMAND REDUCTION/DISCONNECTION SUMMARY SHEET	132
	APPENDIX E - INTERMITTENT POWER SOURCE PLANNING MATRIX WIND POWER FARM POWER STATIONS	133
	CHAPTER 5 - OPERATING CODE “B”.....	134
1.	INTRODUCTION	134
2.	SCOPE	134
3.	SAFETY CO-ORDINATION	134
4.	CONTINGENCY PLANNING	140
5.	INCIDENT INFORMATION SUPPLY.....	145
6.	OPERATIONAL LIAISON	147
7.	NUMBERING AND NOMENCLATURE OF HIGH VOLTAGE APPARATUS	150
8.	SYSTEM TESTS.....	152
9.	TESTING, MONITORING AND INVESTIGATION.....	154
	APPENDIX A - MATTERS APPLICABLE TO THE SIGNIFICANT INCIDENT TO BE INCLUDED IN A WRITTEN REPORT	169
	APPENDIX B - SYSTEM TESTS UNDER TEST PANEL SUPERVISION	170
10.	PRELIMINARY NOTICE	170
11.	TEST PANEL	170
12.	PROPOSAL REPORT	171
13.	TEST PROGRAMME	172
14.	FINAL REPORT	172
	APPENDIX C.....	173
15.	TABLE OF TOLERANCE VALUES FOR DESPATCH CHARACTERISTIC (GENERATING UNITS)	173
16.	TABLE OF TOLERANCE VALUES FOR DESPATCH CHARACTERISTIC (DESALINATION UNITS).....	174
	CHAPTER 6 - SCHEDULING AND DESPATCH CODE.....	175
1.	SCOPE	175
2.	GENERATION AND DESALINATION SCHEDULING	175
3.	GENERATION AND DESALINATION DESPATCH	181
4.	FREQUENCY CONTROL MANAGEMENT	188
5.	AVAILABILITY NOTICE	191
6.	SCHEDULING AND DESPATCH PARAMETERS	191

APPENDIX B - DESPATCH INSTRUCTIONS	193
7. FORM OF DESPATCH INSTRUCTION	193
8. DESPATCHING INSTRUCTION TO INCREASE OR DECREASE OUTPUT	193
9. GENERATING UNIT SYNCHRONISING	193
10. GENERATING UNIT DE-SYNCHRONISING	194
11. FREQUENCY CONTROL	194
12. FIVE MINUTE RESERVE.....	194
13. BLACK START	194
14. EMERGENCY INSTRUCTION	194
15. VOLTAGE CONTROL INSTRUCTION	194
CHAPTER 7 - DATA REGISTRATION CODE.....	196
1. INTRODUCTION	196
2. OBJECTIVE	196
3. SCOPE	196
4. DATA CATEGORIES AND STAGES IN REGISTRATION	196
5. PROCEDURES AND RESPONSIBILITIES	197
6. DATA TO BE REGISTERED	197
CHAPTER 8 - GENERAL CONDITIONS.....	229
1. INTRODUCTION	229
2. SCOPE	229
3. UNFORESEEN CIRCUMSTANCES	229
4. THE ELECTRICITY TRANSMISSION CODE REVIEW PANEL.....	229
5. DUTY OF GOOD FAITH AND STANDARD OF CONDUCT	230
6. COMMUNICATION BETWEEN TRANSCO AND USERS	230
7. MISCELLANEOUS	231
8. OWNERSHIP OF PLANT AND/OR APPARATUS.....	231
9. SYSTEM CONTROL	231
10. COMPLIANCE WITH REVISIONS	231

PREFACE

1. The benefits of the interconnection of individual Power Stations and the supply of electricity from such interconnected **Systems** to discrete **Demand** centres have long been enjoyed world-wide.
2. **High Voltage** interconnected **Systems** confer on electricity supply the readily realisable advantages of increased security of supply and greater economy arising from the immediate accessibility of the required mix of generation at any time.
3. These advantages are made possible only when the interconnected **System** is subject to overall surveillance and control irrespective of ownership and operation of the individual constituent parts of it.
4. The ownership of assets and corporate structures of electricity undertakings throughout the world are as varied and numerous as the interconnected **Systems** themselves but the elements of centralised generation scheduling, despatch and on-line control of the High Voltage transmission **System** are invariably the same. Moreover, the extent to which **Systems** are planned and designed against a unified **System Demand** forecast is also comparable world-wide despite the many and varied organisational structures of the bodies involved in the process.
5. In Abu Dhabi the **System** comprises a network of **High Voltage** transmission **Plant** and **Apparatus** interconnecting the major sources of electricity generation and the major **Demand** centres. Subject to **System** constraints this allows electricity to be supplied to **Customers** from wherever it can be produced. To fulfil this objective requires a certain standard for **Plant** and **Apparatus** as well as centralised co-ordination of all those **Users** who benefit from the existence of the **Transmission System**.
6. Electricity cannot be stored in bulk until it is needed but has to be generated in the correct quantities at virtually the moment it is required otherwise the supply voltage and frequency will deviate outside fairly narrow limits with both undesirable and harmful effects. As a result, it is necessary to forecast **Demand** on a daily basis so that the minute-by-minute operation of **Power Stations** can be scheduled. It is also necessary to forecast **Demand** in the longer term to programme the building of new **Power Stations** and the development of the **Transmission System**.
7. Centralised control of the electricity supply **System** in Abu Dhabi has been implemented from the earliest days of the **Transmission System** when the principal purpose for the interconnection was to increase security and reduce spare generating plant capacity owned and operated by WED.
8. The re-structuring of the water and electricity sector and its privatisation brings yet another change with the setting up of separate **Distribution Companies** which are able to purchase electricity from the **Abu Dhabi Water and Electricity Company** and ultimately from **By-Pass Generators**. Whilst most but not all of the electricity will be transmitted across the **Transmission System**, the interconnected **System** as a whole must continue to be centrally co-ordinated and this will be accomplished by **TRANSCO**.
9. The operating procedures and principles governing **TRANSCO** relationships with all **Users** of the **Transmission System** are set out in the **Transmission Code**. The **Transmission**

Code specifies day-to-day procedures for both planning and operational purposes and covers both normal and exceptional circumstances.

10. The **Transmission Code** is designed to permit the development, maintenance and operation of an efficient, co-ordinated and economical **Transmission System**, is conceived as a statement of what is optimal (particularly from a technical point of view) for all **Users** and **TRANSCO** itself in relation to the planning, operation and use of the **Transmission System**. It seeks to avoid any undue discrimination between **Users** and categories of **Users**.

11. The **Transmission Code** is divided into the following sections:

- i) a **Planning Code** which provides for the supply of information by **Users** in order for **TRANSCO** to undertake the planning and development of the **Transmission System**;
- ii) **Connection Conditions**, which specify the minimum technical, design and operational criteria which must be complied with by **TRANSCO** at **Connection Sites** and by **Users** connected to or seeking connection with the **Transmission System**;
- iii) **Operating Code 'A'** dealing with:
 - a long, medium and short-term **Demand** forecasting;
 - b the co-ordination of the outage planning process in respect of Generating Plant, the **TRANSCO Transmission System** and **User Systems** for construction, repair and maintenance;
 - c the specification of the operating margin comprising different types of reserve and the issue of a **Weekly Operational Policy**; and
 - d different forms of reducing **Demand**;
- iv) **Operating Code 'B'** dealing with:
 - a co-ordination, establishment and maintenance of **Isolation** and **Earthing** in order that work and/or testing can be carried out safely;
 - b the aspects of contingency planning;
 - c the provision of written reports on occurrences such as faults;
 - d the reporting of scheduled and planned actions;
 - e the procedures for numbering and nomenclature of **HV Apparatus** at **Connection Sites**;
 - f and the procedures for the establishment of **System Tests**; and;
 - g testing and monitoring of **Users**;
- v) a **Scheduling and Despatch Code** which deals with: the submission of **Availability Notices** from **GENCOs** and excess production capacity from **Self-Supply Users**; the preparation of a **Generation and Desalination Schedule** indicating which electricity generation plant and water desalination plant may be instructed the following day; the issue of despatch instructions on the day; and the procedures and requirements in relation to **System** frequency control;
- vi) a **Data Registration Code**, which sets out the data required by **TRANSCO** from **Users**, and by **Users** from **TRANSCO**, under the **Transmission Code**;

General Conditions, which are intended to ensure, so far as possible, that the various sections of the **Transmission Code** work together and work in practice and include provisions relating to the establishment of a **Transmission Code Review Panel** and other provisions of a general nature.

CHAPTER 1 - GLOSSARY AND DEFINITIONS (GD)

In the **Electricity Transmission Code** the following words and expressions shall, unless the subject matter or context otherwise requires or is inconsistent therewith, bear the following meanings:

Terms	Definitions
<u>AC/DC Converter</u>	Any Apparatus used to convert alternating current electricity to direct current electricity, or vice versa.
<u>AC/DC Converter Station</u>	An installation comprising one or more AC/DC Converters connecting an External Interconnection to the TRANSCO Transmission System or connecting a Wind Turbine Generating Unit or Photovoltaic Generating Unit or Power Farm to the TRANSCO Transmission System .
<u>Active Energy</u>	The electrical energy produced, flowing or supplied by an electric circuit during a time interval, being the integral with respect to time of the instantaneous power, measured in units of watt-hours or standard multiples thereof, i.e.: $1000 \text{ Wh} = 1 \text{ kWh}$ $1000 \text{ kWh} = 1 \text{ MWh}$ $1000 \text{ MWh} = 1 \text{ GWh}$ $1000 \text{ GWh} = 1 \text{ TWh}$
<u>Active Power</u>	The product of voltage and the in-phase component of alternating current measured in units of watts and standard multiples thereof, i.e.: $1000 \text{ Watts} = 1 \text{ kW}$ $1000 \text{ kW} = 1 \text{ MW}$ $1000 \text{ MW} = 1 \text{ GW}$ $1000 \text{ GW} = 1 \text{ TW}$
<u>Active Power Excursion</u>	A change in the level of Active Power .

Terms	Definitions
<u>AGC Response</u>	The change in Active Power output of a Generating Unit in response to a set-point received from the AGC and/or LFC. The response performance must be in accordance with the provisions of the relevant Power and Water Purchase Agreement which provide the ramp rate expressed in MW/min
<u>Amber Warning</u>	A warning issued by TRANSCO to Users who may be affected when TRANSCO knows there is a risk of widespread and serious disturbance to the whole, or a part of, the Transmission System .
<u>Ancillary Service</u>	Ancillary Services which are required for System reasons and which must be provided by Users in accordance with a Connection Agreement or a Power and Water Purchase Agreement .
<u>Annual Maximum Demand (MD) Conditions</u>	A particular combination of weather elements which gives rise to a level of peak Demand within a TRANSCO Financial Year which has a 50% chance of being exceeded as a result of weather variation alone.
<u>Apparatus</u>	Means all equipment, in which electrical conductors are used, supported or of which they may form a part. In Operating Code “B” it means High Voltage electrical circuits forming part of a System on which Safety from the System may be required or on which Safety Precautions may be applied to allow work and/or testing to be carried out on a System .
<u>Apparent Power</u>	The product of voltage and of alternating current measured in units of volt-amperes and standard multiples thereof, i.e.: 1000 VA = 1 kVA 1000 kVA = 1 MVA
<u>Authority for Access</u>	An authority which grants the holder the right to unaccompanied access to a site containing HV conductors.

Terms	Definitions
<u>Automatic Generation Control (AGC)</u>	The regulation of the power output of Generating Units within a prescribed area in response to a change in System Frequency , interconnection loading, or the relation of these to each other, so as to maintain the System Frequency or the interchange with External Systems within predetermined limits or both.
<u>Automatic Voltage Regulator (AVR)</u>	A continuously acting automatic excitation system to control a Generating Unit terminal voltage.
<u>Auxiliaries</u>	Any item of Plant and/or Apparatus not directly a part of a Generating Unit or Desalination Unit but required for the Units functional operation.
<u>Available or Availability</u>	The state where a Generating Unit or Desalination Unit is capable of providing service, whether or not it is actually in service, regardless of the capacity level that can be provided.
<u>Availability Notice</u>	A submission by each GENCO in respect of each of its Generating Units and Desalination Units to TRANSCO or Self-Supply User in respect of its excess production capacity, stating whether or not such units/excess capacity are Available for generation or desalination.
<u>Average Conditions</u>	That combination of weather elements within a period of time which is the average of the observed values of those weather elements during equivalent periods over many years.
<u>Average Load-Related Steady-State Primary Control Droop</u>	The total average droop of the primary control system as defined in Chapter 4, Operating Code 'A' , Section 5.1.2.1.5
<u>Back-Up Protection</u>	Protection equipment or system which is intended to operate when a system fault is not cleared in due time because of failure or inability of the Main Protection to operate or in case of failure to operate of a circuit-breaker other than the associated circuit breaker.
Battery Storage	A type of energy storage power station that uses a group of batteries to store electrical energy

Terms	Definitions
<u>Black Start</u>	The procedure necessary for a recovery from a Total Shutdown or Partial Shutdown .
<u>Black Start Capability</u>	An ability in respect of a Black Start Station , for at least one of its Generating Units to Start-Up from Shutdown and to energise a part of the System and be Synchronised to the System upon instruction from TRANSCO , within two hours, without an external electrical power supply.
<u>Black Start Stations</u>	Power Stations which are registered, pursuant to the Power and Water Purchase Agreement , as having a Black Start Capability .
<u>Black Start Test</u>	A Black Start Test carried out by a GENCO or Self-Supply User with a Black Start Station , on the instructions of TRANSCO , in order to demonstrate that a Black Start Station has a Black Start Capability .
<u>Business Day</u>	Any day excluding Friday and any day which shall be in the United Arab Emirates or in the Emirate of Abu Dhabi a legal holiday or a day on which banking institutions are authorized or required by Law or other governmental action to be closed.
<u>Cancelled Start</u>	A response by a GENCO to an instruction from TRANSCO cancelling a previous instruction to Synchronise to the System or come to Hot Standby , before Synchronisation has been completed or Hot Standby reached.
<u>Caution Notice</u>	A notice conveying a warning against interference to the device to which the notice is attached.
<u>Central Despatch</u>	The process of Scheduling and issuing direct instructions by TRANSCO referred to in Condition 22 of the Transmission Licence .
<u>Cogeneration Module</u>	A collection of Generating Units and Desalination Units operating in combined cycle.

Terms	Definitions
<u>Combined Cycle Gas Turbine Module or CCGT Module</u>	A collection of Generating Units (registered as a CCGT Module) comprising one or more Gas Turbine Units (or other gas based engine units) and one or more Steam Units where, in normal operation, the waste heat from the Gas Turbines is passed to the water/ steam system of the associated Steam Unit or Steam Units and where the component Units within the CCGT Module are directly connected by steam or hot gas lines which enable those Units to contribute to the efficiency of the combined cycle operation of the CCGT Module . The CCGT Module may contain a single machine or a number of machines that make up a single despatchable unit, for example a gas turbine and associated steam turbine in a CCGT module.
<u>Committed Project Planning Data</u>	Data relating to a User Development once the offer for a Connection is accepted.
<u>Completion Date</u>	Has the meaning set out in the Connection Agreement with each User .
<u>Complex</u>	A Connection Site together with the associated Power Station and/or User substation and/or associated Plant and/or Apparatus , as appropriate.
<u>Computer Scheduling Programme</u>	A computer programme used in the preparation of a Generation Schedule and Subsequent Schedules .
<u>Concentrating Solar Thermal Unit (CSTU)</u>	A synchronous Generating Unit using air, water, oil or molten salt as the heat transfer medium, wherein Solar Radiation collected using arrays is the primary heat source.
<u>Connected Planning Data</u>	Data which replaces data containing estimated values assumed for planning purposes by validated actual values and updated estimates for the future and by updated forecasts for Forecast Data items such as Demand .
<u>Connection Agreement</u>	The agreement for connection envisaged in Condition 14 of the Transmission Licence .
<u>Connection Point</u>	A Transmission Supply Point or Transmission Entry Point .

Terms	Definitions
<u>Connection Site</u>	A TRANSCO Site or User Site .
<u>Contingency Reserve</u>	The margin of generation over forecast Demand which is required in the period from 24 hours ahead down to real time to cover against uncertainties in Generating Plant availability and against both weather forecast and Demand forecast errors.
<u>Control Call</u>	A telephone call whose destination and/or origin is a key on the control desk telephone keyboard at a Control Centre and which has the right to exercise priority over (i.e. disconnect) a call of a lower status.
<u>Control Centre</u>	A location used for the purpose of control and operation of the Transmission System or a User System .
<u>Control Phase</u>	The Control Phase follows on from the Programming Phase and starts with the issue of the Generation Schedule for the next day and covers the period down to real time.
<u>Control Telephony</u>	The method by which a User Responsible Engineer/Operator and TRANSCO Control Engineer(s) speak to one another for the purposes of control of the Total System in both normal and emergency operating conditions.
<u>Customer</u>	A person to whom electricity is provided.
<u>Customer Demand Management</u>	Reducing the supply of electricity to a Customer or disconnecting a Customer in a manner agreed for commercial purposes between a Supplier and its Customer .
<u>Customer Generating Plant</u>	A Power Station or Generating Unit of a Customer to the extent that it operates the same exclusively to supply all or part of its own electricity requirements, and does not export electrical power to any part of the Total System .
<u>DC Network</u>	All items of Plant and Apparatus connected together on the direct current side of a AC/DC Converter .

Terms	Definitions
<u>De-Load</u>	The condition in which a Generating Unit has reduced or is not delivering electrical power to the System to which it is Synchronised .
<u>Demand</u>	The demand of MW and MVA r of electricity or the demand in m ³ /h of desalinated water.
<u>Demand Control</u>	Any or all of the following methods of achieving a Demand reduction: <ul style="list-style-type: none"> (a) Customer Demand Management initiated by Users; (b) Customer Demand reduction by Disconnection initiated by Users; (c) Customer Demand reduction instructed by TRANSCO; (d) automatic low frequency Demand Disconnection; and (e) emergency manual Demand Disconnection.
<u>Demand Control Imminent Warning</u>	A warning relating to a Demand reduction which will be issued by TRANSCO to those DISCOs and to GENCOs at their Generating Plant and to Non-Embedded Customers and relating to Export reduction to Self-Supply Users .
<u>Demand Parameters</u>	Those parameters relating to Demand Reduction Blocks listed in the SDC under the heading Demand Parameters .
<u>Demand Side Response</u>	Control of Active power demand by any User for modulation as required by TRANSCO within the specified time.
<u>Desalinated Water</u>	Distilled water with a total dissolved solid content of less than 500 parts per million.
<u>Desalination Unit</u>	Any apparatus which produces Desalinated Water .
<u>Despatch</u>	The issue by TRANSCO of instructions for Generating Plant and/or Desalination Plant to achieve specific levels within their Scheduling and Despatch Parameters .

Terms	Definitions
<u>De-Synchronise</u>	The action of taking a Generating Unit off a System to which it has been Synchronised , by opening any connecting circuit breaker.
<u>Detailed Planning Data</u>	Detailed additional data which TRANSCO requires under the PC in support of Standard Planning Data .
<u>Discrimination</u>	The characteristic of electrical protection equipment enabling faulty protected equipment to be identified and disconnected.
<u>Disconnection</u>	The physical separation of Users (or Customers) from the Transmission System or a Distribution System .
<u>Distorting Load</u>	Load which results in the non-sinusoidal shape of the voltage or current waveform.
<u>Distribution Code</u>	The distribution code to be prepared and maintained by a DISCO and approved by the Bureau as from time to time revised with the approved of the Bureau .
<u>Distribution Company or DISCO</u>	A holder of a Distribution Licence .
<u>Distribution System</u>	The system consisting of electric lines which are owned or operated by a DISCO and used for the distribution of electricity from Transmission Supply Points or Generating Units .
<u>Distribution System Entry Point</u>	A point at which a Generating Unit which is Embedded connects to the Distribution System .
<u>DoE</u>	Department of Energy (the legal successor of the Regulation and Supervision Bureau)
<u>Earth Fault Factor</u>	At a selected location of a three-phase System and for a given System configuration, the ratio of the highest root mean square phase-to-earth power frequency voltage on a sound phase during a fault to earth to the root mean square phase-to-earth power frequency voltage which would be obtained at the selected location without the fault.

Terms	Definitions
<u>Earthing</u>	A way of providing a connection between conductors and earth by an Earthing Device which is maintained and/or secured in position by such a method which must be in accordance with the Local Safety Instructions of TRANSCO or that User .
<u>Electricity Transmission Code</u>	The document referred to in Condition 3 of the Transmission Licence .
<u>Electricity Transmission Code Review Panel</u>	The " Panel " with the functions set out in the General Conditions.
<u>Electromagnetic Compatibility Level</u>	The specified disturbance level in a system which is expected to be exceeded only with small probability, this level being such that electromagnetic compatibility should exist for most equipment within the system. For more details refer to UK Engineering Recommendation G5/4
<u>Embedded</u>	Having a direct connection to a Distribution System or the System of any other User to which Customers and/or Power Stations are connected, such connection being either a direct connection or a connection via a busbar of another User or of TRANSCO (but with no other connection to the Transmission System).
<u>Emergency Instruction</u>	A Despatch instruction issued by TRANSCO which may require an action or response which is outside Generation Scheduling and Despatch Parameters .
<u>Emergency System Condition</u>	The state in which the power system has left Normal Operating Conditions in terms of voltage in all busses and System Frequency supply as defined in Chapter 3 "Connection Conditions", Section 6 "Technical, Design and Operational Criteria"
<u>Exciter</u>	The source of the electrical power providing the field current of a synchronous machine.
<u>Excitation System</u>	The equipment providing the field current of an alternator, including all regulating and control elements, as well as field discharge or suppression equipment and protective devices.

Terms	Definitions
<u>External Interconnection</u>	Apparatus for the transmission of electricity to or from the Transmission System or a User System of the Emirate of Abu Dhabi into or out of an External System . For the avoidance of doubt a single External Interconnection may comprise several circuits operating in parallel.
<u>External System</u>	Any Transmission or Distribution System outside the Emirate of Abu Dhabi that interconnects to the Transmission System or a User System and is owned and/or operated by an External System Operator .
<u>External System Operator</u>	A person who owns or operates an External System .
<u>Fault Ride Through (FRT)</u>	The ability of a Generating Unit to remain connected to the Transmission System during severe disturbances on the System and return to normal operation after the disturbance has cleared.
<u>Final Outage Programme</u>	The final Outage programme in respect of Generating Units prepared by TRANSCO for Year 1 pursuant to Operating Code 'A' .
<u>Final Report</u>	A report prepared by the Test Proposer at the conclusion of a System Test for submission to TRANSCO and other members of the Test Panel .
<u>Flexible Planned Outage</u>	A Planned Outage which can at the request of TRANSCO be deferred or advanced by a period.
<u>Flicker Severity (Long Term)</u>	A value derived from 12 successive measurements of Flicker Severity (Short Term) (over a two hour period) and a calculation of the cube root of the mean sum of the cubes of 12 individual measurements. For more details refer to UK Engineering Recommendation P28.

Terms	Definitions
<u>Flicker Severity (Short Term)</u>	A measure of the visual severity of flicker derived from the time series output of a flickermeter over a 10 minute period and as such provides an indication of the risk of Customer complaints. For more details refer to UK Engineering Recommendation P28.
<u>Forced Outage</u>	An Outage of a Generating Unit for which no notice can be given by the GENCO to TRANSCO .
<u>Forecast Data</u>	Those items of Standard Planning Data and Detailed Planning Data which will always be forecast.
<u>Frequency Control</u>	The control of the System Frequency on the Total System .
<u>Frequency Deviation</u>	An absolute value of System Frequency that varies from the set point value (49.95 Hz - 50.05 Hz).
<u>Frequency Sensitive Mode</u>	The operation of a Generating Unit whereby its Active Power output is varied automatically in response to a change in System Frequency in a direction which assists in the recovery to Target Frequency by operating so as to provide Primary Response and/or Secondary Response and/or High Frequency Response.
<u>Gas (SF₆) Zone Diagram</u>	A single line diagram showing boundaries of, and interfaces between, SF ₆ gas-insulated HV Apparatus modules which comprise part, or the whole, of a substation at a Connection Site , together with the associated stop valves and SF ₆ gas monitors required for the safe operation of the Transmission System or the User System .
<u>GENCO</u>	An entity which generates electricity and/or produces water under licence or exemption under the Law .
<u>Generating Plant</u>	A Power Station subject to Central Despatch .
<u>Generating Unit</u>	Any Apparatus that produces electricity.

Terms	Definitions
<u>Generation and/or Desalination Licence</u>	The licence granted to a GENCO pursuant to Article 82 of the Law .
<u>Generation and Desalination Schedule</u>	A statement, prepared and issued by TRANSCO under the Scheduling and Despatch Code , of which Generating Units and Desalination Units may be required to ensure (so far as possible) the integrity of the Transmission System , the security and quality of supply and that there is sufficient electricity generation and water production to meet TRANSCO Demand at all times together with an appropriate margin of reserve.
<u>Generation Outage Programme</u>	An outage programme as agreed by TRANSCO with each GENCO at various stages through the Operational Planning Phase and Programming Phase .
<u>Generation Prices</u>	<p>A set of prices calculated by TRANSCO in accordance with the relevant Power and Water Purchase Agreement in respect of each GENCO Generating Unit and Desalination Unit which may include:</p> <ul style="list-style-type: none"> i) a Start-up Price (expressed in Dirhams); ii) a No-Load Price (expressed in Dirhams per hour); and iii) a range of Incremental Prices (expressed in Dirhams per MWh of Active Power and Dirhams per m³ of Desalinated Water) in the form of a matrix detailing Incremental Prices from zero generation to Offered Availability for all modes of individual Unit and Cogeneration Module operation. <p>A range of prices for each tranche of transfer across External Interconnections will also be determined on the basis of the appropriate Interconnection or Trading Agreements.</p>
<u>Generator Performance Chart</u>	A diagram which shows the MW and Mvar capability limits within which a Generating Unit will be expected to operate under steady state conditions.

Terms	Definitions
<u>Good Industry Practice</u>	In relation to any undertaking and any circumstances, the exercise of that degree of skill, diligence, prudence and foresight which would reasonably and ordinarily be expected from a skilled and experienced operator engaged in the same type of undertaking under the same or similar circumstances.
<u>Governor Dead-band</u>	The total magnitude of the change in steady state speed (expressed as a range of Hz ($\pm x$ Hz) where "x" is a numerical value) within which there is no resultant change in the position of the control valves of the turbine speed/load control system.
<u>Governor Droop</u>	The ratio of the per unit steady state change in speed or in frequency to the per unit steady state change in output.
<u>High Voltage or HV</u>	A voltage exceeding Low Voltage .
<u>Hot Standby</u>	A condition of readiness to be able to synchronise and attain an instructed output in a specified timescale that must be maintained by Generating Plant .
<u>HV Connections</u>	Apparatus connected at the same voltage as that of the Transmission System , including Users' circuits, the higher voltage windings of Users transformers and associated connection Apparatus .
<u>IEC</u>	International Electrotechnical Commission.
<u>IEC Standard</u>	A standard published by the International Electrotechnical Commission.
<u>Implementing Safety Co-ordinator</u>	The Safety Co-ordinator implementing Safety Precautions .
<u>Incident</u>	An unscheduled or unplanned occurrence on, or relating to, a System including Embedded Generating Plant or on the System of an External System Operator including, faults, events and breakdowns and adverse weather conditions being experienced.

Terms	Definitions
<u>Incident Centre</u>	A centre established by TRANSCO or a User as the focal point in TRANSCO or in that User for the communication and dissemination of information between the senior management representatives of TRANSCO , or of that User and the relevant other parties during a Joint System Incident in order to avoid overloading TRANSCO's , or that User's , existing operational/control arrangements.
<u>Independent Generating Unit</u>	A Power Station not subject to Central Despatch .
<u>Inflexible Planned Outage</u>	A Planned Outage the start date and start time of which cannot be moved by TRANSCO under Operating Code 'A' .
<u>Interconnection Agreement</u>	An agreement made between TRANSCO and an External System Operator and/or other relevant person for the External Interconnection relating to the operation of an External Interconnection .
<u>Interface Agreement</u>	An agreement between a User and TRANSCO containing provisions for dealing with the consequences of a User owning or operating Plant or Apparatus which is sited on another User's land and/or for the sharing of facilities and/or the provision of services at or near a Connection Site.
<u>Intermittent Power Source</u>	The primary source of power for a Generating Unit that cannot be considered as controllable, e.g. wind or solar.
<u>Intertripping</u>	The tripping of circuit-breaker(s) by commands initiated from Protection at a remote location independent of the state of the local Protection .
<u>Intertrip Apparatus</u>	Apparatus which performs Intertripping .
<u>ISO</u>	International Standards Organisation.
<u>Island operation</u>	The capability of a Generating Unit to supply an isolated load area under stable operation conditions.
<u>Isolating Device</u>	A device for achieving Isolation .

Terms	Definitions
<u>Isolation</u>	<p>The disconnection of HV Apparatus from the remainder of the system in which that HV Apparatus is situated by either of the following:</p> <p>(a) an Isolating Device maintained in an isolating position. The isolating position must be maintained and/or secured by such a method which must be in accordance with the Local Safety Instructions of TRANSCO or the User;</p> <p>(b) an adequate physical separation which must be in accordance with and maintained by the method set out in the Local Safety Instructions of TRANSCO or the User.</p>
<u>Joint System Incident</u>	<p>An Incident which, in the opinion of TRANSCO or a User, has or may have a serious and/or widespread effect on the Transmission System or on a User System.</p>
<u>Law</u>	<p>Law No 2 of 1998 Concerning the Regulation of the Water and Electricity Sector in the Emirate of Abu Dhabi, as amended.</p>
<u>LFC</u>	<p>Load Frequency Control - system to maintain uniform System Frequency, to divide the Load between the Generating Units, and to control the tie-line area interchange schedules</p>
<u>Licence</u>	<p>Any licence granted to TRANSCO or a User, under Article 82 of the Law.</p>
<u>Licensed Electricity Operator</u>	<p>Any person (other than TRANSCO in its capacity as operator of the Transmission System) who is licensed under the Law to generate, transmit or supply electricity.</p>
<u>Licence Standards</u>	<p>Those standards set out or referred to in Condition 19 of the Transmission Licence.</p>
<u>Load</u>	<p>The Active, Reactive or Apparent Power, as the context requires, generated, transmitted or distributed.</p>

Terms	Definitions
<u>Load Control</u>	The mode of operation to maintain a power output to be fed by the Generating Unit to the Transmission System according to a set value. This is achieved by the use of a load governor equipped with an integral-acting element.
<u>Load Factor</u>	The ratio of the actual output of a Generating Unit to the possible maximum output of that Generating Unit .
<u>Loaded</u>	Supplying electrical power to the System .
<u>Local Safety Instructions</u>	Instructions on each User Site and TRANSCO Site , approved by the relevant TRANSCO or User manager, setting down the methods of achieving the objectives of TRANSCO or the User Safety Rules to ensure the safety of personnel carrying out work or testing on Plant and/or Apparatus on which his Safety Rules apply.
<u>Location</u>	A place where Safety Precautions are to be applied.
<u>Low Voltage or LV</u>	A voltage exceeding 50 volts AC but not exceeding 1000 volts AC .
<u>Main Protection</u>	Protection equipment or system expected to have priority in initiating either a fault clearance or an action to terminate an abnormal condition in a power system.
<u>Material Effect</u>	An effect causing a User or TRANSCO to effect any works or to alter the manner of operation of its Plant and/or Apparatus at the Connection Site or the site of connection which in either case involves that User or TRANSCO , as the case may be, in expenditure of more than [50,000] Dirhams.
<u>Maximum Demand</u>	The maximum expected value of Demand .
<u>Minimum Demand Regulation</u>	The margin of Active Power to provide a sufficient regulating margin for adequate frequency control.

Terms	Definitions
<u>Minimum Generation</u>	The minimum output in MW which a Generating Unit can generate, as registered with TRANSCO under the Scheduling and Despatch Code .
<u>Modification</u>	Any actual or proposed replacement, renovation, modification, alteration or construction by or on behalf of a User or TRANSCO to either that User's Plant or Apparatus or TRANSCO's Plant or Apparatus or the manner of its operation which has or may have a Material Effect on TRANSCO or a User at a particular Connection Site .
<u>Monitoring Notice</u>	A notice issued by TRANSCO to a GENCO informing the GENCO that TRANSCO is monitoring one of its Generating Units .
<u>Net Dependable Power Capacity</u>	The capacity of a Generating Unit as notified by the GENCO less the MW consumed by the Generating Unit through the generator unit transformer the resultant expressed as a whole number of MW .
<u>Net Dependable Water Capacity</u>	The capacity of a Desalinating Unit as notified by the GENCO expressed as a whole number of m³/h .
<u>Network Data</u>	The data to be provided by TRANSCO to Users in accordance with the Planning Code .
<u>Non-Embedded Customer</u>	A Customer , except for a DISCO , receiving electricity direct from the Transmission System irrespective of from whom it is supplied.
<u>Normalized Primary Response Characteristic</u>	The Primary Response pattern on the basis of a normalized input signal as defined in Chapter 4, Operating Code 'A' , Section 5.1.2.1.1.
<u>Normal Operating Condition</u>	The operating conditions in which the System Frequency is controlled, voltages are within their admissible limits and loadings are below the thermal ratings

Terms	Definitions
<u>Notice to Synchronise</u>	The amount of time (expressed in minutes) that is declared by a GENCO in relation to a Generating Unit to enable it to be Synchronised following the receipt of an instruction to synchronise from TRANSCO .
<u>Notification of Inadequate System Margin (NISM)</u>	The notification of anticipated inadequate System Margin given by TRANSCO to certain Users pursuant to the relevant provisions of the Scheduling and Despatch Code .
<u>Operating Code Demand</u>	The demand of MW and MVAR of electricity relating to each Transmission Supply Point plus that to be met by Embedded Generating Plant .
<u>Operating Margin</u>	Contingency Reserve plus Operating Reserve .
<u>Operating Reserve</u>	The additional output from Generating Plant or the reduction in Demand , which must be realisable in real-time operation in order to contribute to containing and correcting any System Frequency fall to an acceptable level in the event of a loss of generation or a loss of import from an External Interconnection or mismatch between generation and Demand .
<u>Operation</u>	Operation of Plant and/or Apparatus to the instruction of the relevant TRANSCO Control Engineer and User Responsible Engineer /Operator.
<u>Operation Diagrams</u>	Diagrams which are a schematic representation of the HV Apparatus and the connections to all external circuits at a Connection Site , incorporating its numbering, nomenclature and labelling.
<u>Operational Data</u>	Data required under the Operating Codes and/or Scheduling and Despatch Code .
<u>Operational Effect</u>	Any effect on the operation of a System which causes the Systems of TRANSCO or Users to operate differently to the way in which they would have normally operated in the absence of that effect.

Terms	Definitions
<u>Operational Planning</u>	Planning through various timescales the matching of generation output with forecast TRANSCO Demand together with a reserve of generation to provide a margin, taking into account outages of Generating Units , of parts of the Transmission System and of parts of Distribution Systems carried out to achieve, so far as possible, the standards of security set out in the Transmission Licence .
<u>Operational Planning Phase</u>	The period from 8 weeks to the end of the [5th] year ahead of real time operation.
<u>Operational Procedures</u>	Management instructions and procedures, both in support of the Safety Rules and for the local and remote operation of Plant and Apparatus , issued in connection with the actual operation of Plant and/or Apparatus at or from a Connection Site .
<u>Other Network Operator</u>	A User with a User System directly connected to the Transmission System to which Customers and/or Power Stations are connected.
<u>Outage</u>	In relation to a Generating Unit or Desalination Unit , a total or partial reduction in Availability in connection with the repair or maintenance of the Generating Unit or Desalination Unit . In relation to TRANSCO and a DISCO the removal for repair or maintenance, or as a result of failure or breakdown, of any part of the TRANSCO Transmission System or DISCO Distribution System .
<u>Out of Synchronism</u>	The condition where a System or Generating Unit cannot meet the requirements to enable it to be Synchronised .
<u>Part Load</u>	The condition of a Centrally Despatched Generating Unit or Desalination Unit which is Loaded but is not running at Net Dependable Capacity .

Terms	Definitions
<u>Partial Shutdown</u>	The same as a Total Shutdown except that all generation has ceased in a separate part of the Total System and there is no electricity supply from External Interconnections or other parts of the Total System with the result that it is not possible for that part of the Total System to begin to function again without TRANSCO's directions relating to a Black Start .
<u>Photovoltaic Generating Unit (PVGU)</u>	A Generating Unit which generates electricity directly by photovoltaic means. For the avoidance of doubt a photovoltaic generating unit includes any AC/DC Converter required to convert the DC output of the photovoltaic array to AC and the associated control equipment.
<u>Photovoltaic Power Station (PVPS)</u>	An installation comprising one or more PVGUs owned and/or controlled by the same GENCO , which may reasonably be considered as being managed as one Power Station .
<u>Planned Outage</u>	An outage of Generating Plant or of part of the Transmission System , or of part of a Distribution System , co-ordinated by TRANSCO under the Operating Code 'A' .
<u>Plant</u>	Fixed and movable items used in the generation and/or supply and/or transmission of electricity and/or water, other than Apparatus .
<u>Point of Common Coupling</u>	That point on the Transmission System electrically nearest to the User installation at which either Demands or Loads are connected.
<u>Point of Isolation</u>	The point on Apparatus at which Isolation is achieved as defined in Operating Code 'B' .
<u>Post-Control Phase</u>	The period following real-time operation.
<u>Post Event Notice</u>	A notice issued by TRANSCO to a GENCO re-declaring the Availability or Scheduling and Despatch Parameter of a Generating Unit .
<u>Potable Water</u>	Drinking water with an organic and non-organic content prescribed by the Bureau .

Terms	Definitions
<u>Power and Water Purchase Agreement (PWPA)</u>	An agreement between a GENCO or Self-Supply User and the Procurer covering the sale and purchase of Electricity and Water Capacity and Electricity and Water Output.
<u>Power Factor</u>	The ratio of Active Power to Apparent Power .
<u>Power Farm(PF)</u>	Multiple interconnected Generating Units that have a common Connection Point and utilise renewable energy as the primary energy source.
<u>Power Farm Generating Unit</u>	A Generating Unit associated with a Power Farm
<u>Power Island</u>	An isolated Power Station , or groups of isolated Power Stations , together with complementary local Demand .
<u>Power Station</u>	An installation comprising one or more Generating Units owned and/or controlled by the same GENCO , which may reasonably be considered as being managed as one Power Station .
<u>Power Supply Agreement (PSA)</u>	An agreement between a Self-Supply User and the DISCO covering the Electricity purchase by Self-Supply User
<u>Power System</u>	The Transmission System and all User Systems within the Emirate of Abu Dhabi.
<u>Power System Stabiliser (PSS)</u>	Equipment controlling the Exciter output via the Automatic Voltage Regulator in such a way that power oscillations of the synchronous machines are dampened. Input variables may be speed, frequency or Active Power or voltage (or a combination of these).
<u>Preliminary Notice</u>	A notice in writing, sent by TRANSCO both to all Users identified by it under Operating Code ‘B’ and to the Test Proposer , notifying them of a proposed System Test .
<u>Preliminary Project Planning Data</u>	Data relating to a proposed User Development at the time the User applies for a Connection Agreement but before an offer is made and accepted.

Terms	Definitions
<u>Preliminary Red Warning</u>	A warning which may be issued by TRANSCO to DISCOS, GENCOs and Non-Embedded Customers , to give as much notice as possible whenever TRANSCO anticipates that a protracted period of generation shortage may exist. (For further clarity see Red Warning .)
<u>Primary Control</u>	A Generating Unit or Battery Storage or Interruptible Load operating mode which will result in Active Power output changing, in response to a change in System Frequency in a direction which assists to stabilize the System Frequency at any level according to $df/dt=0$ by operating so as to provide Primary Response and/or Secondary Response proportional to the difference between the Target Frequency and the actual System Frequency .
<u>Primary Reserve</u>	A certain amount of Active Power that must be available for stabilizing the System Frequency after the occurrence of an imbalance

Terms	Definitions
<u>Primary Response</u>	The automatic change in Active Power output of a Generating Unit or Battery Storage or change in consumption of Interruptible Load or any other means in response to a System Frequency decrease or increase. The Positive Primary Response is the automatic increase in Active Power output of a Generating Unit or change in Battery Storage output, or loss of Interruptible Load or any other means in response to a System Frequency fall in accordance with the Primary Control capability and additional mechanisms for releasing Active Power or to arrest frequency decay. The Negative Primary Response is the automatic decrease in Active Power output of a Generating Unit or change in Battery Storage output or loss of Interruptible Load or any other means in response to a System Frequency increase in accordance with the Primary Control capability and additional mechanisms for reducing Active Power generation or arrest frequency rise. This change in Active Power output must be in accordance with the provisions of the relevant Power and Water Purchase Agreement or any other agreement which will provide the Transient Primary Response Characteristics (from t=0 sec up to t=10 sec) and the Steady State Response Characteristic (from t=10 sec up to t=30 sec).
<u>Primary Response Performance Index</u>	A relative figure for the determination of the capability of a unit to provide Primary Response as set forth in Chapter 4, Operating Code ‘A’ , Section 5.1.2.1.2
<u>Primary Response Test Procedures</u>	The definition of test procedures, evaluation methods including simulation, test equipment, accuracy and responsibilities as defined in Chapter 5 Operating Code ‘B’ Section.9.4.6.
<u>Procurer</u>	The Emirates Water and Electricity Company.
<u>Programming Phase</u>	The period between Operational Planning Phase and the Control Phase . It starts at the 8 weeks ahead stage and finishes with the issue of the Generation Schedule for the day ahead.

Terms	Definitions
<u>Proposal Notice</u>	A notice submitted to TRANSCO by a User which would like to undertake a System Test .
<u>Proposal Report</u>	<p>A report submitted by the Test Panel which contains:</p> <p>(a) proposals for carrying out a System Test (including the manner in which the System Test is to be monitored);</p> <p>(b) an allocation of costs (including un-anticipated costs) between the affected parties (the general principle being that the Test Proposer will bear the costs); and</p> <p>(c) such other matters as the Test Panel considers appropriate.</p>
<u>Protection</u>	The provisions for detecting abnormal conditions on a System and initiating fault clearance or actuating signals or indications.
<u>Protection Apparatus</u>	A group of one or more Protection relays and/or logic elements designated to perform a specified Protection function.
<u>Provisional Outage Programme</u>	The provisional Outage programme in respect of Generating Units prepared by TRANSCO for Years 2 and 3 pursuant to Operating Code 'A' .
<u>Rated MW</u>	The "rating-plate" MW output of a Generating Unit , being that output up to which the Generating Unit was designed to operate.
<u>Reactive Energy</u>	The integral with respect to time of the Reactive Power .
<u>Reactive Power (var)</u>	<p>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.:</p> <p>1000 var = 1 kvar</p> <p>1000 kvar = 1 Mvar</p>
<u>Record of Inter-System Safety Precautions (RISSP)</u>	A written record of inter-system Safety Precautions to be compiled in accordance with the provisions of Operating Code 'B' .

Terms	Definitions
<u>Red Warning</u>	A warning that will be issued by TRANSCO to those DISCOs , Self-Supply Users and Non-Embedded Customers who will or may subsequently receive instructions under Operating Code ‘A’ relating to a Demand or Import reduction.
<u>Reference Incident</u>	Maximum positive or negative power deviation occurring instantaneously between generation and demand in a synchronous area, considered in dimensioning of Primary Reserve
<u>Registered Capacity</u>	In the case of a Generating Unit the normal full load capacity measured at the Generating Unit terminals. In the case of a Desalination Unit the normal full load capacity measured at the condensate discharge and in the case of PVGU/ WTGU measured at the AC terminals of AC/DC Converter.
<u>Registered Data</u>	Those items of Standard Planning Data and Detailed Planning Data which upon connection become fixed.
<u>Requesting Safety Co-ordinator</u>	The Safety Co-ordinator requesting Safety Precautions .
<u>Responsible Engineer/Operator</u>	A person nominated by a User to be responsible for System control.
<u>Responsible Manager</u>	A manager who has been duly authorised by a User or TRANSCO to sign Site Responsibility Schedules on behalf of that User or TRANSCO .
<u>Re-synchronisation</u>	The bringing of parts of a System which have become Out of Synchronism with each other back into Synchronism ,
<u>Safety Co-ordinator</u>	A person or persons nominated by TRANSCO and each User to be responsible for the co-ordination of Safety Precautions at each Connection Point when work (which includes testing) is to be carried out on a System which necessitates the provision of Safety Precautions on HV Apparatus pursuant to Operating Code ‘B’ .

Terms	Definitions
<u>Safety From The System</u>	That condition which safeguards persons when work is to be carried out on a System from the dangers which are inherent in the System .
<u>Safety Log</u>	A chronological record of messages relating to safety co-ordination sent and received by each Safety Co-ordinator under Operating Code 'B' .
<u>Safety Precautions</u>	Isolation and/or Earthing .
<u>Safety Rules</u>	The rules of TRANSCO or a User that seek to ensure that persons working on Plant and/or Apparatus to which the rules apply are safeguarded from hazards arising from the System .
<u>Schedule</u>	Either a Generation and Desalination Schedule or a Subsequent Schedule .
<u>Scheduling and Despatch Parameters</u>	Those parameters listed in the Scheduling and Despatch Code under the heading Scheduling and Despatch Parameters relating to Centrally Despatched Generating Units or Desalination Units .
<u>Schedule Day</u>	The period from 0500 hours in the Settlement Day until 0500 hours in the next following Settlement Day .
<u>Scheduling</u>	The process of compiling and issuing a Generation and Desalination Schedule , as set out in the Scheduling and Despatch Code .
<u>Secondary Control</u>	A Generating Unit or Battery Storage or Interruptible Load operating mode causing change of Active Power balance in the control area, in response to a System Frequency and/or interchange deviation, which assists in restoring the System Frequency at its target value ($f=f_{target}$) and/or bringing the tie-line interchanges to schedule value. This service can be provided by Automatic Generation Control (AGC) , Load Frequency Control (LFC) or by manual instructions.

Terms	Definitions
<u>Secondary Reserve</u>	A certain amount of Active Power that must be available for restoring the System Frequency to the target level and for restoring the control area interchange to the scheduled value.
<u>Secondary Response</u>	The automatic change in Active Power output of a Generating Unit or Battery Storage or change in consumption of Interruptible Load or any other means in response to a Frequency Deviation in accordance to the Primary Control capability. The Secondary Response characteristics must be in accordance with the provisions of the relevant Power and Water Purchase Agreement or any other agreement which provide that the response will be fully deployed by 30 seconds from the time of the Frequency deviation and be sustainable for at least a further 30 minutes.
<u>Secondary Response Performance Index</u>	A relative figure for the determination of the capability of a unit to provide Secondary Response
<u>Self-Supply User</u>	The User able to supply of electricity and water by a person to himself, his employees, or his business, as permitted by a Self-Supply license. The license may also allow the sale of excess generation output
<u>Settlement Day</u>	The period from 0000 to 2400 hours in each day.
<u>Settlement Period</u>	A period of 60 minutes ending on the hour in each hour during a Schedule Day .
<u>Seven Year Planning Statement</u>	A statement, prepared by TRANSCO in accordance with the terms of Condition 15 of the Transmission Licence , as amended, showing for each of the seven succeeding TRANSCO Financial Years , the opportunities available for connecting to and using the Transmission System and indicating those parts of the Transmission System most suited to new connections and transport of further quantities of electricity.
<u>SF₆ Gas Zone</u>	A segregated zone surrounding electrical conductors within a casing containing SF ₆ gas.

Terms	Definitions
<u>Short-Circuit Ratio (SCR)</u>	For a Synchronous Generating Unit is the ratio of the field current required for the rated voltage at open circuit to the field current required for the rated generator terminal current at short-circuit.
<u>Significant Incident</u>	<p>An Incident which either:</p> <p>(a) was notified by a User to TRANSCO under Operating Code ‘B’, and which TRANSCO considers has had a significant effect on the Transmission System, and TRANSCO requires the User to report that Incident in writing in accordance with Operating Code ‘B’; or</p> <p>(b) was notified by TRANSCO to a User under Operating Code ‘B’, and which that User considers has had a significant effect on that User's System, and that User requires TRANSCO to report that Incident in writing in accordance with the provisions of Operating Code ‘B’.</p>
<u>Single Line Diagram</u>	A schematic representation of a three-phase network in which the three phases are represented by single lines. The diagram shall include (but not necessarily be limited to) busbars, overhead lines, underground cables, power transformers and reactive compensation equipment. It shall also show where Embedded Power Stations are connected and the points at which Demand is supplied.
<u>Site Common Drawings</u>	Drawings prepared for each Connection Site which incorporates Connection Site layout drawings, electrical layout drawings, common protection/ control drawings and common services drawings.
<u>Site Responsibility Schedule</u>	A schedule containing the information and prepared on the basis of the provisions set out in the Connection Conditions .
<u>Speed Control</u>	The mode of operation to maintain speed according to a speed droop characteristic.
<u>Stability Limits</u>	The point beyond which a Generating Unit is liable to instability.

Terms	Definitions
<u>Standard Planning Data</u>	The general data required by TRANSCO under the Planning Code . It is generally also the data which TRANSCO requires from a new User in an application for a Connection Agreement , as reflected in the Planning Code .
<u>Start Time</u>	The time named as such in an instruction issued by TRANSCO pursuant to the Scheduling and Despatch Code .
<u>Start-Up Price</u>	The start-Up price component for a Generating Unit or a Desalination Unit .
<u>Station Board</u>	A switchboard through which electrical power is supplied to the Auxiliaries of a Power Station , which may be interconnected with a Unit Board .
<u>Steady State Primary Response Coefficient</u>	That portion of the Primary Response Performance Index which determines the capability of the Power Unit to provide Primary Response for the period of 10 to 30 seconds as set forth in Chapter 4, Operating Code 'A' , Section 5.1.2.1.4
<u>Subsequent Schedule</u>	A schedule prepared subsequent to the Generation and Desalination Schedule following a re-optimisation of that Schedule or another Subsequent Schedule , within the applicable Control Phase timescale.
<u>Supplier</u>	A DISCO , Self-Supply User or any other Licensed Electricity Operator authorised to supply electricity.
<u>Synchronised</u>	The condition where a Generating Unit or System is connected to the busbars of another System so that the Frequencies, Voltages and phase relationships of that Generating Unit or System , as the case may be, and the System to which it is connected are identical.
<u>Synchronising Generation</u>	The amount of MW produced at the moment of synchronising.

Terms	Definitions
<u>Synchronous Generating Unit</u>	A Generating Unit in which, under all steady state conditions, the rotor rotates at a mechanical speed equal to the System Frequency of the Transmission System divided by the number of pole pairs of the Generating Unit which operates in synchronism with the System .
<u>Synchronous Speed</u>	That speed required by a Generating Unit to enable it to be Synchronised to a System .
<u>System</u>	Any User System or the Transmission System .
<u>System Constraint</u>	A limitation on the use of a System due to lack of transmission capacity or other System conditions.
<u>System Constraint Group</u>	A part of the Transmission System which, because of System Constraints , is subject to limits of Active Power which can flow into or out of that part.
<u>System Frequency</u>	Actual level of frequency of synchronous area in a certain moment
<u>System Tests</u>	Tests which involve simulating conditions, or the controlled application of irregular, unusual or extreme conditions, on the Total System , or any part of the Total System , but which do not include commissioning or recommissioning tests or any other tests of a minor nature.
<u>Target Frequency</u>	That frequency determined by TRANSCO as the desired operating frequency of the Total System . This will normally be 50.00Hz plus or minus 0.05Hz, except in exceptional circumstances as determined by TRANSCO .
<u>Tariff Customer</u>	Any Customer who has not entered into a specific contract with the DISCO for the supply of electricity.
<u>Tertiary Control</u>	A manual instructions from the Load Despatch Centre which will result in Active Power output change of a Generating Unit or Battery Storage or Interruptible Load or any other means in a direction which assists to relieve the Secondary Reserve and return it to pre-incident level.

Terms	Definitions
<u>Tertiary Reserve</u>	Tertiary Reserve represents a certain amount of active power (provided by generating units and/or or Battery Storage and/or Interruptible Load or any other means) that needs to be available within 30 minutes for restoring and/or supporting the required level of Secondary Reserve in order to be prepared for additional (new) system imbalances.
<u>Test Co-ordinator</u>	A person who co-ordinates System Tests .
<u>Test Panel</u>	A panel, whose composition is detailed in Operating Code 'B' , which is responsible for considering a proposed System Test , and submitting a Proposal Report and a Test Programme .
<u>Test Programme</u>	A programme submitted by the Test Panel to TRANSCO , the Test Proposer , and each User identified by TRANSCO under the Operating Code 'B' which states the switching sequence and proposed timings of the switching sequence, a list of those staff involved in carrying out the System Test (including those responsible for the site safety) and such other matters as the Test Panel deems appropriate.
<u>Test Proposer</u>	The person who submits a Proposal Notice .
<u>Total Harmonic Distortion</u>	The departure of a waveform from sinusoidal shape, that is caused by the addition of one or more harmonics to the fundamental, and is the square root of the sum of the squares of all harmonics expressed as a percentage of the magnitude of the fundamental.
<u>Total Shutdown</u>	The situation existing when all generation has ceased and there is no electricity supply from External Interconnections and, therefore, the Total System has shutdown with the result that it is not possible for the Total System to begin to function again without TRANSCO's directions relating to a Black Start .
<u>Total Speed/Load-Related Dead Band</u>	The total dead band of the Primary Control system as defined in Chapter 4, Operating Code 'A' , Section 5.1.2.1.6

Terms	Definitions
<u>Total System</u>	The Transmission System and all User Systems in the Emirate of Abu Dhabi.
<u>TRANSCO</u>	The Abu Dhabi Transmission and Despatch Company.
<u>TRANSCO Control Engineer</u>	The nominated person employed by TRANSCO to direct the operation of the Transmission System .
<u>TRANSCO Demand</u>	The amount of electricity to be supplied from the Transmission Supply Points plus: <ul style="list-style-type: none"> • the amount to be supplied by Embedded Generating Unit, and • Import from the Transmission System across External Interconnections, and • Transmission System Losses • Less the output of directly connected Independent Generating Unit.
<u>TRANSCO Financial Year</u>	The period referred to in Condition 8 of the Transmission Licence .
<u>TRANSCO Site</u>	Means a site owned (or occupied pursuant to a lease, licence or other agreement) by TRANSCO in which there is a Connection Point .
<u>Transient Primary Response Coefficient (TPRC)</u>	Means that portion of the Primary Response Performance Index which determines the capability of the Power Unit to provide Primary Response for the period of 0 to 10 seconds as set out in Chapter 4 Operating Code ‘A’ , Section 5.1.2.1.3.
<u>Transmission Entry Point</u>	A point at which a Generating Unit which is directly connected to the Transmission System connects to the Transmission System .
<u>Transmission Licence</u>	A licence issued pursuant to Article 82 of the Law authorising the Abu Dhabi Transmission and Despatch Company to transmit water and electricity.

Terms	Definitions
<u>Transmission Supply Point</u>	A point of supply from the Transmission System to DISCOs or to other Users with User Systems with Customers connected to them or Non-Embedded Customers .
<u>Transmission System</u>	The system consisting of HV overhead lines and underground cables owned or operated by TRANSCO and used for the transmission of electricity from one Power Station to a sub-station or to another Power Station or between sub-stations or to or from any External Interconnection , and includes any Plant and Apparatus and meters owned or operated by TRANSCO in connection with the transmission of electricity.
<u>Transmission System Losses</u>	The losses of electricity incurred on the Transmission System .
<u>Unbalanced Load</u>	The situation where the Load on each phase is not equal.
<u>Under Frequency Relay</u>	An electrical measuring relay intended to operate when its characteristic quantity (frequency) reaches the relay settings by decrease in System Frequency .
<u>Unit Board</u>	A switchboard through which electrical power is supplied to the Auxiliaries of a Generating Unit and/or Desalination Unit and which may be interconnected with a Station Board .
<u>Unit Controller</u>	Any control device which is provided to govern the Generating Unit output according to set values (Speed Control , power control, extraction flow control, temperature limitation control, etc.)
<u>User</u>	A term utilised in various sections of the Electricity Transmission Code to refer to the entities using the Transmission System , as more particularly identified in each chapter of the Electricity Transmission Code concerned.
<u>User Site</u>	A site owned (or occupied pursuant to a lease, licence or other agreement) by a User in which there is a Connection Point .

Terms	Definitions
<u>User System</u>	Any system owned or operated by a User comprising Generating Units and/or Distribution Systems which are owned or operated by an entity other than a DISCO and Plant and/or Apparatus connecting Generating Units, Distribution Systems or Non-Embedded Customers to the Transmission System .
<u>Warning Notice</u>	A notice issued by TRANSCO to a GENCO or a User System operator informing the GENCO or User System that it has failed to comply with a despatch instruction or its obligation.
<u>Weekly Maximum Demand (MD) Conditions</u>	A particular combination of weather elements that gives rise to a level of peak Demand within a week which has a particular chance of being exceeded as a result of weather variation alone. This is determined such that the combined probabilities of Demand in all weeks of the year exceeding the annual peak Demand under Annual MD Conditions is 50%, and in the week of maximum risk the weekly peak Demand under Weekly MD Conditions is equal to the annual peak Demand under Annual MD Conditions .
<u>Weekly Operational Policy</u>	A statement issued by TRANSCO each week to GENCOs as set out in the Operating Code ‘A’ of specific requirements to enable TRANSCO to operate the Transmission System within the requirements of the Transmission Licence .
<u>Wind Turbine Generating Unit (WTGU)</u>	A Generating Unit that produces electricity from a wind.
<u>Zonal Availability</u>	The generation declared available contained within the boundary circuits defining the zone.
<u>Zonal System Security Requirements</u>	That generation required, within the boundary circuits defining the zone, which when added to the secured transfer capability of the boundary circuits exactly matches the Demand within the zone.

Construction and Interpretation

In the **Electricity Transmission Code**:

- i) A reference to “this **Electricity Transmission Code**” or “the **Electricity Transmission Code**” is a reference to the whole of the **Electricity Transmission Code**, including any Appendix or Schedule attached to any part thereof.
- ii) a table of contents, a Preface and headings are inserted for convenience only and shall be ignored in construing the **Electricity Transmission Code**;
- iii) unless the context otherwise requires, all references to a particular paragraph, sub-paragraph, Appendix or Schedule shall be a reference to that paragraph, sub-paragraph Appendix or Schedule in or to that part of the **Electricity Transmission Code** in which the reference is made;
- iv) unless the context otherwise requires, the singular shall include the plural and vice versa, references to any gender shall include all other genders and references to persons shall include any individual and any other entity, in each case whether or not having a separate legal personality;
- v) the words “such as”, "include", "including" or “for example” are to be construed by way of an illustration without limitation to the generality of the preceding words;
- vi) unless there is something in the subject matter or the context which is inconsistent therewith, any reference to a **Law** or any Section of or Schedule to, or other provision of a **Law** shall be construed at the particular time, as including a reference to any modification, extension or re-enactment thereof then in force and to all instruments, orders and regulations then in force and made under or deriving validity from the relevant **Law**;
- vii) references to "in writing" or "written" include typewriting, printing, lithography and other modes of reproducing words in a legible and non-transitory form;
- viii) where the **Glossary and Definitions** refers to any word or term which is more particularly defined in a part of the **Electricity Transmission Code**, the definition in that part of the **Electricity Transmission Code** will prevail over the definition in the **Glossary and Definitions** in the event of any inconsistency;
- ix) a cross-reference to another document or part of the **Electricity Transmission Code** shall not of itself impose any additional or further or co-existent obligation or confer any additional or further or co-existent right in the part of the text where such cross-reference is contained;
- x) nothing in the **Electricity Transmission Code** is intended to or shall derogate from **TRANSCO's** statutory or licence obligations;
- xi) references to time are Abu Dhabi time (UTC/GMT+ 4); and
- xii) where there is a reference to an item of data being expressed in a whole number of MW, fractions of a MW below 0.5 shall be rounded down to the nearest whole MW and fractions of a MW of 0.5 and above shall be rounded up to the nearest whole MW.

CHAPTER 2 - PLANNING CODE

1. INTRODUCTION

The **Planning Code** specifies the technical and design criteria and procedures to be applied by **TRANSCO** in the planning and development of the **Transmission System** and to be taken into account by **Users** in the planning and development of their own **Systems**. It details information to be supplied by **Users** to **TRANSCO**, and information to be supplied by **TRANSCO** to **Users**.

Development of the **Transmission System**, involving its reinforcement or extension, will arise for a number of reasons including:

- i) a development on a User System already connected to the Transmission System;
- ii) the introduction of a new **Connection Site** or the modification of an existing **Connection Site** between a **User System** and the **Transmission System**;
- iii) changing requirements for electricity transmission facilities due to changes in factors such as **Demand**, generation, technology, reliability requirements and/or environmental requirements; and
- iv) the cumulative effect of a number of such developments referred to in (i), (ii) and (iii) by one or more **Users**.

Accordingly, the reinforcement or extension of the **Transmission System** may involve work:

- i) at a substation at a **Connection Site** where User Plant and/or Apparatus is connected to the **Transmission System**;
- ii) on transmission lines or other facilities which join that **Connection Site** to the remainder of the **Transmission System**; and
- iii) on transmission lines or other facilities at or between points remote from that **Connection Site**.

The time required for the planning and development of the **Transmission System** will depend on the type and extent of the necessary reinforcement and/or extension work and the degree of complexity in undertaking the new work while maintaining satisfactory security and quality of supply on the existing **Transmission System**.

2. OBJECTIVE

The objectives of the **Planning Code** are:

- i) to promote **TRANSCO/User** interaction in respect of any proposed development on the **User System** which may impact on the performance of the **Transmission System** or the direct connection with the **Transmission System**;
- ii) to provide for the supply of information required by **TRANSCO** from **Users** in order for **TRANSCO** to undertake the planning and development of the **Transmission System** in accordance with the relevant **Licence Standards**, to facilitate existing and proposed connections, and also to provide for the supply of certain information from **TRANSCO** to **Users** in relation to **System** modelling data and short circuit current contributions, and to allow design and operational studies relevant to the connection of **User** equipment.

- iii) to provide the **Procurer** with long term demand forecast including the relevant supporting data based on those developed by **TRANSCO** and **Users**, so that coordinated electricity demand forecasts are prepared by the **Procurer** and the production capacity needs can be identified, planned and procured.

3. SCOPE

The **Users** to whom the **Planning Code** applies are as follows:

- i) **GENCOs**
- ii) **DISCOs**
- iii) **Non-Embedded Customers**
- iv) **Self-Supply Users**

The above categories of **User** will become bound by the **Planning Code** prior to them generating, distributing, consuming or importing/exporting electricity, as the case may be, and references to the various categories (or to the general category) of **User** should, therefore, be taken as referring to a prospective **User** in that role as well as to **Users** actually connected.

The **Planning Code** also applies to the **Procurer** as a **User** for the purpose of co-ordinating long term demand forecast, production capacity and system planning with **TRANSCO** and **Users**.

In the case of **Embedded Power Stations** each **GENCO** shall provide the data direct to **TRANSCO** in respect of **Embedded Generating Plant**.

4. PLANNING PROCEDURES

The means by which **Users** and proposed **Users** of the **Transmission System** are able to assess conditions for connecting to, and using, the **Transmission System** comprise two distinct parts, namely:

- i) a statement, prepared by **TRANSCO** under the **Transmission Licence**, showing for each of the 7 (seven) succeeding **TRANSCO Financial Years**, the opportunities available for connecting to and using the **Transmission System** and indicating those parts of the **Transmission System** most suited to new connections and transport of further quantities of electricity; and
- ii) an offer by **TRANSCO** to enter into a **Connection Agreement** for connection to (or, in the case of **Embedded Generating Plant** use of) the **Transmission System**.

4.1 Data Provision

4.1.1 TRANSCO Seven Year Statement

To enable **TRANSCO** and the **Procurer** (EWEC) to prepare their respective **Seven Planning Year Statement** in Year 0 (Y), , each **User** is required to submit to **TRANSCO** and the **Procurer** both the **Standard Planning Data** and the **Detailed Planning Data** as listed in Appendix A and Appendix B as follows:

- i) with respect to each of the five succeeding **TRANSCO Financial Years** (other than in the case of **Registered Data** which will reflect the current position and data relating to **Demand** or exchange forecasts which relates also to the current year); and

- ii) provided by **Users** in connection with a **Connection and Interface Agreement or any other Agreement**.

This data should be submitted in calendar week 48 of each year of Year 0-1 (Y-1) and should cover each of the five succeeding **TRANSCO Financial Years**. Where, from the date of one submission to another, there is no change in the data to be submitted, instead of re-submitting the data, a **User** may submit a written statement that there has been no change from the data submitted the previous time.

Procurer shall submit draft demand and exchange forecast data (without transmission losses) to the Department of Energy (DoE) and **TRANSCO** by week 52 of Year 0-1 (Y-1).

TRANSCO shall submit the estimated transmission losses and **Non-Embedded Customers** demand data to the **Procurer** by week 2 of Year 0 (Y).

Procurer shall by week 07 of Year 0 (Y) submit to DoE, **TRANSCO** and **Users** the final coordinated long term demand.

The **Procurer** shall submit by week 12 of Year 0 (Y) to **TRANSCO** the most recent view of the generation capacity expansion plan for Year 1 (Y+1) and all succeeding Financial Years of **TRANSCO Seven Year Planning Statement**..

TRANSCO shall submit by week 24 or otherwise as agreed with the Department of Energy (DoE) the draft Electricity **Seven Year Planning Statement** in Year 0 (Y) for approval.

4.1.2 Network Data

To enable **Users** to model the **Transmission System**, **TRANSCO** is required to submit to the **Procurer** for issue to **Users**, as determined by the **Procurer**, **Network Data** as listed in Appendix C as follows:

- i) with respect to the current **TRANSCO Financial Year**;
- ii) provided by **TRANSCO** on a routine annual basis in calendar week 52 of each year. Where from the date of one annual submission to another there is no change in the data to be released, instead of repeating the data, **TRANSCO** may release a written statement that there has been no change from the data released the previous time.

4.2 Offer of Terms for connection

4.2.1 Connection Agreement – Data Requirements

The application for a **Connection Agreement** to be submitted by a **User** when making an application for connection will include:

- i) a description of the **Plant** and/or **Apparatus** to be connected to the **Transmission System** or of the **Modification** relating to the **User Plant** and/or **Apparatus** already connected to the **Transmission System** which shall be termed a "**User Development**";
- ii) the relevant **Standard Planning Data** as listed in Appendix A; and
- iii) the desired **Completion Date** of the proposed **User Development**.

Any offer of a **Connection Agreement** made by **TRANSCO** will provide that it must be accepted by the applicant **User** within the period stated in the offer, after which the offer automatically lapses. Acceptance of the offer renders the **TRANSCO** works relating to that **User Development**, reflected in the offer, committed and binds both parties to the terms of the offer. Within 28 days of acceptance of the offer the **User** shall supply the **Detailed Planning Data** pertaining to the **User Development** as listed in Appendix B.

4.2.2 Self-Supply Users– Data Requirements

A **Self-Supply User** shall submit the following data in respect of a **Generating Unit** of a capacity greater than 10 MW as soon as reasonably practicable:

- i) details of the proposed new connection or variation to the connection within the **Self-Supply System**;
- ii) the relevant **Standard Planning Data** as listed in Appendix A ;
- iii) the proposed **Completion Date** of the proposed connection or variation of the **Self-Supply System**; and
- iv) upon the request of **TRANSCO**, the relevant **Detailed Planning Data** as listed in Appendix B.

4.2.3 Embedded Power Station – Data Requirements

A **DISCO** shall submit the following data in respect of an **Embedded Power Station** of a capacity greater than 10 MW as soon as reasonably practicable after receipt of an application from a **GENCO** to connect to its system:

- i) details of the proposed new connection or variation to the connection within the **Distribution System**;
- ii) the relevant **Standard Planning Data** as listed in Appendix A ;
- iii) the proposed **Completion Date** of the proposed connection or variation of the **Embedded Development**; and
- iv) upon the request of **TRANSCO**, the relevant **Detailed Planning Data** as listed in Appendix B.

4.3 Complex connections

The magnitude and complexity of any **Transmission System** extension or reinforcement will vary according to the nature, location and timing of the proposed **User Development** and it may be necessary for **TRANSCO** to carry out additional and/or more extensive system studies to evaluate more fully the impact of the proposed **User Development** on the **Transmission System**. Where such additional and/or more detailed studies are necessary the offer may indicate the areas that require more detailed analysis and before such additional studies are required, the **User** shall indicate whether it wishes **TRANSCO** to undertake the work necessary to proceed to make a revised offer within the 3 month period normally allowed or, where relevant, the timescale consented to by the **Bureau**.

To enable **TRANSCO** to carry out any of the above mentioned necessary detailed system studies, the **User** may, at the request of **TRANSCO**, be required to provide some or all of the **Detailed Planning Data** listed in Appendix B in advance of the normal timescale referred to in **Planning Code 4.2**.

5. PLANNING DATA STATUS

As far as the **Planning Code** is concerned, there are three relevant levels of data in relation to **Users**. These levels, which relate to levels of confidentiality, commitment and validation, are described in the following paragraphs.

5.1 Preliminary Project Planning Data

At the time the **User** applies for a **Connection Agreement** but before an offer is made and accepted by the applicant **User**, the data relating to the proposed **User Development** will be considered as **Preliminary Project Planning Data**. Data relating to an **Embedded Development** provided by a **DISCO** in accordance with Planning Code 4.2.2, if requested, will be considered as **Preliminary Project Planning Data**. All such data will be treated as confidential within the scope of the provisions relating to confidentiality in the **Connection Agreement**.

Preliminary Project Planning Data will normally only contain the **Standard Planning Data** unless the **Detailed Planning Data** is required in advance of the normal timescale to enable **TRANSCO** to carry out additional detailed system studies.

5.2 Committed Project Planning Data

Once the offer for a **Connection Agreement** is accepted, the data relating to the **User Development** already submitted as **Preliminary Project Planning Data**, and subsequent data required by **TRANSCO**, will become **Committed Project Planning Data**. This data, together with other data held by **TRANSCO** relating to the **Transmission System** will form the background against which new applications by any **User** will be considered and against which planning of the **Transmission System** will be undertaken.

5.3 Connected Planning Data

The **Planning Code** requires that when any estimated values assumed for planning purposes are confirmed or replaced by validated actual values this data is then termed **Connected Planning Data**.

5.3.1 Confidentiality of Data

Committed Project Planning Data and **Connected Planning Data**, together with other data held by **TRANSCO** relating to the **Transmission System**, will form the background against which new applications by any **User** will be considered and against which planning of the **Transmission System** will be undertaken. Accordingly, data will not be treated as confidential to the extent that **TRANSCO**:

- i) is obliged to use it in the preparation of the **Seven Year Planning Statement**;
- ii) is obliged to use it when considering and/or advising on applications of other **Users** which is relevant to that other application; and
- iii) is obliged to use it for **TRANSCO** operational planning purposes.

6. PLANNING STANDARDS

TRANSCO shall apply the **Licence Standards** relevant to planning and development, in the planning and development of the **Transmission System**.

APPENDIX A - STANDARD PLANNING DATA

1. DEMAND AND ACTIVE ENERGY DATA

1.1 Introduction

Each **User** directly connected to the **Transmission System** with **Demand** shall provide **TRANSCO** with the **Demand** data. Data shall be supplied for each of the next five operational years by:

- i) each **DISCO** directly connected to the **Transmission System**, in relation to **Demand** and **Active Energy** requirements on its **Distribution System**;
- ii) each **Non-Embedded Customer** in relation to its **Demand** and **Active Energy** requirements;
- iii) each **GENCO** in relation to the **Demand** (for example works **Load**) of each **Power Station** directly connected to the **Transmission System**, and
- iv) each **Self Supply User** with respect to anticipated imports or exports of **Active Energy** and **Water** from or to the **Transmission System** under **PWPA** or **PSA** or any other Agreement, and
- v) the **Procurer** with respect to anticipated imports or exports of **Active Energy** from or to the **Transmission System**.

1.2 Demand (Active and Reactive Power) and Active Energy Data

1.2.1 User Total System Demand (Active Power) and Active Energy

Forecast daily **Demand (Active Power)** profiles, as specified in i), ii) and iii) below, in respect of each **User System** (summed over all **Transmission Supply Points** in each **User System**) are required for:

- i) peak day on each of the **User Systems** giving the numerical value of the maximum **Demand (Active Power)** that could be imposed on the **Transmission System**;
- ii) day of peak **TRANSCO Demand (Active Power)** which, for planning purposes will be as specified from time to time by **TRANSCO**; and
- iii) day of minimum **TRANSCO Demand (Active Power)** which, for planning purposes will be as specified from time to time by **TRANSCO**;

The annual **Active Energy** requirement for each **User System** is required to be subdivided into the following categories of **Customer**:

- Domestic;
- Agricultural;
- Commercial;
- Industrial;
- Municipality;
- Public Lighting;
- Any other identifiable categories of **Customers**; and
- **User System** losses.

All forecast **Demand (Active Power)** and **Active Energy** specified in 1.2.1 shall:

- be such that the profiles comprise average **Active Power** levels in **MW** for each hour throughout the day;
- be that remaining after any deductions considered appropriate by the **User** to take account of the output profile of all **Embedded Generating Plant** that are not despatched by **TRANSCO**; and
- in the case of 1.2.1 i) and ii) be based on **Annual MD Conditions**.

1.2.2 Connection Point Demand (Active and Reactive Power)

Forecast **Demand (Active Power)** and **Power Factor** to be met at each **Connection Point** are required for:

- i) the maximum **Demand (Active Power)** at the **Connection Point** that in the **Users** opinion could be imposed on the **Transmission System**;
- ii) the **Demand (Active Power)** at the time of peak **TRANSCO Demand** which, for planning purposes will be as specified from time to time by **TRANSCO**; and
- iii) the **Demand (Active Power)** at the time of minimum **TRANSCO Demand** which, for planning purposes will be specified from time to time by **TRANSCO**.

All forecast **Demand** specified in 1.2.2 shall relate to each **Connection Point** and be in the form of:

- i) one set of **Demand** data where the **User System** is connected to the **Transmission System** via a busbar arrangement which is not normally operated in separate sections; and
- ii) separate sets of **Demand** data where the **User System** is connected to the **Transmission System** via a busbar arrangement which is, or is expected to be, operated in separate sections.

All forecast **Demand** specified in 1.2.2 shall:

- i) be that remaining after any deductions reasonably considered appropriate by the **User** to take account of the output of all **Embedded Generating Plant** that are not despatched by **TRANSCO**;
- ii) include any **User System** series reactive losses but exclude any reactive compensation equipment; and
- iii) in the case of 1.2.2 i) and ii) be based on **Annual MD Conditions** and in the case of 1.2.2 iii) be based on **Average Conditions**.

1.3 General Demand Data

The following information is infrequently required and should be supplied (wherever possible) when requested by **TRANSCO**:

- i) details of any individual loads which have characteristics significantly different from the typical range of Domestic, Commercial or Industrial loads supplied;

- ii) the sensitivity of the **Demand (Active and Reactive Power)** to variations in voltage and frequency on the **Transmission System** at the time of the peak **Demand (Active Power)**.
- iii) the average and maximum phase unbalance which the **User** would expect its **Demand** to impose on the **Transmission System**;
- iv) the maximum harmonic content which the **User** would expect its **Demand** to impose on the **Transmission System**; and
- v) details of all loads which may cause **Demand** fluctuations greater than those permitted under UK Engineering Recommendation P28, at a **Point of Common Coupling** including the **Flicker Severity (Short Term)** and the **Flicker Severity (Long Term)**.

2. GENERATING UNIT DATA

2.1 Introduction

Each **GENCO** with existing, or proposed, **Generating Plant** directly connected, or to be directly connected, to the **Transmission System** and/or with existing, or proposed, **Embedded Generating Plant**, or **Self-Supply User** with an existing, or proposed, **Power Station** directly connected, or to be directly connected, to the Self-Supply system, shall provide **TRANSCO** with data relating to that **Generating Plant** as specified in 2.2 and 2.3.

2.2 Generating Plant Performance Data

The following data items are required with respect to each directly connected **Generating Unit** and to each **Generating Unit** of an **Embedded Power Station** or **User System**:

- i) **Registered Capacity (MW)**;
- ii) **Net Dependable Power Capacity (MW)** on a monthly basis;
- iii) System constrained capacity (**MW**) i.e. any constraint placed on the capacity of the **Embedded Generating Plant** due to the **DISCO System** in which it is embedded;
- iv) **Minimum Generation (MW)**;
- v) **MW** obtainable from **Generating Units** in excess of **Registered Capacity**;
- vi) **Generator Performance Chart**
 - (a) At the **Synchronous Generating Unit** stator terminals;
 - (b) At the electrical **Connection Point** to the **Transmission System** (or **User System** if **Embedded**) for a **Power Farm Generating Unit**; and
- vii) expected running regime(s) at each **Power Station** and type of **Generating Unit**, eg. steam turbine unit, gas turbine unit, **Cogeneration Module** (specify by type), **PVGU**, **WTGU**, **CSGU** etc.

2.3 Rated Parameters Data

The following information is required with an application for a **Connection Agreement** to facilitate an early assessment by **TRANSCO**, of the need for more detailed studies:

- i) The point of connection to the **Transmission System** in terms of geographical and electrical location and system voltage;
- ii) for all **Generating Units**:

- Rated MVA;
 - **Rated MW**;
 - **Exciter** category, for example whether rotating **Exciter** or static **Exciter** or in the case of a **Power Farm Generating Unit** the voltage control system; and
 - Whether a **Power System Stabiliser** is fitted.
- iii) For all **Synchronous Generating Units**:
- Inertia constant (alternator plus prime mover) MWs/MVA;
 - **Short Circuit Ratio**; and
 - Direct axis transient reactance.
- iv) for each **Generating Unit** step-up transformer:
- Rated MVA; and
 - Positive sequence reactance (at max, min and nominal tap).
- v) for each **AC/DC Converter** at a **AC/DC Converter Station** or **AC/DC Converter** connecting a **PVPS** or **WFPS**:
- **AC/DC Converter** type (e.g. current/voltage sourced);
 - **Rated MW** for import and export;
 - Number of poles and pole arrangement;
 - Rated DC voltage/pole (kV); and
 - Return path arrangement.
- vi) for each type of **WTGU** not connected to the **Transmission System** by a **AC/DC Converter**:
- Rated MVA;
 - **Rated MW**;
 - Rated terminal Voltage;
 - Inertia constant (MWsec/MVA);
 - Stator reactance;
 - Magnetising reactance;
 - Rotor resistance;
 - Rotor reactance;
 - Rotor speed range (Doubly fed induction only); and
 - Converter MVA rating (Doubly fed induction only).

3. USER SYSTEM DATA

3.1 Introduction

Each **User**, whether connected directly via an existing **Connection Point** to the **Transmission System** or seeking such a direct connection, shall provide **TRANSCO** with data on its **System** which relates to the **Connection Site** and/or which may have a system effect on the performance of the **Transmission System**.

Each **User** must reflect the system effect at the **Connection Site(s)** of any third party **Embedded** within its **System** whether existing or proposed.

Although not itemised here, each **User** with an existing or proposed **Embedded Power Station** in its **System** may, at **TRANSCO's** reasonable discretion, be required to provide additional details relating to the **User's System** between the **Connection Site** and the existing or proposed **Embedded Power Station**.

3.2 Single Line Diagram

The information is to comprise a **Single Line Diagram** showing all HV equipment and connections together with equipment ratings for such equipment.

3.3 Reactive Compensation Equipment

For all reactive compensation equipment connected to the **User System** at 11kV and above, other than **Power Factor** correction equipment associated directly with **Customer's Plant and Apparatus**, the following information is required:

- i) type of equipment (eg. fixed or variable);
- ii) capacitive and/or inductive rating or its operating range in **MVar**;
- iii) details of any automatic control logic to enable operating characteristics to be determined;
- iv) the point of connection to the **User System** in terms of electrical location and **System** voltage; and
- v) in respect of **AC/DC Converter Stations** information about the reactive compensation and harmonic filtering equipment installed to ensure that their **Plant and Apparatus** complies with the criteria set out in Connection Conditions 6.1.3.

3.4 Short Circuit Contribution to Transmission System

To allow **TRANSCO** to model a **User System** with **Generating Unit(s)** and/or motor loads connected to it, a **User** is required to provide data, calculated in accordance with **Good Industry Practice**.

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 network conditions reflect a credible **System** operating arrangement.

The following data is required:

- i) symmetrical three-phase short circuit current infeed at the instant of fault, (I_1'');

- ii) symmetrical three-phase short circuit current after the sub-transient fault current contribution has substantially decayed, (I_1');
- iii) the zero sequence source resistance and reactance values of the **User System** as seen from the **Point of Connection**, consistent with the maximum infeed above;
- iv) root mean square of the pre-fault voltage at which the maximum fault currents were calculated;
- v) the positive sequence X/R ratio at the instant of fault;
- vi) The **Active Power** being generated pre-fault by the **Power Farm** and by each **PVGU** and **WTGU**;
- vii) The **Power Factor** of the **Power Farm** and of each **PVGU** and **WTGU**.

3.5 Demand Transfer Capability

Where a **User Demand** or group of **Demands** may be offered by the **User** to be supplied from alternative **Connection Point(s)**, and the **User** considers it appropriate that this should be taken into account by **TRANSCO** in designing the **Connection Site** the following information is required:

- i) the alternative **Connection Point(s)**;
- ii) the **Demand** which may be transferred under the loss of the most critical circuit from or to each alternative **Connection Point** (to the nearest 1MW/1MVAR); and
- iii) the arrangements (eg. manual or automatic) for transfer together with the time required to effect the transfer.

3.6 Switchgear

The following information is required with respect to switchgear (including circuit breakers, switch disconnectors and isolators) on all circuits directly connected to the **Connection Point** including those at **Power Stations**:

- i) Rated voltage (kV)
- ii) Operating voltage (kV)
- iii) Rated short-circuit breaking current, 3-phase (kA) and 1-phase (kA)
- iv) Rated load-breaking current, 3-phase (kA) and 1-phase (kA)
- v) Rated peak short-circuit making current, 3-phase (kA) and 1-phase (kA)

3.7 User System Data

Each **User** with an existing or proposed **System** at 11kV and above connecting the **User System** to the **Transmission System** shall provide the following details relating to that **Connection Point**.

3.7.1 Circuit Parameters (for all circuits), when requested by **TRANSCO**:

- i) Rated voltage (kV);
- ii) Operating voltage (kV);
- iii) Positive phase sequence resistance, reactance and susceptance; and

- iv) Zero phase sequence resistance, reactance; and susceptance.

3.7.2 Interconnecting Transformers

For transformers between the **Transmission System** and the **User System** the following data shall be provided for each transformer:

- i) Transformer rating and impedance voltage;
- ii) Winding arrangements and vector group;
- iii) Tap changing facilities and tapping range.

APPENDIX B - DETAILED PLANNING DATA

Some data items set out below are already requested under Appendix A to facilitate an early assessment by **TRANSCO** as to whether detailed stability studies will be required before an offer of terms for a **Connection Agreement** can be made. Such data items have been repeated here merely for completeness and need not be resubmitted unless their values, known or estimated, have changed.

4. GENERATING UNIT DATA

Each **GENCO** with an existing, or proposed, **Power Station** directly connected, or to be directly connected, to the **Transmission System** and/or with an existing, or proposed, **Embedded Power Station**, or **Self-Supply User** with an existing, or proposed, **Power Station** directly connected, or to be directly connected, to the Self-Supply system, shall provide **TRANSCO** with data relating to that **Plant and Apparatus**.

4.1 Demand

For each **Generating Unit** which 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.

Where the **Power Station** has associated **Demand** additional to the unit-supplied **Demand** which is supplied from either the **Transmission System** or the **GENCO User System**, the **GENCO** shall supply forecasts for each **Power Station** of:

- i) the maximum **Demand** that could be imposed on the **Transmission System**;
- ii) the **Demand** at the time of the peak **TRANSCO Demand**; and
- iii) the **Demand** at the time of minimum **TRANSCO Demand**.

4.2 Synchronous Generating Unit and Associated Control System Data

The following **Synchronous Generating Unit** and **Power Station** data should be supplied:

4.2.1 Synchronous Generating Unit Parameters

- i) Rated terminal volts (kV);
- ii) Rated MVA;
- iii) **Rated MW**;
- iv) Minimum Generation MW;
- v) **Short Circuit Ratio**;
- vi) Direct axis synchronous reactance;
- vii) Direct axis transient reactance;
- viii) Direct axis sub-transient reactance;
- ix) Direct axis short-circuit transient time constant;
- x) Direct axis short-circuit sub-transient time constant;
- xi) Quadrature axis synchronous reactance;

- xii) Quadrature axis sub-transient reactance;
- xiii) Quadrature axis short-circuit sub-transient time constant;
- xiv) Stator time constant;
- xv) Stator leakage reactance;
- xvi) Armature winding direct-current resistance;
- xvii) Turbo-generator inertia constant (MWs/MVA);
- xviii) Rated field current (amps) at **Rated MW** and MVA_r output and at rated terminal voltage; and
- xix) 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.

4.2.2 Generating Unit Step-up Transformer Parameters

- i) Rated MVA;
- ii) Voltage ratio;
- iii) Winding arrangement and vector group;
- iv) Positive sequence resistance and reactance (at max, min, & nominal tap);
- v) Zero phase sequence reactance;
- vi) Tap changer range;
- vii) Tap changer step size; and
- viii) Tap changer type: on load or off circuit.

4.2.3 Excitation Control System parameters

Excitation System (including **PSS** if fitted) transfer function block diagram showing gains, time constants, limits, rates of change etc. of individual elements including details of:

- i) Rated field voltage;
- ii) Generator no-load field voltage;
- iii) Excitation positive ceiling voltage;
- iv) Excitation system negative ceiling voltage;
- v) Over-excitation limiter; and
- vi) Under-excitation limiter.

4.2.4 Governor and Associated Prime Mover Parameters

4.2.4.1 Governor Parameters - All Generating Units

Governor Block Diagram system transfer function block diagram showing gains, time constants, limits, rates of change etc. of individual elements including details of:

- i) Filters;
- ii) Converters;

- iii) Overall average gain (MW/Hz).

4.2.4.2 Prime Mover Parameters - Steam Turbine Units

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 electrical **Generating Unit Rated MW** including details of:

- i) Boilers;
- ii) HP turbine;
- iii) HP turbine power fraction;
- iv) HP steam extraction range (expressed in terms of the boiler rated output);
- v) HP steam extraction valves;
- vi) LP turbine;
- vii) LP turbine power fraction.

4.2.4.3 Prime Mover Parameters - Gas Turbine Units

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

- i) Inlet guide vanes;
- ii) Compressor;
- iii) Fuel valve;
- iv) Combustion chamber; and
- v) Power turbine.

4.2.5 Plant Flexibility Performance

The following data is required with respect to **Generating Plant**:

- i) Rate of loading following 48 hours shutdown (**Generating Unit and Power Station**);
- ii) Rate of loading following 6 hours shutdown (**Generating Unit and Power station**);
- iii) Block **Load** following **Synchronising**;
- iv) Rate of **De-loading** from normal **Rated MW**;
- v) Regulating range; and
- vi) **Load** rejection capability while still **Synchronised** and able to supply **Load**.

4.3 Power Farm Generating Unit and Associated Control System Data

The following data is required in respect of **WTGUs** not connected via a **AC/DC Converter** to the **Transmission System**:

4.3.1 WTGU Modelling

A mathematical model of each type of **WTGU** capable of representing its transient and dynamic behaviour under both small and large disturbance conditions. The model shall include non-linear effects and represent all equipment relevant to the dynamic performance of the **WTGU** as agreed with **TRANSCO**. The model shall be suitable for the study of balanced, root mean square, positive phase sequence time-domain behaviour, excluding the effects of electromagnetic transients, harmonic and sub-harmonic frequencies. The model shall accurately represent the overall performance of the **WTGU** over its entire operating range including that which is inherent to the **WTGU** and that which is achieved by use of supplementary control systems providing either continuous or stepwise control. Model resolution should be sufficient to accurately represent **WTGU** behaviour both in response to operation of **Transmission System Protection** and in the context of longer-term simulations.

The overall structure of the model shall include:

- i) any supplementary control signal modules.
- ii) any blocking, deblocking and protective trip features that are part of the **WTGU**.
- iii) any other information required to model the **WTGU** behaviour to meet the model functional requirement described above.

The model shall be submitted in the form of a transfer function block diagram and may be accompanied by dynamic and algebraic equations. This model shall display all the transfer functions and their parameter values, any signal limits and non-linearities.

4.3.2 Wind Turbine Generating Unit Parameters

- i) Rated MVA;
- ii) **Rated MW**;
- iii) Rated Terminal Voltage;
- iv) Inertia constant (MWsec/MVA);
- v) Stator resistance;
- vi) Stator reactance;
- vii) Magnetising reactance;
- viii) Rotor resistance;
- ix) Rotor reactance;
- x) The optimal rotor power coefficient (CP) versus tip speed ratio curve where applicable. The tip speed ratio is defined as WR/U where W is the angular velocity of the rotor, R is the radius of the wind turbine rotor and U is the wind speed;
- xi) Where applicable the electrical power versus rotor speed for a range of wind speeds; and
- xii) Where applicable, the transfer function block diagram including parameters should be provided including the torque/speed controller (maximum power tracking control system)

Note: Rotor resistance and reactance values should be given for both starting and running conditions.

Additionally for doubly fed induction generators the following information is also required:

- i) The rotor speed range;
- ii) Power converter rating (MVA); and
- iii) Transfer function block diagram, parameters and description of the operation of the power electronic converter including the torque/speed controller.

4.3.3 Voltage/Reactive Power/Power Factor Control System Parameters

For the **WTGU** details of voltage/**Reactive Power/Power Factor** controller (and **PSS** if fitted) described in block diagram form showing transfer functions and parameters of individual elements.

4.3.4 Frequency Control System Parameters

For the **WTGU** details of the frequency controller described in block diagram form showing transfer functions and parameters of individual elements.

4.3.5 Protection

Details of settings for the following protection relays: Under frequency, Over frequency, Under voltage, Over voltage, Rotor over current, Stator over current, High wind speed shut down level, etc.

4.4 AC/DC CONVERTERS

For a **Power Farm** connected to the **Transmission System** by a **AC/DC Converter** the following information for each **AC/DC Converter** and **DC network** should be supplied:

4.4.1 AC/DC Converter Parameters

- i) **Rated MW** per pole for transfer in each direction;
- ii) **AC/DC Converter** type (i.e. current or voltage source);
- iii) Number of poles and pole arrangement;
- iv) Rated DC voltage/pole (kV); and
- v) Return path arrangement.

4.4.2 AC/DC Converter Transformer Parameters

- i) Rated MVA;
- ii) Nominal primary voltage (kV);
- iii) Nominal secondary (converter-side) voltage(s) (kV);
- iv) Winding and earthing arrangement;
- v) Positive phase sequence reactance at minimum, maximum and nominal tap;
- vi) Positive phase sequence resistance at minimum, maximum and nominal tap;
- vii) Zero phase sequence reactance;
- viii) Tap-changer range in %; and

- ix) Number of tap-changer steps.

4.4.3 DC Network Parameters

- i) Rated DC voltage per pole;
- ii) Rated DC current per pole;
- iii) **Single Line Diagram** of the complete **DC Network**;
- iv) Details of the complete **DC Network**, including resistance, inductance and capacitance of all DC cables and/or DC lines; and
- v) Details of any DC reactors (including DC reactor resistance), DC capacitors and/or DC-side filters that form part of the **DC Network**.

4.4.4 AC Filter Reactive Compensation Equipment Parameters

- i) Total number of AC filter banks;
- ii) Type of equipment (e.g. fixed or variable);
- iii) **Single Line Diagram** of filter arrangement and connections;
- iv) **Reactive Power** rating for each AC filter bank ,capacitor bank or operating range of each item of reactive compensation equipment, at rated voltage; and
- v) Performance Chart showing **Reactive Power** capability of the **AC/DC Converter**, as a function of MW transfer, with all filters and reactive compensation plant, belonging to the **AC/DC Converter Station** working correctly.

Note: Details in this section are required for each **AC/DC Converter** connected to the **DC Network**, unless each is identical or where the data has already been submitted for an identical **AC/DC Converter** at another **Connection Point**.

4.4.5 AC/DC Converter Control System Models

The following data is required by **TRANSCO** to represent **AC/DC Converters** and associated **DC Networks** in dynamic power system simulations, in which the **AC Transmission System** is typically represented by a positive sequence equivalent. **AC/DC Converters** are represented by simplified equations and are not modelled to switching device level.

- i) Static VDC-IDC (DC voltage - DC current) characteristics, for both the rectifier and inverter modes for a current source converter. Static VDC-PDC (DC voltage - DC power) characteristics, for both the rectifier and inverter modes for a voltage source converter. Transfer function block diagram including parameters representation of the control systems of each **AC/DC Converter** and of the **AC/DC Converter Station**, for both the rectifier and inverter modes. A suitable model would feature the **AC/DC Converter** firing angle as the output variable;
- ii) Transfer function block diagram representation including parameters of the **AC/DC Converter** transformer tap changer control systems, including time delays;

- iii) Transfer function block diagram representation including parameters of AC filter and reactive compensation equipment control systems, including any time delays;
- iv) Transfer function block diagram representation including parameters of any **Frequency** and/or load control systems;
- v) Transfer function block diagram representation including parameters of any small signal modulation controls such as power oscillation damping controls or sub-synchronous oscillation damping controls, that have not been submitted as part of the above control system data; and
- vi) Transfer block diagram representation of the reactive power control at converter ends for a voltage source converter.

4.5 Harmonic and Flicker Parameters

When connecting a **Power Farm**, it is necessary for **TRANSCO** to evaluate the production of flicker and harmonics on **TRANSCO** and **User's Systems**. At **TRANSCO's** reasonable request, the **User** (a **DISCO** in respect of an **Embedded Power Station**) is required to submit the following data (as defined in IEC 61400-21 (2001)) for each **PVPS** and **WFPS**:

- i) Flicker coefficient for continuous operation;
- ii) Flicker step factor;
- iii) Number of switching operations in a 10 minute window;
- iv) Number of switching operations in a 2 hour window;
- v) Voltage change factor; and
- vi) Harmonic current injection.

4.6 Black Start Related Information

The following data items/text must be supplied, from each **Genco** to **TRANSCO** with respect to each **Generating Unit** at each **Power Station** excluding the **Generating Units** that are not contracted to provide **Black Start Capability**, or **Power Farm**:

- i) Expected time for each **Generating Unit** to be synchronised following a **Total Shutdown** or **Partial Shutdown**. The assessment should include the **Power Station's** ability to re-synchronise all **Generating Units**, if all were running immediately prior to the **Total Shutdown** or **Partial Shutdown**. Additionally this should highlight any specific issues (i.e. those that would impact on the **Generating Unit's** time to be synchronised) that may arise, as time progresses without external supplies being restored; and
- ii) Block Loading Capability should be provided in either graphical or tabular format showing the estimated block loading capability from 0 MW to **Registered Capacity**. Any particular 'hold' points should also be identified. The data of each **Generating Unit** should be provided for the condition of a 'hot' unit that was synchronised just prior to the **Total Shutdown** or **Partial Shutdown** and also for the condition of a 'cold' unit. The block loading assessment should be done against a **System Frequency** variation of 49.5Hz – 50.5Hz.

5. USERS SYSTEM DATA

5.1 Introduction

Each **User**, whether connected directly via an existing **Connection Point** to the **Transmission System** or seeking such a direct connection, shall provide **TRANSCO** with data on its **User System** which relates to the **Connection Site** containing the **Connection Point** both current and forecast. Each **User** must reflect the system effect at the **Connection Site(s)** of any third party **Embedded** within its **User System** whether existing or proposed.

5.2 User System Layout

When requested by **TRANSCO**, each **User** shall provide a **Single Line Diagram** depicting both its existing and proposed arrangement(s) of all load current carrying **Apparatus** relating to both existing and proposed **Connection Points**

The above mentioned **Single Line Diagram** shall include:

- i) busbar layout(s);
- ii) electrical circuitry (i.e. overhead lines, underground cables, power transformers and similar equipment);
- iii) phasing arrangements;
- iv) earthing arrangements;
- v) switching facilities;
- vi) operating voltages; and
- vii) numbering and nomenclature.

5.3 HV Motor Drives

In the case of Users system including HV motors the following data shall be provided for each HV motor:

- i) Rated MVA;
- ii) **Rated MW**;
- iii) Full load current;
- iv) Means of starting and starting current;
- v) Motor torque/speed characteristic;
- vi) Driven load torque/speed characteristic; and
- vii) Motor plus driven load inertia constant.

5.4 Interconnecting Transformers

For transformers between the **Transmission System** and the **User System** the following data shall be provided for each transformer:

- i) Rated MVA;
- ii) Rated Voltage Ratio;

- iii) Winding arrangement and vector group;
- iv) Positive sequence resistance and reactance (max, min and nominal tap);
- v) Zero sequence reactance;
- vi) Tap changer range and step size;
- vii) Tap changer type: on load or off circuit; and
- viii) Earthing method: Direct, resistance or reactance.

5.5 Transient Over-voltage Assessment Data

When undertaking insulation co-ordination studies **TRANSCO** will need to conduct transient overvoltage assessments . When requested by **TRANSCO**, each **User** is required to submit data with respect to the **Connection Site** as follows:

- i) busbar layout, including dimensions and geometry together with electrical parameters of any associated current transformers, voltage transformers, wall bushings, and support insulators;
- ii) 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;
- iii) specification details of all **Apparatus** connected directly or by lines and cables to the busbar including Basic Insulation Levels;
- iv) characteristics of overvoltage protection at the busbar and at the termination of lines and cables connected at the busbar;
- v) the following **Generating Unit** or **Power Station** transformer data is required: three or five limb cores or single phase units to be specified, and operating peak flux density at nominal voltage

5.6 User Protection Data

The following information is required which relates only to **Protection** equipment which can trip or inter-trip or close any **Connection Point** circuit-breaker or any **TRANSCO** circuit-breaker:

- i) a full description, including estimated settings, for all relays and details of settings systems installed or to be installed on the **User System**;
- ii) a full description of any auto-reclose facilities installed or to be installed on the **User System**, including type and time delays;
- iii) a full description, including estimated settings, for all relays and **Protection** systems or to be installed on the generator, generator transformer, station transformer and their associated connections;
- iv) for **Generating Units** having (or intended to have) a circuit breaker at the generator terminal voltage, clearance times for electrical faults within the **Generating Unit** zone;
- v) the most probable fault clearance time for electrical faults on any part of the **User System** directly connected to the **Transmission System**.

5.7 Additional Data

Notwithstanding the **Standard Planning Data** and **Detailed Planning Data** set out in Appendices A and B respectively, **TRANSCO** may reasonably request additional data to represent correctly **User Systems Plant** and **Apparatus** for the purpose of carrying out studies.

APPENDIX C - NETWORK DATA

6. SYSTEM MODEL

TRANSCO will provide **Users** and potential **Users**, through the Emirates Water and Electricity Company or directly, with a complete listing of the data submitted and registered under the requirements of the **Electricity Transmission Code** and in addition the positive, negative and zero sequence data related to the **TRANSCO** transmission system. This data will be validated by **TRANSCO** in accordance with **Good Industry Practice**.

7. SHORT CIRCUIT CALCULATIONS

To allow those **Users** who only need to model the **Transmission System** for the purpose of short circuit calculations, **TRANSCO** will provide the following **Network Data**, calculated in accordance with **Good Industry Practice**, as an equivalent 400kV, 220kV, 132kV, source at the **HV** point of connection to the **User System**.

- i) symmetrical three-phase short circuit current infeed at the instant of fault from the **Transmission System**, (I_1'');
- ii) symmetrical three-phase short circuit current from the **Transmission System** after the sub-transient fault current contribution has substantially decayed, (I_1');
- iii) the zero sequence source resistance and reactance values at the **Point of Connection**, consistent with the maximum infeed below;
- iv) the pre-fault voltage magnitude at which the maximum fault currents were calculated;
- v) the positive sequence X/R ratio at the instant of fault;

Since the equivalent will be produced for the 400kV, 220kV or 132kV parts of the **Transmission System** **TRANSCO** will provide the appropriate interconnection transformer data

CHAPTER 3 - CONNECTION CONDITIONS

1. INTRODUCTION

The **Connection Conditions** specify both the minimum technical, design and operational criteria which must be complied with by any **User** connected to or seeking connection with the **Transmission System** and the minimum technical, design and operational criteria with which **TRANSCO** shall comply in relation to the part of the **Transmission System** at the **Connection Site** with **Users**.

2. OBJECTIVE

The objective of the **Connection Conditions** is to ensure that by specifying minimum technical, design and operational criteria the basic rules for connection to the **Transmission System** shall enable **TRANSCO** to comply with its statutory and **Transmission Licence** obligations.

3. SCOPE

The **Connection Conditions** applies to **TRANSCO** and to the following **Users**:

- i) **GENCOs**
- ii) **DISCOs**
- iii) **Non-Embedded Customers**
- iv) **Self-Supply Users**
- v) **User Systems**

The obligations within the **Connection Conditions** that are expressed as to be applicable to **GENCOs** in respect of **Embedded Power Stations** shall be read and construed as obligations that the **DISCO** or **User** within whose **System** such a **Power Station** is **Embedded** must ensure are performed and discharged by the **GENCO**.

4. PROCEDURE

The **Connection Agreements** contain provisions relating to the procedure for connection to the **Transmission System** or, in the case of **Embedded Generating Plant**, include provisions relating to certain conditions to be complied with by **Users** prior to **TRANSCO** notifying the **User** that it has the right to become operational.

5. CONNECTION

The provisions relating to connecting to the **Transmission System** (or to a **Distribution** or **User System** in relation to an **Embedded Power Station**) are contained in:

- i) each **Connection Agreement** with a **User** or
- ii) in the case of an **Embedded Development**, the **Distribution Code** and/or the **Connection Agreement** with the **DISCO**,

and include provisions relating to both the submission of information and reports relating to compliance with the relevant **Connection Conditions** for that **User**, **Safety**

Rules, commissioning programmes, **Operation Diagrams** and approval to connect and their equivalents in the case of **Embedded Power Stations**.

Prior to the **Completion Date** under the **Connection Agreement**, the following is to be submitted by the **User**:

- i) updated **Planning Code** data with any estimated values assumed for planning purposes confirmed or, where practical, replaced by validated actual values and by updated estimates for the future and by updated forecasts for items such as **Demand** or the **Export/Import** in case of **Self-Supply User**;
- ii) details of the **Protection** arrangements and settings as set out in Connection Conditions 6.2.2.4;
- iii) copies of all **Safety Rules** and **Local Safety Instructions** applicable at **Users Sites** which shall be used at the **TRANSCO/User** interface;
- iv) information to enable **TRANSCO** to prepare **Site Responsibility Schedules** on the basis of the provisions set out in Appendix A;
- v) an **Operation Diagram** for all **HV Apparatus** on the **User** side of the **Connection Point** as set out in Connection Conditions 7.3.1;
- vi) the proposed name of the **User Site** (which shall not be the same as, or confusingly similar to, the name of any **TRANSCO Site** or of any other **User Site**);
- vii) a list of **Safety Co-ordinators**;
- viii) a list of the telephone numbers for **Joint System Incidents** at which senior management representatives nominated for the purpose can be contacted and confirmation that they are fully authorised to make binding decisions on behalf of the **User**;
- ix) a list of managers who have been duly authorised to sign **Site Responsibility Schedules** on behalf of the **User**;
- x) information to enable **TRANSCO** to prepare **Site Common Drawings** as set out in Connection Conditions 7.4; and
- xi) a list of the telephone numbers for the **User** facsimile machines.

Prior to the **Completion Date** the following must be submitted to **TRANSCO** by the **DISCO** or **User** in respect of an **Embedded** development:

- i) updated **Planning Code** data with any estimated values assumed for planning purposes confirmed or, where practical, replaced by validated actual values and by updated estimates for the future and by updated forecasts for items such as **Demand**;
- ii) details of **Protection** arrangements and settings as set out in Connection Conditions 6.2.2.4;

- iii) the proposed name of the **Embedded Power Station** (which shall not be the same as, or confusingly similar to, the name of any **TRANSCO Site** or of any other **User Site**).

6. TECHNICAL, DESIGN AND OPERATIONAL CRITERIA

6.1 Transmission System Performance Characteristics

TRANSCO shall ensure that the **Transmission System** complies with the following technical, design and operational criteria in relation to the part of the **Transmission System** at the **Connection Site** with a **User**.

6.1.1 Frequency Variations

The **System Frequency** of the **Transmission System** shall be nominally 50 Hz with **System Frequency** set points between 49.950 Hz - 50.050 Hz and shall be controlled within the limits of 49.9 and 50.1 Hz unless exceptional circumstances prevail.

Under transient disturbed conditions, **System Frequency** could rise to 53 Hz or fall to 47 Hz. However, under disturbed steady state conditions, System Frequency will not exceed 51.5 Hz or fall below 48 Hz. Design of **Plant** and **Apparatus** must enable operation within frequency and time ranges specified in Clause 6.3.1. Operation outside the range of 47-53Hz need not be taken into account in the design of **Plant** and **Apparatus**...

6.1.2 Voltage Variations

The voltage on the 400kV, 220kV and 132kV parts of the **Transmission System** at each **Connection Site** with a **User** will normally remain within $\pm 5\%$ of the nominal value. The minimum voltage is -10% and the maximum voltage is +10% but for 400kV system, voltages between +5% and +10% will not last longer than 15 minutes unless abnormal conditions prevail.

- i) The voltage on the 33kV, 22kV and 11kV parts of the **Distribution System** will normally remain within the limits $\pm 6\%$ of the nominal value unless abnormal conditions prevail.

Under fault conditions, voltage may collapse transiently to zero at the point of fault until the fault is cleared.

6.1.3 Voltage Waveform Quality

All **Plant** and **Apparatus** connected to the **Transmission System**, and that part of the **Transmission System** at each **Connection Site**, should be capable of withstanding the following distortions of the voltage waveform in respect of harmonic content and phase unbalance.

6.1.3.1 Harmonic Distortion

The **Electromagnetic Compatibility Levels** for harmonic distortion on the **Transmission System** from all sources under both **Planned Outage** and fault outage conditions, (unless abnormal conditions prevail) shall comply with the levels shown in the tables of Appendix F.

Appendix F also contains planning levels which **TRANSCO** will apply to the connection of non-linear load to the **Transmission System**, which may result in harmonic emission limits being specified for these loads in the relevant **Connection Agreement**. **TRANSCO** shall apply planning criteria that will take into account the position of existing and prospective **Users' Plant and Apparatus** in relation to harmonic emissions. **Users** must ensure that connection of distorting loads to their **User Systems** do not cause any harmonic emission limits specified in the **Connection Agreement** to be exceeded.

6.1.3.2 Phase Unbalance

Under **Planned Outage** conditions, the maximum negative phase sequence component of the phase voltage on the **Transmission System** should remain below 1% unless abnormal conditions prevail. Under **Planned Outage** infrequent short duration peaks with a maximum value of 2% are permitted for phase unbalance, subject to the prior agreement of **TRANSCO** under the **Connection Agreement**.

6.1.4 Voltage Fluctuations

Voltage fluctuations at a **Point of Common Coupling** with a fluctuating **Load** directly connected to the **Transmission System** shall not exceed:

- i) 1% of the voltage level for step changes which may occur repetitively. Any large voltage excursions other than step changes may be allowed up to a level of 3% provided that this does not constitute a risk to the **Transmission System** or, in **TRANSCO's** view, to the **System** of any **User**.
- ii) **Flicker Severity (Short Term)** of 0.8 Unit and a **Flicker Severity (Long Term)** of 0.6 Unit, as set out in IEC 61000-3-7 standard.

6.1.5 Demand Power Factor

Demand Power Factor shall be maintained in the range 0.91lag-Unity at 33kV, 22kV and 11kV connection points between **TRANSCO** and **Distribution Companies** during the summer period. **TRANSCO** may request **Distribution Companies** to maintain an appropriate **Demand Power Factor** level at the connection points during any other period in the Year. This is to ensure that the transmission system voltages are maintained at all times within the desired levels per the Clause 6.1.2 above and there is no excessive reactive power injected into the **Transmission System**.

Demand Power Factor shall be maintained in the range 0.91lag-Unity at connection points between **TRANSCO** and **NON-Embedded Customers**.

For **Self-Supply Users**, the actual reactive power range specified by the **TRANSCO** for importing and exporting reactive power shall not be wider than:

- a) 45 percent of active power (i.e. 0.91 power factor) of the larger of the maximum import power or maximum export power during reactive power import (consumption) unless agreed by Transco LDC; and
- b) 45 percent of active power (i.e. 0.91 power factor) of the larger of the maximum import power or maximum export power during reactive power export (production) unless agreed by Transco LDC

To avoid power factor non-compliance for zero exchange regimes, caused by reactive power volatility around the zero, **Self-Supply User** and the **TRANSCO** should define a reactive power dead band within which the power factor is not being calculated

Obligations should apply to both parties, **TRANSCO** and **Self-Supply User**, unless otherwise specified by **Connection and Interface Agreement** or some other agreement.

6.1.5.1 Power Factor determination

Demand Power Factor shall be calculated based on the settlement meter data at the connection point in a way which provides an hourly average value.

Compliance assessment and further consequent activities shall be specified in a separate procedure.

6.2 Plant and Apparatus Relating To User/TRANSCO Connection Site

The following requirements apply to **Plant** and **Apparatus** relating to the **User/TRANSCO Connection Point**, which each **User** must ensure are complied with in relation to its **Plant** and **Apparatus**.

6.2.1 General Requirements

The design of connections between the **Transmission System** and:

- i) any **Generating Unit**, or
- ii) any **Distribution** or **User System**
- iii) **Self-Supply User**, or
- iv) **Non-Embedded Customers** equipment;

shall be consistent with the **Licence Standards**.

The **Transmission System** at nominal **System** voltages of 132kV and above is designed to be earthed with an **Earth Fault Factor** of below 1.4. Under fault conditions the rated **Frequency** component of voltage could fall transiently to zero on one or more phases or rise to 140% phase-to-earth voltage. The voltage rise would last only for the time that the fault conditions exist. The fault conditions referred to here are those existing when the type of fault is single or two phase-to-earth.

6.2.1.1 Substation Plant and Apparatus

All circuit breakers, switch disconnectors, disconnectors, **Earthing Devices**, power transformers, voltage transformers, reactors, current transformers, surge arresters, bushings, neutral equipment, capacitors, line traps, coupling devices, external insulation and insulation co-ordination at the **User/TRANSCO Connection Point** shall comply with the **IEC Standards/Specifications** (or equivalent) as current at the time that the **Plant** and/or **Apparatus** was designed provided that by applying such **IEC Standards/Specifications** (or equivalent) the **Plant** and/or **Apparatus** shall be reasonably fit for its intended purpose having due regard to the obligations of **TRANSCO** and the relevant **User** under their respective **Licences**.

Plant and **Apparatus** shall be designed, manufactured and tested in premises certified in accordance with the quality assurance requirements of ISO9001 or equivalent.

6.2.2 GENCO/TRANSCO Connection Points

6.2.2.1 Short Circuit Levels

Each connection between a **Generating Unit** and the **Transmission System** must be controlled by a circuit breaker capable of interrupting the maximum short circuit current at the point of connection as determined by **TRANSCO**.

6.2.2.2 Generating Unit and Power Station Protection Arrangements

Protection of Generating Units and their connections to the **Transmission System** must meet the minimum requirements given below. These are necessary to reduce to a practical minimum the impact on the **Transmission System** of faults on circuits owned by **GENCOs**.

6.2.2.3 Fault Clearance Times

The fault clearance times for faults on the **GENCO** equipment directly connected to the **Transmission System** and for faults on the **Transmission System** directly connected to the **GENCO** equipment, from fault inception to the circuit breaker arc extinction, shall be set out in accordance with the **Connection Agreement**. The times specified in accordance with the **Connection Agreement** shall not be faster than:

- i) 50ms for faults cleared by busbar protection at 400kV, 220kV and 132kV; and
- ii) 60ms for faults cleared by ultra-high speed directional comparison protection on 400kV, 220kV and 132kV overhead lines.

Slower fault clearance times may be specified in accordance with the **Connection Agreement** for faults on the **Transmission System**. Slower fault clearance times for faults on the **GENCO** equipment may be agreed in accordance with the terms of the **Connection Agreement** but only if **System** requirements, in **TRANSCO** view, permit. The probability that the fault clearance times stated in accordance with the **Connection Agreement** shall be exceeded by any given fault, must be less than 2%.

For the event that the above fault clearance times are not met as a result of failure to operate on the **Main Protection System(s)**, the **GENCOs** shall provide **Back-Up Protection**. **TRANSCO** shall also provide **Back-Up Protection** and these **Back-Up Protections** shall be co-ordinated so as to provide discrimination and protect equipment from damage.

6.2.2.4 Protection Equipment to be provided

Protection of Interconnecting Connections

The requirements for the provision of **Protection** equipment for interconnecting connections (i.e. the primary conductors from the current transformer accommodation on the circuit side of the circuit breaker to the **Connection Point**) shall be specified in the **Connection Agreement**.

Circuit-breaker fail Protection

When the **Generating Unit** is connected to the **Transmission System** at 400kV, 220kV or 132kV and a circuit breaker is provided by the **GENCO** or **TRANSCO**, circuit breaker fail **Protection** shall be provided by the **GENCO** or **TRANSCO** on this circuit breaker. In the event, following operation of a **Protection** system, of a failure to interrupt fault current by these circuit-breakers within the **Fault Current Interruption Time**, the circuit breaker fail **Protection** is required to initiate tripping of all the necessary electrically adjacent circuit-breakers so as to interrupt the fault current within the next 200 ms.

Loss of Excitation

The **GENCO** must provide **Protection** to detect loss of excitation on a **Generating Unit** and initiate a **Generating Unit** trip.

Pole-Slipping Protection

Where **System** requirements dictate, **TRANSCO** shall specify in the **Connection Agreement** a requirement for **GENCOs** to fit pole-slipping **Protection** on their **Generating Units**.

Signals for Tariff Metering

GENCOs shall install current and voltage transformers supplying all tariff meters at a voltage to be specified in, and in accordance with, the **Connection Agreement**.

Work on Protection Equipment

No busbar **Protection**, circuit-breaker fail **Protection** relays, AC or DC wiring (other than power supplies or DC tripping associated with the **Generating Unit** itself) may be worked upon or altered by the **GENCO** personnel in the absence of a representative of **TRANSCO**.

Relay Settings

Protection and relay settings shall be co-ordinated across the **Connection Point** in accordance with the **Connection Agreement** to ensure effective disconnection of faulty **Apparatus**.

6.2.3 DISCO and Non-Embedded Customers

6.2.3.1 Protection Arrangements

Protection of **Distribution Systems** of **DISCOs** and **Non-Embedded Customers** directly supplied from the **Transmission System** must meet the minimum requirements referred to below.

6.2.3.2 Fault Clearance Times

The fault clearance times for faults on **DISCO** and **Non-Embedded Customer** equipment directly connected to the **Transmission System**, and for faults on the **Transmission System** directly connected to the **DISCO** or **Non-Embedded Customer** equipment, from fault inception to the circuit breaker arc extinction, shall be set out in accordance with each **Connection Agreement**. The times specified in accordance with the **Connection Agreement** shall not be faster than:

- i) 50ms for faults cleared by busbar protection at 400kV, 220kV and 132kV; and

- ii) 60ms for faults cleared by ultra-high speed directional comparison protection on 400kV, 220kV and 132kV overhead lines

Slower fault clearance times may be specified in accordance with the **Connection Agreement** for faults on the **Transmission System**. Slower fault clearance times for faults on the **DISCO** and **Non-Embedded Customers** equipment may be agreed in accordance with the terms of the **Connection Agreement** but only if **System** requirements, in **TRANSCO**'s view, permit. The probability that the fault clearance times stated in accordance with the **Connection Agreement** shall be exceeded by any given fault must be less than 2%.

For the event of failure of the **Protection** systems provided to meet the above fault clearance time requirements, back-up **Protection** shall be provided by the **DISCO** or **Non-Embedded Customer**. **TRANSCO** shall also provide back-up **Protection**, which shall result in a fault clearance time slower than that specified for the **DISCO** or **Non-Embedded Customer** back-up **Protection** so as to provide **Discrimination**.

For connections with the **Transmission System** at 400kV, 220kV or 132kV, the back-up **Protection** shall be provided by the **DISCO** or **Non-Embedded Customer** with a fault clearance time not slower than 300ms for faults on the **DISCO** or **Non-Embedded Customer Apparatus**.

6.2.3.3 Fault Disconnection Facilities

Where no **TRANSCO** circuit breaker is provided at the **User** connection voltage, the **User** must provide **TRANSCO** with the means of tripping all the **User** circuit breakers necessary to isolate faults or **System** abnormalities on the **Transmission System**. In these circumstances, for faults on the **User System**, the **User Protection** should also trip higher voltage **TRANSCO** circuit breakers. These tripping facilities shall be in accordance with the requirements specified in the **Connection Agreement**.

6.2.3.4 Automatic Switching Equipment

Where automatic reclosure of **TRANSCO** circuit breakers is required following faults on the **User System**, automatic switching equipment shall be provided in accordance with the requirements specified in the **Connection Agreement**.

6.2.3.5 Relay Settings

Protection and relay settings shall be co-ordinated across the **Connection Point** in accordance with the **Connection Agreement** to ensure effective disconnection of faulty **Apparatus**.

6.2.3.6 Work on Protection equipment

Where **TRANSCO** owns the busbar at the **Connection Point**, no busbar **Protection**, AC or DC wiring (other than power supplies or DC tripping associated with the **DISCO** or **Non-Embedded Customers Apparatus**) may be worked upon or altered by the **DISCO** or **Non-Embedded Customer** personnel in the absence of a representative of **TRANSCO**.

6.2.3.7 Neutral Earthing

At nominal **System** voltages of 132kV and above the higher voltage windings of three phase transformers and transformer banks connected to the **Transmission System** must be star connected with the star point suitable for connection to earth. The earthing and lower voltage winding arrangement shall be such as to ensure that the **Earth Fault Factor** requirement shall be met on the **Transmission System** at nominal **System** voltages of 132kV and above.

6.2.3.8 Under Frequency Relays

As required under **Operating Code 'A' Section 6.4**, each **DISCO** shall make arrangements that shall facilitate automatic low frequency disconnection of **Demand**. The **Connection Agreement** shall specify the manner in which **Demand** subject to low frequency disconnection shall be split into discrete **MW** blocks with associated **Under Frequency Relay** settings. Technical requirements relating to **Under Frequency Relays** are listed in Appendix E.

6.2.4 Self-Supply User/TRANSCO connection point

6.2.4.1 Short Circuit Levels

Each connection between a **Self-Supply User** and the **Transmission System** must be controlled by a circuit breaker capable of interrupting the maximum short circuit current at the point of connection as determined by **TRANSCO**.

6.2.4.2 Protection Arrangements

Protection of Self-Supply Users and their connections to the **Transmission System** must meet the minimum requirements given below. These are necessary to reduce to a practical minimum the impact on the **Transmission System** of faults on circuits owned by **Self-Supply Users**.

6.2.4.3 Fault Clearance Times

The **Fault Clearance Times** for faults on **Self-Supply User** equipment directly connected to the **Transmission System**, and for faults on the **Transmission System** directly connected to the **Self-Supply User** equipment, from fault inception to the circuit breaker arc extinction, shall be set out in accordance with the **Connection and Interface Agreement**. The times specified in accordance with the **Connection Agreement** shall not be faster than:

- a) 50ms for faults cleared by busbar protection at 400kV, 220kV and 132kV; and
- b) 60ms for faults cleared by ultra-high speed directional comparison protection on 400kV, 220kV and 132kV overhead lines

In accordance with the **Connection and Interface Agreement**, slower fault clearance times may be specified for faults on the **Transmission System**. Slower fault clearance times for faults on the **Self-Supply User** equipment may be agreed in accordance with the terms of the **Connection and Interface Agreement** but only if system requirements, in **TRANSCO's** sole view, and acting reasonably, permit. The probability that the fault clearance times stated in accordance with the **Connection and Interface Agreement** shall be exceeded by any given fault must be less than 2%.

In the event of failure of the protection systems provided to meet the above fault clearance time requirements, back-up protection shall be provided by the **Self-Supply User**. **TRANSCO** shall also provide **Back-Up Protections**, and these **Back-Up Protections** shall be co-ordinated so as to provide discrimination and protect equipment from damage

6.2.4.4 Protection Equipment to be provided

Self-Supply User and **TRANSCO** shall specify the fault equipment to be provided in **Connection Point** in accordance with the **Connection and Interface Agreement**.

Protection of Interconnecting Connections

The requirements for the provision of **Protection** equipment for interconnecting connections (i.e. the primary conductors from the current transformer accommodation on the circuit side of the circuit breaker to the **Connection Point**) shall be specified in the **Connection and Interface Agreement**.

Circuit-breaker fail Protection

When the **Self-Supply User** is connected to the **Transmission System** at 400kV, 220kV or 132kV and a circuit breaker is provided by the **Self-Supply User** or **TRANSCO**, circuit breaker fail **Protection** shall be provided by the **Self-Supply User** or **TRANSCO** on this circuit breaker. In the event, following operation of a **Protection** system, of a failure to interrupt fault current by these circuit-breakers within the **Fault Current Interruption Time**, the circuit breaker fail **Protection** is required to initiate tripping of all the necessary electrically adjacent circuit-breakers so as to interrupt the fault current within the next 200 ms.

Signals for Tariff Metering

Self-Supply User shall install current and voltage transformers supplying all tariff meters at a voltage to be specified in, and in accordance with, the **Connection and Interface Agreement**.

Work on Protection Equipment

No busbar **Protection**, circuit-breaker fail **Protection** relays, AC or DC wiring may be worked upon or altered by the **Self-Supply User** personnel in the absence of a representative of **TRANSCO**

Relay Settings

Protection and relay settings shall be co-ordinated across the **Connection Point** in accordance with the **Connection and Interface Agreement** to ensure effective disconnection of faulty **Apparatus**

6.2.4.5 Neutral Earthing

At nominal **System** voltages of 132kV and above the higher voltage windings of three phase transformers and transformer banks connected to the **Transmission System** must be star connected with the star point suitable for connection to earth through Neutral Ground Reactor (NGR)

6.3 Generating Unit Requirements

This section sets out the technical and design criteria and performance requirements for **Generating Units**, whether directly connected to the **Transmission System** or **Embedded**, which each **GENCO** must ensure are complied with in relation to its **Generating Units**.

6.3.1 Plant Performance Requirements

All **Synchronous Generating Units** with an **Apparent Power** rating of less than 1600 MVA must be capable of supplying **Rated MW** at any point between the limits **0.85 Power Factor** lagging and **0.95 Power Factor** leading at the **Synchronous Generating Unit** terminals.

Synchronous Generating Units with a rated **Apparent Power** of 1600 MVA or above shall supply rated power at 0.90 **Power Factor** lagging and 0.95 **Power Factor** leading at the **Synchronous Generating Unit** terminals. At **Active Power** output levels other than **Rated MW**, all **Synchronous Generating Units** must be capable of continuous operation at any point between the **Reactive Power** capability limits identified on the **Generator Performance Chart**.

The **Short Circuit Ratio** of **Synchronous Generating Units** with an **Apparent Power** rating of less than 1600 MVA shall be not less than 0.5. The **Short Circuit Ratio** of **Synchronous Generating Units** with a rated **Apparent Power** of 1600 MVA or above shall be not less than 0.4.

All **Non-Synchronous Generating Units** and **Power Farm Generating Units** must be capable of maintaining zero transfer of **Reactive Power** at the **Transmission Entry Point** at all **Active Power** output levels under steady state voltage conditions. For **Non-Synchronous Generating Units** and **Power Farm Generating Units** the steady state tolerance on **Reactive Power** transfer to and from the **Transmission System** expressed in MVAR shall be no greater than 5% of the **Rated MW**.

All **Non-Synchronous Generating Units** and **Power Farm Generating Units** must be capable of supplying **Rated MW** output between the limits 0.95 **Power Factor** lagging and 0.95 **Power Factor** leading at the **Transmission Entry Point** (or **User System Entry Point**, if **Embedded**) subject to the paragraphs below and Figure 6.1.

With all **Plant** in service, the **Reactive Power** limits defined at **Rated MW** at lagging **Power Factor** will apply at all **Active Power** output levels above 20% of the **Rated MW** as defined in **Figure 6.1**. With all **Plant** in service, the **Reactive Power** limits defined at **Rated MW** at leading **Power Factor** will apply at all **Active Power** output levels above 50% of the **Rated MW** output as defined in **Figure 6.1**. With all **Plant** in service, the **Reactive Power** limits will reduce linearly below 50% **Active Power** output as shown in **Figure 6.1** unless the requirement to maintain the **Reactive Power** limits defined at **Rated MW** at leading **Power Factor** down to 20% **Active Power** output is specified in the **Bilateral Agreement**. These **Reactive Power** limits will be reduced pro rata to the amount of **Plant** in service.

For the avoidance of doubt, all **Non-Synchronous Generating Units** and **Power Farm Generating Units** must be capable of providing, as a minimum, **Reactive Power** as defined in the “V” characteristic of **Figure 6.1** bordered by the 0.95 leading and lagging **Power Factor** lines. Where the **Non-Synchronous Generating Units** and **Power Farm Generating Units** have an inherent capability to provide **Reactive Power** in accordance with the quadrilateral characteristic or **TRANSCO** has a system requirement for the **Non-Synchronous Generating Units** and **Power Farm Generating Units** to provide **Reactive Power** in accordance with the quadrilateral characteristic, **TRANSCO** will notify the **User** of this requirement and it shall be formalised in the **Bilateral Agreement**.

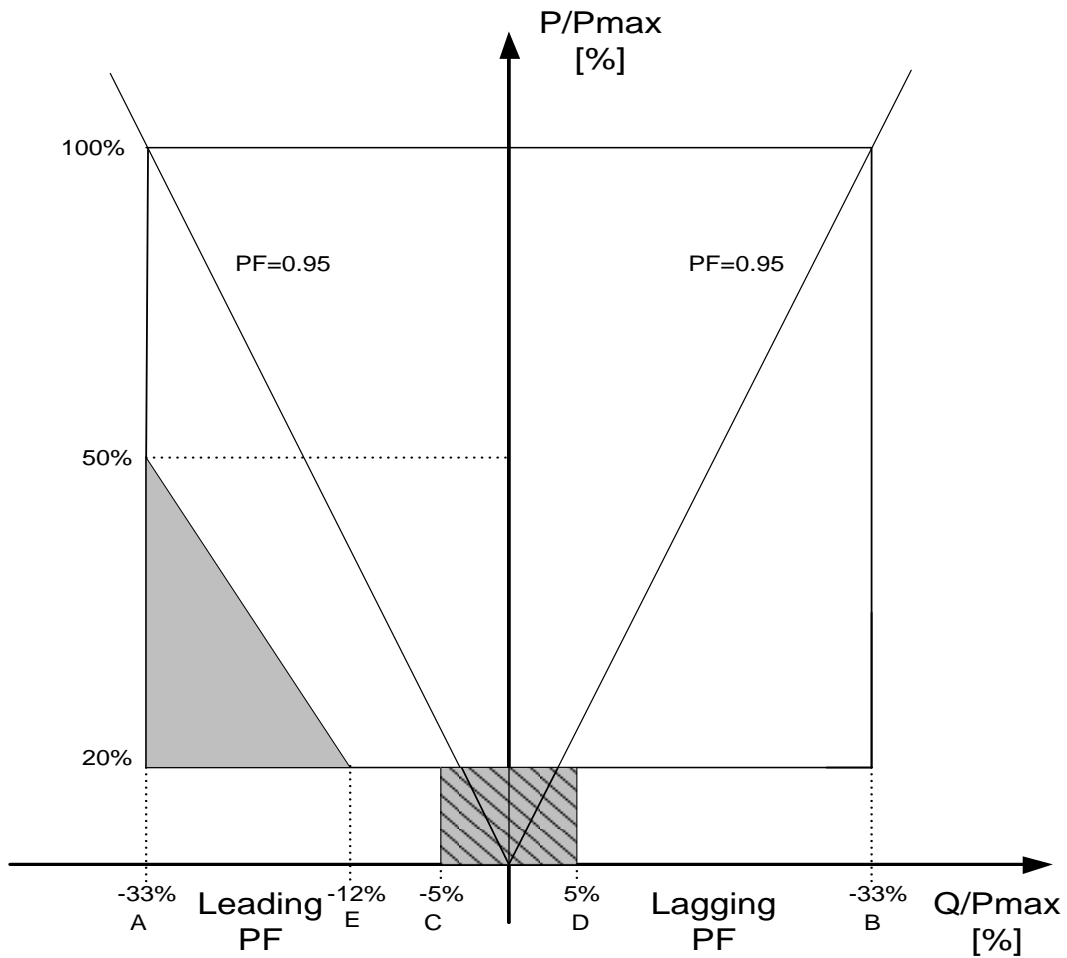


Figure 6.1

Point A is equivalent (in MVar) to: 0.95 leading **Power Factor** at **Rated MW** output

Point B is equivalent (in MVar) to: 0.95 lagging **Power Factor** at **Rated MW** output

Point C is equivalent (in MVar) to: -5% of **Rated MW** output

Point D is equivalent (in MVar) to +5% of **Rated MW**

Point E is equivalent (in MVar) to: -12% of **Rated MW** output

Following frequency requirements are to be applicable for **Generating Units**:

- a) Each **Generating Unit** must be capable of continuously supplying its rated **Active Power** output within the **System Frequency** range 49 to 51 Hz.
- b) In respect to time constraints, each **Generating Unit** (except the Intermittent source **Generating Units**) shall have following minimum capabilities:

Frequency Range	Requirement
47 - 47.5 Hz	Operation for a period of at least 20 continuous seconds is required each time the System Frequency is below 47.5Hz
47.5 - 48 Hz	Operation for a period of at least 90 continuous minutes is required each time the System Frequency is below 48Hz.
48 - 51.5 Hz	Continuous operation is required. Any decrease of output power occurring in the frequency range 49 to 48Hz should not be more than pro-rata with System Frequency .
51.5 - 52 Hz	Operation for a period of at least 15 continuous minutes is required each time the System Frequency is above 51.5Hz
52 - 53 Hz	Operation for a period of at least 20 continuous seconds is required each time the System Frequency is above 52Hz

c) In respect to time constraints, intermittent source **Generating Units** are required to operate continuously within the range 47 – 53 Hz. When the **System Frequency** is within the range 47.00 Hz to 49.00 Hz and only for a **Generating Unit** which uses an **Intermittent Power Source**, the power output should not decrease by more than 5% of **Active Power** output (*compared to the Active Power output at 50.00 Hz*)

d) **Generating Units** are not expected to operate: (i) below 47.00 Hz; nor (ii) above 53.00 Hz

The **Active Power** output under steady state conditions of any **Generating Unit** directly connected to the **Transmission System** should not be affected by voltage changes in the normal operating range. The **Reactive Power** output under steady state conditions should be fully available within the voltage range $\pm 5\%$ at 400kV, 220kV, 132kV and lower voltages.

It is an essential requirement that the **Transmission System** must incorporate a **Black Start Capability**. This shall be achieved by agreeing a **Black Start Capability** at a number of strategically located **Power Stations**. For each **Power Station** TRANSCO shall state in the **Connection Agreement** whether or not a **Black Start Capability** is required.

6.3.2 Control Arrangements

Each **Generating Unit**, other than the **Steam Unit** within a **CCGT Module** where the steam turbine does not contribute initially to a system frequency change, must be capable of contributing to **Primary Control** by supplying **Active Power** to the **Transmission System** or the **Distribution** or **User System** if **Embedded** according to its **Primary Response** capabilities as set out in the **Power and Water Purchase Agreement** or the **Connection Agreement**.

The capability for contributing to **Secondary Control** (AGC and LFC) shall be as set out in the **Power and Water Purchase Agreement** or the **Connection Agreement**. The required participation shall be determined by **TRANSCO**.

Each **Generating Unit** must be capable of supporting voltage regulation at the interconnection point by continuous modulation of **Reactive Power** supplied to the **Transmission System** or the **Distribution** or **User System** if **Embedded**.

6.3.2.1 Generating Unit to have a Unit Controller

Each **Generating Unit** must be fitted with a fast acting **Unit Controller** or equivalent control device capable of providing **Frequency** response under normal operational conditions in accordance with the Scheduling and Despatch Code. The control principle shall be in such a way that the **Generation Unit** output shall vary with rotational speed or frequency according to a proportional droop characteristic (**Primary Control**).

The **Unit Controller** and any other superimposed control loop (**Load Control**, gas turbine temperature limiting control, etc.) shall contribute to the **Primary Control** according to the **Primary Response Performance Index** as set out in the **Power and Water Purchase Agreement** or the **Connection Conditions**.

In the case of a **Power Farm** the **Unit Controller** or equivalent control device(s) may be on the whole **Power Farm** or on each individual **Generating Unit AC/DC Converter**. **Power Farm** units will only be expected to deliver response as per their **Power Purchase Agreement**.

Superimposed **Load Control** loops shall have no negative impact on the steady state and transient performance of the **Unit Controller**.

The **Unit Controller** shall be sufficiently damped for both isolated and interconnected operation modes. Under all operation conditions, the damping coefficient of the **Unit Controller** shall be above 0.25 for speed droop settings above 3% for gas turbines and 5% for steam turbines. In the case of a **Power Farm** the speed droop should be equivalent of a fixed setting between 3% and 5% applied to each **WTGU** or **PVGU** in service.

In the case of all **Generating Units** the **Frequency Control** device (or speed governor) deadband should be no greater than 0.04Hz (for the avoidance of doubt, $\pm 0.02\text{Hz}$).

Under all system operation conditions, the **Synchronous Generating Unit** speed shall not exceed 106%.

For generator oscillations with frequencies below 2 Hz, the **Unit Load Controller** shall have no negative effect on generator oscillation damping.

The **Normalized Primary Response Characteristic** as defined by the **Primary Response Performance Index** shall be maintained under all operation conditions. Consequently, in the event that a **Generating Unit** becomes isolated from the System but is still supplying **Demand** the **Generating Unit** must be able to provide **Primary Control** according to the **Primary Response Performance Index**.

All steam turbine **Generating Units** must be fitted with a **Unit Controller** which is designed and operated to the requirements of **IEC 45**.

All Gas Turbine Units must be fitted with a **Unit Controller** capable of a power related speed droop characteristic of between 3% and 5%.

6.3.2.2 Automatic Voltage Regulator

A continuous **Automatic Voltage Regulator (AVR)** acting on the excitation system is required to provide constant terminal voltage control of the **Synchronous Generating Unit** without instability over the entire operating range of the **Generating Unit**. Control performance of the voltage control loop shall be such that under isolated operation conditions the damping coefficient shall be above 0.25 for the entire operating range.

The **Automatic Voltage Regulator (AVR)** shall have no negative impact on generator oscillation damping.

In the case of a **Power Farm Generating Unit**, a continuously acting automatic control system is required to provide control of the voltage at the **Connection Point** without instability over the entire operating range of the **Power Farm** or **Generating Unit**. Any **Plant** or **Apparatus** used in the provision of such voltage control within a **Power Farm** may be located at the **WTGU** or **PVGU** terminals, an appropriate intermediate busbar or the **Connection Point**. When operating below 20% **Rated MW** the automatic control system may continue to provide voltage control utilising any available reactive capability

The specific requirements for automatic excitation control facilities, including **Power System Stabilizers** where these are necessary for system reasons, shall be specified in the **Power and Water Purchase Agreement** or the **Connection and Interface Agreement**. Operation of such control facilities shall be in accordance with the **Scheduling and Despatch Code**.

6.3.3 Despatch Inaccuracies

The standard deviation of **Load** error at steady state **Load** over a 60 minute period must not exceed 2.5 per cent of a **Generating Unit Net Dependable Power Capacity** for **Synchronous Generating Units** in accordance with its **Availability Notice**.

6.3.4 Negative Phase Sequence Loadings

Each **Generating Unit** shall be required to withstand, without tripping, the negative phase sequence loading incurred by clearance of a close-up phase-to-phase fault, by **System** back-up **Protection** on the **Transmission System** or **Distribution** or **User System** if **Embedded**.

6.3.5 Neutral Earthing

At nominal **System** voltages of 132kV and above the higher voltage windings of a transformer of a **Generating Unit**, or the step-up transformer of a **Power Farm** must be star connected with the star point suitable for connection to earth. The earthing and lower voltage winding arrangement shall be such as to ensure that the **Earth Fault Factor** as set out in **Connection Conditions** Section 6.2.1 shall be met on the **Transmission System** at nominal **System** voltages of 132kV and above.

6.3.6 Frequency Sensitive Relays

All **Generating Units** must continue to operate within the frequency ranges for a certain periods of time as defined in Clause 6.3.1 unless **TRANSCO** has agreed to any frequency-level relays and/or rate-of-change-of-frequency relays which shall trip such **Generating Units** within this frequency range, under the **Connection and Interface Agreement**.

GENCOs shall be responsible for protecting all their **Generating Units** against damage should **Frequency** excursions outside the range 53.0Hz to 47.0Hz ever occur. Should such excursions occur, it is up to the **GENCO** to decide whether to disconnect his **Apparatus** for reasons of safety of **Apparatus**, **Plant** and/or personnel. Such disconnection requirements shall be advised in writing to **TRANSCO** and recorded in the **Connection and Interface Agreement**.

6.3.7 Fault Ride Through

The following Fault Ride Through requirements are applicable to Generating Units (including for the avoidance of doubt WFPS, PVPS and AC/DC Converters):

- i) During a 3 phase fault at 132, 220 or 400kV for 140msec the Generating Unit shall:
 - (a) Remain transiently stable and connected for all transmission phase voltages down to a minimum of zero;
 - (b) Generate the maximum possible reactive current without exceeding the transient rating limit of the Generating Unit; and
 - (c) Within 0.5 second following fault clearance and restoration of the transmission voltage to at least 90% of nominal, the Active Power output shall be restored to at least 90% of the level immediately available before the fault.

- ii) In addition for voltage dips greater than 140msec in the vicinity of the Generating Unit, the Unit shall:
 - (a) Remain connected to the system for any dip-duration on or above the blue line of Figure 2 below;
 - (b) Supply active power to at least 90% of its pre-fault value within 1 second of restoration of the voltage to 90% of the nominal; and
 - (c) Retain Active Power output at least in proportion to the retained balanced transmission voltage.

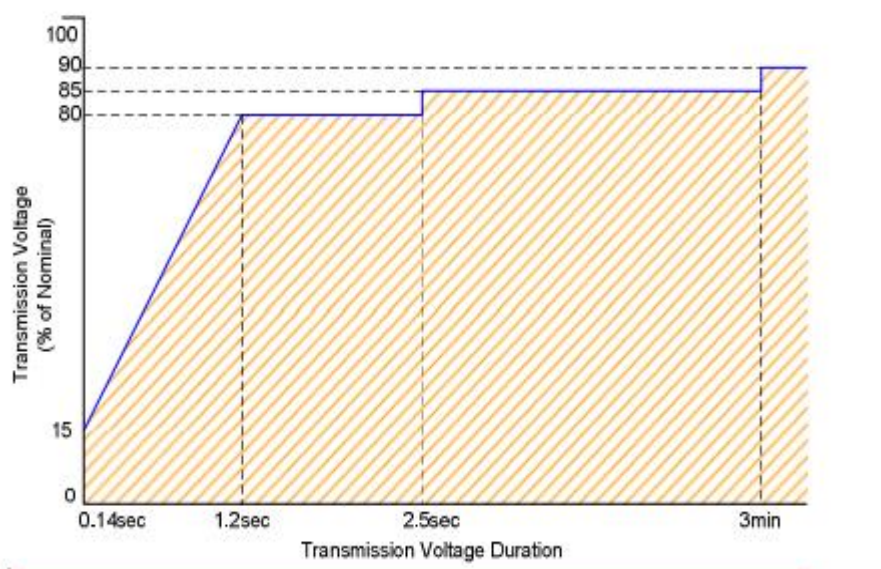


Figure 6.2. Voltage Duration Envelope

6.4 Communications Equipment

In order to ensure control of the **Transmission System**, telecommunications between **Users** and **TRANSCO** must, if required by **TRANSCO**, be established in accordance with the requirements set down below.

6.4.1 Control Telephony

Control Telephony is the method by which a **User Responsible Engineer/Operator** and **TRANSCO Control Engineers** speak to one another for the purposes of control of the **Total System** in both normal and emergency operating conditions. **Control Telephony** provides secure point to point telephony for routine **Control Calls**, priority **Control Calls** and emergency **Control Calls**.

TRANSCO shall install **Control Telephony** at the **User** location where the **User** telephony equipment is not capable of providing the required facilities or is otherwise incompatible with the **TRANSCO Control Telephony**. Details of and relating to the **Control Telephony** required are contained in the **Connection Agreement**.

6.5 Operational Metering

TRANSCO shall provide supervisory control and data acquisition (SCADA) outstation interface equipment. The **User** shall provide such voltage, current, frequency, **Active Power** and **Reactive Power** measurement outputs and plant status indications and alarms to the **TRANSCO SCADA** outstation interface equipment as required by **TRANSCO** in accordance with the terms of the **Connection Agreement**.

Active Power and **Reactive Power** measurements, circuit breaker and disconnector status indications from **Generating Units** must each be provided to **TRANSCO** on an individual **Generating Unit** basis.

In the case of an **Intermittent Power Source** an energy input signal (e.g. wind speed or insolation) may be required by **TRANSCO**. The signal may be used to establish the level of energy input from the **Intermittent Power Source** for monitoring pursuant to Connection Conditions 6.7 and Connection Conditions 8 **Ancillary Services** and will, in the case of a **WFPS**, be used to provide **TRANSCO** with advanced warning of excess wind speed shutdown.

Where required by **TRANSCO** a **User** shall provide measurements of power quality such as harmonics, voltage flicker and power factor to the **TRANSCO** outstation interface. The manner in which information is required to be presented to the outstation equipment is set out in Appendix D.

6.6 Facsimile Machines

Each **User** and **TRANSCO** shall provide a facsimile machine or machines:

- i) in the case of **GENCOs**, at each **Power Station**;
- ii) in the case of **TRANSCO** and **DISCOs**, at the respective **Control Centre(s)**; and
- iii) in the case of **Non-Embedded Customers** at the **Control Point**.
- iv) in the case of **Self-Supply User**, at the respective **Control Centre**

Each **User** shall, prior to connection to the **System** of the **User Plant and Apparatus** notify **TRANSCO** of its telephone number or numbers, and shall notify **TRANSCO** of any changes. Prior to connection to the **System** of the **User Plant and Apparatus** **TRANSCO** shall notify each **User** of the telephone number or numbers of its facsimile machine or machines and shall notify any changes.

6.6.1 Busbar Voltage

TRANSCO shall provide each **GENCO** at each **Transmission Entry Point** where its **Generating Plant** is connected with appropriate voltage signals to enable the **GENCO** to obtain the necessary information to synchronise its **Generating Units** to the **Transmission System**.

6.7 System Monitoring

Monitoring equipment is provided on the **Transmission System** to enable **TRANSCO** to monitor the **System** dynamic performance. To allow the monitoring of individual **Generating Unit TRANSCO** requires voltage and current signals from the secondary windings of **Generating Unit** circuit current transformers and voltage transformers. They shall be provided by the **GENCO** with the installation of the monitoring equipment being dealt with in the **Power and Water Purchase Agreement** or the **Connection and Interface Agreement**.

7. SITE RELATED CONDITIONS

In the absence of agreement between the parties to the contrary, construction, commissioning, control, operation and maintenance responsibilities follow ownership.

7.1 Responsibilities for Safety

Any **User** entering and working on its **Plant** and/or **Apparatus** on a **TRANSCO Site** shall work to the **TRANSCO Safety Rules**.

TRANSCO entering and working on its **Plant** and/or **Apparatus** on a **User Site** shall work to the **User Safety Rules**.

A **User** may apply to **TRANSCO** for permission to work according to that **Users** own **Safety Rules** when working on its **Plant** and/or **Apparatus** on **TRANSCO Sites**. If **TRANSCO** is of the opinion that the **User Safety Rules** provide for a level of safety commensurate with that of the **TRANSCO Safety Rules**, it shall notify the **User**, in writing, that the **User** may use its own **Safety Rules**. Until receipt of such notice, the **TRANSCO Safety Rules** will apply.

TRANSCO may apply to a **User** for permission to work according to **TRANSCO Safety Rules** when working on its **Plant** and/or **Apparatus** on that **User Sites**. If the **User** is of the opinion that **TRANSCO Safety Rules** provide for a level of safety commensurate with that of that **User Safety Rules**, it shall notify **TRANSCO**, in writing, that **TRANSCO** may use its own **Safety Rules**. Until receipt of such notice, the **User Safety Rules** will apply.

7.2 Site Responsibility Schedules

In order to inform site operational staff and **TRANSCO Control Engineers** of agreed responsibilities for **Plant** and/or **Apparatus** at the operational interface, a **Site Responsibility Schedule** shall be produced for **TRANSCO** and **Users** with whom they interface.

The format, principles and basic procedure to be used in the preparation of **Site Responsibility Schedules** are set down in Appendix A.

7.3 Operation and SF₆ Gas Zone Diagrams

7.3.1 Operation Diagrams

An **Operation Diagram** shall be prepared for each **Connection Site** at which a **Connection Point** exists using, where appropriate, the graphical symbols shown in Appendix B.

The **Operation Diagram** shall include all **HV Apparatus** and the connections to all external circuits and incorporate numbering, nomenclature and labelling, as set out in **Operating Code 'B'**. At those **Connection Sites** where SF₆ gas-insulated metal enclosed switchgear and/or other SF₆ gas-insulated **HV Apparatus** is installed, those items must be depicted within an area delineated by a chain dotted line which intersects SF₆ gas-zone boundaries. The nomenclature used shall conform with that used on the relevant **Connection Site** and circuit. The **Operation Diagram** (and the list of technical details) is intended to provide an accurate record of the layout and circuit interconnections, ratings and numbering and nomenclature of **HV Apparatus** and related **Plant**.

7.3.2 SF₆ Gas Zone Diagrams

An SF₆ **Gas Zone Diagram** shall be prepared for each **Connection Site** at which a **Connection Point** exists where SF₆ gas-insulated switchgear and/or other SF₆ gas-insulated **HV Apparatus** is utilised. They shall use, where appropriate, the graphical symbols shown in Appendix B. The nomenclature used shall conform with that used in the relevant **Connection Site** and circuit.

7.3.3 Preparation of Operation and SF₆ Gas Zone Diagrams for User Sites

In the case of a **User Site**, the **User** shall prepare and submit to **TRANSCO**, an **Operation Diagram** for all **HV Apparatus** on the **User** side of the **Connection Point** and **TRANSCO** shall provide the **User** with an **Operation Diagram** for all **HV Apparatus** on the **TRANSCO** side of the **Connection Point** in accordance with the requirements of the **Connection Agreement**.

The **User** shall then prepare, produce and distribute, using the information submitted on the **User Operation Diagram** and the **TRANSCO Operation Diagram**, a composite **Operation Diagram** for the complete **Connection Site** also in accordance with the requirements of the **Connection Agreement**.

7.3.4 Preparation of Operation and SF₆ Gas Zone Diagrams for TRANSCO Sites

In the case of a **TRANSCO Site**, the **User** shall prepare and submit to **TRANSCO** an **Operation Diagram** for all **HV Apparatus** on the **User** side of the **Connection Point** in accordance with the requirements of the **Connection Agreement**.

TRANSCO shall then prepare, produce and distribute, using the information submitted on the **User Operation Diagram**, a composite **Operation Diagram** for the complete **Connection Site** also in accordance with the requirements of the **Connection Agreement**.

7.3.4.1 Changes to Operation and SF₆ Gas Zone Diagrams

When **TRANSCO** has decided that it wishes to install new **HV Apparatus** or it wishes to change the existing numbering or nomenclature of its **HV Apparatus** at a **TRANSCO Site**, **TRANSCO** shall one month prior to the installation or change, send to each such **User** a revised **Operation Diagram** of that **TRANSCO Site**, incorporating the new **TRANSCO HV Apparatus** to be installed and its numbering and nomenclature or the changes, as the case may be.

When a **User** has decided that it wishes to install new **HV Apparatus**, or it wishes to change the existing numbering or nomenclature of its **HV Apparatus** at its **User Site**, the **User** shall one month prior to the installation or change, send to **TRANSCO** a revised **Operation Diagram** of that **User Site** incorporating the new **User HV Apparatus** to be installed and its numbering and nomenclature or the changes as the case may be.

7.3.5 Validity

The composite **Operation Diagram** prepared by **TRANSCO** or the **User** shall be the definitive **Operation Diagram** for all operational and planning activities associated with the **Connection Site**. If a dispute arises as to the accuracy of the composite **Operation Diagram**, a meeting shall be held at the **Connection Site**, as soon as reasonably practicable, between **TRANSCO** and the **User**, to endeavour to resolve the matters in dispute.

7.4 Site Common Drawings

Site Common Drawings shall be prepared for each **Connection Site** and shall include **Connection Site** layout drawings, electrical layout drawings, common **Protection/control** drawings and common services drawings.

7.4.1 Preparation of Site Common Drawings for a User Site

In the case of a **User Site**, **TRANSCO** shall prepare and submit to the **User**, **Site Common Drawings** for the **TRANSCO** side of the **Connection Point** in accordance with the requirements of the **Connection Agreement**.

The **User** shall then prepare, produce and distribute, using the information submitted by **TRANSCO**, **Site Common Drawings** for the complete **Connection Site** in accordance with the requirements of the **Connection Agreement**.

7.4.2 Preparation of Site Common Drawings for a TRANSCO Site

In the case of a **TRANSCO Site**, the **User** shall prepare and submit to **TRANSCO** **Site Common Drawings** for the **User** side of the **Connection Point** in accordance with the requirements of the **Connection Agreement**.

TRANSCO shall then prepare, produce and distribute, using the information submitted by the **User**, **Site Common Drawings** for the complete **Connection Site** in accordance with the requirements of the **Connection Agreement**.

7.4.2.1 User Changes to Site Common Drawings

When a **User** becomes aware that it is necessary to change any aspect of the **Site Common Drawings** at a **Connection Site** it shall:

- i) if it is a **User Site** prepare, produce and distribute revised **Site Common Drawings** for the complete **Connection Site**; and
- ii) if it is a **TRANSCO Site** prepare and submit to **TRANSCO** revised **Site Common Drawings** for the **User** side of the **Connection Point** and **TRANSCO** shall then prepare, produce and distribute, using the information submitted in by the **User**, revised **Site Common Drawings** for the complete **Connection Site**.

If the **User** change can be dealt with by it notifying **TRANSCO** in writing of the change and for each party to amend its copy of the **Site Common Drawings** then the **User** shall so notify and each party shall so amend.

7.4.2.2 TRANSCO Changes to Site Common Drawings

When **TRANSCO** becomes aware that it is necessary to change any aspect of the **Site Common Drawings** at a **Connection Site** it shall:

- i) if it is a **TRANSCO Site** prepare, produce and distribute revised **Site Common Drawings** for the complete **Connection Site**; and
- ii) if it is a **User Site** prepare and submit to the **User** revised **Site Common Drawings** for the **TRANSCO** side of the **Connection Point** and the **User** shall then prepare, produce and distribute, using the information submitted in by **TRANSCO**, revised **Site Common Drawings** for the complete **Connection Site**.

If the **TRANSCO** change can be dealt with by it notifying the **User** in writing of the change and for each party to amend its copy of the **Site Common Drawings** then **TRANSCO** shall so notify and each party shall so amend.

7.4.3 Validity

The **Site Common Drawings** for the complete **Connection Site** prepared by the **User** or **TRANSCO**, as the case may be, shall be the definitive **Site Common Drawings** for all operational and planning activities associated with the **Connection Site**. If a dispute arises as to the accuracy of the **Site Common Drawings**, a meeting shall be held at the **Site**, as soon as reasonably practicable, between **TRANSCO** and the **User**, to endeavour to resolve the matters in dispute.

7.5 Access

The provisions relating to access to **TRANSCO Sites** by **Users**, and to **User Sites** by **TRANSCO**, are set out in each **Interface Agreement** with **TRANSCO** and each **User**.

In addition to those provisions, where a **TRANSCO Site** contains exposed **HV** conductors, unaccompanied access shall only be granted to individuals holding an **Authority for Access** issued by **TRANSCO**.

7.6 Maintenance Standards

It is a requirement that all **User Plant** and **Apparatus** on **TRANSCO Sites** is maintained adequately for the purpose for which it is intended and to ensure that it does not pose a threat to the safety of any of **TRANSCO Plant, Apparatus** or personnel on the **TRANSCO Site**. **TRANSCO** shall have the right to inspect the test results and maintenance records relating to such **Plant** and **Apparatus** at any time.

It is a requirement that all **TRANSCO Plant** and **Apparatus** on **User Sites** is maintained adequately for the purposes for which it is intended and to ensure that it does not pose a threat to the safety of any of the **User Plant, Apparatus** or personnel on the **User Site**. **Users** shall have the right to inspect the test results and maintenance records relating to such **Plant** and **Apparatus**, at any time.

7.7 Site Operational Procedures

TRANSCO and **Users** with an interface with **TRANSCO**, must make available staff to take necessary **Safety Precautions** and carry out operational duties as may be required to enable work/testing to be carried out and for the operation of **Plant** and **Apparatus** connected to the **Total System**.

8. ANCILLARY SERVICES

The relevant **Power and Water Purchase Agreement** or the **Connection and Interface Agreement** will contain requirements for the capability for certain **Ancillary Services**, which are needed for **System** reasons. The following list of **System Ancillary Services** is divided into two categories: Part 1 lists the **System Ancillary Services** which **GENCOs or Self-Supply Users** are obliged to provide, and Part 2 lists the **System Ancillary Services** which **GENCOs, Self-Supply Users or other Users** shall provide only if agreement to provide them is reached with **TRANSCO** or the **Procurer**:

Part 1

- 1) **Reactive Power** supplied by **Generating Units**;
- 2) **Voltage Control** support at;
- 3) Participation on **Primary Control** of **Generation Units** and **Self-Supply User System**;

Part 2

- 4) Provision of dedicated **Primary Response**;
- 5) **Frequency** control by means of **Demand** reduction;
- 6) **Black Start Capability**;
- 7) **Hot Standby**;
- 8) **Secondary Control (Automatic Generation Control (AGC))** of generating unit **Active Power** from the **Load Despatch Center** for Load Frequency Control (**LFC**) purposes);
- 9) **Reactive Power** supplied by means of synchronous or static compensators;

APPENDIX A - FORMAT, PRINCIPLES AND BASIC PROCEDURE TO BE USED IN THE PREPARATION OF SITE RESPONSIBILITY SCHEDULES

9. PRINCIPLES

At all **Complexes** the following **Site Responsibility Schedules** shall be drawn up using the proforma attached or with such variations as may be agreed between **TRANSCO** and **Users**, and in the absence of agreement the proforma attached shall be used:

- i) Schedule of **HV Apparatus**
- ii) Schedule of **Plant, LV Apparatus**, services and supplies;
- iii) Schedule of telecommunications and measurements **Apparatus**.

Other than at **Generating Unit** and **Power Station** locations, the schedules referred to in (b) and (c) may be combined.

Each **Site Responsibility Schedule** for a **Connection Site** shall be prepared by **TRANSCO** in consultation with other **Users** at least 2 weeks prior to the **Completion Date** under the **Connection Agreement** for that **Connection Site** (which may form part of a **Complex**). Each **User** shall, in accordance with the timing requirements of the **Connection Agreement**, provide information to **TRANSCO** to enable it to prepare the **Site Responsibility Schedule**.

Each **Site Responsibility Schedule** shall be subdivided to take account of any separate **Connection Sites** on that **Complex**.

Each **Site Responsibility Schedule** shall detail for each item of **Plant** and **Apparatus**;

- i) **Plant/Apparatus** ownership;
- ii) Site Manager (Controller);
- iii) Safety (applicable **Safety Rules** and **Control Person** or other responsible person (**Safety Co-ordinator**), or such other person who is responsible for safety);
- iv) Operations (applicable **Operational Procedures** and control engineer).
- v) Responsibility to undertake statutory inspections, fault investigations and maintenance.

The **HV Apparatus Site Responsibility Schedule** for each **Connection Site** must include lines and cables emanating from the **Connection Site**.

Every page of each **Site Responsibility Schedule** shall bear the date of issue and the issue number.

When a **Site Responsibility Schedule** is prepared it shall be sent by **TRANSCO** to the **Users** involved for confirmation of its accuracy.

The **Site Responsibility Schedule** shall then be signed on behalf of **TRANSCO** by the [**Area Manager**] responsible for the area in which the **Complex** is situated and on behalf of each **User** involved by its **Responsible Manager**, by way of written confirmation of its accuracy. Once signed, two copies shall be distributed by **TRANSCO**, not less than two weeks prior to its implementation date, to each **User** which is a party on the **Site Responsibility Schedule**, accompanied by a note indicating the issue number and the date of implementation.

10. ALTERATIONS TO EXISTING SITE RESPONSIBILITY SCHEDULES

When a **User** identified on a **Site Responsibility Schedule** becomes aware that an alteration is necessary, it must inform **TRANSCO** immediately and in any event 8 weeks prior to any change taking effect.

Where **TRANSCO** has been informed of a change by a **User**, or itself proposes a change, it shall prepare a revised **Site Responsibility Schedule** by not less than six weeks prior to the change taking effect.

The revised **Site Responsibility Schedule** shall then be signed and accompanied by a note indicating where the alteration(s) has/have been made, the new issue number and the date of implementation.

When a **User** identified on a **Site Responsibility Schedule**, or **TRANSCO**, as the case may be, becomes aware that an alteration to the **Site Responsibility Schedule** is necessary urgently to reflect, for example, an emergency situation, the **User** shall notify **TRANSCO**, or **TRANSCO** shall notify the **User**, as the case may be, immediately and shall discuss:

- i) what change is necessary to the **Site Responsibility Schedule**;
- ii) whether the **Site Responsibility Schedule** is to be modified temporarily or permanently;
- iii) the distribution of the revised **Site Responsibility Schedule**.

TRANSCO shall prepare a revised **Site Responsibility Schedule** as soon as possible, and in any event within seven days of it being informed of or knowing the necessary alteration. The **Site Responsibility Schedule** shall be confirmed by **Users** and signed on behalf of **TRANSCO** and **Users** as soon as possible after it has been prepared and sent to **Users** for confirmation.

11. RESPONSIBLE MANAGERS

Each **User** shall, prior to the **Completion Date** under each **Connection Agreement**, supply to **TRANSCO** a list of managers who have been duly authorised to sign **Site Responsibility Schedules** on behalf of the **User** and **TRANSCO** shall, prior to the **Completion Date** under each **Connection Agreement**, supply to that **User** the name of the manager responsible for the area in which the **Complex** is situated.


















ATTACHMENT TO APPENDIX A - PROFORMA FOR SITE RESPONSIBILITY SCHEDULE

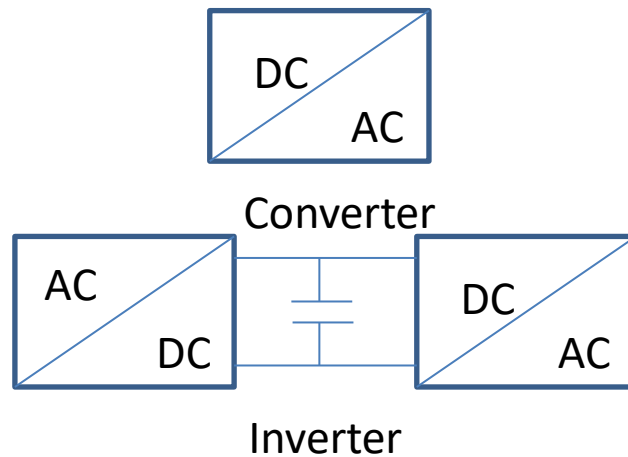
COMPANY: _____ SCHEDULE: _____

CONNECTION SITE: _____

ITEM OF PLANT/ APPARATUS	PLANT/ APPARATUS OWNER	SITE MANAGER	SAFETY		OPERATIONS		PARTY RESPONSIBLE FOR UNDERTAKING STATUTORY INSPECTIONS, FAULT INVESTIGATION & MAINTENANCE	REMARKS
			SAFETY RULES	CONTROL OR OTHER RESPONSIBLE PERSON (SAFETY CO-ORDINATOR)	OPERATIONAL PROCEDURES	CONTROL OR OTHER RESPONSIBLE ENGINEER		

APPENDIX B - SYMBOLS FOR OPERATION DIAGRAMS

	Circuit Breaker
	Circuit Breaker
	Isolator
	Earth Switch
	Double Busbar with Selection
	2 Winding Transformer
	Earthing Resistance
	Surge Arrester
	Capacitor
	A. C. Generator
	Motor
	Fuse
	Automatic Reclose Switch
	Cable
	Overhead Line
	Current Transformer
	Voltage Transformer



APPENDIX C - APPARATUS TO BE INCLUDED ON OPERATION DIAGRAMS

12. BASIC PRINCIPLES

- i) Where practicable, all the **HV Apparatus** on any **Connection Site** shall be shown on one **Operation Diagram**. Provided the clarity of the diagram is not impaired, the layout shall represent as closely as possible the geographical arrangement on the **Connection Site**.
- ii) Where more than one **Operation Diagram** is unavoidable, duplication of identical information on more than one **Operation Diagram** must be avoided.
- iii) The **Operation Diagram** must show accurately the current status of the **Apparatus** eg whether commissioned or decommissioned. Where decommissioned, the associated switchbay shall be labelled "spare bay".
- iv) Provision shall be made on the **Operation Diagram** for signifying approvals, together with provision for details of revisions and dates.
- v) **Operation Diagrams** shall be prepared in A4 format or such other format as may be agreed with **TRANSCO**.
- vi) The **Operation Diagram** should normally be drawn single line. However, where appropriate, detail which applies to individual phases shall be shown. For example, some **HV Apparatus** is numbered individually per phase.

13. APPARATUS TO BE SHOWN ON OPERATION DIAGRAM

1. Busbars
2. Circuit Breakers
3. Disconnectors (Isolators)
4. Switch Disconnectors (Switching Isolators)
5. Bypass Facilities
6. Earthing Switches
7. Maintenance Earths
8. Overhead Line Entries
9. Overhead Line Traps
10. Cable and Cable Sealing Ends
11. Capacitor Voltage Transformers (CVTs)
12. Power Line Carrier Line Matching Units (LMUs)
13. Generating Units
14. Generator Transformers
15. Generating Unit Transformers
16. Station Transformers
17. Static VAr Compensators
18. Series or Shunt Capacitors
19. Series or Shunt Reactors

20. System Transformers including Tertiary Windings
21. Earthing and Auxiliary Transformers
22. Voltage Transformers (VTs) and Current Transformers (CTs)
23. Surge Arrestors/Diverters
24. Neutral Earthing Arrangements on HV Plant
25. Fault Throwing Devices
26. Phase Shifting Transformers (Quadrature Boosters)
27. Arc Suppression Coils
28. Wall Bushings
29. Shorting and Discharge Switches
30. SF₆ Gas Zones

APPENDIX D - SCADA OUTSTATION INTERFACING

14. INTRODUCTION

This Appendix sets out the technical requirements for connections to the **TRANSCO** Supervisory Control and Data Acquisition system outstation in terms of electrical characteristics.

15. GENERAL REQUIREMENTS

In all cases signals shall be arranged such that the level of electrical interference does not exceed those defined in IEC 870-2-1: "Telecontrol Equipment and Systems - Operating Conditions - Power Supply and Electromagnetic Compatibility" and IEC870-3: "Telecontrol Equipment and Systems - Specification for Interfaces (Electrical Characteristics)".

15.1 Digital Inputs

Digital inputs cover both single and double points for connection to digital input modules on the **TRANSCO** outstation equipment. The **Plant** contacts shall be free of potential, whereas the input circuitry of the outstation are common to the negative 48 volt potential.

15.2 Single Points

Single point inputs must be used for alarms and where single contact indications are available. The off (contact open or 0) state is considered to be the normal state and the on (contact closed or 1) state the alarm condition.

15.3 Double Points

Double points are used to indicate primary plant states by the use of complementary inputs for each plant item. Only the "10" and "01" states are considered valid with the "00" and "11" states considered invalid. The "10" state is considered to be the normal or closed state.

15.4 Energy Meter Inputs

Energy meter input pulses for connection to pulse counting input modules on the **TRANSCO** outstation equipment must operate for a minimum of 100ms to indicate a predetermined flow of MWh or MVArh. The contact must open again for a minimum of 100ms. The normal state of the input must be open.

15.5 Analogue Inputs

Analogue inputs for connection to analogue input modules on the **TRANSCO** outstation equipment must all be electrically isolated with a two wire connection required. Signals shall be in the form of 4-20mA (or other range to be agreed between the **User** and **TRANSCO**) for both unidirectional and bi-directional measured values. Signal converters shall be provided as necessary to produce the correct input signals.

15.6 Command Outputs

All command outputs for connection to command output modules on the **TRANSCO** outstation equipment switch both the 0 volts and -48 volts for a period of 2.5 seconds at a maximum current of 1 amp. All outputs shall electrically be isolated with a two wire connection to control interposing relays on the plant to be operated.

APPENDIX E - TECHNICAL REQUIREMENTS FOR UNDER FREQUENCY RELAYS FOR THE AUTOMATIC DISCONNECTION OF SUPPLIES AT LOW FREQUENCY

16. UNDER FREQUENCY RELAYS

The **Under-Frequency Relays** to be used shall be in accordance with the requirements of the **Connection and Interface Agreement**. Under **Frequency Relays** shall have a **Frequency** setting range of 46.0 to 52.0Hz and be suitable for operation from a nominal AC input of 63.5, 110 or 240V. The following general parameters on the requirements of approved **Frequency Relays** for automatic installations is given as an indication to the provisions that may be included in a **Connection and Interface Agreement**:

- i) Frequency settings: 46 - 52Hz in steps of 0.01Hz;
- ii) Measurement period: Within a minimum settings selectable settings range of 3 to 7 cycles;
- iii) Operating time: Between 100 and 160ms dependent on measurement period setting;
- iv) Voltage lock-out: 20 to 90% of nominal voltage;
- v) Facility stages: Four stages of **Frequency** operation;
- vi) Output contacts: Two output contacts per stage.

16.1 Under Frequency Relay Voltage Supplies

The voltage supply to the **Under Frequency Relays** shall be derived from the primary **System** at the supply point concerned so that the **Frequency** of the **Under Frequency Relays** input voltage is the same as that of the primary **System**. This requires either:

- i) the use of a secure supply obtained from voltage transformers directly associated with the **Transmission System** interconnection transformer(s) concerned, the supply being obtained where necessary via a suitable automatic voltage selection scheme; or
- ii) the use of the substation 240V phase-to-neutral selected auxiliary supply, provided that this supply is always derived at the supply point concerned and is never derived from a standby supply **Generating Unit** or from another part of the **DISCO Distribution System**.

16.2 Scheme Requirements

The tripping facility should be engineered in accordance with the following reliability considerations:

- i) **Dependability**: Failure to trip at any one particular **Demand** shedding point shall not harm the overall operation of the scheme. However, many failures would have the effect of reducing the amount of **Demand** under low **Frequency** control. An overall reasonable minimum requirement for the dependability of the **Demand** shedding scheme is 96%, i.e. the average probability of failure of each **Demand** shedding point should be less than 4%. Thus the **Demand** under low **Frequency** control shall not be reduced by more than 4% due to relay failure.

- ii) Outages: Low **Frequency Demand** shedding schemes shall be engineered such that the amount of **Demand** under control is as specified by **TRANSCO** and is not reduced unacceptably during equipment outage or maintenance conditions.

**APPENDIX F - HARMONIC DISTORTION ON THE TRANSMISSION SYSTEM
PLANNING LEVELS AND COMPATIBILITY LEVELS**

Planning Levels for Harmonic Voltage in Transco Transmission System*

Planning Levels for Harmonic Voltage (in percent of nominal voltage) in the 132kV System

Odd harmonics Non-multiple of 3		Odd harmonics Multiple of 3		Even Harmonics	
Order 'h'	Harmonic Voltage (%)	Order 'h'	Harmonic Voltage (%)	Order 'h'	Harmonic Voltage (%)
5	2.0	3	2.0	2	1.0
7	2.0	9	1.0	4	0.8
11	1.5	15	0.3	6	0.5
13	1.5	21	0.2	8	0.4
17	1.0	>21	0.2	10	0.4
19	1.0			12	0.2
23	0.7			>12	0.2
25	0.7				
>25	0.2 + 0.5x25/h				

Total Harmonic Distortion (THD) level is 3 %

Planning Levels for Harmonic Voltage (in percent of nominal voltage) in the 220 and 400kV Systems

Odd harmonics Non-multiple of 3		Odd harmonics Multiple of 3		Even Harmonics	
Order 'h'	Harmonic Voltage (%)	Order 'h'	Harmonic Voltage (%)	Order 'h'	Harmonic Voltage (%)
5	2.0	3	1.5	2	1.0
7	1.5	9	0.5	4	0.8
11	1.0	15	0.3	6	0.5
13	1.0	21	0.2	8	0.4
17	0.5	>21	0.2	10	0.4
19	0.5			12	0.2
23	0.5			>12	0.2
25	0.5				
>25	0.2 + 0.3x25/h				

Total Harmonic Distortion (THD) level is 3 %

* The above tabulated harmonic distortion levels are the total allowed in the **TRANSCO Transmission System**, hence harmonic emission allocations for individual Users will take into account the position of existing and prospective Users as indicated in Section 6.1.3.1.

Compatibility Levels for Harmonic Voltage in Transco Transmission System*

Harmonic Voltage Compatibility Levels (in percent of nominal voltage) in the 132kV System

Odd harmonics Non-multiple of 3		Odd harmonics Multiple of 3		Even Harmonics	
Order 'h'	Harmonic Voltage (%)	Order 'h'	Harmonic Voltage (%)	Order 'h'	Harmonic Voltage (%)
5	4.0	3	2.0	2	1.0
7	2.0	9	1.0	4	0.8
11	1.5	15	0.3	6	0.5
13	1.5	21	0.2	8	0.4
17	1.0	>21	0.2	10	0.4
19	1.0			12	0.2
23	0.7			>12	0.2
25	0.7				
>25	0.2 + 0.5x25/h				

Total Harmonic Distortion (THD) level is 5%

Harmonic Voltage Compatibility Levels (in percent of nominal voltage) in the 220 and 400kV Systems

Odd harmonics Non-multiple of 3		Odd harmonics Multiple of 3		Even Harmonics	
Order 'h'	Harmonic Voltage (%)	Order 'h'	Harmonic Voltage (%)	Order 'h'	Harmonic Voltage (%)
5	3.0	3	1.7	2	1.0
7	1.5	9	0.5	4	0.8
11	1.0	15	0.3	6	0.5
13	1.0	21	0.2	8	0.4
17	0.5	>21	0.2	10	0.4
19	0.5			12	0.2
23	0.5			>12	0.2
25	0.5				
>25	0.2 + 0.3x25/h				

Total Harmonic Distortion (THD) level is 3.5 %

* The above tabulated harmonic distortion levels are the total allowed in the **TRANSCO Transmission System**, hence harmonic emission allocations for individual Users will take into account the position of existing and prospective Users as indicated in Section 6.1.3.1

CHAPTER 4 - OPERATING CODE "A"

1. INTRODUCTION

Operating Code 'A' is concerned with:

- i) **Demand** forecasts;
- ii) **Operational Planning** and data provision;
- iii) **Operating Margin**; and
- iv) **Demand Control**.
- v) **Demand side response**

2. SCOPE

Operating Code 'A' applies to **TRANSCO** and the following **Users**:

- i) **GENCOs**;
- ii) **DISCOs**;
- iii) **Non-Embedded Customers**;
- iv) **Self-Supply Users**;
- v) **User System**; and
- vi) **Procurer** with respect to **External System Operators**

3. DEMAND FORECASTS

3.1 Introduction

This Section of **Operating Code 'A'** is concerned with **Demand** forecasting for operational purposes. In order to match generation output with **Demand** for electricity, it is necessary to undertake **Demand** forecasting of **Active Power (MW)** and **Reactive Power (MVA_r)**.

This Section specifies procedures to be followed and the data to be supplied to **TRANSCO** to enable **TRANSCO** to forecast **Demand** on the **Transmission System** through the following timescales ranging from 3 years ahead to post time operation including real time operation:

- i) **Operational Planning Phase**;
- ii) **Programming Phase**;
- iii) **Control Phase**; and
- iv) **Post Control Phase**.

In the **Operational Planning Phase**, **Demand** forecasting shall be conducted by **TRANSCO** taking account of **Demand** forecasts furnished by **DISCOs** and **Non-Embedded Customers** and procurer for **Self-Supply Users** and **External Systems**.

In the **Programming Phase** and **Control Phase**, **TRANSCO** shall conduct its own **Demand** forecasting taking into account, information to be furnished by **DISCOs**, **Non-Embedded Customers**, **GENCOs**, **Self-Supply Users** and **External System Operators**.

This Section also deals with the provision of data on **Demand Control** in the **Operational Planning Phase**, the **Programming Phase** and the **Post Control Phase**.

3.2 Definitions

In this Code, Year 0 means the current calendar year, Year 1 means the next calendar year, Year 2 means the calendar year after Year 1, etc.

References to data being supplied on an hourly basis refer to it being supplied for each period of 60 minutes ending on the hour.

Reactive Power Demand includes the series **Reactive** losses of the **User System** but excludes any network susceptance and any **Reactive** compensation on the **User System**.

3.3 Objective

The objective is to set out the requirements for **Users** to provide **Demand** and **Generating Plant Output** data to **TRANSCO** to enable **TRANSCO** to maintain a sufficient margin during **Operational Planning Phase**, **Programming Phase**, **Control Phase** and **Post Control Phase**, and to specify factors which will be taken into consideration by **TRANSCO** when conducting **Demand** forecasting.

3.4 Data Required by TRANSCO

3.4.1 Operational Planning Phase

The data shall be supplied by each of following **Users** who are directly connected to the **Transmission System**:

- i) each **DISCO** in relation to its **Demand** and **Active Energy** requirements on its **Distribution System**;
- ii) each **Non-Embedded Customer** in relation to its **Demand** and **Active Energy** requirements on its **System**; and
- iii) each **Self-Supply User** in relation to its **Demand** and **Active Energy** requirements on its **System**
- iv) the **Procurer** with respect to each **External System Operator** in relation to its anticipated **Demand** and **Active Energy** requirements.

Forecasts of **Demand** and **Active Energy** requirements must contain the **User** best estimates of **Demand** and **Active Energy** requirements.

By calendar week 48 of each year of Year 0-1 (Y-1), each **User** shall provide to **TRANSCO** and the **Procurer** in writing, the forecast information listed below for the remainder of the current calendar year and each of the succeeding five calendar years:

- a) For each **DISCO** (summed over all **Transmission Supply Points**) and for each **Non-Embedded Customer** (at the **Connection Point**), the hourly **Active Power** forecast **Demand** profiles for the day of that **User** maximum **Demand** and for the specified day of the annual peak of the **TRANSCO Demand**, both at **Annual MD Conditions**.

- b) For each **DISCO** (summatd over all **Transmission Supply Points**) and for each **Non-Embedded Customer** (at the **Connection Point**) the annual **Active Energy** requirements for average conditions subdivided into the following categories of **Customer**:
 - i) Domestic;
 - ii) Agricultural;
 - iii) Commercial;
 - iv) Industrial;
 - v) Municipality;
 - vi) Public Lighting;
 - vii) Any other identifiable categories of **Customers**; and
 - viii) **User System** losses.
- c) For each **DISCO** (summatd over all **Transmission Supply Points**) and **Non-Embedded Customer** the hourly **Active** forecast **Demand** profile for the specified day of minimum **TRANSCO Demand** at **Average Conditions**.
- d) For each **DISCO** individual **Transmission Supply Point Demand (Active Power)** and **Power Factor** at **Annual MD Conditions** for the annual peak hour at the **Transmission Supply Point** and at the specified time of the annual peak hour of the **TRANSCO Demand**.
- e) For each **DISCO** individual **Transmission Supply Point Demand (Active Power only)** and **Power Factor** at **Average Conditions** at the specified hour at the annual minimum **TRANSCO Demand**.
- f) For each **Self-Supply User** its anticipated import or export requirements for the specified day of **Transco Maximum Demand**
- g) For each **Self-Supply User** its anticipated import or export requirements for the specified day of **Transco Minimum Demand**
- h) For each **External System Operator** its anticipated import or export requirements for the specified day of **Transco Maximum Demand**.
- i) For each **External System Operator** its anticipated import or export requirements for the specified day of **Transco minimum Demand**.

In circumstances when the busbar arrangement at a **Transmission Supply Point** is expected to be operated in separate sections, separate sets of forecast information for each section shall be provided to **TRANSCO**.

TRANSCO and the **Procurer** will rationalize and use the information supplied to it in preparing **Forecast Demand** information in their respective **Seven Year Planning Statement** and for use in **TRANSCO's Operational Planning**.

No later than calendar week 41 each year of Year 0-1 (Y-1), **TRANSCO** shall notify each **User** in writing of the following, for the current calendar year and for each of the following 7 calendar years:

- i) the date and time of the annual peak **TRANSCO Demand** at **Annual MD Conditions**; and

- ii) the date and time of the annual minimum **TRANSCO Demand** at **Average Conditions**.

3.4.2 Programming Phase

For the period of 1 to 8 weeks ahead the following shall be supplied to **TRANSCO** in writing by 10:00 hours each Saturday:

- i) Each **DISCO** shall supply MW profiles of the amount and duration of their proposed use of **Demand Control** which may result in a **Demand** change of 1 MW or more on an hourly and **Transmission Supply Point** basis;
- ii) Each **Self-Supply User** shall supply MW profiles of the amount and duration of their proposed use of **Demand Control** which may result in an **import or export** change of 10 MW or more on an hourly and **Transmission Supply Point** basis.

3.4.3 Control Phase

- i) Each **DISCO** shall notify **TRANSCO** of any **Demand Control** which may result in a **Demand** change of 10 MW or more averaged over any hour on any **Transmission Supply Point** which is planned after 10:00 hours, and of any changes to the planned **Demand Control** notified to **TRANSCO** prior to 10:00 hours as soon as possible after the formulation of the new plans.
- ii) Each **Self-Supply User** shall notify **TRANSCO** of any **Demand Control** which may result in an **import or export** change of 10 MW or more averaged over any hour on any **Transmission Supply Point** which is planned after 10:00 hours, and of any changes to the planned **Demand Control** notified to **TRANSCO** prior to 10:00 hours as soon as possible after the formulation of the new plans.

3.4.4 Post Control Phase

The following will be supplied to **TRANSCO** in writing by 06:00 hours each day in respect of **Active Power** data and **Reactive Power** data:

- i) Each **DISCO** shall supply MW profiles for the previous calendar day of the amount and duration of **Demand** reduction achieved from the use of **Demand Control** of 1 MW or more (averaged over any hour on any **Transmission Supply Point**), on an hourly and **Transmission Supply Point** basis;

3.5 TRANSCO Forecasts

The following factors will be taken into account by **TRANSCO** when conducting **Demand** forecasting in the **Programming Phase** and **Control Phase**:

- i) Historic **Demand** data including **Transmission System Losses**;
- ii) Weather forecasts and the current and historic weather conditions;
- iii) The incidence of major events or activities which are known to **TRANSCO** in advance;
- iv) **Generating Plant Schedules**;
- v) **Demand Control** of 10 MW or more proposed to be exercised by **DISCOs** and of which **TRANSCO** has been informed;
- vi) Anticipated flows to/from **Self-Supply Users**
- vii) Anticipated flows across **External Interconnections**; and

viii) Other information supplied by **Users**.

TRANSCO will produce forecasts of **TRANSCO Demand** using a forecast methodology taking into account the above factors to produce, by statistical means, unbiased forecasts of **Demand** including that to be met by **Generating Plant**.

4. OPERATIONAL PLANNING AND DATA PROVISION

4.1 Introduction

This Section of **Operating Code 'A'** is concerned with:

- i) the co-ordination of the release of **Generating Plant** and the **Transmission System** for construction, repair and maintenance; and
- ii) the provision by **GENCOS and Self-Supply Users** of planning parameters for **Generating Units** to **TRANSCO** for planning purposes only.

Operational Planning involves planning through various timescales, the matching of generating capacity with forecast **Demand** on the **Transmission System** together with a reserve of generation to provide a margin taking into account **Outages of Generating Units** and **Outages of and constraints on parts of the Transmission System** and on parts of **DISCO Distribution Systems** and transfers of electricity across any **External Interconnection and Self-Supply User** in order to achieve, so far as possible, the standards of security set out in the **Transmission Licence**.

In general terms there is an "envelope of opportunity" for the release of **Generating Units**, parts of the **Transmission System** and parts of **DISCO Distribution Systems** for **Outages** in accordance with this section of **Operating Code 'A'**. The envelope is determined by reference to the excess of the total capacity of **Generating Plant** (including transfers across any **External Interconnection**) available over the sum of **Demand** plus the **Operating Margin** at the relevant time.

This Section of **Operating Code 'A'** sets out the data required by **TRANSCO** from **GENCOS** in order to conduct the **Operational Planning** process, and the procedures to be adopted by **TRANSCO** in the planning and co-ordination of **Generating Unit Outages** and **Transmission System Outages**.

In this **Operating Code 'A'**, "Year 0" means the current calendar year at any time, Year 1 means the next calendar year at any time, Year 2 means the calendar year after Year 1, etc.

4.2 Objective

The objective of this section of **Operating Code 'A'** is to ensure, as far as possible, that **TRANSCO** co-ordinates, optimises and approves **Outages of Generating Units** taking into account **Transmission System Outages** and **DISCO Distribution System Outages** in order to minimise the number and effect of constraints on the **Transmission System** and in order to ensure that, so far as possible, forecast **Demand plus transfer to/from Self-Supply Users** plus transfers across **External Interconnections** and the **Operating Margin** is met.

In relation to all matters to be undertaken pursuant to this **Operating Code 'A'**, including making requests for **Outages** and supplying information to **TRANSCO** concerning overruns,

each **GENCO** must act reasonably and in good faith. Each **GENCO** shall act in accordance with **Good Industry Practice** in planning its **Outages**.

In relation to all matters to be undertaken pursuant to this **Operating Code 'A'**, each **DISCO** and **Non-Embedded Customer** must act reasonably and in good faith.

TRANSCO must, in relation to all matters to be undertaken pursuant to this **Operating Code 'A'**, including the co-ordination of **GENCOs Outages**, act reasonably and in good faith in the discharge of its obligations.

4.3 Planning of Generating Unit Outages

The provisions of this Section also consider an **External System Operators** as if references to **GENCOs** refer to **External Interconnections**.

The procedure set out below is to be followed in each calendar year.

4.3.1 Long Term Operational Planning - Planning for Years 2 and 3

4.3.1.1 By the end of March

Each **GENCO** will provide **TRANSCO** in writing with a suggested **Provisional Outage Programme** for Years 2 and 3 which will contain the following information in relation to each proposed **Planned Outage** in the suggested **Provisional Outage Programme**:

- a) identity of the **Generating Units** concerned;
- b) **MW** concerned (i.e. **MW** which will not be available as a result of the **Outage** and that which will, notwithstanding the **Outage**, still be available, if any);
- c) required duration of **Outage**;
- d) preferred start date and start time or range of start dates and start times;
- e) whether the **Outage** is a **Flexible Planned Outage** or an **Inflexible Planned Outage**, provided that the **GENCO** must not declare an **Outage** to be an **Inflexible Planned Outage** unless **Good Industry Practice** would not permit the **Outage** to be declared as a **Flexible Planned Outage**;
- f) if it is a **Flexible Planned Outage**:
 - (i) the period for which the **Outage** could be deferred at the request of **TRANSCO**, which period shall be not less than 30 days in length;
 - (ii) the period for which the **Outage** could be advanced at the request of **TRANSCO**, which period shall be not less than 10 days in length.

In relation to sub-paragraph (e) above, the **GENCO** must provide **TRANSCO** with such evidence as it may reasonably require in order to substantiate the declaration as an **Inflexible Planned Outage** and, if the **GENCO** fails to establish to **TRANSCO** reasonable satisfaction

that the **Outage** is required to be an **Inflexible Planned Outage**, the **Outage** shall be deemed to have been submitted as a **Flexible Planned Outage** with an attendant **Flexible Planned Outage Period** of 10 days for advancement and 30 days for deferment.

The updates to the programme for Year 3 when, by the passage of time, Year 3 has become Year 2, may only reflect the **GENCO** reasonable response to changed circumstances and changes which, in the context of the **Provisional Outage Programme**, are minimal in their effect on the operation of the **Transmission System**, otherwise it must reflect the **Provisional Outage Programme** for Year 3 issued the previous September.

4.3.1.2 Between the end of March and the end of September

TRANSCO will be calculating the weekly peak generating capacity required from **Generating Plant** in Years 2 and 3 taking into account insofar as **TRANSCO** may consider to be appropriate:

- a) **Demand Forecasts**;
- b) **TRANSCO** estimate of **Customer Demand Management**;
- c) the **Operating Margin** as set by **TRANSCO**;
- d) **Transmission System** and **Distribution System** constraints;
- e) **Transmission System** and **Distribution System Outages** to ensure that, in general, these have the least restraint on **Generating Unit Outages** and
- f) Transfers across **External Interconnections**.

The above calculation will, with anticipated **Outages** other than **Planned Outages** taken into account, effectively define the "envelope of opportunity" for **Planned Outages** of **Generating Units**.

During this period **TRANSCO** may, as appropriate, contact each **User** or **User System** which has supplied information to seek clarification on information received or such additional relevant information as is reasonable.

4.3.1.3 By the end of September

TRANSCO will, having taken into account the information notified to it and, having discussed it with **Users** if appropriate, provide each **GENCO** and **DISCO** in writing with a **Provisional Outage Programme** showing the **Generating Units** that may be potentially withdrawn from service during each week of Years 2 and 3 for a **Planned Outage** and showing the **Flexible Planned Outage Periods**, by way of amendment to, or confirmation of, the suggested **Provisional Outage Programme** submitted by the **GENCO**.

The **Provisional Outage Programme** may differ from the suggested **Provisional Outage Programme** as follows:

- a) **Flexible Planned Outages** and **Inflexible Planned Outages** may have been moved to co-ordinate all **Outage** proposals received by **TRANSCO** or for reasons relating to the

proper operation of the **Transmission System**. When dealing with Year 2, **TRANSCO** will give priority to including proposed **Inflexible Planned Outages** for the dates proposed by the **GENCO** in the case of newly proposed **Inflexible Planned Outages** and for the dates included in the **Provisional Outage Programme** prepared the previous September in the case of **Inflexible Planned Outages** which were included in that **Provisional Outage Programme**;

- b) a **Flexible Planned Outage** may have been re-designated as an **Inflexible Planned Outage**;

In addition, where in the opinion of **TRANSCO** the **Licence Standards** could not otherwise be met, **TRANSCO** may request:

- a) that a **Flexible Planned Outage** or an **Inflexible Planned Outage** be excluded from the **Provisional Outage Programme** where:
 - (i) planning for Year 3 was requested by the **GENCO**; or
 - (ii) planning for Year 2 was shown in the **Provisional Outage Programme** for such year or is newly requested by the **GENCO**; or
- b) that an **Inflexible Planned Outage** which was proposed by the **GENCO** be re-designated as a **Flexible Planned Outage**.

4.3.1.4 By the End of October

Where a **GENCO** or **DISCO** objects to the **Provisional Outage Programme** showing the **Generating Units** that can be withdrawn from service during each week of Years 2 and 3 for **Planned Outage** it may contact **TRANSCO** to explain its concerns and **TRANSCO** and that **GENCO** or **DISCO** will then discuss the problem and seek to resolve it.

The resolution of the problem may require **TRANSCO** to contact other **GENCOs** or **DISCOs** and joint meetings of parties may be convened by **TRANSCO**. A **GENCO** or **DISCO** which notifies **TRANSCO** of its objections may request that such a meeting be convened and **TRANSCO** will give due and reasonable consideration to such request. The need for further discussions, be they on the telephone or at meetings, can only be determined at the time.

In the event of the above discussions not producing an agreed result, **TRANSCO** will determine the **Provisional Outage Programme**.

4.3.2 Medium Term Operational Planning - Planning For Year 1

The **Outage Programme** for Year 2 forming part of the **Provisional Outage Programme** will become the **Outage Programme** for Year 1 when, by the passage of time, Year 2 becomes Year 1.

4.3.2.1 By the end of March

Each **GENCO** will provide **TRANSCO** in writing with its suggested **Final Outage Programme** for Year 1 (showing any updates to the **Outage Programme** for Year 2 which, by the passage of time, has become that for Year 1), which will then become the **Final Outage**

Programme. The suggested **Final Outage Programme** will contain the following information in relation to each proposed **Planned Outage** in the suggested **Final Outage Programme**:

- a) identity of the **Generating Units** concerned;
- b) **MW** concerned (i.e. **MW** which will not be available as a result of the **Outage** and that which will, notwithstanding the **Outage**, still be available, if any);
- c) required duration of **Outage**;
- d) preferred start date and start time or range of start dates and start times;
- e) whether the **Outage** is a **Flexible Planned Outage** or an **Inflexible Planned Outage**, provided that the **GENCO** must not declare an **Outage** to be an **Inflexible Planned Outage** unless **Good Industry Practice** would not permit the **Outage** to be declared as a **Flexible Planned Outage**;
- f) if it is a **Flexible Planned Outage**:
 - (i) the period for which the **Outage** could be deferred at the request of **TRANSCO**, which period shall be not less than 30 days in length; and
 - (ii) the period for which the **Outage** could be advanced at the request of **TRANSCO**, which period shall be not less than 10 days in length.

In relation to sub-paragraph (e) above, the **GENCO** must provide **TRANSCO** with such evidence as it may reasonably require in order to substantiate the declaration as an **Inflexible Planned Outage** and, if the **GENCO** fails to establish to **TRANSCO** reasonable satisfaction that the **Outage** is required to be an **Inflexible Planned Outage**, the **Outage** shall be deemed to have been submitted as a **Flexible Planned Outage** with an attendant **Flexible Planned Outage Period** of 10 days for advancement and 30 days for deferment.

The updates to the programme for Year 2 when, by the passage of time, Year 2 has become Year 1, may only reflect the **GENCO** reasonable response to changed circumstances and changes which, in the context of the **Provisional Outage Programme** as a whole, are minimal in their effect on the operation of the **Transmission System**, otherwise it must reflect the **Provisional Outage Programme** for Year 2 issued the previous September.

4.3.2.2 Between the end of March and the end of June

TRANSCO will be considering the suggested **Final Outage Programme** in the light of the factors set out in subsection 4.3.1.2 and the requirement for **Minimum Demand Regulation** and will be analysing whether the **Operating Margin** for the period can be met.

4.3.2.3 By the end of June

TRANSCO will provide each **GENCO** and **DISCO** in writing, with a draft **Final Outage Programme** showing the **Generating Units** that may be potentially withdrawn from service during each week of Year 1 for a **Planned Outage** and showing the **Flexible Planned Outage**

Periods, by way of amendment to, or confirmation of, the suggested **Final Outage Programme** submitted by the **GENCO**.

The draft **Final Outage Programme** may differ from the suggested **Final Outage Programme** as follows:

- a) **Flexible Planned Outages** (and associated **Flexible Planned Outage Periods**) may have been moved to co-ordinate all **Outage** proposals received by **TRANSCO** or generally for reasons relating to the proper operation of the **Transmission System**; or
- b) a **Flexible Planned Outage** may have been re-designated as an **Inflexible Planned Outage**;

In addition, where in the opinion of **TRANSCO** the **Licence Standards** could not otherwise be met, **TRANSCO** may, by giving to the **GENCO** a written notice, request:

- a) that a **Flexible Planned Outages** or an **Inflexible Planned Outage** which was shown in the **Provisional Outage Programme** or is newly requested by the **GENCO** (such request not reflecting a change in any **Outage** included in the **Provisional Outage Programme** prepared the previous September as the Year 2 programme) be excluded from the **Provisional Outage Programme**; or
- b) that an **Inflexible Planned Outage** which was shown in the **Provisional Outage Programme** prepared the previous September as the Year 2 programme, be re-designated as a **Flexible Planned Outage**, or that the start date thereof be moved.

4.3.2.4 By the end of July

Where a **GENCO**, **DISCO** or the **Procurer**, acting on behalf of an **External System Operator**, objects to any changes to the suggested **Final Outage Programme**, equivalent provisions to those set out in subsection 4.3.1.4 will apply.

4.3.2.5 Between the end July and the end of September

TRANSCO will be considering the draft **Final Outage Programme** in the light of the factors set out in subsection 4.3.1.2, any changes as a result of subsection 4.3.2.4 and the requirement for **Minimum Demand Regulation** and will be analysing whether the **Operating Margin** for the period can be met.

4.3.2.6 By the end of September

TRANSCO will notify each **GENCO**, **DISCO** in writing of any further changes to the draft **Final Outage Programme** by the issue of a **Final Outage Programme** showing the **Generating Units** that may be potentially withdrawn from service during each week of Year 1 for a **Planned Outage** and showing the **Flexible Planned Outage Periods**.

The **Final Outage Programme** may differ from the draft **Final Outage Programme** as follows:

- a) **Flexible Planned Outages** (and associated **Flexible Planned Outage Periods**) may have been moved to co-ordinate all **Outage** proposals received by **TRANSCO** or for reasons relating to the proper operation of the **Transmission System**;

- b) a **Flexible Planned Outage** may have been re-designated as an **Inflexible Planned Outage**;
- c) In addition, where in the opinion of **TRANSCO** the **Licence Standards** could not otherwise be met, **TRANSCO** may request:
 - (i) that a **Flexible Planned Outage** or an **Inflexible Planned Outage** which was shown in the draft **Final Outage Programme** be excluded from the **Final Outage Programme**; or
 - (ii) that an **Inflexible Planned Outage** which was shown in the draft **Final Outage Programme** be re-designated as a **Flexible Planned Outage** or that the start date thereof (shown in the draft **Final Outage Programme**) be moved.

4.3.3 Short Term Operational Planning - Planning for Year 0

Throughout each calendar year and from 1st October of the preceding year **TRANSCO** will monitor the **Operating Margin** continuously in the light of any movement of **Planned Outages**, the factors specified in subsection 4.3.1.2, the incidence of **Outages** other than **Planned Outages** and the requirement for **Minimum Demand Regulation**.

4.3.3.1 Flexible Planned Outage Movements

In the case of a **Flexible Planned Outage**, **TRANSCO** may, upon giving a **GENCO** written notice of not less than 7 days require the start date or start time of the **Flexible Planned Outage** to be advanced or deferred within the **Flexible Planned Outage** period, and the **GENCO** will take that **Outage** in accordance with the revised timing set out in that notice.

4.3.3.2 Amendments to Planned Outages

In the case of:

- a) a **Flexible Planned Outage** which **TRANSCO** would like to move outside the **Flexible Planned Outage Period**;
- b) a **Flexible Planned Outage** which **TRANSCO** would like to move within the **Flexible Planned Outage Period** on less than seven days notice; or
- c) an **Inflexible Planned Outage** which **TRANSCO** would like to move.

TRANSCO may, upon giving a **GENCO** written notice, request that the start date or start time of a **Planned Outage** be advanced or deferred. If the **GENCO** agrees to such advancement or deferral, or **TRANSCO** and the **GENCO** agree to some other advancement or deferral, the **GENCO** will take the **Outage** in accordance with that agreement.

4.3.3.3 Generating Unit Substitution

A **GENCO** may, on reasonable grounds, by notice in writing submitted to **TRANSCO** at any time during Year 0, request that a **Generating Unit** for which there is a **Flexible Planned Outage** or an **Inflexible Planned Outage**, as specified in the **Final Outage Programme**,

remain in service and that one of the other **Generating Units** at the same **Power Station** (having substantially the same **Contracted Power Capacity** and **Scheduling and Despatch Parameters**) be permitted to be taken out of service during the period for which such **Flexible Planned Outage** or **Inflexible Planned Outage** has been planned. **TRANSCO** shall not unreasonably withhold its consent to such substitution and, if **TRANSCO** does consent, the **Final Outage Programme** shall be amended and the **GENCO** shall be entitled to take the **Outage** accordingly.

4.3.3.4 Short Term Planned Maintenance Outage

A **GENCO** may at any time in Year 0 request **TRANSCO**, by giving not less than 7 days notice before the earliest start date, for a Short Term Planned Maintenance Outage ("STPM Outage"). The request notice must contain the following information:

- a) identity of the **Generating Unit(s)** concerned;
- b) **MW** concerned (i.e. **MW** which would not be **Available** as a result of the **Outage** and that which would, notwithstanding the **Outage**, still be **Available**, if any);
- c) required duration of **Outage** (which must not exceed 72 hours); and
- d) preferred start date and start time or range of start dates and start times.

On receipt of a request notice **TRANSCO** shall consider the request and shall, having discussed the position with the **GENCO** (and the **DISCO** in the case of an **Embedded Generating Unit**), reply within one **Business Day** in writing indicating:

- a) acceptance of the request, confirming the requested start time and duration of the STPM Outage;
- b) proposals for the advancement or deferment of the STPM Outage if taken, indicating alternative start time and duration; or
- c) rejection of the request.

If **TRANSCO** has accepted the request, the STPM Outage, if taken, must be taken by the **GENCO** in accordance with the request. If **TRANSCO** has indicated an alternative start time and/or duration, **TRANSCO** and the **GENCO** must discuss the alternative and any other options which may arise during the discussions. If agreement is reached, then the **Outage**, if taken, must be taken by the **GENCO** in accordance with the agreement. If the request is refused by **TRANSCO** or if agreement is not reached then the **Outage** may not be taken by the **GENCO**.

If, in respect of a particular **Generating Unit**, **TRANSCO** has rejected requests on two successive occasions which were not less than 7 days apart, **TRANSCO** may not reject a third request. However, **TRANSCO** may require that such **Outage**, if it is to be during the three months of peak summer **Demand**, be deferred if in **TRANSCO** reasonable opinion (were the **Outage** not to be deferred):

- a) the **Licence Standards** could not be met; or

- b) there would otherwise be insufficient generating capacity to meet forecast **Demand** and the **Operating Margin**;

Any such deferral shall be for so long as the above circumstances exist, but shall not be beyond the end of the month following the end of the three months of peak summer **Demand**.

In the event that an STPM Outage is scheduled pursuant to this subsection, **TRANSCO** shall by notice in writing confirm the details thereof within one **Business Day** after the details of the STPM Outage have been settled. Such notice shall contain the following information:

- a) the identity of the **Generating Unit(s)** concerned;
- b) **MW** concerned (i.e. **MW** which will not be available as a result of the **Outage** and that which will notwithstanding the **Outage**, still be available, if any);
- c) duration of the **Outage**; and
- d) the start date and start time.

4.3.4 Notified Unplanned Outages

A **GENCO** must, if it considers that a **Generating Unit** will require an **Outage** which cannot reasonably be deferred to become a **Planned Outage** or a Short Term Planned Maintenance Outage but of which it has some warning, give **TRANSCO** as much notice as is reasonably possible. Such notice must include an identification of the **Generating Unit** the expected start date and start time and duration of the unplanned **Outage** and the nature of the **Outage** together with the **MW** concerned (i.e. **MW** which will not be available as a result of the **Outage** and that which will still be available, if any). **TRANSCO** must acknowledge such notification as soon as reasonably possible after the notification was received by **TRANSCO**.

TRANSCO may request the **GENCO** to advance or defer the **Outage** and if the **GENCO** agrees to such a request, the **GENCO** shall send **TRANSCO** a written notice confirming this agreement, which **TRANSCO** will acknowledge, and the **GENCO** must then (subject to any intervening **Outage**) take the **Outage** in accordance with that agreement.

4.3.5 Forced Outages

In the event that a **Generating Unit** suffers a **Forced Outage**, the relevant **GENCO** shall, as soon as possible after the commencement of the **Outage** inform **TRANSCO** by written notice of the **GENCO** best estimate of the date and time by which the **Generating Unit** is likely to have been repaired and restored to its full level of availability. If the **GENCO** is unable for any reason to comply with this requirement, the **GENCO** shall not later than 48 hours after the commencement of the **Forced Outage**, provide **TRANSCO** such information as is then known to the **GENCO** regarding the date and time of return from such **Outage** and shall provide such updates thereafter as **TRANSCO** may reasonably require. The **GENCO** shall as soon as the **GENCO** is able inform **TRANSCO** by written notice of the **GENCO** best estimate of the date and time by which the **Generating Unit** is likely to have been repaired and restored to its full level of availability.

A **GENCO** shall use all reasonable endeavours to ensure that, following a **Forced Outage**, the **Generating Unit** is repaired and restored to its full level of availability as soon as possible and in accordance with **Good Industry Practice**.

4.3.6 Release of Generating Units

GENCOs may only undertake **Planned Outages** with **TRANSCO** agreement in accordance with **Outage** programmes produced pursuant to this **Operating Code 'A'**.

In real time operation **Generating Units** must not be withdrawn for a **Planned Outage** or a Short Term Planned Maintenance Outage without **TRANSCO** express formal permission for such release according to the procedures set out below.

TRANSCO express formal permission shall specify:

- a) the identity of the **Generating Unit** and **MW** concerned (i.e. **MW** which will not be available as a result of the **Outage** and that which will, notwithstanding the **Outage**, still be available, if any), for **GENCO**
- b) the identity of the **Generating Unit** and **import/export** concerned (i.e. **import/export** which will not be available as a result of the **Outage** and that which will, notwithstanding the **Outage**, still be available, if any), for **Self-Supply Users**
- c) the duration of the **Outage**; and
- d) the start date and start time.

TRANSCO may withhold its permission for the release of a **Generating Unit** for a **Planned Outage** or a Short Term Planned Maintenance Outage where such **Outage** has previously been planned in accordance with this **Operating Code 'A'** where, in **TRANSCO's** reasonable opinion (were such **Outage** not to be deferred):

- a) the **Licence Standards** could not be met; or
- b) there would be insufficient generating capacity to meet forecast **Demand** and the **Operating Margin**.

TRANSCO may require the **GENCO or Self-Supply User** to continue to defer such **Outage** for so long as the above circumstances exist, but under the conditions that it does not cause any damage to Self-Supply User`s units.

4.3.7 Return to service and overruns

In relation to a **Planned Outage**, not later than 7 days before the expiry of the **Flexible Planned Outage** period or the **Inflexible Planned Outage** period, the **GENCO** must notify **TRANSCO** either that its **Generating Unit** is returning to service earlier than expected, or at the time and date expected, or later than expected and if, upon return, it is expected to be fully available. Where a **Generating Unit** is not expected to be fully available upon its return to service, the **GENCO** shall state the **MW** level at which the **Generating Unit** is expected to be available. In the case of a **Generating Unit** which is capable of firing both on gas and on oil, the

availability must be stated for each fuel. In the case of a Self-Supply Generating Unit, the **Self-Supply User** shall state the change in import/export level upon its return to service.

In the case of a return from a **Planned Outage** earlier than expected, notice of return to service must be given as far as possible in advance of return but in any event not later than required indicated above.

In the case of a return from a **Planned Outage** later than expected, notice of return to service must be given not later than required above and shall state the reason for the delay in the return of the **Generating Unit** to service and the **GENCO** best estimate of the date and time at which the **Generating Unit** will return to service.

A **GENCO** must use all reasonable endeavours to ensure that, in respect of each **Planned Outage** of the **GENCO Generating Units**, the **Outage** as included in the **Final Outage Programme** (or as moved in accordance with this **Operating Code 'A'**) is followed.

Before returning from any **Outage** other than a **Planned Outage**, a **GENCO** must inform **TRANSCO**, as far in advance as reasonably possible that its **Generating Unit** is returning to service. The **GENCO** must, in addition, give an **Availability Notice** in accordance with the **Scheduling and Despatch Code** on the day prior to the **Schedule Day** on which the **Generating Unit** is to return to service.

Before returning from any **Outage** other than a **Planned Outage**, a **Self-Supply User** must inform **TRANSCO**, as far in advance as reasonably possible if import/export level is expected to be changed. The **Self-Supply User** must, in addition, give an **Availability Notice** in accordance with the **Scheduling and Despatch Code** on the day prior to the **Schedule Day** on which the import/export is to return to scheduled level.

If at any time during an **Outage** the **GENCO** becomes aware that its **Generating Unit** will not have been maintained, repaired or restored to be available by the expiry of the period specified for the duration of the **Outage** in the **Final Outage Programme** or as otherwise notified in the case of **Outages** other than **Planned Outages**, the **GENCO** shall notify **TRANSCO** immediately in writing stating the reason for the delay and the **GENCO** best estimate of the date and time by which the **Generating Unit** will actually have been maintained, repaired or restored to be available in accordance with the **Scheduling and Despatch Code**.

4.4 Planning of Transmission System Outages

The provisions of this Section also consider an **External System Operators** as if references to **Users** refer to **External Interconnections**.

The procedure set out below is to be followed in each calendar year.

4.4.1 Long Term Operational Planning - Planning for Years 2 and 3 ahead

TRANSCO shall plan **Transmission System Outages** required in Years 2 and 3 as a result of construction or refurbishment works taking due account of known requirements. The planning of **Transmission System Outages** required in Years 0 and 1 ahead will, in addition, take into account **Transmission System Outages** required as a result of maintenance. **Transmission System Outages** and **Generating Unit Outages** shall, during Years 2 and 3 but not in Year 1 or later, be co-ordinated so that, in general, **Generating Unit Outages** shall take precedence

over **Transmission System Outages** but subject always, in any particular case, to **TRANSCO** discretion to determine otherwise on the basis of reasons relating to the proper operation of the **Transmission System**.

4.4.1.1 By the end of September

TRANSCO will draw up a draft **Transmission System Outage** plan covering the period Years 2 and 3 for **TRANSCO** internal use and will notify each **User** in writing of those aspects of the draft plan which may operationally affect such **User** including, in particular, proposed start dates and end dates of relevant **Transmission System Outages**. **TRANSCO** will indicate to a **GENCO** where a need may exist to use **Intertripping** or other measures including restrictions on the **Scheduling and Despatch of Generating Units** to allow the security of the **Transmission System** to be maintained within the **Licence Standards**.

4.4.2 Medium Term Operational Planning - Planning for Year 1

The plan produced pursuant to subsection 4.4.1 will become the draft **Transmission System Outage** plan for Year 1 when, by the passage of time, Year 2 becomes Year 1. Each calendar year **TRANSCO** shall update the draft **Transmission System Outage** plan and shall, in addition, take into account **Outages** required as a result of maintenance work.

4.4.2.1 By the end of June

TRANSCO will draw up a draft **Transmission System Outage** plan and will inform each **User** of any potential restrictions which may affect it and generally the impact on the **Transmission System** in Year 1.

4.4.2.2 By the end of July

Where a **User** objects to the proposed restrictions or impact notified to it under subsection 4.4.2.1 above, equivalent provisions to those set out in subsection 4.3.1.4 will apply.

4.4.2.3 Between the end of June and the end of September

TRANSCO will draw up a final **Transmission System Outage** plan covering Year 1.

4.4.2.4 By the end of September

TRANSCO will issue the final **Transmission System Outage** plan for Year 1.

TRANSCO will notify each **User** in writing of those aspects of the plan which may operationally affect such **User** including, in particular, proposed start dates and end dates of relevant **Transmission System Outages**. **TRANSCO** will also indicate where a need exists to use **Intertripping**, emergency switching, emergency load management or other measures including restrictions on the **Scheduling and Despatch of Generating Units** to allow the security of the **Transmission System** to be maintained within the **Licence Standards**.

4.4.3 Short Term Operational Planning - Year 0 down to the Programming Phase

The **Transmission System Outage** plan for Year 1 issued under subsection 4.4.2.4 shall become the final plan for Year 0 when by the passage of time Year 1 becomes Year 0.

4.4.4 Programming Phase

4.4.4.1 By 11.00 hours each Thursday

TRANSCO shall update the **Transmission System Outage** plan for the following one week period beginning on the Friday.

TRANSCO will notify each **User** in writing of those aspects of the plan which may operationally affect such **User** including in particular proposed start dates and end dates of relevant **Transmission System Outage**. TRANSCO will also indicate where a need exists to use **Intertripping**, emergency switching emergency load management or other measures including, restrictions on the Despatch of **Generating Units** to allow the security of the **Transmission System** to be maintained within the **Licence Standards**.

4.4.4.2 During the Programming Phase

Each **User** and TRANSCO will inform each other immediately if there is any unavoidable requirement to depart from the **Outages** and actions determined and notified under subsection 4.4.4.1 above.

4.5 DATA REQUIREMENTS

When requested initially under a **Power and Water Purchase Agreement** and thereafter in calendar week 48 in each calendar year, each **Genco** and each **Self-Supply User** shall in respect of each of its **Generating Units** submit to TRANSCO in writing the **Generator Performance Chart** and the Generation Planning Parameters to be applied from the beginning of week 49 onwards, in the format indicated in Appendix A and Appendix B of this **Operating Code 'A'**. The Generation Planning Parameters shall be used by TRANSCO for **Operational Planning** purposes only and not in **Scheduling and Despatch**.

In the case of a **Generating Unit** which is capable of firing on two different fuels, the **Genco** must submit to TRANSCO, by separate written notifications, the Generation Planning Parameters in respect of each fuel, each clearly marked to indicate for which fuel it applies.

The **Generator Performance Chart** must be on a **Generating Unit** specific basis at the generator terminals, except in the case of a **Power Farm**, where it shall be on a **Power Farm** basis at the **Transmission Entry Point** or **Distribution System Entry Point** if **Embedded** and must include details of the generator transformer parameters (or, in the case of a **Power Farm** to the extent present, the main step-up transformer(s) or, otherwise, the step-up transformers that relate exclusively to the operation of each **WTGU** or **PVGU** therein) and demonstrate the limitation on **Reactive Power** capability of the **Transmission System** voltage at 3% above nominal.

For each **Generating Unit** whose performance varies significantly with ambient temperature, the **Generator Performance Chart** shall show curves for at least two values of ambient temperature so that TRANSCO can assess the variation in performance over all likely ambient temperatures by a process of linear interpolation or extrapolation. One of these curves shall be for the ambient temperature at which the **Generating Unit** output equals its **Registered Capacity**. Examples of **Generator Performance Charts** for **Synchronous** and **Power Farm Generating Units** are shown in Appendix A.

Each **GENCO** with a **WTGU**, **PVPS** or **CSTU** shall submit to **TRANSCO** in writing an **Intermittent Power Source Planning Matrix**. It shall be prepared on a best estimate basis relating to how it is anticipated the **WTGU**, **PVPS** or **CSTU** will be running and which shall reasonably reflect the operating characteristics of the relevant farm or module. The Planning Matrix must show the number of each **WTGU**, **PVPU** or **CSTU** expected to be available to generate, in the format indicated in Appendix E. The **Intermittent Power Source Planning Matrix** shall be accompanied by a graph showing the variation in MW output with **Intermittent Power Source** (e.g. MW versus wind speed or solar irradiation) for the relevant farm or module as the case may be.

The **Intermittent Power Source Planning Matrix** will be used by **TRANSCO** for operational planning purposes only and not in connection with the operation of Scheduling and Dispatch.

5. OPERATING MARGIN

This Section of **Operating Code ‘A’** sets out the different types of reserve which make up the **Operating Margin** that **TRANSCO** may use in the **Control Phase**.

5.1 Constituents of Operating Margin

The **Operating Margin** comprises **Contingency Reserve** plus **Operating Reserve**.

5.1.1 Contingency Reserve

Contingency Reserve is the margin of generation over forecast **Demand** which is required in the period from 24 hours ahead down to real time to cover against uncertainties in **Generating Plant** availability or transfers across **External Interconnections** and against both weather forecast and **Demand** forecast errors. It is provided by **Generating Plant** which is not required to be **Synchronised** but which must be held available to **Synchronise** within a defined timescale.

5.1.2 Operating Reserve

Operating Reserve is output change from **Generating Plant** or transfer change across **External Interconnections** and or a reduction in **Demand** which must be realisable in real time operation to respond in order to contribute to containing and correcting any **System Frequency** change (fall or rise) to an acceptable level in the event of a loss of generation, loss of **Demand** or mismatch between generation and **Demand** or a loss of import/export from/to an **External Interconnection**. The **Operating Reserve** is managed in three distinct control processes:

5.1.2.1 Control processes

5.1.2.1.1 Primary Control

which assists to stabilize the **System Frequency** at any level according to $df/dt=0$ by operating so as to provide **Primary Response and/or Secondary Response by Generating Unit** or **Battery Storage** or Interruptible Load proportional to the difference between the **Target Frequency** and the actual **System Frequency**. **Primary Control** is triggered by change in **System Frequency**.

5.1.2.1.2 Secondary Control

which assists to restore the **System Frequency** at target level by operating so as to provide response by **Generating Unit** or **Battery Storage** or Interruptible Load based on set-point received from **Automatic Generation Control (AGC)**, **Load Frequency Control (LFC)** or manually. **Secondary Control** is triggered by Area Control Error (ACE)≠0.

5.1.2.1.3 Tertiary Control

which assists to relieve the **Secondary Reserve** and return them to pre-incident level, by operating so as to provide response by **Generating Unit** or **Battery Storage** or Interruptible Load based on the **Despatch** instruction.

5.1.2.2 Generating Unit Response

5.1.2.2.1 Primary Response

The automatic change in **Active Power** output of a **Generating Unit** or **Battery Storage** or change in consumption of Interruptible Load or any other means in response to a **System Frequency** decrease or increase.

The Positive **Primary Response** is the automatic increase in **Active Power** output of a **Generating Unit** or change in **Battery Storage** output, or loss of Interruptible Load or any other means in response to a **System Frequency** fall in accordance with the **Primary Control** capability and additional mechanisms for releasing **Active Power** (e.g. condensate stop) or to arrest frequency decay.

The Negative **Primary Response** is the automatic decrease in **Active Power** output of a **Generating Unit** or change in **Battery Storage** or any other means in response to a **System Frequency** increase in accordance with the Primary Control capability and additional mechanisms for reducing **Active Power** generation (e.g. fast valving) or arrest frequency rise.

This change in **Active Power** output must be in accordance with the provisions of the relevant **Power and Water Purchase Agreement** or any other agreement which will provide the **Transient Primary Response Coefficient** (from t=0 sec up to t=10 sec) and the **Steady State Response Coefficient** (from t=10 sec up to t=30 sec).

5.1.2.2.1.1 Normalized Primary Response Characteristic

The **Normalized Primary Response Characteristic** means the **Primary Response** pattern on the basis of a normalized input signal. The normalized input signal shall be determined individually for each **Generation Unit** and is defined by the speed response of the unit under assumed island conditions supplying a constant power load. The load step (increase of MW load) applied shall be such that with the **Guaranteed Load-Related Average Primary Control Droop** setting and under the consideration of the **Total Speed/Load-Related Dead Band**, the response of the **Generation Unit** shall result in the **Normalized Primary Response Characteristic** and must be in accordance with the provisions of the relevant **Power and Water Purchase Agreement** or the **Connection Agreement**.

If the **Normalized Primary Response Characteristic** is varying with the unit loading, at least three **Normalized Primary Response Characteristics** shall be given.

5.1.2.2.1.2 *Primary Response Performance Index*

The **Primary Response Performance Index** is defined as the product of the **Transient Primary Response Coefficient TPRC** and the **Steady State Primary Response Coefficient SSPRC** according to:

$$\text{PRPI} = \text{TPRC} * \text{SSPRC}$$

5.1.2.2.1.3 *Transient Primary Response Coefficient (TPRC)*

The **Transient Primary Response Coefficient (TPRC)** is defined by the weighted sum of the **Generator Power** increase released in the first 10 seconds according to:

$$\text{TPRC} = \sum_{ti} \text{RES}_{ti} * a_{ti}$$

where: $ti = 1$ to 10 with the consideration of the corresponding weighting factors a_{xi} as specified in the **Power and Water Purchase Agreement** or the **Connection Agreement**.

5.1.2.2.1.4 *Steady State Primary Response Coefficient (SSPRC)*

The **Steady State Primary Response Coefficient (SSPRC)** is defined by the weighted sum of the **Generator Power** increase released from seconds 11 to 30 according to:

$$\text{SSPRC} = \sum_{ti} \text{RES}_{ti} * b_{ti}$$

where: $ti = 11$ to 30 with the consideration of the corresponding weighting factors b_{xi} as specified in the **Power and Water Purchase Agreement** or the **Connection Agreement**.

5.1.2.2.1.5 *Average Load-Related Primary Control Droop*

The **Average Load-Related Primary Control Droop** (\mathcal{C} , Load-related steady-state regulation) of the governing system is defined as the ratio of the governor input (Δn) related to the rated speed n_n to the equally related value (ΔP_G) of the generator power output P_G .

$$\mathcal{C} = \text{abs} (\Delta n / \Delta P_G) * P_n / n_n$$

5.1.2.2.1.6 *Total Speed/Load-Related Dead Band*

The **Total Speed/Load-Related Dead Band** (o_p , p.u.) of the speed governing system is defined as the amount of speed change (Δn) which is necessary to produce a change of the Generator output (ΔP_G) from one direction into the opposite direction, according to:

$$o_p = \Delta P_G / P_{GN} = o_n * 100 / \mathcal{C}$$

with:

$$O_n = \Delta n_G / n_N$$

5.1.2.2.2 Secondary Response

The automatic increase in **Active Power** output of a **Generating Unit** or **Battery Storage** or change in consumption of Interruptible Load or any other means in response to **Frequency Deviation** in accordance to the **Primary Control** capability. The **Secondary Response** characteristics must be in accordance with the provisions of the relevant **Power and Water Purchase Agreement** or any other agreement which will provide that the response will be fully deployed by 30 seconds from the time of the **Frequency** fall and be sustainable for at least a further 30 minutes.

5.1.2.2.1 Secondary Response Characteristic

The capability of **Generating Unit** or **Battery Storage** or change in consumption of Interruptible Load to provide a sustainable response, achieved 30 seconds after the frequency deviation, for a further 30 minutes. The response performance must be in accordance with the provisions of the relevant **Power and Water Purchase Agreement** or any other agreement.

5.1.2.2.3 AGC Response

The portion of the total unit generation to **Secondary Control** is determined by the unit set point value sent by AGC, LFC or manual instruction.

The **AGC response** represents the change in **Active Power** output of a **Generating Unit** in response to a set-point received from the AGC and/or LFC. The response performance must be in accordance with the provisions of the relevant **Power and Water Purchase Agreement** which provide the ramp rate expressed in MW/min.

5.2 Provision of Operating Margin

The categories of **Operating Margin** can be fulfilled by a number of different types of **Generating Units**.

5.2.1 Contingency Reserve

The amount of **Contingency Reserve** required at the day ahead **Scheduling** stage and in subsequent timescales will be decided by **TRANSCO** on the basis of historical trends in the reduction in availability of **Generating Plant** and increases in forecast **Demand** up to real time operation. **Contingency Reserve** is held on thermal **Peak Load Generation** and **TRANSCO** will include in the **Generation Schedule** the length of time from **TRANSCO** giving the **Notice to Synchronise** in which that **Generating Plant** has to reach **Synchronous Speed**.

Uncertainties in **Generating Plants** as well as **Demand** forecast errors, availability inside the self-supply network should be covered by **Self-Supply User** itself.

5.2.2 Operating Reserve

Based on different types of control sorted out in Clause 5.1.2, **Operating Reserve** is comprised of:

- a) **Primary Reserve:**
- b) **Secondary Reserve**
- c) **Tertiary Reserve**

5.2.2.1 Primary Reserve

It represents a certain amount of **Active Power** that must be available for stabilizing the **System Frequency** after the occurrence of an imbalance

5.2.2.2 Secondary Reserve

It represents a certain amount of **Active Power** that must be available for restoring the **System Frequency** to the target level and for restoring the control area interchange to the scheduled value.

5.2.2.3 Tertiary Reserve

It represents a certain amount of **Active Power** (provided by **Generating Units** and/or interruptible load) that needs to be available for restoring or supporting the required level of **Secondary Reserve** in order to be prepared for additional system imbalances.

5.2.2.4 Operating Reserve Determination

The amount of **Operating Reserve** required at any time will be determined by **TRANSCO** on annual basis having regard to the **Demand** levels, **Generating Plant** availability shortfalls and the greater of the largest secured loss of generation or loss of import from or sudden export across any **External Interconnections** against which, as a requirement of the **Licence Standards**, the **Transmission System** must be secured. **TRANSCO** will allocate the **Operating Reserve** to the various classes of **Generating Plant**, to **Self-Supply Users** or to an **External Interconnection** so as to fulfil the required levels of **Primary Reserve**, **Secondary Reserve** and **Tertiary Reserve**.

The amount of **Operating Reserve** required from **Self-Supply Users** at any time will be determined mutually by **TRANSCO** and **Self Supply Users** on annual basis.

Allocation of **Operating Reserve** for **Self-Supply Users** will be specified in **Connection and Interface Agreement** or PPA and may be either:

- a) by various classes of **Generating Units** within the self-supply network.
- b) by **Demand Response**.
- c) by support from **TRANSCO**.

5.3 Instruction of Operating Margin

TRANSCO will instruct sufficient individual **Generating Units** or **External Interconnection** transfer so as to fulfil in total the required levels of **Contingency Reserve** and **Operating Reserve** with the required levels of response.

Each instruction will be issued pursuant to the **Scheduling and Despatch Code**.

5.4 Data Requirements

The response capability data required for each **Generating Unit** in connection with **Operating Margin** relates to circumstances when the **System Frequency** falls to a level which fully opens

the **Generating Unit** governor valve, is listed in Appendix C. This data should be provided initially under the **Power and Water Purchase Agreement** or **Connection and Interface Agreement** and thereafter in Week 48 in each calendar year.

5.5 Weekly Operational Policy

The **Weekly Operational Policy** will include an indication of the level of **Operating Margin** to be utilised by **TRANSCO** in the **Scheduling** and **Despatch** process in the week beginning with the **Schedule Day** commencing during the subsequent Saturday, which level shall be purely indicative.

6. DEMAND CONTROL

6.1 Introduction

This Section of **Operating Code A** is concerned with the provisions to be made by **DISCOs**, **User System** and in relation to **Non-Embedded Customers**, and **Independent Generating Units** by **TRANSCO**, to permit the reduction of **Demand** in the event of insufficient **Generating Plant**, or transfers across an **External Interconnection** or across the **Self-Supply User** or in the event of breakdown or operating problems on any part of the **Transmission System**.

Demand Control deals with the following:

- i) **Customer Demand Management** initiated by **DISCOs**;
- ii) **Customer Demand** reduction by **Disconnection** initiated by **DISCOs**;
- iii) **Customer Demand** reduction instructed by **TRANSCO**;
- iv) automatic low frequency **Demand Disconnection**;
- v) emergency manual **Demand Disconnection**;
- vi) Provision of reduction in export or increase in import through connection with **Self-Supply Users**, and
- vii) Provision of reduction in export or increase in import through **External Interconnection** should be included.

The term **Demand Control** is used to describe any or all of these methods of achieving a **Demand** reduction.

The procedure set out in **Demand Control** includes a system of warnings to give advance notice of **Demand Control** that may be required by **TRANSCO**.

Data relating to **Demand Control** should include details relating to **Active Power** (MW).

6.2 Objective

The overall objective of **Demand Control** is to require the provision of facilities to enable **TRANSCO** to achieve reduction in **Demand** that will either avoid or relieve operating problems on the **Transmission System**, in whole or in part, and thereby to enable **TRANSCO** to instruct **Demand Control** in a manner that does not unduly discriminate against, or unduly prefer, any one or any group of **DISCOs** or **Non-Embedded Customers**. It is also to ensure

that **TRANSCO** is notified of any **Demand Control** utilised by **DISCOs** or **Non-Embedded Customers** other than following an instruction from **TRANSCO**.

6.3 Procedure for Demand Control on the Instructions of TRANSCO

A **Red Warning** will be, where possible, issued by **TRANSCO** when it is anticipated that it will instruct **DISCOs** and **Non-Embedded Customers** to implement **Demand** reduction.

6.3.1 Demand Control Procedure

Each **DISCO** and **Non-Embedded Customer** shall abide by the instructions of **TRANSCO** with regard to **Demand** reduction without delay.

- i) The **Demand** reduction must be achieved within the **Distribution System** as far as possible uniformly across all **Transmission Supply Points** by **Customer Demand Disconnection**, as soon as possible but in any event no longer than 5 minutes from the instruction being given by **TRANSCO**.
- ii) Each **DISCO** must notify **TRANSCO** in writing by calendar week 48 each year of the integral multiples it will use with effect from the succeeding calendar year onwards.
- iii) The **Red Warning** will specify the percentage of **Demand** reduction that **TRANSCO** may require in integral multiples of the percentage levels notified by **Users** up to 20 per cent of **Demand**, measured at the time the **Demand** reduction is required, of a **DISCO**.
- iv) Where **TRANSCO** wishes to instruct a **Demand** reduction of more than 20 per cent of a **DISCO Demand**, it shall, if it is able, issue a **Red Warning** to the **DISCO** by 16:00 hours on the previous day stating that **TRANSCO** may want to instruct the reduction of more than 20 per cent of its **Demand**.
- v) If **TRANSCO** has issued the **Red Warning** by 16:00 hours on the previous day, on receipt of it the relevant **DISCO** shall make available the percentage reduction in **Demand** specified in the **Red Warning**.
- vi) If **TRANSCO** has not issued the **Red Warning** by 16:00 hours the previous day, but after that time, the **DISCO** shall make available as much of the required **Demand** reduction as it is able.
- vii) If **TRANSCO** has given a **Red Warning** to a **DISCO** and has issued it by 16:00 hours on the previous day, it can instruct the **DISCO** to reduce its **Demand** by the percentage specified in the **Red Warning**.
- viii) **TRANSCO** accepts that if it has not issued the **Red Warning** by 16:00 hours on the previous day or if it has issued it by 16:00 hours on the previous day, but it requires a further percentage of **Demand** reduction from that set out in the **Red Warning**, it can only receive an amount that can be made available at that time by the **DISCO**.
- ix) In circumstances of protracted shortage of generation or where a statutory instruction has been given and when a reduction in **Demand** is envisaged by **TRANSCO** to be prolonged, **TRANSCO** will notify the **DISCO** of the expected duration.
- x) **TRANSCO** may itself implement **Demand** reduction and subsequent restoration on **Non-Embedded Customers** as part of a **Demand Control** requirement and it will organise the **Transmission System** so that it will be able to reduce **Demand** by **Disconnection** of all or any **Non-Embedded Customers**. Equivalent provisions to those in above shall apply to issuing **Red Warnings** to **Non-Embedded Customers**.

- xi) The **DISCO** will notify **TRANSCO** in writing that it has complied with **TRANSCO's** instruction within 5 minutes of so doing, together with an estimation of the **Demand** reduction or restoration achieved.
- xii) Each **DISCO** shall abide by the instructions of **TRANSCO** with regard to the restoration of **Demand** without delay. It shall not restore **Demand** until it has received such instruction. The restoration of **Demand** must be achieved as soon as possible and the process of restoration must begin within 2 minutes of the instruction being given by **TRANSCO**.

6.4 Automatic Low Frequency Demand Disconnection

- i) Each **DISCO** shall make arrangements that will enable automatic low frequency **Demand Disconnection** up to 60 per cent of its total **Demand** as determined by **TRANSCO**. The scheme shall be based upon selecting sufficient **Load** to ensure that up to 60 per cent of its peak **Demand** (based on **Annual MD Conditions**) would be disconnected in order to seek to limit the consequences of a major loss of generation or an **Incident** on the **Total System** which leaves part of the **Total System** with a generation deficit.
- ii) The **Demand** of each **DISCO** which is subject to automatic low frequency **Demand Disconnection** will be split into discrete MW blocks.
- iii) The number, location, size and the associated low frequency settings of these blocks, will be as specified by **TRANSCO** by week 48 in each calendar year following discussion with the **DISCO** and will be reviewed annually by **TRANSCO**.
- iv) The distribution of the blocks will be such as to give a reasonably uniform **Disconnection** within the **Distribution System** across all **Transmission Supply Points**.
- v) Where conditions are such that, following automatic low frequency **Demand Disconnection**, and the subsequent frequency recovery, it is not possible to restore a large proportion of the total **Demand** so disconnected within a reasonable period of time, **TRANSCO** may instruct a **DISCO** to implement additional **Demand Disconnection** manually, and restore an equivalent amount of the **Demand** that had been disconnected automatically. The purpose of such action is to ensure that a subsequent fall in frequency will again be contained by the operation of automatic low frequency **Demand Disconnection**.
- vi) Once an automatic low frequency **Demand Disconnection** has taken place, the **DISCO** on whose **Distribution System**, it has occurred, will not reconnect until **TRANSCO** instructs that **DISCO** to do so.
- vii) Once the **System Frequency** has recovered, each **DISCO** shall abide by the instructions of **TRANSCO** with regard to reconnection without delay. Reconnection must be achieved as soon as possible and the process of reconnection must begin within 2 minutes of the instruction being given by **TRANSCO**.
- viii) **Non-Embedded Customers** including any **Self Supply User** must provide automatic low **Frequency Demand Disconnection**, (which will be split into discrete blocks) unless otherwise agreed with **TRANSCO**. The number and size of blocks and the associated low frequency settings will be as specified by **TRANSCO** by week 48 each calendar year following discussion with the **Non-Embedded Customers and Self-Supply Users**.
- ix) The **DISCO, Self-Supply User** or **Non-Embedded Customer** shall notify **TRANSCO** with an estimation of the **Demand** reduction which has occurred under automatic low

frequency **Demand Disconnection** and similarly notify the restoration, as the case may be, in each case within 5 minutes of the **Disconnection** or restoration.

6.5 Emergency Manual Demand Disconnection

- i) Each **DISCO** shall make arrangements that will enable it, following an instruction from **TRANSCO**, to disconnect **Customers** on its **Distribution System** under emergency conditions irrespective of **System Frequency** within 30 minutes. It must be possible to apply the **Demand Disconnections** to individual or specific groups of **Transmission Supply Points**, as determined by **TRANSCO**.
- ii) Each **DISCO** shall provide **TRANSCO** in writing by week 48 in each calendar year, in respect of the next following year beginning week 48, on a **Transmission Supply Point** basis, with the following information as set out in Appendix D:
 - i) its total peak **Demand** (based on **Annual MD Conditions**); and
 - ii) the percentage value of the total peak **Demand** that can be disconnected within timescales of 5/10/15/20/25/30 minutes.
 - iii) The information should include, in relation to the first 5 minutes, as a minimum, the 20 per cent of **Demand** that must be reduced on instruction.
 - iv) Each **DISCO** shall abide by the instructions of **TRANSCO** with regard to **Disconnection** without delay, and the **Disconnection** must be achieved as soon as possible after the instruction being given by **TRANSCO**. The instruction may relate to an individual **Transmission Supply Point** and/or groups of **Transmission Supply Points**.
 - v) **TRANSCO** will notify a **DISCO** who has been instructed, of what has happened on the **Transmission System** to necessitate the instruction.
 - vi) Once a **Disconnection** has been applied by a **DISCO** at the instruction of **TRANSCO**, that **DISCO** shall not reconnect until **TRANSCO** instructs it to do so.
 - vii) Each **DISCO** shall abide by the instructions of **TRANSCO** with regard to reconnection without delay, and shall not reconnect until it has received such instruction. Reconnection must be achieved as soon as possible and the process of reconnection must begin within 2 minutes of the instruction being given by **TRANSCO**.
 - viii) **TRANSCO** may itself disconnect manually and reconnect **Non-Embedded Customers** as part of a **Demand Control** requirement under emergency conditions.
 - ix) Each **Self-Supply User** shall make arrangements that will enable it, following an instruction from **TRANSCO**, to reduce the import up to zero on its **System** under emergency conditions.
 - x) If **TRANSCO** determines that emergency manual **Disconnection** is inadequate, **TRANSCO** may disconnect **DISCOs** and/or **Non-Embedded Customers** at **Transmission Supply Points**, to preserve the security of the **Transmission System**; and
 - xi) **DISCO** shall supply to **TRANSCO** details of the amount of **Demand** reduction or restoration actually achieved.

6.6 Warning System

The following system of warnings will be adopted by **TRANSCO**. Recipients of the warnings should take such preparatory action as they deem necessary in view of the warning. All warnings will be of a form determined by **TRANSCO** and will remain in force from the stated

time of commencement until the cancellation, amendment or re-issue is notified by **TRANSCO**, other than in the case of a **Demand Control Imminent Warning** which will automatically lapse after 2 hours unless renewed.

Where any of the following warnings has been issued and is current, **Demand Control** should not be employed unless instructed by **TRANSCO**. If **Demand Control** is, however, necessary to preserve the integrity of the **DISCO System**, then the impact upon the integrity of the **Total System** should be considered by the **DISCO** and where practicable discussed with **TRANSCO** prior to its implementation.

6.6.1 Red Warning

- i) A **Red Warning** will be issued by **TRANSCO** to those **DISCOs, Self-Supply Users** and **Non-Embedded Customers** who may subsequently receive instructions relating to a **Demand** reduction.
- ii) It will also be issued to **GENCOS** with **Generating Plant** which may be affected by such instructions.
- iii) The **Red Warning** will specify the period during which **Demand** reduction may be required and the part of the **Total System** to which it applies and any other matters.

6.6.2 Demand Control Imminent Warning

- i) A **Demand Control Imminent Warning**, relating to a **Demand** reduction will be issued by **TRANSCO** to those **DISCOs**, to **GENCOS** and **Non-Embedded Customers** who may subsequently receive **Demand** reduction instructions.
- ii) A **Demand Control Imminent Warning**, relating to a import reduction will be issued by **TRANSCO** to those **Self-Supply Users** who may subsequently receive import reduction instructions
- iii) A **Demand Control Imminent Warning** need not be preceded by any other warning and will be issued when a **Demand** reduction is expected within the following 30 minutes. It will automatically lapse if not reissued by **TRANSCO** after 2 hours from issue.

6.6.3 Preliminary Red Warning

- i) A **Preliminary Red Warning** may be issued by **TRANSCO**, to give as much notice as possible and in any event not later than the time at which the **Generation Schedule** is issued, to **DISCOs** whenever **TRANSCO** anticipates that a protracted period of generation shortage may exist.
- ii) It may also be issued to **GENCOS** with if the **Preliminary Red Warning** is issued 3 hours or less prior to the time at which it is likely that the **GENCOS** may be affected by such instructions.
- iii) It may also be issued to **Non-Embedded Customers**.
- iv) It may also be issued to **Self-Supply Users**.
- v) A **Preliminary Red Warning** will include an estimate of the percentage of **Demand** reduction that may be required and the anticipated duration of the **Demand** reduction. It will also include an estimate of any further percentage of **Demand** reduction that may be required.

- vi) The **Preliminary Red Warning** is intended to enable recipients to plan ahead on the various aspects of **Demand** reduction.

6.7 Scheduling and Despatch During Demand Controls

During **Demand Control**, **Scheduling** and **Despatch** in accordance with the **Merit Order** may cease and will not be re-implemented until **TRANSCO** so decides.

7. DEMAND SIDE RESPONSE

Demand Response services may be provided by each **Non-Embedded Customer** or **Self-Supply User** if agreed with **TRANSCO** or the **Procurer** under **Ancillary Services** agreement and shall be distinguished based on the following categories:

- a) Remotely controlled:
 - i) demand response active power control (represents demand within each **Non-Embedded Customer** or **Self-Supply User** that is available for modulation, which results in an active power modification)
 - ii) demand response transmission constraint management (represents demand within each **Non-Embedded Customer** or **Self-Supply User** that is available for modulation, to manage transmission constraints within the system)
- b) Autonomously controlled:
 - i) Demand Response system frequency control (represents demand within each **Non-Embedded Customer** or **Self-Supply User** that is available for reduction or increase in response to frequency fluctuations, made by an autonomous response from the each **Non-Embedded Customer** or **Self-Supply User** to diminish these fluctuations)
 - ii) Demand Response very fast active power control (represents demand within a demand facility or distribution system that can be modulated very fast in response to a frequency deviation, which results in a very fast active power modification)

Each **Non-Embedded Customer** or **Self-Supply User** may provide demand response services that shall be agreed with **TRANSCO** within the **Connection and Interface Agreement**. **Demand Response** services can include, jointly or separately, upward or downward modification of demand.

Each **Non-Embedded Customer** or **Self-Supply User** may offer **Demand Response** for **System Frequency** control to **TRANSCO**. They shall comply with the following requirements:

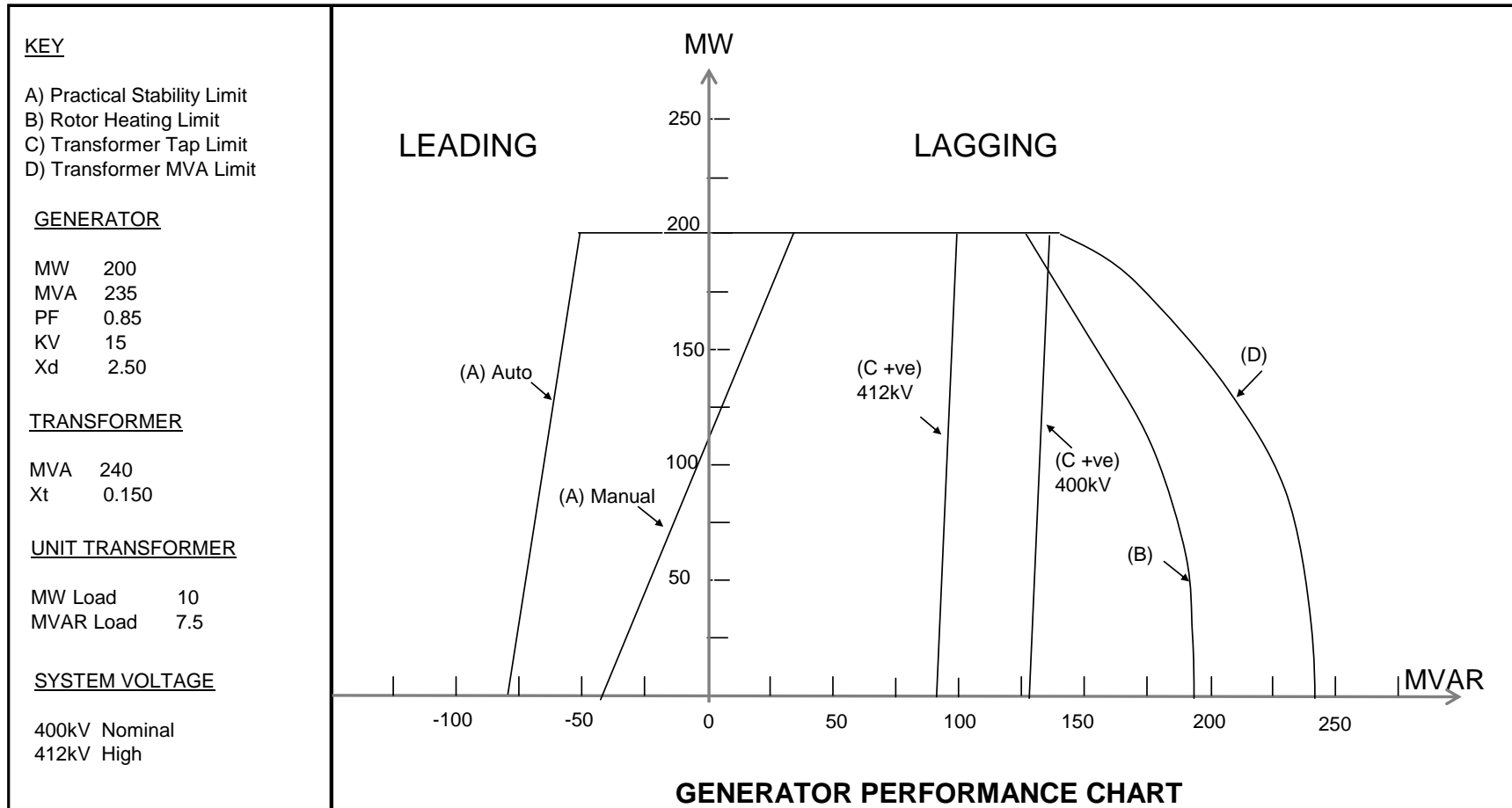
- i) be capable of operating across the frequency ranges specified in section 6.1.1
- ii) be capable of operating across the voltage ranges specified in section 6.1.2
- iii) be equipped with a control system that is insensitive within a dead band around the nominal **System Frequency** of 50.00 Hz, of a width to be specified by **TRANSCO** in consultation with the TSOs in the synchronous area
- iv) be equipped with a controller that measures the actual **System Frequency**.

TRANSCO may agree with each **Non-Embedded Customer** or **Self-Supply User** on a contract for the delivery of demand response very fast active power control. The contract shall specify:

- i) a change of active power related to a measure such as the rate-of-change-of-frequency for that portion of its demand
- ii) the operating principle of this control system and the associated performance parameters
- iii) the response time for very fast active power control, which shall not be longer than two seconds

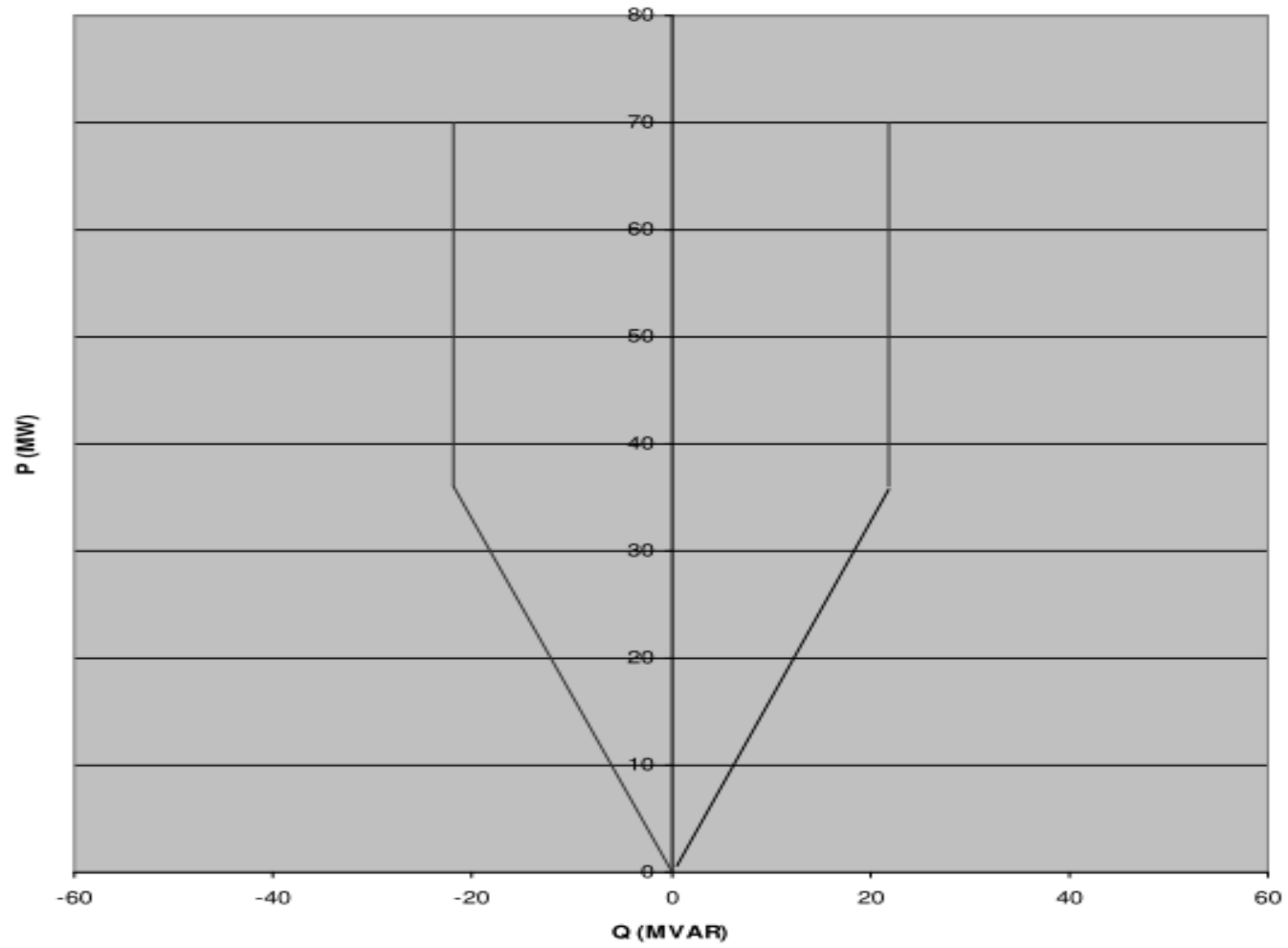
APPENDIX A

1) - SYNCHRONOUS GENERATOR PERFORMANCE CHART



APPENDIX A

2) - WIND AND PHOTOVOLTAIC POWER FARM PERFORMANCE CHART



APPENDIX B - GENERATION PLANNING PARAMETERS

The following parameters are required in respect of each **Generating Unit** and **CCGT Module**:

8. STEAM TURBINE GENERATING UNITS

- i) Minimum notice required to **Synchronise** under following conditions:
 - Cold start;
 - Warm start;
 - Hot start;
- ii) Minimum time between **Synchronising** different **Generating Units** at a **Power Station**;
- iii) Minimum block load requirements on **Synchronising**;
- iv) Maximum **Generating Unit** loading rates from **Synchronising** under the following conditions:
 - Cold start;
 - Warm start;
 - Hot start;
- v) Maximum **Generating Unit** de-loading rate; and
- vi) Minimum interval between **De-Synchronising** and **Synchronising** a **Generating Unit**.

9. GAS TURBINE GENERATING UNITS

- i) Minimum notice required to **Synchronise**;
- ii) Minimum time between **Synchronising** different **Generating Units** at a **Power Station**;
- iii) Minimum block load requirements on **Synchronising**;
- iv) Maximum **Generating Unit** loading rates from **Synchronising** for:
 - Fast start;
 - Normal start;
- v) Maximum **Generating Unit** de-loading rate; and
- vi) Minimum interval between **De-Synchronising** and **Synchronising** a **Generating Unit**.

10. COMBINED CYCLE GAS TURBINE (CCGT) MODULES

Data as in (1) and (2) above is required for Steam Turbine and Gas Turbine generating units of the combined cycle as applicable. In addition, for Gas Turbine generating units that can be run in open cycle mode, data for both modes of operation is required.

11. POWER FARMS

The following parameters are required in respect of each **Power Farm**:

- i) the minimum time to connect or reconnect the **Power Farm** (or part thereof) to the **Transmission System** following a **Despatch** instruction;
- ii) the minimum time to connect or reconnect the **Power Farm** (or part thereof) to the **Transmission System** automatically following a trip of the **Power Farm** (or part thereof) that does not cause damage to the **Power Farm** (or part thereof);
- iii) the maximum rate at which **Load** can be increased following connection of the **Power Farm** (or part thereof) to the **Transmission System**; and
- iv) the minimum fault level or voltage at the **Connection Point** below which the **Power Farm** cannot be connected.

APPENDIX C - OPERATING MARGIN DATA REQUIREMENTS

12. PRIMARY RESPONSE CHARACTERISTICS

The **Primary Response Characteristic** shall be given for each **Generation Unit** for various generator loading conditions as defined in Table C.1:

Generation Unit: _____					
Unit Loading [%]	TPRC [p.u.]	SSPRC [p.u.]	PRPI [p.u.]	TPRC [1...10]	SSPRC[11...30]
(1*)				1 2 3 4 5 6	
(1**)				1 2 3 4 5 6	
(1***)				1 2 3 4 5 6	
(1****)				1 2 3 4 5 6	
(1*****)				1 2 3 4 5 6	

- (1*) Minimum Generation [MW]
- (1**) Intermediate Load 1 [MW]
- (1***) Intermediate Load 2 [MW]
- (1****) Intermediate Load 3 [MW]
- (1*****) Registered Capacity minus Primary Response Reserve [MW]

13. PRIMARY CONTROLLER DROOP CHARACTERISTIC AND DEAD BAND

The **Primary Controller Droop Characteristic and Dead Band** shall be given for each **Generation Unit** for various generator loading conditions as defined in Table C.2:

Generation Unit: _____											
Unit Loading [%]	0.0	10.	20.	30.	40.	50.	60.	70.	80.	90.	100.
Droop (*) [%]											

(*) Load-Related Primary Control Droop

14. PRIMARY CONTROLLER DEAD BAND

The **Primary Controller Dead Band** should be stated as follows:

Generation Unit: _____	
Actual Setting [mHz] / [p.u] ^{1*}	
Minimum Setting [mHz]	
Maximum Setting [mHz]	

(*) Load-Related Controller Dead Band acc. to average Droop

APPENDIX D - EMERGENCY MANUAL DEMAND REDUCTION/DISCONNECTION
SUMMARY SHEET

Transmission Supply Point (Name)	Peak MW	% of Group Demand Disconnection (and/or reduction in the case of the first 5 minutes) (Cumulative)						Remarks
		5	10	15	20	25	30	

Notes: Data to be provided annually by week 48 to cover the following year.

**APPENDIX E - INTERMITTENT POWER SOURCE PLANNING MATRIX WIND
POWER FARM POWER STATIONS**

UNITS	ENERGY INPUT (WIND SPEED) KPH								
		5	10	15	20	25	30		
1									
2									
3									
4									
5									

PHOTOVOLTAIC POWER FARMS and CSTUs

UNITS	ENERGY INPUT (INSOLATION)					
1						
2						
3						

The **Intermittent Power Sources** Planning Matrix may have as many columns as are required to provide information on the number of units, values of intermittent energy inputs and MW outputs for the Farm or **CST** unit.

CHAPTER 5 - OPERATING CODE "B"

1. INTRODUCTION

Operating Code 'B' is concerned with:

- i) Safety Co-ordination;
- ii) Contingency Planning;
- iii) Incident Information Supply;
- iv) Operational Liaison;
- v) Numbering and Nomenclature of **HV Apparatus**;
- vi) System Tests; and
- vii) Testing, Monitoring and Investigation.

2. SCOPE

Operating Code 'B' applies to **TRANSCO**, the Procurer the following **Users**:

- i) **GENCOs**;
- ii) **DISCOs**
- iii) **Non-Embedded Customers**;
- iv) **Self-Supply Users**; and
- v) **User Systems**

The procedures for the establishment of **Safety Precautions** by **TRANSCO** in respect of **External Interconnections** are set out in the appropriate **Interconnection Agreement**.

The procedures for the establishment of **Safety Precautions** by **TRANSCO** in respect of **Self-Supply Users** are set out in the appropriate **Connection and Interface Agreement**.

3. SAFETY CO-ORDINATION

3.1 Introduction

This Section specifies the standard procedures to be used by **TRANSCO** and **Users** for the co-ordination, establishment and maintenance of necessary **Safety Precautions** when work is to be carried out on the **TRANSCO Transmission System** and **User Systems**.

This Section does not seek to impose a particular set of **Safety Rules** on **TRANSCO** and **Users** and the **Safety Rules** to be adopted and used by **TRANSCO** and each **User** shall be those chosen by each.

Following terms shall have the following meanings in this Section only:

1. "**HV Apparatus**" means **High Voltage** electrical circuits forming part of a **System**, on which **Safety** from the **System** may be required or on which **Safety Precautions** may be applied to allow work to be carried out on a **System**.
2. "**Isolation**" means the disconnection of **Apparatus** from the remainder of the **System** in which that **Apparatus** is situated by either of the following:

- i) an **Isolating Device** maintained in an isolating position. The isolating position must be maintained and/or secured by such a method which must be in accordance with the **Local Safety Instructions** of **TRANSCO** or that **User**, or
 - ii) an adequate physical separation which must be in accordance with, and maintained by, the method set out in the **Local Safety Instructions** of **TRANSCO** or that **User**, as the case may be, and, if it is a part of that method, a **Caution Notice** must be placed at the point of separation.
3. "**Earthing**" means a way of providing a connection between conductors and earth by an **Earthing Device** which is maintained and/or secured in position by such a method which must be in accordance with the **Local Safety Instructions** of **TRANSCO** or that **User**.

3.2 Objective

The objective is to achieve **Safety From The System** when work on or near a **System** necessitates the provision of **Safety Precautions** on another **System** on **HV Apparatus** up to a **Connection Point**.

3.3 Procedure

3.3.1 Approval of Local Safety Instructions

Each **User** shall supply to **TRANSCO** a copy of its **Local Safety Instructions** relating to its side of the **Connection Point** at each **Connection Site**.

TRANSCO will supply to each **User** a copy of its **Local Safety Instructions** relating to the **TRANSCO** side of the **Connection Point** at each **Connection Site**.

Prior to connection each party must have approved the other relevant **Local Safety Instructions** in relation to **Isolation** and **Earthing**.

If the party required to give approval requires more stringent provisions relating to **Isolation** and/or **Earthing** the other party will make such changes as soon as reasonably practicable to the provisions in its **Local Safety Instructions**. There is no right to withhold approval on the grounds that the party required to approve reasonably believes the provisions relating to **Isolation** and/or **Earthing** are too stringent.

If, following approval, a party wishes to change the provisions in its **Local Safety Instructions** relating to **Isolation** and/or **Earthing**, it must inform the other party. If the change is to make the provisions more stringent, then the other party merely has to note the changes. If the change is to make the provisions less stringent, then the other party needs to approve the new provisions and the procedures referred to above apply.

3.3.2 Safety Co-ordinators

TRANSCO and each **User** shall at all times have nominated a **Safety Co-ordinator** to be responsible for the co-ordination of **Safety Precautions** at each **Connection Point**, when work is to be carried out on a **System** which necessitates the provision of **Safety Precautions** on **HV Apparatus**. A **Safety Co-ordinator** may be responsible for the co-ordination of safety on **HV Apparatus** at more than one **Connection Point**.

Each **User** shall, prior to being connected to the **Transmission System**, give notice in writing to **TRANSCO** of the identity of its **Safety Co-ordinator(s)** and will update the written notice whenever there is a change to the identity of its **Safety Co-ordinator(s)** or **Connection Points**.

TRANSCO will, at the time of a **User** being connected to the **Transmission System**, give notice in writing to that **User** of its **Safety Co-ordinator(s)** and will update the written notice whenever there is a change to the **Safety Co-ordinator(s)** or **Connection Points**.

Contact will be made between **Safety Co-ordinators** via normal operational channels, and accordingly separate telephone numbers for **Safety Co-ordinators** need not be provided.

If work is to be carried out on a **System** or on equipment of **TRANSCO** or a **User** near to a **System** which necessitates provision of **Safety Precautions** on **HV Apparatus** the **Safety Co-ordinator** who is identified on the relevant **Site Responsibility Schedule** as responsible for the **HV Apparatus** on which **Safety From The System** is to be achieved (the "**Requesting Safety Co-ordinator**") shall contact the **Safety Co-ordinator** who is identified on that same **Site Responsibility Schedule** as responsible for the **HV Apparatus** which is connected at the **Connection Point** to the **HV Apparatus** on which **Safety From The System** is required (the "**Implementing Safety Co-ordinator**"), to co-ordinate the **Safety Precautions**.

3.3.3 Record of Inter-System Safety Precautions ("RISSP")

This Section sets out the procedures for utilising the **Record of Inter-System Safety Precautions** ("**RISSP**").

TRANSCO will use forms designated "**RISSP-A**" [to be detailed] when **TRANSCO** is the **Requesting Safety Co-ordinator**, and forms designated as "**RISSP-B**" [to be detailed] when **TRANSCO** is the **Implementing Safety Co-ordinator**.

Users may either adopt the **TRANSCO** format or use an equivalent format, provided that it includes sections requiring insertion of the same information and has the same numbering of sections as **RISSP-A** and **RISSP-B**.

RISSP forms will have an identifying number, comprising a prefix which identifies the location at which it is issued, and a unique serial number [to be detailed].

It should be noted that there may be more than one **RISSP** covering an isolated zone, each **RISSP** possibly covering the same points of **Isolation**. This would arise, for example, where work is being carried out simultaneously by **TRANSCO** and a **User** within the same points of **Isolation**. Each of **TRANSCO** and the **User** must utilise the **RISSP** procedure separately in that case, each having a **Requesting Safety Co-ordinator** for their **RISSP**.

3.4 Safety Precautions on HV Apparatus

3.4.1 Safety Precautions

For the purpose of the co-ordination of safety relating to **HV Apparatus** the term "**Safety Precautions**" means **Isolation** and/or **Earthing**.

3.4.2 Agreement of Safety Precautions

When **TRANSCO** or a **User** wishes to carry out work on its **System** and for this to be done safely, **Safety Precautions** are required on **HV Apparatus** the **Requesting Safety Co-ordinator** will contact the **Implementing Safety Co-ordinator** in order to agree the **Location** at which the **Safety Precautions** will be implemented or applied.

When the **Implementing Safety Co-ordinator** is of the opinion that **Safety Precautions** are required on the **Requesting Safety Co-ordinator System**, the **Implementing Safety Co-ordinator** shall inform the **Requesting Safety Co-ordinator**.

When **TRANSCO** wishes to carry out work on the **Transmission System** and it is of the opinion that for this to be done safely, **Safety Precautions** are required on the **System** of more than one **User** the provisions of this Section shall be followed with regard to each **User** separately.

3.4.3 Agreement of Isolation

The **Requesting Safety Co-ordinator** shall inform the **Implementing Safety Co-ordinator** of the **HV Apparatus** on which **Safety From the System** is to be achieved and they will need to reach agreement on the **Location(s)** at which **Isolation** is to be established.

The **Implementing Safety Co-ordinator** shall promptly then inform the **Requesting Safety Co-ordinator** of the following:

- i) for each **Location**, the identity (by means of **HV Apparatus** name, nomenclature and numbering or position) of each point of **Isolation**;
- ii) whether **Isolation** is to be achieved by an **Isolating Device** in the isolating position or by an adequate physical separation;
- iii) where an **Isolating Device** is to be used that the isolating position will be maintained and/or secured by such a method which must be in accordance with the **Local Safety Instructions** of **TRANSCO** or that **User**.

3.4.4 Agreement of Earthing

If the **Requesting Safety Co-ordinator** requires **Earthing** he shall inform the **Implementing Safety Co-ordinator** of the **HV Apparatus** on which **Safety From The System** is to be achieved and that **Earthing** is to be provided and they will need to reach agreement on the **Location(s)** at which **Earthing** is to be established.

The **Implementing Safety Co-ordinator** shall then inform the **Requesting Safety Co-ordinator** of the following:

- i) for each **Location**, the identity (by means of **HV Apparatus** name, nomenclature and numbering or position) of each point of **Earthing**; and
- ii) in respect of the **Earthing Device** to be used that it will be maintained and/or secured in position by such a method which is in accordance with the **Local Safety Instructions** of **TRANSCO** or that **User**.

3.4.5 In the event of disagreement

In any case where the **Requesting Safety Co-ordinator** and the **Implementing Safety Co-ordinator** are unable to agree the **Location** of the **Isolation** and (if requested) **Earthing**, it shall be at the closest available points on the infeeds to the **HV Apparatus** on which **Safety From The System** is to be achieved as indicated on the **Operation Diagram**.

3.4.6 Implementation of Isolation and Earthing

Once the **Location** of **Isolation** and (if requested) **Earthing** are agreed in accordance with above Sections, the following procedure will apply:

- i) the **Implementing Safety Co-ordinator** will ensure the implementation of the **Isolation**;
- ii) the **Implementing Safety Co-ordinator** will confirm to the **Requesting Safety Co-ordinator** that the **Isolation** has been established on his **System** and that **Isolation** has been established on the **System** of any other **User**;
- iii) when the **Implementing Safety Co-ordinator** has confirmed the establishment of **Isolation** in accordance with (ii) above, the **Requesting Safety Co-ordinator** shall confirm to the **Implementing Safety Co-ordinator** the establishment of relevant **Isolation** on his **System** and request, if it has been required, the implementation of the **Earthing**;
- iv) the **Implementing Safety Co-ordinator** will ensure the implementation of the **Earthing** ; and
- v) the **Implementing Safety Co-ordinator** will confirm to the **Requesting Safety Co-ordinator** that the **Earthing** has been established on his **System** and that **Earthing** has been established on the **System** of any other **User** (if that is the case).

3.4.7 Recording of Safety Precautions

Following confirmation by the **Implementing Safety Co-ordinator** to the **Requesting Safety Co-ordinator** that:

- i) all the agreed **Safety Precautions** have been established on the **System** of the **Implementing Safety Co-ordinator**; and
- ii) any other **User(s)** which has been obliged to achieve **Safety Precautions** has done so,

the **Implementing Safety Co-ordinator** will record the details of the **HV Apparatus** on which he has been told that **Safety From The System** is required and the **Safety Precautions** established on the **System** of the **Implementing Safety Co-ordinator** onto the **RISSP-B**.

The **Implementing Safety Co-ordinator** shall then contact the **Requesting Safety Co-ordinator** and confirm, by reading out the details entered on the **RISSP-B**, to the **Requesting Safety Co-ordinator**, that the **Safety Precautions** have been established.

The **Requesting Safety Co-ordinator** will then complete **RISSP-A** with the precise details received from the **Implementing Safety Co-ordinator** and then read out all those details to the **Implementing Safety Co-ordinator**. If both confirm that the details entered are the same, the **Requesting Safety Co-ordinator** shall issue the **RISSP** identifying number, as stated on the **RISSP-A**, to the **Implementing Safety Co-ordinator** who shall ensure that the number including its prefix and suffix is correctly entered on the **RISSP-B**.

The **Requesting Safety Co-ordinator** and the **Implementing Safety Co-ordinator** shall then respectively complete **RISSP-A** and **RISSP-B** (which relates to the identity and location of the **Implementing Safety Co-ordinator** and the **Requesting Safety Co-ordinator** respectively). Each **Safety Co-ordinator** shall then complete the issue of the **RISSP** by signing their respective **RISSPs** and then enter the time and date.

The **Requesting Safety Co-ordinator** is then free to authorise work including a test that does not affect the **Implementing Safety Co-ordinator System**.

3.4.8 Testing affecting other Safety Co-ordinator System

The carrying out of the test may affect **Safety Precautions** on other **RISSPs** or work being carried out where other **RISSPs** are in place. Testing can, for example, include the application of an independent test voltage. Accordingly, where the **Requesting Safety Co-ordinator** wishes to authorise the carrying out of a test to which the procedures in this Section apply he may not do so and the test will not take place unless and until the steps in i) to iii) below have been followed:

- i) confirmation must be obtained from the **Implementing Safety Co-ordinator** that
 - i) no person is working on, or testing, or has been authorised to work on, or test, any part of its **System** within the points of **Isolation** identified on the **RISSP** form relating to the test which is proposed to be undertaken (the "**Relevant RISSP Associated with the Test**"), and the points of **Isolation** on the **Requesting Safety Co-ordinator System**, and
 - ii) no person will be so authorised until the proposed test has been completed (or cancelled) and the **Requesting Safety Co-ordinator** has notified the **Implementing Safety Co-ordinator** of its completion (or cancellation) and thereby the cancellation of the requirements;
- ii) all current **RISSPs** (except for the **Relevant RISSP Associated with the Test**) between the **Requesting Safety Co-ordinator** and the **Implementing Safety Co-ordinator** which relate to that part of the **System** between the points of **Isolation** identified on the **Relevant RISSP Associated with the Test** and the points of **Isolation** on the **Requesting Safety Co-ordinator System**, must have been cancelled in accordance with the procedures set out in this Section.
- iii) the **Implementing Safety Co-ordinator** must agree with the **Requesting Safety Co-ordinator** to permit the testing on that part of the **System** between the points of **Isolation** identified in the **Relevant RISSP Associated with the Test** and the points of **Isolation** on the **Requesting Safety Co-ordinator System**.

The **Requesting Safety Co-ordinator** will inform the **Implementing Safety Co-ordinator** by notice as soon as the test has been completed or cancelled.

3.4.9 Loss of Integrity of Safety Precautions

In any instance when any **Safety Precautions** may be ineffective for any reason the relevant **Safety Co-ordinator** shall inform the other **Safety Co-ordinator(s)** without delay of that being the case and, if requested, of the reasons why.

3.5 Safety Log

TRANSCO and Users shall maintain **Safety Logs** which shall be a chronological record of all messages relating to safety co-ordination under this Section sent and received by the **Safety Co-ordinator(s)**. The **Safety Logs** must be retained for a period of not less than one year.

4. CONTINGENCY PLANNING

4.1 Introduction

This Section of **Operating Code 'B'** covers the following:

- i) **Black Starts:** The implementation of recovery procedures following a **Total Shutdown** or **Partial Shutdown**.
- ii) **Re-Synchronisation of Islands:** The **Re-Synchronisation** of parts of the **Total System** which have become **Out of Synchronism** with each other but where there is no **Total Shutdown** or **Partial Shutdown**.
- iii) **Joint System Incident Procedure:** The establishment of a communication route and arrangements between senior management representatives of **TRANSCO** and **Users** involved in, or who may be involved in, an actual or potential serious or widespread disruption to the **Total System** or a part of the **Total System**, which requires, or may require, urgent managerial response, day or night, but which does not fall within the provisions of a civil emergency, and
- iv) The procedure to be followed to continue safe and reliable operations in the event of the total loss of **TRANSCO's** or a **User's Control Centre** or communication facilities.

In the event of a civil emergency Crown Prince has powers to make orders and give directions controlling the production, supply, acquisition or use of electricity. In the event of such directions the provisions of the **Electricity Transmission Code** will be suspended.

4.2 Objective

The overall objectives are:

- i) To achieve, as far as possible, restoration of the **Total System** and associated **Demand** in the shortest possible time, taking into account **Power Station** capabilities, including **Embedded Generating Units**, transfers across any **External Interconnections**, transfer across any connection with **Self-Supply User** and the operational constraints of the **Total System**.
- ii) To achieve the **Re-Synchronisation** of parts of the **Total System** which have become **Out of Synchronism** with each other.
- iii) To ensure that communication routes and arrangements are available to enable senior management representatives of **TRANSCO** and **Users**, who are authorised to make binding decisions on behalf of **TRANSCO** or the relevant **User** to communicate with each other during a **Joint System Incident**; and
- iv) To ensure that the **Transmission System** can continue to operate in the event of the total loss of **TRANSCO** or a **User Control Centre** or communication facilities.

4.3 Black Start

4.3.1 System Shutdown

A "**Total Shutdown**" is the situation existing when all generation has ceased and there is no electricity supply across **External Interconnections**. Therefore, the **Total System** has shutdown with the result that it is not possible for the **Total System** to begin to function again without **TRANSCO** directions relating to a **Black Start**.

A **Total Shutdown** for the **User System** at **Self-Supply User** is the situation when all their generators has ceased and there is no electricity supply across connection points with **TRANSCO**.

A "**Partial Shutdown**" is the same as a **Total Shutdown** except that all generation has ceased in a separate part of the **Total System** and there is no electricity supply from other parts of the **Total System** or from **External Interconnections** to that part of the **Total System**. Therefore, that part of the **Total System** is shutdown with the result that it is not possible for that part of the **Total System** to begin to function again without **TRANSCO** directions relating to a **Black Start**.

During a **Total Shutdown** or **Partial Shutdown** and during the subsequent recovery, the **Licence Standards** may not apply and the **Total System** may be operated outside normal voltage and frequency standards. Also **Scheduling** and **Despatch** will need to take account of the **System** conditions and this may mean that **Table 'x' Merit Orders** are departed from in compiling the **Generation Schedule and Despatch**.

Certain **Power Stations** ("**Black Start Stations**") are registered as having an ability for at least one of its **Generating Units** to **Start-Up** from **Shutdown** and to energise a part of the **Total System**, or be **Synchronised** to the **System**, upon instruction from **TRANSCO** within two hours, without an external electrical power supply ("**Black Start Capability**").

Each **Self-Supply User** shall have an ability for at least one of **Generating Units** to **Start-Up** from **Shutdown** and to energise its system (or a part of that system) and, on **TRANSCO** request, a part of total system (when the circumstances are such that **TRANSCO** needs a support). **Self-Supply User** shall keep the right not to accept the instructions which might lead to endangerment of its system.

Some types of **Generating Units** are not capable of operating in island mode and should not therefore be considered for **Black Start Capability**. These types of **Generating Unit** include those powered by intermittent sources and nuclear plants. The limitations on the operation of these types of **Generating Unit** shall be taken into account when drawing up **System** restoration plan.

4.3.2 Black Start Situation

In the event of a **Total Shutdown** or **Partial Shutdown**, **TRANSCO** will inform **Users** that a **Total Shutdown** or a **Partial Shutdown** exists and that **TRANSCO** intends to implement a **Black Start**.

In the case the **Shutdown** commenced in **Self-Supply System**, **Self-Supply User** will inform **TRANSCO** that a shutdown exist and that **Self-Supply User** intends to implement a **Black Start**.

The complexities and uncertainties of recovery from a **Total Shutdown** or **Partial Shutdown** require that the procedure is sufficiently flexible in order to accommodate the full range of **Power Station** and **Total System** characteristics and operational possibilities, and this precludes the setting out of concise chronological sequences. The overall strategy will, in general, include the overlapping phases of establishment of isolated **Power Stations**, or isolated groups of **Power Stations**, together with complementary local **Demand**, termed "**Power Islands**", step by step integration of these **Power Islands** into larger sub-systems and eventually re-establishment of a complete **Total System**.

The procedure for a **Black Start** will, therefore, be that specified by **TRANSCO** at the time. **Users** shall abide by **TRANSCO** instructions during a **Black Start** situation provided that the instructions are to operate within each **Generating Unit** declared operational capability.

TRANSCO instructions may be to a **Black Start Station** or to a **DISCO** with an **Embedded Black Start Station** relating to the commencement of generation or to a **Non-Embedded Customer** relating to the restoration of **Demand**, or to an **Self-Supply User** in relation to supplying a part of Total System by **Self-Supply User**, or to an **External System Operator** in relation to an **External Interconnection** and to a **Power Station** relating to preparation for commencement of generation when an external power supply is made available to it, and in each case may include switching instructions.

4.3.2.1 Procedure

- i) Where **TRANSCO** has given an instruction to a **Black Start Station** to initiate **Start-Up**, the **Black Start Station** will **Start-Up** as soon as possible and within two hours and will confirm to **TRANSCO** when **Start-Up** of a **Generating Unit** has been completed.
- ii) **Self-Supply User** will initiate **Start-Up**, independently as soon as possible and inform **TRANSCO** when it is ready to connect the **System** on **Connection point**.
- iii) Following such confirmation, **TRANSCO** will endeavour to stabilise that **Generating Unit** by the establishment of appropriate **Demand**, following which **TRANSCO** may instruct the **Start-Up** and **Synchronisation** of the remaining available **Generating Units** at that **Black Start Station** and their loading with appropriate **Demand** to create a **Power Island**.
- iv) If during this **Demand** restoration process any **Generating Unit** cannot, because of the **Demand** being experienced, keep within its safe operating parameters, the **GENCO** shall inform **TRANSCO** and **TRANSCO** will, where possible, either instruct **Demand** to be altered or will re-configure the **Transmission System** or will instruct a **User** to re-configure its **System** in order to alleviate the problem being experienced by the **GENCO**.
- v) **TRANSCO** accepts that the decision to keep that **Generating Unit** operating, if outside its safe operating parameters, is one for the **GENCO** concerned alone and accepts that the **GENCO** may change generation on that **Generating Unit** if it believes it is necessary for safety reasons.
- vi) **TRANSCO** will instruct the relevant **User**, where possible, to interconnect **Power Islands** to achieve larger sub-systems, and subsequently may instruct the interconnection of these sub-systems to form an integrated system. This should eventually achieve the re-establishment of the **Total System** or that part of the **Total System** subject to the **Partial Shutdown**.

As part of the **Black Start** strategy, **DISCOs** with any **Embedded Power Stations** within their **Distribution System** and **Self-Supply User** with any **Power Station** in its System, which have become islanded, may in liaison with **TRANSCO** sustain and expand these islands and they will inform **TRANSCO** of their actions and will not **Re-Synchronise** to the **Transmission System** without **TRANSCO** agreement.

The conclusion of the **Black Start**, and the time of the return to normal operation of the **Total System**, will be determined by **TRANSCO** who shall inform **Users** that the **Black Start** situation no longer exists and that normal operation of the **Total System** has begun.

4.4 Re-Synchronisation of De-Synchronised Islands

Where parts of the **Total System** are **Out of Synchronism** with each other (each such part being termed a "**De-Synchronised Island**"), but there is no **Total Shutdown** or **Partial Shutdown**, **TRANSCO** will instruct **Users** to regulate generation or **Demand** to enable the **De-Synchronised Islands** to be **Re-Synchronised** and **TRANSCO** will inform those **Users** when **Re-Synchronisation** has taken place.

In case the **Self-Supply User** is **Out of Synchronism** and operates as a "**De-Synchronised Island**" but there is no **Total Shutdown** or **Partial Shutdown**, **TRANSCO** will instruct **Self-Supply User** to regulate frequency to enable the **De-Synchronised Islands** to be **Re-Synchronised** and **TRANSCO** will inform those **Self-Supply User** when **Re-Synchronisation** has taken place.

TRANSCO may decide that, to enable **Re-Synchronisation**, **Scheduling** and **Despatch** needs to take account of the **System** conditions and this may mean that the unit commitment schedule is departed from in compiling the **Generation Schedule** and **Despatch**.

4.5 Joint System Incident Procedure

A "**Joint System Incident**" is

- i) an **Incident**, wherever occurring which, in the opinion of **TRANSCO** or a **User**, has or may have a serious and/or widespread effect.
- ii) In the case of an **Incident** on a **User System** the effect must be on the **Transmission System**, and in the case of an **Incident** on the **Transmission System**, the effect must be on a **User System**.

4.5.1 Joint System Incident Communications

Telephone numbers at which, or through which, senior management representatives nominated for this purpose and who are fully authorised to make binding decisions on behalf of **TRANSCO** or the relevant **User** can be contacted day or night when there is a **Joint System Incident** shall be provided by:

- i) Each **User** in writing to **TRANSCO**; and
- ii) **TRANSCO** in writing to each **User**.

The lists of telephone numbers will be provided prior to the time that a **User** connects to the **Transmission System** and must be up-dated (in writing) as often as the information contained in them changes.

4.5.2 Notification of an Incident Leading to a Joint System Incident

Following notification of an **Incident TRANSCO** or a **User** will, if it considers necessary, telephone the **User** or **TRANSCO** to obtain such additional information as it requires.

Following notification of an **Incident** and/or the receipt of any additional information **TRANSCO** or a **User** will determine whether or not the **Incident** is a **Joint System Incident**, and, if so, **TRANSCO** and/or the **User** may set up an **Incident Centre** in order to avoid overloading the existing **TRANSCO** or that **User** operational/control arrangements.

Where **TRANSCO** has determined that an **Incident** is a **Joint System Incident**, **TRANSCO** shall, as soon as possible, notify all relevant **Users** that a **Joint System Incident** has occurred and, if appropriate, that it has established an **Incident Centre** and the telephone number(s) of its **Incident Centre** if different from those already supplied.

If a **User** establishes an **Incident Centre** it shall, as soon as possible, notify **TRANSCO** that it has been established and the telephone number(s) of the **Incident Centre** if different from those already supplied.

The **TRANSCO Incident Centre** and/or the **User Incident Centre** will not assume any responsibility for the operation of the **Transmission System** or **User System** but will be the focal point in **TRANSCO** or the **User** for:

- i) the communication and dissemination of information between **TRANSCO** and the senior management representatives of **User(s)**; or
- ii) between the **User** and the senior management representatives of **TRANSCO**.

The term "**Incident Centre**" does not imply a specially built centre for dealing with **Joint System Incidents**, but is a communications focal point. During a **Joint System Incident**, the normal communication channels, for operational/control communication between **TRANSCO** and **Users** will continue to be used.

All communications between the senior management representatives of the relevant parties with regard to **TRANSCO** role in the **Joint System Incident** shall be made via **TRANSCO Incident Centre** if it has been established.

All communications between the senior management representatives of **TRANSCO** and a **User** with regard to that **User** role in the **Joint System Incident** shall be made via that **User Incident Centre** if it has been established.

TRANSCO will decide when conditions no longer justify the need to use its **Incident Centre** and will inform all relevant **Users** of this decision.

Each **User** which has established an **Incident Centre** will decide when conditions no longer justify the need to use that **Incident Centre** and will inform **TRANSCO** of this decision.

4.6 Loss of the TRANSCO Control Centre

Following notification of the loss of the **TRANSCO Control Centre**, each **GENCO** shall continue to operate its **Generating Units** in accordance with the last **Despatch** instructions to

have been issued by **TRANSCO** but shall use all reasonable endeavours to maintain **System Frequency** at the **Target Frequency** of 50Hz plus or minus 0.05 Hz by monitoring **System Frequency** and increasing/decreasing the output of its **Generating Units** as necessary until such time as new **Despatch** instructions are received from **TRANSCO**.

Following notification of the loss of the **TRANSCO Control Centre**, each **Self-Supply User** shall continue to operate its **Generating Units** in accordance with the pre-incident import / export level.

TRANSCO will have arrangements in place whereby, if the circumstances described above arise, **TRANSCO** may transfer the functions of its **Control Centre** to an alternative control facility whereupon **TRANSCO** will re-commence the issue of **Despatch** instructions in accordance with the **Scheduling and Despatch Code** and inform **Users** of the communications details for the new location. **TRANSCO** will inform all **GENCOS** as and when **Scheduling** and/or **Despatch** in accordance with the principles in the **Scheduling and Despatch Code** for determining which **Generating Units** will be Scheduled and Despatched can be re-implemented.

5. INCIDENT INFORMATION SUPPLY

5.1 Introduction

This section of **Operating Code 'B'** sets out:

- i) the requirements for the reporting in writing those **Significant Incidents** which were initially reported to **TRANSCO** or a **User** orally; and
- ii) the mechanism for the joint investigation of a **Significant Incident** or a series of **Significant Incidents** if **TRANSCO** and the relevant **Users** agree.

5.2 Objective

The objective of **Incident Information Supply** is to facilitate the provision of more detailed information, in writing, of **Significant Incidents** which were initially orally reported under Section 6 of this **Operating Code 'B'** and to enable joint investigations to take place if **TRANSCO** and the relevant **Users** agree.

5.3 Procedure

5.3.1 Written Reporting of Incidents by Users to TRANSCO

In the case of an **Incident** which was initially reported by a **User** to **TRANSCO** orally and subsequently determined by **TRANSCO** to be a **Significant Incident** the **User** will give a written report to **TRANSCO**. **TRANSCO** will not pass on this report to other affected **Users** but may use the information contained therein in preparing a report to another **User** in relation to a **Significant Incident**.

5.3.1.1 Written Reporting of Incidents by TRANSCO to Users

In the case of an **Incident** which was initially reported by **TRANSCO** to a **User** orally and subsequently determined by the **User** to be a **Significant Incident** **TRANSCO** will give a written report to the **User**. The **User** will not pass on the report to other affected **Users** but:

- i) a **DISCO** may use the information contained therein in preparing a written report to a **GENCO** with a **Generating Unit** connected to its **System** in connection with reporting the equivalent of a **Significant Incident** under the **Distribution Code**; and
- ii) a **GENCO** may use the information contained therein in preparing a written report to another **GENCO** with a **Generating Unit** connected to its **System** or to a **DISCO** connected to its **System** if it is required to do so in connection with the equivalent of a **Significant Incident** on its **System**.

5.3.1.2 Form of Report

A report shall be sent to **TRANSCO** or to a **User** and will contain a confirmation of the oral notification together with more details relating to the **Significant Incident**. The report should, as a minimum, contain those matters specified in the Appendix A. **TRANSCO** or the **User** may raise questions to clarify the notification and the giver of the notification will, in so far as it is able, answer any questions raised.

5.3.1.3 Timing of Report

A full written report must, if possible, be received by **TRANSCO** or the **User** within 2 hours of **TRANSCO** or the **User** receiving oral notification. If this is not possible, the **User** or **TRANSCO** shall, within this period, submit a preliminary report setting out, as a minimum, those matters specified in the Appendix A. As soon as reasonably practical thereafter, the **User** or **TRANSCO** shall submit a full written report.

5.3.2 Joint Investigations

Where a **Significant Incident** has been declared and a report submitted, **TRANSCO** or a **User** which has either given or received a written report may request that a joint investigation of a **Significant Incident** should take place.

Where there has been a series of **Significant Incidents** (i.e. where a **Significant Incident** has caused or exacerbated another **Significant Incident**) the party requesting a joint investigation or the recipient of such a request, may request that the joint investigation should include an investigation into that other **Significant Incident(s)**.

TRANSCO or a **User** may also request that:

- (i) an **External System Operator** and/or
- (ii) in the case of a **DISCO** a **GENCO** with a **Generating Unit** connected to its **System** or another **User System** connected to its **System** or
- (iii) in the case of a another **GENCO** with a **Generating Unit** connected to its **System** or a **User System** connected to its **System**.

be included in the joint investigation.

A joint investigation will only take place if **TRANSCO** and the **Users** involved agree to it. The form and rules of, the procedure for, and all matters relating to the joint investigation will be agreed at the time of a joint investigation.

6. OPERATIONAL LIAISON

6.1 Introduction

This section of **Operating Code B** sets out the requirements for the exchange of information in relation to operations and/or events on the **Total System** which will have an **Operational Effect**:

- i) on the **Transmission System** in the case of an operation and/or event occurring on the **System** of a **User**; and
- ii) on the **System** of a **User** in the case of an operation and/or event occurring on the **Transmission System**.

It also provides for **Amber Warnings**.

The requirement relates to notifying of what is expected to happen or what has happened and not the reasons why. However when an event or operation has occurred on the **Transmission System** which itself has been caused by (or exacerbated by) an operation or event on a **User System**, **TRANSCO** in reporting the event or operation on the **Transmission System** to another **User** can pass on what it has been told by the first **User** in relation to the operation or event on the first **User System**.

6.2 Objective

To provide for the exchange of information so that the implications of an operation and/or event can be considered, possible risks arising from it can be assessed and appropriate action taken by the relevant party in order to maintain the integrity of the **Total System**.

6.3 Procedure

The term "**Operation**" means a scheduled or planned action relating to the operation of a **System**.

The term "**Incident**" means an unscheduled or unplanned (although it may be anticipated) occurrence on, or relating to, a **System** including, faults, events and breakdowns and adverse weather conditions being experienced.

The term "**Operational Effect**" means any effect on the operation of the relevant other **System** which causes the **Systems** of **TRANSCO** or the other **Users** to operate differently to the way in which they would or may have normally operated in the absence of that effect.

6.3.1 Requirement to notify Operations

The following are examples of situations where notification will be required if they will or may have an **Operational Effect**:

- i) the implementation of a planned outage of **Plant** and/or **Apparatus**;
- ii) the operation (other than, in the case of a **User**, at the instruction of **TRANSCO**) of any circuit breaker or isolator/disconnector or any sequence or combination of the two; or
- iii) voltage control.

6.3.1.1 Operation on the TRANSCO Transmission System

In the case of an operation on the **Transmission System**, which will have an **Operational Effect** on the **System** of a **User**, TRANSCO will notify the **User** whose **System** will be affected.

6.3.1.2 Operation on a User System

In the case of an operation on the **System** of a **User** which will have an **Operational Effect** on the **Transmission System** the **User** will notify TRANSCO. Following notification by the **User**, TRANSCO will notify any other **Users** on whose **Systems** the **Operation** will have an **Operational Effect**.

6.3.1.3 Form of Notification

A notification and any response to any questions of an operation which has arisen independently of any other operation or of an event, shall be of sufficient detail to describe the operation and to enable the recipient of the notification reasonably to consider and assess the implications and risks arising and will include the name of the individual reporting the operation on behalf of TRANSCO or the **User**. The recipient may ask questions to clarify the notification and the giver of the notification will, insofar as it is able, answer any questions raised.

6.3.1.4 Timing

A notification will be given as far in advance as possible and in any event shall be given in sufficient time as will reasonably allow the recipient to consider and assess the implications and risks arising.

6.3.2 Requirements to notify Incidents

Without limiting the requirements under 6.3.1.1 or 6.3.1.2, the following are examples of situations where notification will be required if they have an **Operational Effect**:

- i) where **Plant** and/or **Apparatus** is being operated in excess of its capability or may present a hazard to personnel;
- ii) the activation of any alarm or indication of any abnormal operating condition;
- iii) adverse weather conditions being experienced;
- iv) breakdown of, or faults on, or temporary changes in the capabilities of, **Plant** and/or **Apparatus**;
- v) breakdown of, or faults on, control, communication and metering equipment; or
- vi) increased risk of inadvertent protection operation.

6.3.2.1 Incidents on the Transmission System

In the case of an **Incident** on the **Transmission System** which has had an **Operational Effect** on the **System** of a **User**, TRANSCO will notify the **User** whose **System** has been affected.

6.3.2.2 Incidents on a User System

In the case of an **Incident** on the **System** of a **User** which has had an **Operational Effect** on the **Transmission System**, the **User** will notify **TRANSCO**.

6.3.2.3 Incidents caused by another Incident or by an Operation

An **Incident** may be caused (or exacerbated by) another **Incident** or by an **Operation** on another **System** and in that situation the information to be notified is different to that where the **Incident** arose independently of any other **Incident** or **Operation**.

TRANSCO or a **User** may enquire of the other whether an **Incident** has occurred on the other **System**. If it has, and the party on whose **System** the **Incident** has occurred is of the opinion that it may have had an **Operational Effect** on the **System** of the party making the enquiry, it shall notify the enquirer.

6.3.2.4 Form of Notification

A notification and any response to any questions asked of an **Incident** which has arisen independently of any other **Incident** or of an **Operation**, will describe the **Incident**, although it need not state the cause of the **Incident**, and will be of sufficient detail to enable the recipient of the notification reasonably to consider and assess the implications and risks arising and will include the name of the individual reporting the **Incident** on behalf of **TRANSCO** or the **User**. The recipient may ask questions to clarify the notification and the giver of the notification will, insofar as it is able, answer any questions raised.

6.3.2.5 Timing

A notification shall be given as soon as possible after the occurrence of the **Incident**, or time that the **Incident** is known of or anticipated by the giver of the notification.

6.3.3 Significant Incidents

Where a **User** notifies **TRANSCO** of an **Incident** which **TRANSCO** considers has had or may have had a significant effect on the **Transmission System**, **TRANSCO** will require the **User** to report that **Incident** in writing and will notify that **User** accordingly.

Where **TRANSCO** notifies a **User** of an **Incident** which the **User** considers has had a significant effect on that **User System**, that **User** will require **TRANSCO** to report that **Incident** in writing and will notify **TRANSCO** accordingly.

Incidents which **TRANSCO** requires a **User** to report in writing and **Incidents** which a **User** requires **TRANSCO** to report in writing are known as "**Significant Incidents**".

A **Significant Incident** will include **Incidents** having an **Operational Effect** which result in, or may result in, the following:

- i) operation of **Plant** and/or **Apparatus** either manually or automatically;
- ii) voltage outside statutory limits;
- iii) **System Frequency** outside limits within which is controlled (se 6.1.1 of Connection Code);
or

- iv) **System** instability.

6.3.4 Amber Warning

- i) An **Amber Warning** will be issued by **TRANSCO** to **Users** who may be affected when **TRANSCO** knows there is a risk of widespread and serious disturbance to the whole, or a part of, the **Transmission System**;
- ii) the **Amber Warning** will contain such information as **TRANSCO** deems appropriate;
- iii) for the duration of an **Amber Warning**, each **User** in receipt of the **Amber Warning** shall take the necessary steps to warn its operational staff and to maintain its **Plant** and/or **Apparatus** in the condition in which it is best able to withstand the anticipated disturbance;
- iv) **Scheduling** and **Despatch** in accordance with the **Merit Order** may be affected during the period which an **Amber Warning** covers. Further provisions on this are contained in the **Scheduling and Despatch Code**.

7. NUMBERING AND NOMENCLATURE OF HIGH VOLTAGE APPARATUS

7.1 Introduction

This section of **Operating Code 'B'** sets out the **TRANSCO** requirements for numbering and nomenclature at:

- i) **TRANSCO HV Apparatus** on **Users Sites**; and
- ii) **User HV Apparatus** on **TRANSCO Sites**;

The numbering and nomenclature of each item of HV Apparatus shall be included in the **Operation Diagram** prepared for each **TRANSCO Site** or **User Site**.

7.2 Objective

The overall objective is to ensure, so far as possible, the safe and effective operation of the **Total System** and to reduce the risk of human error faults by requiring that the numbering and nomenclature of **User HV Apparatus** shall be in accordance with the system used by **TRANSCO**.

7.3 Procedure

The term "**User Site**" means a site owned (or occupied pursuant to a lease, licence or other agreement) by a **User** in which there is a **Connection Point**.

The term "**TRANSCO Site**" means a site owned (or occupied pursuant to a lease, licence or other agreement) by **TRANSCO** in which there is a **Connection Point**.

7.4 TRANSCO HV Apparatus on a User Site

- i) **TRANSCO HV Apparatus** on **User Sites** shall have numbering and nomenclature in accordance with the system used by **TRANSCO**;

- ii) when **TRANSCO** is to install its **HV Apparatus** on a **User Site**, **TRANSCO** shall notify the relevant **User** of the numbering and nomenclature to be adopted for that **HV Apparatus** at least eight months prior to proposed installation;
- iii) the notification will be made in writing to the relevant **User** and will consist of both a proposed **Operation Diagram** incorporating the proposed new **TRANSCO HV Apparatus** to be installed, its proposed numbering and nomenclature, and the date of its proposed installation;
- iv) the relevant **User** will respond in writing to **TRANSCO** within one month of the receipt of the notification, confirming receipt and confirming either that any other **HV Apparatus** of the relevant **User** on such **User Site** does not have numbering and/or nomenclature which could be confused with that proposed by **TRANSCO**, or, to the extent that it does, that the relevant other numbering and/or nomenclature will be changed before installation of the **TRANSCO HV Apparatus**;
- v) the relevant **User** will not install, or permit the installation of, any **HV Apparatus** on such **User Site** which has numbering and/or nomenclature which could be confused with **TRANSCO HV Apparatus** which is either already on that **User Site** or which **TRANSCO** has notified that **User** will be installed on that **User Site**.

7.4.1 User HV Apparatus on TRANSCO Sites

- i) **User HV Apparatus** on **TRANSCO Sites** shall have numbering and nomenclature in accordance with the system used by **TRANSCO**;
- ii) when a **User** is to install its **HV Apparatus** on a **TRANSCO Site**, or it wishes to replace existing **HV Apparatus** on a **TRANSCO Site** and it wishes to adopt new numbering and nomenclature for such **HV Apparatus**, the **User** shall notify **TRANSCO** of the details of the **HV Apparatus** and the proposed numbering and nomenclature to be adopted for that **HV Apparatus**, at least eight months prior to proposed installation;
- iii) the notification will be made in writing to **TRANSCO** and shall consist of both a proposed **Operation Diagram** incorporating the proposed new **HV Apparatus** of the **User** to be installed, its proposed numbering and nomenclature, and the date of its proposed installation;
- iv) **TRANSCO** will respond in writing to the **User** within one month of the receipt of the notification stating whether or not **TRANSCO** accepts the **User** proposed numbering and nomenclature and, if they are not acceptable, it shall give details of the numbering and nomenclature which the **User** shall adopt for that **HV Apparatus**.

Users will be provided upon request with details of **TRANSCO** current numbering and nomenclature system in order to assist them in planning the numbering and nomenclature for their **HV Apparatus** on **TRANSCO Sites**.

7.4.2 Changes

Where **TRANSCO** has decided that it needs to change the existing numbering or nomenclature of **TRANSCO HV Apparatus** on a **User Site** or of **User HV Apparatus** on a **TRANSCO Site**:

- i) the provisions of paragraph 7.4 shall apply to such change of numbering or nomenclature of **TRANSCO HV Apparatus** with any necessary amendments to those provisions to reflect that only a change is being made; and

- ii) in the case of a change in the numbering or nomenclature of **User HV Apparatus** on a **TRANSCO Site**, **TRANSCO** will notify the **User** of the numbering and/or nomenclature the **User** shall adopt for that **HV Apparatus** at least eight months prior to the change being needed and the **User** will respond in writing to **TRANSCO** within one month of the receipt of the notification, confirming receipt.

In either case the notification shall indicate the reason for the proposed change.

7.4.3 Labelling

When either **TRANSCO** or a **User** installs **HV Apparatus** **TRANSCO** or the **User** installing such **HV Apparatus** shall be responsible for the provision, erection and maintenance of clear and unambiguous labelling showing the numbering and nomenclature. Where a **User** is required to change the numbering and/or nomenclature of **HV Apparatus** the **User** will be responsible for the provision and erection of clear and unambiguous labelling by the required date. Where **TRANSCO** changes the numbering and/or nomenclature of its **HV Apparatus** **TRANSCO** will be responsible for the provision and erection of clear and unambiguous labelling showing the numbering and nomenclature by the required date.

8. SYSTEM TESTS

8.1 Introduction

This section of **Operating Code 'B'** relates to **System Tests** which involve:

- i) tests to be carried out by a **User** or **TRANSCO** simulating conditions or the controlled application of irregular, unusual or extreme conditions, on the **User's System** or the **TRANSCO System**, but which do not include commissioning or recommissioning tests or any other tests of a minor nature.
- ii) Commissioning/acceptance tests of **Plant** and **Apparatus** to be carried out by a **User** or **TRANSCO** simulating conditions or the controlled application of irregular, unusual or extreme conditions, on the **User's System** or the **TRANSCO System**

This section deals with the responsibilities and procedures for arranging and carrying out **System Tests** which have, or may have, an effect on the **Systems** of **TRANSCO** and **Users** and/or on any **External System**.

8.2 Objective

The overall objectives are:

- i) to ensure, so far as possible, that **System Tests** proposed to be carried out either by a **User** or by **TRANSCO** which may have an effect on the **Total System** do not threaten the safety of personnel, cause minimum threat to the security of supplies and to the integrity of **Plant** and/or **Apparatus**, and cause minimum detriment to **TRANSCO** and **Users**;
- ii) to set out the procedures to be followed for establishing and where appropriate reporting **System Tests** and to set out guidelines for which tests need to be notified to **TRANSCO** prior to the test being carried out.

8.3 Procedure

8.3.1 Proposal Notice

Where a **User** has decided that it would like to undertake a **System Test** it shall submit a notice (a "**Proposal Notice**") to **TRANSCO** as far in advance of the date it would like to undertake the proposed **System Test** as is reasonably practicable.

The **Proposal Notice** shall be in writing and shall contain details of the nature and purpose of the proposed **System Test** and shall indicate the extent and situation of the **Plant** and/or **Apparatus** involved.

If **TRANSCO** is of the view that the information set out in the **Proposal Notice** is insufficient, it will contact the person who submitted the **Proposal Notice** (the "**Test Proposer**") as soon as reasonably practicable, with a written request for further information. **TRANSCO** will not be required to do anything until it is satisfied with the details supplied in the **Proposal Notice** or pursuant to a request for further information.

If **TRANSCO** wishes to undertake the **System Test**, **TRANSCO** shall be deemed to have received a **Proposal Notice** for that **System Test**.

TRANSCO will use all reasonable endeavours to accommodate requests for the **System Tests** but has absolute discretion as to the timing of such tests to ensure the proper operation of the **Transmission System** and to ensure **Licence Standards** are not breached.

Any **System Test** which will result in a temporary deviation from **Despatch** instructions causing a deviation of active and reactive power infeed at the plant interconnection point of more than 2.5% is to be dealt with under this **Operating Code 'B'**.

8.3.2 Establishment of Test Panel

Using the information submitted with the **Proposal Notice** **TRANSCO** will determine, in its reasonable estimation, which **Users** may be materially affected by the proposed **System Test** and will notify such **Users** accordingly.

TRANSCO will then determine, in its reasonable opinion, whether a **Test Panel** is required taking into account the degree of severity of the effect of the proposed **System Test**. A **Test Panel** will not generally be needed for a routine test and since the majority of **System Tests** are routine, the establishment of a **Test Panel** is the exception rather than the rule. If **TRANSCO** decides that a **Test Panel** is necessary, the provisions of Appendix B will apply.

8.3.3 TRANSCO Supervision

If **TRANSCO** determines that no **Test Panel** is required, it will determine whether and when the proposed **System Test** can take place and will consider:

- i) the nature, technical reasons for and the timing of the test;
- ii) the economic, operational and risk implications of the proposed **System Tests** ; and
- iii) the possibility of combining the proposed **System Test** with any other tests .

If **TRANSCO** determines that the proposed **System Test** cannot take place it will notify the **Test Proposer** of the reasons for such a decision.

8.3.4 TRANSCO Test Programme

If **TRANSCO** approves the proposed **System Test** taking place it shall prepare a Test Programme appropriate for the test which will include:

- i) the procedure to be adopted for carrying out the **System Test** including the switching sequence and proposed timings of the switching sequence;
- ii) the manner in which the **System Test** is to be monitored;
- iii) a list of personnel to be involved in carrying out the **System Test** including those responsible for site safety; and
- iv) any other matters **TRANSCO** considers appropriate.

TRANSCO, the **Test Proposer** and each **User** that will be affected by the **System Test** will determine by agreement the basis on which the costs (for example costs arising from modifications to accommodate the test) of the **System Test** shall be borne between the affected parties (the general principle being the **Test Proposer** will bear such costs). If agreement cannot be reached the **System Test** will be cancelled.

Any problems with the proposed **System Test** perceived by the **Test Proposer** or any affected **User** or **TRANSCO** which arise after the issue of the **Test Programme** must be notified to the other parties as soon as possible in writing. If **TRANSCO** decides that these anticipated problems merit an amendment to, or postponement of, the **System Test**, it shall notify the **Test Proposer** and affected **Users** accordingly.

If on the day of the proposed **System Test**, operating conditions on the **Total System** are such that any of **TRANSCO**, the **Test Proposer** or an affected **User** wishes to delay or cancel the start or continuance of the **System Test**, they shall immediately inform the others of this decision and the reasons for it. **TRANSCO** shall then postpone or cancel the **System Test** and another suitable time and date shall be arranged in accordance with this section of **Operating Code 'B'**.

9. TESTING, MONITORING AND INVESTIGATION

9.1 Introduction

This section of **Operating Code 'B'** specifies the procedures to be followed by **TRANSCO** in carrying out:

- (a) **Monitoring:**
 - i. of the compliance of **Generating Units** and **Desalination Units** with **Despatch** instructions issued by **TRANSCO** under **Scheduling and Despatch Code** and of compliance with **Ancillary Service** requirements and of whether **Operating Reserve** requirements can be met;
 - ii. of the compliance of any **User** with requirements under the **Connection Conditions**

- (b) **Testing:**

- (i) in certain circumstances, (whether by means of a formal test or verification by inspection) to ascertain whether the **Scheduling and Despatch Parameters** and/or **Connection Conditions** are being complied with in respect of **Generating Units, Desalination Units**, any other **User** and **Users Equipment** and whether **Operating Margin** requirements can be met; and
- (ii) at the request of a **User**, in certain circumstances; and
- (c) **Investigations** in relation to equipment and operational procedures at **Power Stations** and other **User Sites**.

9.2 Objectives

The objectives of this **Operating Code** are to establish:

- (a) whether **Generating Units, Desalination Units** and **User Equipment** comply with **Scheduling and Despatch Parameters** and **Connection Conditions**.
- (b) whether any other **Users** and **User Equipment** comply with **Connection Conditions**.

9.3 Procedure For Monitoring

Monitoring may be carried out at any time by **TRANSCO** and involves the analysis of the output of monitoring equipment (as required or permitted under the **Connection Conditions, Power and Water Purchase Agreements, Metering and Data Exchange Code** and/or relevant **Connection and Interface Agreements**), either on the **Generating Unit, the Desalination Unit, the User System, External Interconnection** or the **Transmission System**, which shows the output and/or performance of the **Generating Unit, Desalination Unit, External Interconnection** or any other **User** in order to see whether the **Generating Unit** or **Desalination Unit** is complying with **Despatch** instructions, or whether the connection point of **User** is complying with the **Connection Conditions** The output from such monitoring equipment may be used to monitor the performance of **Generating Units** in the event System Emergency Conditions shall prevail, or to monitor the performance of **User** for comparison with the contracted performance under the **Power and Water Purchase Agreements, and/or Connection and Interface, and/or Interconnection Agreements**, or any other agreement

In determining whether a **Generating Unit** or **Desalination Unit** has complied, or is complying, with a **Despatch** instruction, **TRANSCO** shall in each case give due regard to operating conditions on the **Transmission System** and Water Trunk Main System. **TRANSCO** shall also apply the **Tolerance Bands** set out in the relevant table in Appendix C to the monitoring of the relevant **Despatch Characteristic**. In the event of a **Frequency Deviation** occurring whilst **TRANSCO** is monitoring the compliance by a **Generating Unit** with a **Despatch Characteristic** to which the **Generating Unit** responds in accordance with the relevant **GENCO** obligations to provide **Operating Reserve Response**, the **Generating Unit** shall not fail the monitoring by reason of such response.

In the case of any other **Users** the monitoring procedure will be set out in the **Connection and Interface Agreement**.

In the case of **External Interconnections** the monitoring procedures will be as set out in the **Interconnection Agreement**.

9.3.1 Warning Notice

If **TRANSCO** suspects that a **Generating Unit** or **Desalination Unit** has not complied, or is not complying, with a **Despatch** instruction, **TRANSCO** will, if it wishes to continue with the monitoring inform the relevant **GENCO** by submitting a **Warning Notice** (either orally or in writing) and, subject to the requirements of **System** security (which may require the **Despatch** instruction to be cancelled in which case the **Warning Notice** will be deemed to have been withdrawn), **TRANSCO** will allow the **GENCO** 10 minutes after such notice to comply with the **Despatch** instruction.

9.3.2 Monitoring Notice

If **GENCO** fails to comply with the **Despatch** instruction 10 minutes following the issue of a **Warning Notice**, **TRANSCO** may give notice to the **GENCO** by submitting a **Monitoring Notice** (either orally or in writing) that the **Generating Unit** or **Desalination Unit** is being monitored. The **Monitoring Notice** will:

- a) identify the **Despatch Characteristic** which is being monitored and the underlying **Scheduling and Despatch Parameter**;
- b) specify, if relevant, whether the **Tolerance Band** to be used is the **Wide Tolerance Band** or the **Narrow Tolerance Band**; and
- c) specify, if relevant, whether the **Narrow Tolerance Band** is to apply as a **Maximum Tolerance Band** or as a **Minimum Tolerance Band**.

The **GENCO** has the right, before the issue of the **Monitoring Notice**, or at any time thereafter by submitting to **TRANSCO** an **Availability Notice** to re-declare **Availability** or the **Scheduling and Despatch Parameters** in respect of the **Despatch Characteristic** to be monitored, such re-declaration to take effect from the time of receipt of the **Warning Notice** by the **GENCO**.

The period of monitoring shall not exceed the period set out in the relevant table in Appendix C for the relevant **Despatch Characteristic** and the selected **Tolerance Band**.

9.3.3 Consequences of Monitoring and Post Event Notices

At the end of the period of monitoring, if the **GENCO** has achieved each **Despatch** instruction for the period of the monitoring, within the relevant **Tolerance Band**, the **Generating Unit** or **Desalination Unit** will be deemed to have complied with each **Despatch** instruction.

If the average value of the **Despatch Characteristic** in any 5 minute period during the period of monitoring falls outside the relevant **Tolerance Band** **TRANSCO** may by submitting a **Post Event Notice** to the **GENCO** re-register the value of **Availability** or of the relevant **Scheduling and Despatch Parameter** corresponding to that **Despatch Characteristic** to the most inferior value outside the **Tolerance Band** for any 5 minute period during the period of monitoring (with effect from the **Settlement Period** in which the **Monitoring Notice** was issued) and **TRANSCO** may also notify the **GENCO** not later than 10 minutes before the end of the period of monitoring, that it will continue to **Monitor** the **Generating Unit** or **Desalination Unit** for a further period not exceeding that shown in the relevant Table in Appendix C.

If at the end of the further period of monitoring the average value of the **Despatch Characteristic** in any 5 minute period during the monitoring falls outside the relevant **Tolerance Band**, TRANSCO may re-register the value of the **Availability** or of the relevant **Scheduling and Despatch Parameter** corresponding to that **Despatch Characteristic** to the most inferior value for any 5 minute period during the period of monitoring (with effect from the **Settlement Period** in which the **Monitoring Notice** was issued). Further periods of monitoring may also take place, in accordance with the procedure set out in the previous paragraph and the provisions of this paragraph will apply to such further periods of monitoring.

9.3.4 Operating Reserve Monitoring (including Governor Droop Monitoring)

The provisions of this subsection shall apply to the monitoring of **Operating Reserve** and **Governor Droop** unless the relevant **Power and Water Purchase Agreement** otherwise requires. In the event of any conflict between the provisions of this subsection and the provisions of the relevant **Power and Water Purchase Agreement**, the provisions of the **Power and Water Purchase Agreement** shall apply.

9.3.4.1 Frequency Deviations

For the purposes of this **Operating Code** in respect of any **Frequency Deviation**:

- a) "**Pretransient Load**" means the average **Load** level (in MW) of the **Generating Unit** at 10 seconds before the **Frequency Deviation** commenced;
- b) the response of the **Generating Unit** to such **Frequency Deviation**, in terms of **Load** lift (in MW) above **Pretransient Load**, continuously over the period of 5 minutes starting when the **Frequency Deviation** commenced, is referred to as "**Operating Reserve Response**" and comprises "**Primary Response**" and "**Secondary Response**";
- c) the **Operating Reserve Response** achieved by the **Generating Unit** in response to such **Frequency Deviation** is referred to as the "**Achieved Response**".

9.3.4.2 Operating Reserve Response

For the purposes of this **Operating Code** the **Operating Reserve Response** for the period from the commencement of a **Frequency Deviation**:

- a) from 0 to 30 seconds, is referred to as **Primary Response**, where the period from 0 to 10 seconds is referred to as the **Transient Primary Response** and the period from 10 to 30 seconds is referred to as the **Steady State Primary Response** ; and
- b) from 30 seconds to 30 minutes, is referred to as **Secondary Response**.

9.3.4.3 Contracted Response

For the purposes of this **Operating Code** the responses of a **Generating Unit** to a **Frequency Deviation** as determined from the relevant **Power and Water Purchase Agreement** are referred to as the "**Contracted**" responses.

9.3.4.4 Expected Response

To determine expected **Primary Response** following frequency drop, **TRANSCO** shall derive following inputs:

- the **Pretransient Load** of the Generating Unit – P_{gi}
- the Generating Unit Nominal Capacity P_{ginom}

the **Pretransient Frequency** - f_0

- the Frequency drop, being the minimum frequency during the steady state **Primary Response** period - f_{st}
- The Providing Unit load (in MW) after the frequency drop
- the "Providing Unit Load Delta" being the change in the Providing Unit Load from the **Pretransient Load** to the Providing Unit Load at the time of frequency drop
- the Declared Maximum **Primary Response**
- the declared Governor Droop - δ_{gi}
- the Unit Controller settings (Turbine governor settings) – frequency dead-band - f_{db}

if the **Primary Response** capability being assessed is that of a relevant Steam Turbine Unit the declared **Governor Droop** will be multiplied by a factor of 3 if the Load of the **Generating Unit** is greater than 90% of the **Governor Droop** of **Generating Unit** related capacity

Expected **Primary Response** is determined as:

$$\Delta P = \frac{1}{X * \delta_{gi}} * \Delta f * \frac{P_{ginom}}{f_0}$$

Where:

$$\Delta f = (f_0 - f_{st}) - f_{db}$$

Primary response Governor Droop Multiplier X is defined as:

$$X = 1 + \alpha * e^{-\beta t}$$

Where: α , β – coefficient defined by TSO (typical value for α is 2 and for β is 0.25)

Governor Droop multipliers are not used for CCGT Modules and open cycle Gas Turbine Units which have short physical time delays -they are used just for Steam Turbine units.

The Expected **Primary Response** is the increase from the **Pretransient Load** from the **Generating Unit** at the **System Frequency** drop and is calculated as the minimum of:

- the difference between the **Generating Unit Pretransient Load** and the declared maximum Load
- Expected **Primary Response**.
- the Declared Maximum **Primary Response** as per **PWPA**

9.3.4.5 Achieved Response

Monitoring equipment (described in the **Power and Water Purchase Agreement** and/or in the **Connection Conditions**) will upon the occurrence of a **Frequency Deviation**, record, from not less than 10 seconds before the **Frequency Deviation** commenced, the **Load** level of the **Generating Unit**.

The **Operating Reserve Response Achieved** by the **Generating Unit** will be determined from the data recorded by the monitoring equipment and will be compared with the:

- a) "**Contracted**" response corresponding initial **Frequency Deviation** Δf_{max} as determined from the **Power and Water Purchase Agreement**.
- b) determined "**Expected**" response corresponding any **Frequency Deviation**

9.3.4.6 Operating Reserve Failure

There is deemed to be an "Operating Reserve Failure" whenever following a **Frequency Deviation**, the **Operating Reserve Response Achieved** deviated below the **Contracted** response.

9.3.4.7 Primary Response Index PRIG

Describes the design capability of a unit to provide spinning reserve according to an agreed dynamic characteristic on the basis of a unified response. Deviations from the guaranteed value PRIG may either occur for the sub-index RES1 and RES2 as well as for two additional characteristics which are the "Droop and Droop Linearity" as well as the "Increased Regulator Dead Band".

For each individual unit the contracted Performance Index is defined as:

$\text{PRIG} = \Sigma_{x1} \text{RESg}_{x1} * a_{x1} * \Sigma_{x2} \text{RESg}_{x2} * b_{x2}$

where:

$\Sigma_{x1} \text{RESg}_{x1} * a_{x1} =$ Transient Primary Response Coefficient for $x1 = 1$ to 10 with consideration of the weighting factor a_{x1} according to Table 1.

Table 1: Transient Primary Response Coefficient Weighting Factor a_{x1}

x1 – Time [s]	a_{x1} -Weighting Factor
1	1
2	2
3	2
4	0.5
5	0.25
6	0.125
7	0.0625
8	0.0625
9	0.0625
10	0.0625

$\Sigma_{x2} \text{RESg}_{x2} * b_{x2} =$ Steady State Primary Response Coefficient for $x2 = 11$ to 30 with consideration of the weighting factor b_{x1} according to Table 2

Table 2: Steady State Primary Response Coefficient Weighting Factor b_{x2}

x2 - Time [s]	b_{x2} –Weighting Factor
11 – 15	0.0625
16 – 20	0.0625
21 – 25	0.1375

26 – 30	0.1375
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9.3.4.8 Secondary Response Index SRIG,

Describes the capability of a unit to provide Secondary Response according to a contracted characteristic on the basis of a unified response. The response itself describes the capability of maintaining the increased loading over a defined period. For each individual unit the contracted Secondary Response Index is defined to be one (1.0).

9.3.4.9 AGC Response Index AGCRIG

Describes the capability of a unit to provide **AGC Response** according to a contracted characteristic. The response itself is subdivided into two main sections describing (a) the capability to provide the contracted ramp-up rate and (b) to maintain the increased loading over a defined period.

9.3.4.10 Operating Reserve Deviations

9.3.4.10.1 Achieved Primary Response Index

The Primary Response Index is defined on the basis of four main characteristics which determine the capability of the Plant to primarily provide frequency regulation as well as the capability to release spinning reserve. For deviations of characteristics from the contracted values as per Guaranteed Data, Appendix A, the calculation of deduction shall be applied on the basis of a Primary Response Index Deviation PRIG-PRIA.

For the consideration of the Achieved Primary Response Index , the achieved Performance Index is defined as:

$$\text{PRIA} = \Sigma_{x1} \text{RESa}_{x1} * a_{x1} * \Sigma_{x2} \text{RESa}_{x2} * b_{x2} * 1/(e^{\Delta p * g1}) * 1/(e^{\Delta f / \sigma / g2})$$

where:

$\Sigma_{x1} \text{RESa}_{x1} * a_{x1}$ = as previously defined

$\Sigma_{x2} \text{RESa}_{x2} * b_{x2}$ = as previously defined

$1/(e^{\Delta p * g1})$ = Increased Droop Deduction Coefficient with the consideration of the weighting factor $g1=1$

$1/(e^{\Delta f / \sigma / g2})$ = Increased Dead Band Deduction Coefficient with the consideration of the weighting factor $g2=100$

Δp = Total operation region where the contracted load-related steady state droop is exceeded by more than 10%; this is to be given in full consistence with the first Primary Response Index section REAS1;

Δf = Speed controller dead band given in [mHz] when exceeding the contracted value by a tolerance margin of 20%;

σ = Contracted load-related steady state droop.

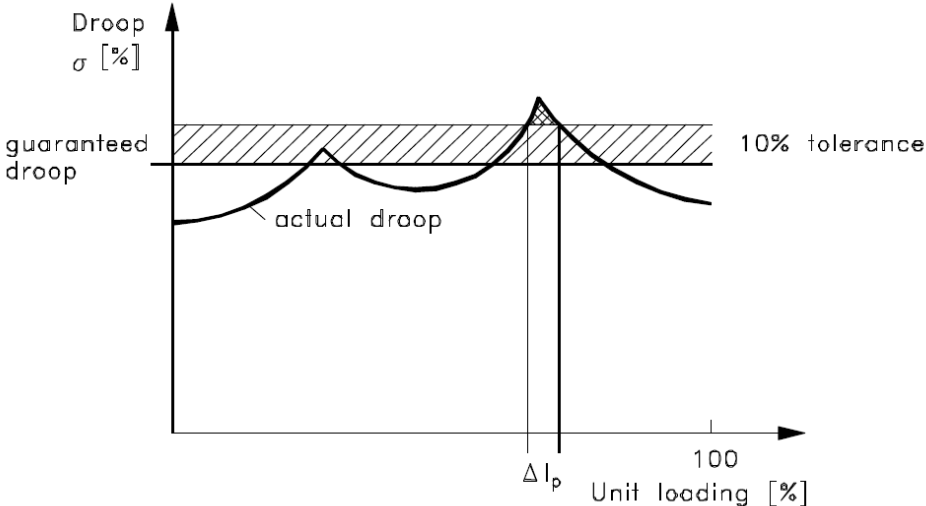


Fig. 1

Table F-3: Weighting Coefficients g1 and g2

Weighting Factor g1	1
Weighting Factor g2	100

9.3.4.10.2 Achieved Secondary Response Index

For deviations of characteristics from the contracted values the calculation of deduction shall be applied on the basis of a **Secondary Response** Index Deviation SRIG-SRIA.

For the consideration of the **Secondary Response** Index Deviation, the Achieved Secondary Response Index is defined as:

$$SRIA = F_a/F_g$$

Where:

- F_a - Achieved **Secondary Response** maintainability
- F_g - Guaranteed **Secondary Response** maintainability

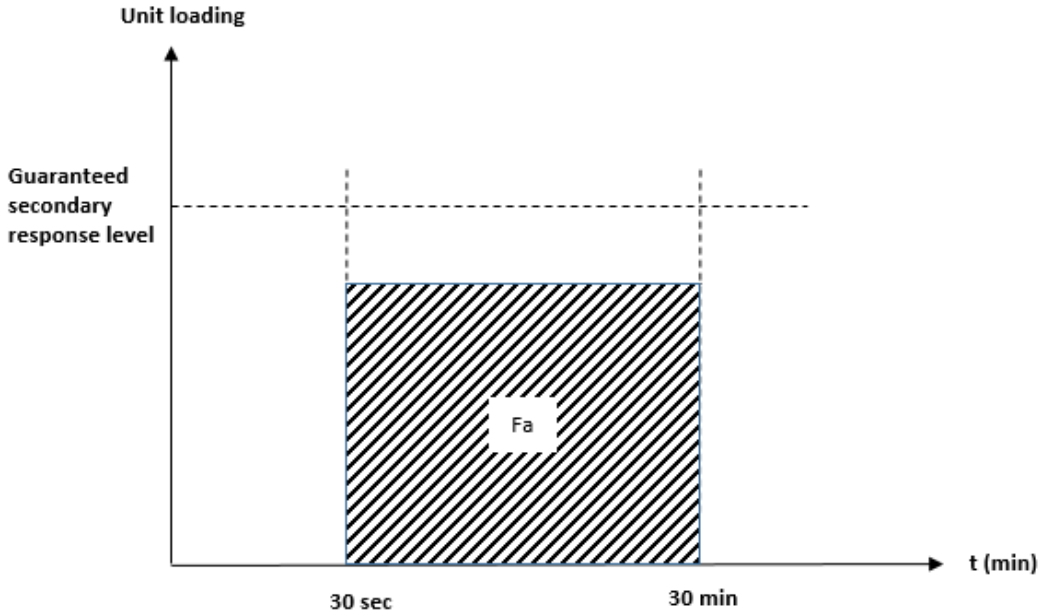


Fig. 2

9.3.4.10.3 Achieved AGC Response Index

For deviations of characteristics from the contracted values the calculation of deduction shall be applied on the basis of a **AGC Response Index Deviation AGCRIG-AGCRIA**.

For the consideration of the **AGC Response Index Deviation**, the **Achieved AGC Response Index** is defined as:

$$AGCRIA = \Delta p_a / \Delta p_g * (F1_a + F2_a) / (F1_g + F2_g)$$

where:

- $\Delta p_a / \Delta p_g$ = Ramp-up rate deviation as defined per Fig. 3 below
- $(F1_a + F2_a) / (F1_g + F2_g)$ = Increased power maintainability ratio as defined per Fig. 3 below

- Δp_g - Contracted ramp-up margin;
- Δp_a - Achieved Actual ramp-up margin;
- $F1_g + F2_g$ - Contracted **AGC Response** maintainability
- $F1_a + F2_a$ - Achieved **AGC Response** maintainability

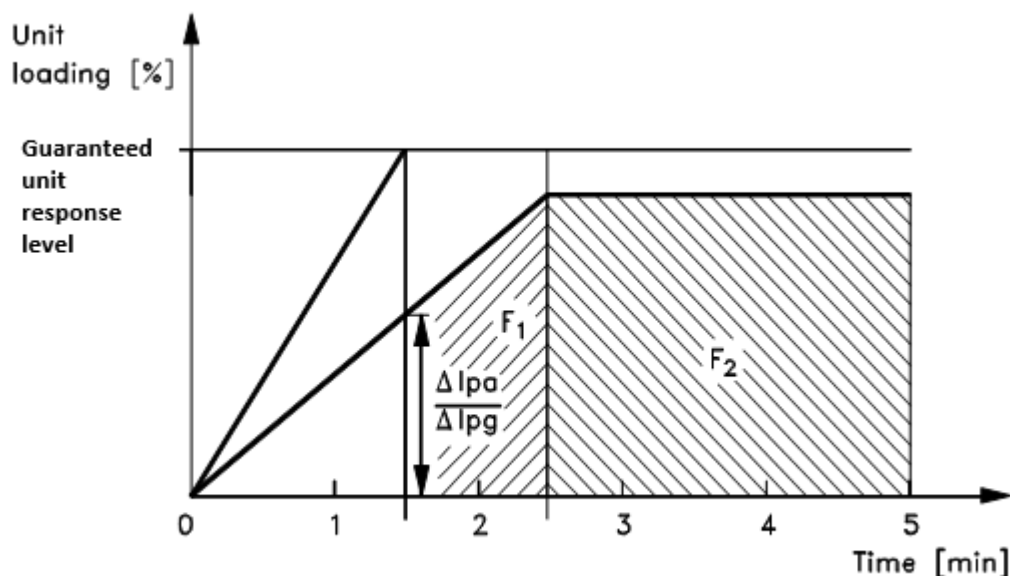


Fig. 3

9.3.4.11 Successive Frequency Deviations

Where a **Frequency Deviation** has occurred while the **Generating Unit** was **Synchronised**, the **Generating Unit** will not be required to respond to any further **Frequency Deviation** for 5 minutes after the end of the first **Frequency Deviation**.

The **GENCO** shall be entitled at any time, by submitting a **Availability Notice** to **TRANSCO**, to re-declare the **Sustained Response Capability** or the **Governor Droop** value of a **Generating Unit**. Within 48 hours of receiving the **Availability Notice** from the **GENCO**, **TRANSCO** may require the **GENCO** to carry out a **Sustained Response Test** or a **Governor Droop Test** and if the test is failed, **TRANSCO** may by issuing a **Post Event Notice** to the **GENCO**, re-register the **Operating Reserve Capability** or the **Governor Droop** value for that **Generating Unit**, such re-registration to take effect from the beginning of the **Settlement Period** in which the **Availability Notice** took effect.

In addition a **GENCO** shall, having re-declared or having had a **Scheduling and Dispatch Parameter** of one of its **Generating Units** re-registered as a result of non-compliance, notify **TRANSCO** when it has rectified the fault which caused that non-compliance by submitting an **Availability Notice** to **TRANSCO** under the **Scheduling and Dispatch Code**. Upon **TRANSCO** receiving such notification, the relevant **Scheduling and Dispatch Parameter** will be deemed to be re-declared.

TRANSCO may then **Monitor** that re-declared value and may, if the **Generating Unit** fails to comply with the re-registered **Scheduling and Dispatch Parameter**, follow the procedures set out in this **Operating Code**.

9.4 Procedure For Testing

9.4.1 Testing (other than relating to Operating Reserve)

In circumstances where **TRANSCO** reasonably considers that, in relation to a **Generating Unit**, **Desalination Unit**, any other **User** or item of **User Equipment**, a **User** might be failing

to comply with the relevant **Scheduling and Despatch Parameters** or **Connection Conditions**, **TRANSCO** may, upon giving reasonable notice identifying the **Scheduling and Despatch Parameter** and/or **Connection Condition** concerned, send representatives to the relevant **Power Station** or **User Site** in order to verify by testing or inspection (in the case of testing, conducted by the **User**) whether the **Scheduling and Despatch Parameter** or **Connection Condition** is being complied with. The test or inspection may involve the giving of specific **Despatch** instructions within the provisions of the **Scheduling and Despatch Code**.

9.4.2 Access

A **GENCO** or any other **User** must allow the **TRANSCO** representatives access to all relevant parts of its **Power Station** or **User Site** for the purposes of this **Operating Code**.

9.4.3 Procedure

The procedure for the test, and the criteria for passing the test, will, if not agreed between **TRANSCO** and the **GENCO** or other **User**, be as determined by **TRANSCO** acting reasonably and as notified to the **GENCO** or other **User** at the time and the **GENCO** or other **User** will comply with all reasonable instructions of **TRANSCO** in carrying out the test.

If the procedure for the test, and the criteria for passing the test, are so determined by **TRANSCO** and, within 48 hours after completion of the test, the **User** notifies **TRANSCO** in writing that it objects to the procedure and/or the criteria which were used for the test, then the question of whether the test procedure and/or the criteria were valid shall:

- a) in the case of a **Scheduling and Despatch Parameter** contained in the **User's** relevant **Power and Water Purchase Agreement**, be decided in accordance with the relevant dispute resolution procedure set out in that **Agreement**; or
- b) in the case of a **Connection Condition** contained in the **Transmission Code**, be decided in accordance with the relevant dispute resolution procedure set out in the **User's** relevant **Connection Agreement**.

The effects of the test shall be suspended until such time as it has been determined that the procedure for the test or the criteria for passing the test were valid. If it is determined that the procedure for the test or the criteria for passing the test were not valid, then the test shall not be effective for the purposes of the relevant **Agreement**. **TRANSCO** may, however, conduct a further test in accordance with relevant subsections of this **Operating Code**, taking into account any relevant findings of the disputes resolution procedure of the relevant **Agreement** in determining the procedure and/or criteria for such further test.

9.4.4 Test Result

In determining whether the **Generating Unit, Desalination Unit**, any other **User** or item of **User's Equipment** has passed a test, due regard will be given by **TRANSCO** to operating conditions on the **Transmission System** and (where applicable) the relevant **Tolerance Bands** will be applied to the relevant matters being tested as set out in Appendix C.

If, within 48 hours after completion of the test, the **User** notifies **TRANSCO** in writing that it disagrees that the results show that the **Generating Unit, Desalination Unit**, any other **User**

or item of **User's Equipment** has failed the test, then the question of whether the test has been passed or failed shall:

- a) in the case of a **Scheduling and Despatch Parameter** contained in the **User's relevant Power and Water Purchase Agreement**, be decided in accordance with the relevant dispute resolution procedure set out in that **Agreement**; or
- b) in the case of a **Connection Condition** contained in the **Transmission Code**, be decided in accordance with the relevant dispute resolution procedure set out in the **User's relevant Connection and Interface Agreement**.

The effects of the test shall be suspended until such time as it has been determined that the **Generating Unit, Desalination Unit** or item of **User's Equipment** has failed the test.

9.4.5 Failure

If in relation to the **Generating Unit, Desalination Unit** or item of **User's Equipment** the **GENCO** or **User** fails the test then:

- a) **TRANSCO** may, in the case of those **Scheduling and Despatch Parameters** where a parameter or other data item is registered under the **Transmission Code**, re-register the value of the relevant **Scheduling and Despatch Parameter** to reflect the lower level of compliance shown by the test;
- b) the **GENCO** will, if the **Scheduling and Despatch Parameter** is one under a **Power and Water Purchase Agreement** to which it is a party, be subject to such consequences (if any) as may arise under that agreement; and
- c) the **User** will, if the **Connection Condition** is one under a **Connection Agreement** to which it is a party, be subject to such consequences (if any) as may arise under that agreement.

9.4.6 Testing relating to Operating Reserve

Primary Response Capability and **Secondary Response Capability** may, unless the **Power and Water Purchase Agreement** otherwise requires, be tested as described in this subsection. For the purposes of this subsection, in the event of any conflict between the provisions of this subsection and the provisions of the relevant **Power and Water Purchase Agreement**, the provisions of the **Power and Water Purchase Agreement** shall apply.

The following provisions apply as to testing of **Response Capability** for **Generating Units**:

A test ("**Response Test**") in respect of **Response Capability** may be requested in the following circumstances:

- a) by the **GENCO**, at any time, in which case **TRANSCO** will by the same time on the second **Business Day** thereafter specify the time (within 3 days) for the test which shall be as soon as reasonably practicable having regard to **System** constraints (but in any event within 3 days); and
- b) by **TRANSCO**, on not less than 24 hours notice of the start of the test:

- (i) at any time, if **TRANSCO** has reasonable grounds to believe that the **Response Capability** is impaired; or
- (ii) within 48 hours (the test to start within 72 hours) after the **GENCO** re-declared up the value of the **Response Capability** either:
 - (aa) where the **Response Capability** had earlier been declared down following a **Frequency Deviation**; or
 - (bb) where following a previous test under this subsection **Response Capability** had been determined at a level lower than previously declared by the **GENCO**.

If **TRANSCO** requests a test and the **Response Capability** determined from the test is lower than the value which had been re-declared by **TRANSCO**, the value determined from the test shall be applied retrospectively (from the **Settlement Period** in which **TRANSCO** re-declaration was made) for the purposes of the **Power and Water Purchase Agreement**.

9.4.7 Primary and Secondary Response Testing

A test and verification of the Primary and Secondary Response Indices may be requested by **TRANSCO**, on not less than 24 hours notice, at any time if **TRANSCO** has reasonable grounds to believe that the value of the indices for a Generating Unit is lower than the declared or guaranteed value.

TRANSCO may then re-declare the value of **Specified Governor Droop** to the value determined according to such test (to the extent that it is higher than the value previously declared by the **GENCO**).

To the extent that **TRANSCO** and a **GENCO** are unable to agree on any further details or procedures for carrying out the **Response Test** or testing of **Governor Droop**, the dispute resolution procedure pursuant to the relevant **Power and Water Purchase Agreement** shall be followed to determine such details or procedures, which will then be adopted and thereafter applied in any further testing by the parties.

In the event of a dispute as to the result of a **Response Test** or a test of **Governor Droop**, the dispute resolution procedure pursuant to the relevant **Power and Water Purchase Agreement** shall be followed.

9.5 Investigations

TRANSCO may, upon giving reasonable notice (in any event not less than 2 **Business Days**), send representatives to a **Power Station** or **User Site** in order to investigate any equipment or operational procedure.

An investigation may take place only for the purposes of enabling **TRANSCO** to fulfil its obligations relating to the operation of the **Transmission System** (and where in the reasonable opinion of **TRANSCO** in the absence of an investigation it would be unable properly to fulfil such obligations).

An investigation shall not take place during or less than 2 days before or after a period of monitoring (carried out following the issue of a **Warning Notice**) or test in respect of **Plant** or equipment at the relevant **Power Station** or **User Site**.

The **TRANSCO** notice shall specify:

- a) the nature and purpose of the investigation and the reasons therefor;
- b) the equipment or operational procedure subject to the investigation; and
- c) the procedure (as reasonably determined by **TRANSCO**) for the investigation.

The scope of an investigation and the information and parts of the **Power Station** or **User Site** to which **TRANSCO** shall be entitled to access shall be limited to that required for the purposes of the investigation as specified in **TRANSCO** notice.

The **User** shall comply with the reasonable requests of **TRANSCO** in carrying out the investigation, and allow the **TRANSCO** representative access to all relevant parts of the **Power Station** or **User Site** to conduct the investigation.

An investigation shall not of itself result in consequences for the **User** under the **Transmission Code** or any **Power and Water Purchase Agreement** or **Connection Agreement**.

9.6 Testing at the Request of a User

A **User** shall be entitled, by notice in writing setting out the desired procedure (or, if **TRANSCO** acting reasonably so agrees, taking into account the nature of the test being requested, by oral request specifying the desired procedure, such oral request to be confirmed in writing as soon as reasonably practicable thereafter), to request **TRANSCO** to assist it (by **Despatch**) in carrying out a test on any of its **Generating Units**, **Desalination Units** or **User's Equipment** as such **User**, acting reasonably in accordance with **Good Industry Practice**, may request.

9.6.1 Refusal to Conduct Test

TRANSCO shall be entitled to refuse to conduct any test requested if, in **TRANSCO** reasonable opinion, it is unsafe for the **Transmission System** to conduct such a test or if it is otherwise not practicable to do so for **System** or any other reasons, including if all reasonable costs and expenses of **TRANSCO** are not, in **TRANSCO** reasonable view, adequately covered by the **User**. **TRANSCO** may only continue to refuse to conduct the test for so long as these reasons continue.

If **TRANSCO** refuses to conduct the test **TRANSCO** and the **User** may discuss an alternative form of test or procedure for conducting the test or timing, of the test to see whether agreement can be reached.

If **TRANSCO** does not agree to the test taking place, then it will not take place, provided that **TRANSCO** may only continue to refuse to conduct the test for so long as the reasons set out above continue to apply.

9.6.2 Test Procedure and Timing

If **TRANSCO** agrees to the test taking place, to the procedure for conducting the test and to the time of the test it will notify the **User** accordingly.

If **TRANSCO** does not agree to the procedure for conducting the test, then if the test is to go ahead, **TRANSCO** requirements relating to the procedure will prevail.

If **TRANSCO** does not agree to the timing of the test, then if the test is to go ahead, **TRANSCO** requirements relating to timing will prevail.

9.6.3 Witnessing of Tests by TRANSCO

TRANSCO may, in accordance with the agreed procedure and timing and if agreed by the **User**, send representatives to the **Power Station** or **User Site** in order to witness the test. The **User** must, if having agreed to **TRANSCO** witnessing the test, allow the **TRANSCO** witnesses access to all relevant parts of its **Power Station** or **User Site** in order to witness such a test.

TRANSCO shall take all reasonable steps to ensure that any representatives that it sends to the **Power Station** or **User Site** above comply at all times with all relevant safety requirements of the **User** of which they are made aware and with all reasonable directions of the **User** and any reasonable restrictions on access whilst at the **Power Station** or **User Site** in question.

9.7 Commissioning/Acceptance Testing

The **Connection Agreement** reflects the **Commissioning/Acceptance Testing** which will be required for **User Equipment** prior to being certified as acceptable to be and remain connected (or to be reconnected) to the **Transmission System** and for modifications to existing **User Equipment**.

**APPENDIX A - MATTERS APPLICABLE TO THE SIGNIFICANT INCIDENT
TO BE INCLUDED IN A WRITTEN REPORT**

- i) Time and date of **Significant Incident**.
- ii) Location.
- iii) **Plant** and/or **Apparatus** directly involved (and not merely affected by the **Incident**).
- iv) Description of **Significant Incident**.
- v) **Demand** (in **MW**) and/or generation (in **MW**) interrupted and duration of interruption.
- vi) **Generating Unit** - Frequency response (**MW** correction achieved subsequent to the **Significant Incident**).
- vii) **Generating Unit** - **MVAr** performance (change in output subsequent to the **Significant Incident**).
- viii) Estimated time and date of return to service.

APPENDIX B - SYSTEM TESTS UNDER TEST PANEL SUPERVISION

10. PRELIMINARY NOTICE

If **TRANSCO** determines pursuant to Section 8.3.2 of **Operating Code 'B'** that a **Test Panel** is required **TRANSCO** will appoint a person to co-ordinate the **System Test** (a "**Test Co-ordinator**") as soon as reasonably practicable after it has received a **Proposal Notice** and in any event prior to the distribution of the **Preliminary Notice** referred to below. The **Test Co-ordinator** shall act as Chairman of the **Test Panel** and shall be an ex-officio member of the **Test Panel**.

TRANSCO will notify all **Users** that may be affected by the **System Test** of the proposed **System Test** by a notice in writing (a "**Preliminary Notice**") and will send a **Preliminary Notice** to the **Test Proposer**. The **Preliminary Notice** will contain:

- i) the details of the nature and purpose of the proposed **System Test**, the extent and situation of the **Plant** and/or **Apparatus** involved, the identity of the **Users** that may be affected by the **System Test** and the identity of the **Test Proposer**;
- ii) an invitation to nominate within one month a suitably qualified representative to be a member of the **Test Panel** for the proposed **System Test**;
- iii) the name of the **TRANSCO** representative whom **TRANSCO** has appointed as the **Test Co-ordinator** and who will be a member of the **Test Panel** for the proposed **System Test**; and

The **Preliminary Notice** will be sent within one month of the proposed **System Test** being formulated.

Replies to the invitation in the **Preliminary Notice** to nominate a representative to be a member of the **Test Panel** must be received by **TRANSCO** within one month of the date on which the **Preliminary Notice** was sent to the **User** by **TRANSCO**. Any **User** which has not replied within that period will not be entitled to be represented on the **Test Panel**. If the **Test Proposer** does not reply within that period, the proposed **System Test** will not take place and **TRANSCO** will notify all **Users** identified by it accordingly.

TRANSCO will, as soon as possible after the expiry of that one month period, appoint the nominated persons to the **Test Panel** and notify all **Users** that may be affected by the **System Test** and the **Test Proposer**, of the composition of the **Test Panel**.

11. TEST PANEL

A meeting of the **Test Panel** will take place as soon as possible after **TRANSCO** has notified all **Users** that may be affected by the **System Test** and the **Test Proposer** of the composition of the **Test Panel**, and in any event within one month of the appointment of the **Test Panel**.

The **Test Panel** shall consider:

- i) the details of the nature and purpose of the proposed **System Test** and other matters set out in the **Proposal Notice**;
- ii) the economic, operational and risk implications of the proposed **System Test**;

- iii) the possibility of combining the proposed **System Test** with any other tests and with **Plant** and/or **Apparatus** outages which arise pursuant to the **Operational Planning** requirements of **TRANSCO** and **Users**; and
- iv) whether at the conclusion of the **System Test**, the **Test Proposer** should be required to prepare a written report on the **System Test** (a "**Final Report**"), and if so, the period within which the **Final Report** must be prepared.

Users identified by **TRANSCO** that may be affected by the **System Test**, the **Test Proposer** and **TRANSCO** shall be obliged to supply that **Test Panel**, upon written request, with such details as the **Test Panel** reasonably requires in order to consider the proposed **System Test**.

The **Test Panel** shall be convened by the **Test Co-ordinator** as often as he deems necessary to conduct its business.

12. PROPOSAL REPORT

As soon as practicable after first meeting the **Test Panel** will prepare a report (a "**Proposal Report**"), which will contain:

- i) proposals for carrying out the **System Test** including the manner in which the **System Test** is to be monitored;
- ii) an allocation of costs between the affected parties (the general principle being that the **Test Proposer** will bear the costs); and
- iii) such other matters as the **Test Panel** considers appropriate.

The **Proposal Report** may include requirements for indemnities to be given in respect of claims and losses arising from the **System Test**.

The **Proposal Report** will be submitted to **TRANSCO**, the **Test Proposer** and to each **User** identified by **TRANSCO** that may be affected by the **System Test**.

Each recipient will respond to the **Test Co-ordinator** with its approval of the **Proposal Report** or its reason for non-approval within fourteen days of receipt of the **Proposal Report**.

In the event of non-approval by one or more recipients, the **Test Panel** will meet as soon as practicable in order to determine whether the proposed **System Test** can be modified to meet the objection or objections.

If the proposed **System Test** cannot be so modified, the **System Test** will not take place and the **Test Panel** will be dissolved.

If the proposed **System Test** can be so modified, the **Test Panel** will, as soon as practicable, and in any event within one month of meeting to discuss the responses to the **Proposal Report**, submit a revised **Proposal Report** for approval.

In the event of non-approval of the revised **Proposal Report** by one or more recipients, the **System Test** will not take place and the **Test Panel** will be dissolved.

13. TEST PROGRAMME

If the **Proposal Report** is approved by all recipients, the proposed **System Test** can proceed and at least one month prior to the date of the proposed **System Test**, the **Test Panel** will submit to **TRANSCO**, the **Test Proposer** and each **User** identified by **TRANSCO** that may be affected by the **System Test**, a programme (the "**Test Programme**") stating the switching sequence and proposed timings of the switching sequence, the manner in which the **System Test** is to be monitored, a list of those staff involved in carrying out the **System Test** (including those responsible for site safety) and such other matters as the **Test Panel** deems appropriate.

Any problems with the proposed **System Test** which arise or are anticipated after the issue of the **Test Programme** and prior to the day of the proposed **System Test**, must be notified to the **Test Co-ordinator** as soon as possible in writing. If the **Test Co-ordinator** decides that these anticipated problems merit an amendment to, or postponement of, the **System Test**, he shall notify the **Test Proposer**, **TRANSCO** and each **User** identified by **TRANSCO** that may be affected by the **System Test** accordingly.

If on the day of the proposed **System Test**, operating conditions on the **Total System** are such that any party involved in the proposed **System Test** wishes to delay or cancel the start or continuance of the **System Test**, they shall immediately inform the **Test Co-ordinator** of this decision and the reasons for it. The **Test Co-ordinator** shall then postpone or cancel, the **System Test** and shall, if possible, agree with the **Test Proposer**, **TRANSCO** and all **Users** identified by **TRANSCO** that may be affected by the **System Test** another suitable time and date. If he cannot reach such agreement, the **Test Co-ordinator** shall reconvene the **Test Panel** as soon as practicable, which will endeavour to arrange another suitable time and date for the **System Test**.

14. FINAL REPORT

At the conclusion of the **System Test**, the **Test Proposer** shall be responsible for preparing a written report on the **System Test** (the "**Final Report**") for submission to **TRANSCO** and other members of the **Test Panel**. The **Final Report** shall be submitted within three months of the conclusion of the **System Test** unless a different period has been agreed by the **Test Panel** prior to the **System Test** taking place.

The **Final Report** shall not be submitted to any person who is not a member of the **Test Panel** unless the **Test Panel**, having considered the confidentiality issues arising, shall have unanimously approved such submission.

The **Final Report** shall include a description of the **Plant** and/or **Apparatus** tested and a description of the **System Test** carried out, together with the results, conclusions and recommendations.

When the **Final Report** has been prepared and submitted the **Test Panel** will be dissolved.

APPENDIX C

15. TABLE OF TOLERANCE VALUES FOR DESPATCH CHARACTERISTIC
(GENERATING UNITS)

Despatch Characteristic	Wide Tolerance Band	Maximum Period of Monitoring at Wide Tolerance Band	Narrow Tolerance Band	Maximum Period of Monitoring at Narrow Tolerance Band
Active Power (MW)	±5% of Despatched Load	6 HOURS	±2.5% of Despatched Load	60 minutes
Reactive Power (MVar)	± 2.5% of system voltage at Connection Point	2 hours	± 2.5% of system voltage at Connection Point	1 hour
Loading Rate (MW/min)	±5% for period to achieve load	Period to achieve load	Not Applicable	Not Applicable
Synchronising Time	±5 minutes	Not Applicable	Not Applicable	Not Applicable
Governor Droop	3.5-5.5%	Not Applicable	Not Applicable	Not Applicable

**16. TABLE OF TOLERANCE VALUES FOR DESPATCH CHARACTERISTIC
(DESALINATION UNITS)**

Despatch Characteristic	Wide Tolerance Band	Maximum Period of Monitoring at Wide Tolerance Band	Narrow Tolerance Band	Maximum Period of Monitoring at Narrow Tolerance Band
Water Production m³/h	±5% of Despatched Load	6 hours	Not Applicable	Not Applicable
Loading Rate m³/h/h	±15 minutes for period to achieve load	Period to achieve load	Not Applicable	Not Applicable
Start Up Time	±15 minutes	Not Applicable	Not Applicable	Not Applicable

CHAPTER 6 - SCHEDULING AND DESPATCH CODE

The **Scheduling and Dispatch Code (SDC)** sets out the procedure for **TRANSCO** to:

- i) **Schedule and Dispatch Generating Units;**
- ii) **Schedule and Dispatch Desalination Units** to local storage facilities; and
- iii) **Manage System Frequency** and voltage.

The forecasting of **Potable Water** demand and the scheduling and despatch of **Potable Water** from storage local to the **Desalination Units** to the **Water Trunk Main System** is dealt with in the **Electricity Transmission Code (Water)**.

1. SCOPE

The **Scheduling and Dispatch Code (SDC)** applies to;

- i) **TRANSCO;**
- ii) **GENCOs** with regard to their **Generating Plant** (including **WTGUs** and **PVGUs**) and **Desalination Plant;**
- iii) **DISCOs**
- iv) **Self-Supply User Operator** in accordance with the terms of the appropriate **Connection and Interface Agreement;** and
- v) **External System Operators** in accordance with the terms of the appropriate **Interconnection Agreement.**

2. GENERATION AND DESALINATION SCHEDULING

Generation and Desalination Scheduling sets out the procedure for:

- i) the submission of an **Availability Notice** by each **GENCO** or by each **Self-Supply User** for its excess capacity;
- ii) the submission of any revised **Scheduling and Dispatch Parameters** in respect of the **Availability Notice** by each **GENCO** or by each **Self-Supply User;** and
- iii) the issue of a **Generation Schedule** and **Desalination Schedule** the day before the **Schedule Day** as a statement of which **Generating Units** and **Desalination Units** may be required.

2.1 Objective

The procedure for submission of an **Availability Notice** is to enable **TRANSCO** to prepare and issue a **Generation Schedule** and **Desalination Schedule** which is an indicative statement of which **Generating Units** and **Desalination Units** are required to meet water and electricity **Demand** at minimum cost whilst ensuring the integrity of the **Transmission System**, the security and quality of supply and ensuring that there is sufficient generation to meet **TRANSCO Demand** at all times together with an appropriate margin of reserve.

2.2 Procedure

2.2.1 Generation Data

2.2.1.1 Availability Notice

1. Each **GENCO** shall in respect of each of its **Generating Units** and **Desalination Units** submit to **TRANSCO** an **Availability Notice** stating whether or not such **Generating Unit** and **Desalination Unit** is proposed by that **GENCO** to be available for generation. If available it must state the **Availability** expressed as follows:
 - i) **Co-generation Module: Net Dependable Power Capacity** for each **Generating Unit** declared **Available** and also **Net Dependable Water Capacity** for each **Desalination Unit** declared **Available**;
 - ii) **Electricity Only Plant: Net Dependable Power Capacity** for each **Generating Unit** declared **Available**; and
 - iii) **Water Only Plant: Net Dependable Water Capacity** for each **Desalination Unit** declared **Available**.
2. Each **Self-Supply User** shall provide the available transfer capacity of each **Connection point** as defined in the appropriate **Connection and Interface Agreement**.
3. Each **External System Operator** shall provide the available transfer capacity of each **External Interconnection** as defined in the appropriate **Interconnection Agreement**.
4. Such **Availability Notice** will replace any previous **Availability Notice**.
5. Climatic Conditions: In the case of **WTGUs**, **CSTUs** and **PVGUs** which are affected by climatic conditions, an **Availability Notice** submitted by a **GENCO** shall be stated as being the **GENCO's** best estimate of **Availability** for the prevailing climatic conditions for the period to which each part of the **Availability Notice** relates.

2.2.1.2 Scheduling and Despatch Parameters

Each **GENCO** shall in respect of each **Generating Unit** and **Desalination Unit** which the **GENCO** shall have declared **Available** submit to **TRANSCO** under the **Availability Notice** any revisions to the **Scheduling and Despatch Parameters** to those submitted under a previous declaration.

Each **Self-Supply User** shall in respect of transfer capacity of each **Connection point** which the **Self-Supply User** shall have declared **Available** submit to **TRANSCO** under the **Availability Notice** any revisions to the **Scheduling and Despatch Parameters** to those submitted under a previous declaration.

The **Scheduling and Despatch Parameters** shall reasonably reflect the true operating characteristics. In so far as not revised, the previously submitted **Scheduling and Despatch Parameters** shall apply.

2.2.1.3 Other Relevant Scheduling and Despatch Data

Each **GENCO** shall in respect of each **Generating Unit** and **Desalination Unit** which the **GENCO** shall have declared **Available** submit to **TRANSCO** the following:

- i) details of any special factors which may have a material effect on the likely output of such **Generating Unit** and/or **Desalination Unit**;
- ii) any temporary changes, and their possible duration, to the **Registered Data** of such **Generating Unit** and/or **Desalination Unit**;
- iii) any temporary changes, and their possible duration, to the availability of **Ancillary Services** provided pursuant to its **Power and Water Purchase Agreement**; and
- iv) details of any **Generating Unit** and/or **Desalination Unit** commissioning or re-commissioning programmes.

2.2.1.4 Generation Prices

TRANSCO shall in respect of each **Generating Unit** and each **Desalination Unit** which the **GENCO** shall have declared **Available** calculate, in accordance with the relevant **Power and Water Purchase Agreement**, a set of **Generation Prices** at which the **GENCO** can supply **Active Power**, and/or **Desalinated Water**, from such **Units**.

The set of **Generation Prices** shall include in respect of each **Generating Unit** and **Desalination Unit**:

- i) a **Start-up Price** (expressed in **Dirhams**);
- ii) a **No-Load Price** (expressed in **Dirhams per hour**); and
- iii) a range of **Incremental Prices** (expressed in **Dirhams per MWh of Active Energy** and **Dirhams per m³ of Desalinated Water**) from zero generation to **Net Dependable Capacity** for all modes of individual **Unit** and **Cogeneration Module** operation.

A range of prices for each tranche of transfer across each **External Interconnection** will also be determined on the basis of the appropriate **Agreement**.

2.2.1.5 Scheduling and Despatch Data Revisions

At any time between 1000 hours each day and the expiry of the next following **Schedule Day**, a **GENCO** or **Self-Supply User** may submit to **TRANSCO** revisions to the submitted data:

- i) If revised **GENCO Data** or **Self-Supply User Data** is received by **TRANSCO** prior to 1300 hours on the day prior to the relevant **Schedule Day**, **TRANSCO** shall, if there is sufficient time prior to the issue of the **Generation and Desalination Schedule**, take into account the revised **Availability Notice** in preparing the **Generation and Desalination Schedule**.
- ii) If revised **GENCO Data** or **Self-Supply User Data** is received by **TRANSCO** at or after 1300 hours in each day but before the end of the next following **Schedule Day**, **TRANSCO** shall, if it re-schedules the **Generating Units** and/or **Desalination Units**, take into account the revised **Availability Notice** in that re-scheduling.

2.2.2 The Generation and Desalination Schedule

TRANSCO shall input into the **Computer Scheduling Programme** the last valid set of calculated **Generation Prices** and **Scheduling and Despatch Parameters** for the **Generating Unit** and/or **Desalination Unit** and/or **Self-Supply Users** and/or **External Interconnection** in question.

The **Generation and Desalination Schedule** shall be compiled by **TRANSCO** to schedule such **Generating Units and Desalination Units, transfer to/from Self-Supply User and External Interconnection** tranche in respect of which there is an **Availability Notice** and in accordance with **Availability**:

- i) as will in aggregate minimise the cost of procuring the required **Electricity and Water** in accordance with the relevant **Power and Water Purchase Agreements, Connection and Interface Agreements and Interconnection Agreements** to match the forecast **Demand**;
- ii) as will in aggregate be sufficient to match at all times (to the extent possible having regard to the declared **Availability**) the forecast electricity **Demand, transfer to/from Self-Supply User Connections and External Interconnection** transfer together with an appropriate margin of **Operating Reserve**;
- iii) as will in aggregate be sufficient to match minimum electricity **Demand** levels, **transfer to/from Self-Supply User Connections and External Interconnection** transfer together with a sufficient **Minimum Demand Regulation**; and
- iv) as will in aggregate be sufficient to maintain **Frequency Control**.

2.2.2.1 Factors taken into account

A **Generation and Desalination Schedule** will be compiled daily by **TRANSCO** as a statement of which **Generating Units and Desalination Units** may be required for the next following **Schedule Day**. In compiling the **Generation and Desalination Schedule**, **TRANSCO** will take account of and give due weight to the following factors:

- i) **Total System** constraints as determined by **TRANSCO** and as advised by **Users** including **Zonal Availability of Generating Units**;
- ii) In respect of **Generating Unit and Desalination Unit** parameters registered as **Scheduling and Dispatch Parameters**;
- iii) **Generation Prices** of each **Generating Unit, Desalination Unit** and tranche of **External Interconnection** transfer or **Self-Supply User connection** transfer;
- iv) the requirements, as determined by **TRANSCO** and as advised by **Users**, for voltage control and **MVar** reserves;
- v) **Generating Unit** stability and **Desalination Unit** water quality as determined by **TRANSCO** after due consultation with the **GENCO**;
- vi) the need to provide an **Operating Margin** as determined by **TRANSCO**;
- vii) the requirements, as determined by **TRANSCO** for maintaining **Frequency Control**;
- viii) monitoring and/or testing and/or commissioning/acceptance testing to be carried out;
- ix) operation of **Generating Plant** to provide a sufficient **Minimum Demand Regulation**;
- x) availability of **Ancillary Services** and
- xi) in the case of generation from **Intermittent Power Sources**, the prevailing and forecast climatic conditions including wind speed and cloud cover.

2.2.2.2 Adjustments to the Generation Schedule

After the completion of the **Scheduling** process, but before the issue of the **Generation and Desalination Schedule**, **TRANSCO** may deem it necessary to make adjustments to the output of the **Scheduling** process. Such adjustments would be made necessary by the following factors:

1. changes to **Availability** and/or **Scheduling and Despatch Parameters** of **Generating and Desalination Units, Self-Supply Users** or **External Interconnections** notified to **TRANSCO** after the commencement of the **Scheduling** process;
2. changes to **TRANSCO Demand Forecast**;
3. changes to transmission constraints emerging from the iterative process of **Scheduling** and **Network Security Assessment**, including:
 - i) changes to the numerical values prescribed to existing constraint groups;
 - ii) identification of new constraint groups;
4. changes to **Generating Unit** requirements within constrained groups, following re-appraisal of **Demand** forecast within that constrained group;
5. changes to any conditions which in the reasonable opinion of **TRANSCO**, would impose increased risk to the **Total System** and would therefore require **TRANSCO** to increase operational reserve levels, either zonally or universally. Examples of these conditions are:
 - i) unpredicted transmission equipment outages which places more than the equivalent of one large **Generating Unit** at risk to a fault;
 - ii) unpredicted outage of **Generating** and/or **Desalinating Plant** equipment which imposes increased risk to the station output;
 - iii) unpredicted outage of **Potable Water** pumping plant and/or water trunk main equipment;
 - iv) volatile weather situation giving rise to low confidence in **TRANSCO Demand** forecasts or in the output of **Generating Units** reliant on **Intermittent Power Sources**;
 - v) severe (unpredicted) weather conditions imposing high risk to the **Total System**;
6. examples of the known limitations and/or deficiencies of **TRANSCO Scheduling** process computational algorithms; and
7. adjustments necessary to make the output of the **Scheduling** process to reflect the allocation of **Operating Reserve**.

2.2.2.3 Content of Generation and Desalination Schedule

The information contained in the **Generation and Desalination Schedule** will indicate on an individual **Generating Unit** and **Desalination Unit** basis the period for which it is **Scheduled** during the following **Schedule Day**.

It will also indicate **Generating Units** and **Desalination Units** running as a result of non-**System** reasons (such as test purposes, including **System Tests** and **System** requirements (such as **Reactive Power** reserve) and **Generating Units** assigned to a specific reserve role.

The **Generation and Desalination Schedule** will also indicate the anticipated transfers across connection to the **Self-Supply Users** or across **External Interconnections** to an **External System Operator**.

2.2.2.4 Special Actions

The **Generation and Desalination Schedule** may be followed by a list of special actions (either pre-fault or post-fault) that **TRANSCO** may request a **GENCO** to take in respect of a procedure to be taken by a **Generating Unit** in order to maintain the integrity of the **Transmission System** in accordance with the **Licence Standards** and **TRANSCO Weekly Operational Policy**.

- i) For a **GENCO** special actions will generally involve a **Load** change or a change of required **Notice to Synchronise**, (for example, to be on **Hot Standby**) in a specific timescale on individual or groups of **Generating Units**. They may also include selection of "System to Generating Unit" intertrip schemes for stability or thermal reasons.
- ii) For **DISCOs** these special actions will generally involve **Load** transfers between **Transmission Supply Points** or arrangements for **Demand** reduction by manual or automatic means.
- iii) For **Self-Supply User` Operators** these special actions will generally involve an increase or decrease of net power flows across a **Connection Point** by either manual or automatic means.
- iv) For **External System Operators** these special actions will generally involve an increase or decrease of net power flows across an **External Interconnection** by either manual or automatic means.

These special actions will be discussed and agreed with the **GENCO**, **DISCO** or other **User** concerned as appropriate. The actual implementation of these special actions will be part of the **Despatch** procedure. If not agreed, generation may be restricted or **Demand** may be at risk.

2.2.2.5 Issue of Generation and Desalination Schedule

The **Generation and Desalination Schedule** will be issued by 1400 hours each day, providing that all the necessary information was made available by 1000 hours. However, if during the period in which the **Generation and Desalination Schedule** is being prepared, **Incidents** on the **Total System** (for example, loss of generation in a critical part of the **Total System**) occur which require a substantial amendment to the data being used in preparing the **Generation and Desalination Schedule**, **TRANSCO** reserve the right to extend the timescale for **Generation and Desalination Schedule** issue to the extent necessary as a result of such **Incidents**.

TRANSCO may instruct **Generating Units** before the issue of the **Generation Schedule** for the **Schedule Day** to which the instruction relates, if the length of **Notice to Synchronise** requires the instruction to be given at that time. When the length of the time required for **Notice to Synchronise** is within 30 minutes of causing the **Generating Unit** to be unable to meet the

indicative **Synchronising** time in the **Generation Schedule** or a subsequent **Despatch** instruction the **GENCO** must inform **TRANSCO** without delay.

2.2.2.6 Negative Minimum Demand Regulation (MDR)

Synchronised Generating Units must at all times be capable of reducing output sufficient to offset the loss of the largest secured **Demand** on the **System** and must be capable of sustaining this response. **TRANSCO** will monitor the output data of the **Generation Schedule** against forecast **Demand** to see whether the level of **MDR** is sufficient. Where the level of **MDR** for any period is insufficient **TRANSCO** may contact all **GENCOs** in relation to relevant **Generating Plant** in the case of low **MDR** and will discuss whether:

1. any change is possible to **Generating Unit** inflexibility;
2. any change is possible in declared **Availability** of a **Generating Unit** which has been notified to **TRANSCO**;
3. In the event that **TRANSCO** is unable to differentiate between **Generating Unit Costs**, **TRANSCO** will instruct a **GENCO** to **Shutdown** a specified **Generating Unit** based upon the following factors:
 - i) effect on power flows (resulting in the minimisation of transmission losses);
 - ii) reserve capability;
 - iii) **Co-generation** water production worth;
 - iv) **Reactive Power** worth; and
 - v) in the case of localised **MDR** the effectiveness of output reduction in the management of the **System Constraint**.

2.2.2.7 Inadequate System Margin

In the period following 1000 hours each day and in relation to the following **Schedule Day** **TRANSCO** will monitor the output data of the **Generation Schedule** against forecast **Demand** and the **Operating Margin** to see whether the anticipated level of the **System Margin** for any period is insufficient.

- i) Where the level of the **System Margin** for any period is anticipated to be insufficient, **TRANSCO** will send a **Notification of Inadequate System Margin (NISM)** to each **GENCO, DISCO** and **Users System**. The **NISM** will indicate the insufficiency and the period for which the insufficiency is anticipated.
- ii) The monitoring will be conducted on a regular basis and revised **NISMs** may be sent out from time to time. These will reflect any changes in declared **Availability** which have been notified to **TRANSCO**, and will reflect any **Demand Control** which has also been so notified. They will also reflect generally any changes in the forecast **Demand** and the relevant **Operating Margin**.

3. GENERATION AND DESALINATION DESPATCH

Generation and Desalination Despatch sets out the procedure:

- i) to optimise the **Despatch** of **Generating Units** and **Desalination Units** such that the cost of procuring the required electricity and water to meet the demand is minimised;

- ii) to issue **Despatch** instructions to **GENCOs** in respect of their **Generating Units** and **Desalination Units**;
- iii) to issue exchange schedules to **External System Operators** in respect of transfers across **External Interconnections** in accordance with relevant Interconnection Agreements;
- iv) to issue exchange schedules to **Self-Supply Users** in respect of transfers across its **connection points** in accordance with relevant **PWPA** or **Connection and Interface Agreements**;
- v) to carry out a re-optimising **Scheduling** process as may be required in **TRANSCO** reasonable opinion; and
- vi) to issue instructions in relation to **Ancillary Services**.

Generating Units powered by **Intermittent Power Sources** are not subject to **Despatch** unless they are equipped with appropriate energy storage facilities.

3.1 Objective

The procedure for the optimisation and re-optimising of **Schedules** and the issue of **Despatch** instructions to **GENCOs**, **Self-Supply Users** and **External System Operators** by **TRANSCO**, is intended to enable **TRANSCO** to match continuously **Generating Unit** and **Desalination Unit** output, transfer to/from **Self-Supply Users** and **External System** transfer to **TRANSCO Demand** together with an appropriate margin of reserve whilst maintaining the integrity of the **Transmission System** together with the security and quality of supply. The optimisation and re-optimisation of **Schedules** is intended to be within the context of minimising the cost of procuring the required electricity and water to meet the demand.

3.2 Procedure

3.2.1 Information Used

The information which **TRANSCO** shall use in assessing

- i) which **Generating** and **Desalination Unit**, transfer to/from **Self-Supply Users** or **External Interconnection** tranche to **Despatch**, will be the declared **Availability**, **Plant Selection**, **Scheduling and Despatch Parameters** (including, in the **Despatch** phase, the choice between run-up rates and run-down rates or loading rates and de-loading rates made by each **GENCO**) and other relevant data in respect of that **Generating Unit**; and
- ii) which **Generating Units** to **Despatch** to provide **Ancillary Services**, will include the declared **Availability**, **Scheduling and Despatch Parameters** (including the choice between run-up rates and run-down rates or loading rates and de-loading rates made by each **GENCO**).

The factors used in the **Despatch** phase in assessing which **Generating Units** to **Despatch**, in conjunction with the **Plant Selection** will be those used by **TRANSCO** to compile the **Generation and Desalination Schedule**.

Additional factors which **TRANSCO** will, however, also take into account are the effect of those **GENCOs** who have not complied with **Despatch** instructions or agreed special actions (including **Demand Control**) and variation between forecast and actual demand as these will have an effect on **Despatch**.

In the event of two or more **Generating Units** having the same **Generation Price**, then **TRANSCO** will select first for **Despatch** the one which in **TRANSCO's** reasonable judgement will give the highest reduction in transmission losses.

3.2.2 Re-optimisation of Generation and Desalination Schedules

TRANSCO will re-optimize the **Schedules** when, in its reasonable judgement, a need arises. As it may be the case that no notice will be given prior to this re-optimisation it is important that **GENCOs** always keep **TRANSCO** informed of changes of **Availability** and **Scheduling and Despatch Parameters** immediately they occur.

3.2.2.1 Indicative Times to GENCOs

Indicative **Generating Unit Synchronising** and **De-Synchronising** times and **Desalination Unit** start-up and shut-down times extracted from the output of the **Computer Scheduling Programme** used by **TRANSCO** in re-optimisation of **Schedules** will be made available to each **GENCO** in respect of its **Generating Units**.

3.2.2.2 Indicative Times to DISCOs

Indicative **Synchronising** and **De-Synchronising** times extracted from the output of the **Computer Scheduling Programme** used by **TRANSCO** in re-optimisation of **Schedules** will also be made available to each **DISCO** but only relating to **Generating Units Embedded** within its **Distribution System**.

3.2.3 Despatch instructions

Despatch instructions relating to the **Schedule Day** will normally be issued at any time during the period beginning immediately after the issue of the **Generation and Desalination Schedule** in respect of that **Schedule Day**.

Despatch instructions will always be to the **GENCO** at its **Generation** and/or **Desalination Plant**, to the **Self-Supply User** or to the **External System Operator**.

For **Generating Unit** that operates within a **Self-Supply User**, **Despatch** instructions should be determined by the operator of the **Self-Supply User**.

Despatch instructions will recognise the **Availability, Scheduling and Despatch Parameters** (including the applicable run-up rates and run-down rates or loading rates and de-loading rates) supplied to **TRANSCO**. A **Despatch** instruction may be subsequently cancelled or varied.

3.2.4 Additional Despatch Instructions

In addition to instructions relating to **Despatch** of **Active Power**, **Despatch** instructions may include:

3.2.4.1 Notice to Synchronise

Notice and changes in notice to **Synchronise** or **De-synchronise** **Generating Units** in a specific timescale will be given direct to the **Generating Plant**.

3.2.4.2 Reserve

Details of the reserve (in the categories set out in **Operating Code 'A'**) to be carried on each **Generating Unit** including specification of the timescale in which that reserve may be transferable into increased **Generating Unit** output.

3.2.4.3 Ancillary Services

An instruction for a **User** to provide **Ancillary Services**.

3.2.4.4 Reactive Power

To ensure that a satisfactory **System** voltage profile is maintained and that sufficient **Reactive Power** reserves are maintained, **Despatch** instructions may include, in relation to **Reactive Power**:

- i) **MVAr Output.** The individual **MVAr** output from the **Generating Unit** onto the **Transmission System** at the **Transmission Entry Point** (or at the **Distribution System Entry Point** in the case of **Embedded Generating Plant**), namely on the HV side of the generator step-up transformer. In relation to each **Generating Unit**, where there is no HV indication, **TRANSCO** and the **GENCO** will discuss and agree equivalent **MVAr** levels for the corresponding LV indication.

Where a **Generating Unit** is instructed to a specific **MVAr** output, the **GENCO** must achieve that output within a tolerance of ± 1 **MVAr** (or such other figure as may be agreed with **TRANSCO**) by either:

- i) on load tap changing on the generator step-up transformer; or
- ii) adjusting the generator stator terminal voltage.

Once this has been achieved, the **GENCO** will not tap again or adjust terminal voltage again without prior consultation with and the agreement of **TRANSCO**, on the basis that **MVAr** output will be allowed to vary with **System** conditions;

- ii) **MVAr exchange on connection points to Self-Supply User:** **TRANSCO** and **Self-Supply User** will discuss and agree **MVAr** level, based on which the **MVAr** outputs from the **Generating Units** will be despatched by **Self-Supply User** operator;
- iii) **Target Voltage Levels.** Target voltage levels to be achieved by the **Generating Unit** on the **Transmission System** at the **Transmission Entry Point** (or on the **Distribution System** at the **Distribution System Entry Point** in the case of **Embedded Generating Plant**), namely on the higher voltage side of the generator step-up transformer. Where a **Generating Unit** is instructed to a specific target voltage, the **GENCO** must achieve that target within a tolerance of ± 1 kV (or such other figure as may be agreed with **TRANSCO**) by either:
 - i) on load tap changing on the generator step-up transformer; or
 - ii) adjusting the generator stator terminal voltage.

In relation to each **Generating Unit**, where there is no HV indication, **TRANSCO** and the **GENCO** will discuss and agree equivalent voltage levels for the corresponding LV indication.

Under normal operating conditions, once this target voltage level has been achieved the **GENCO** will not tap again or adjust terminal voltage again without prior consultation with, and with the agreement of, **TRANSCO**.

However, under certain circumstances the **GENCO** may be instructed to maintain a target voltage until otherwise instructed and this will be achieved by on load tap changing on the generator step-up transformer or adjusting generator stator terminal voltage without reference to **TRANSCO**;

- iv) Maximum MVar Output ("maximum excitation"). Under certain conditions, such as low **System** voltage, an instruction to maximum **MVar** output at instructed **MW** output ("maximum excitation") may be given, and a **GENCO** should take appropriate actions to maximise **MVar** output unless constrained by plant operational limits or safety grounds (relating to personnel or plant);
- v) Maximum MVar Absorption ("minimum excitation"). Under certain conditions, such as high **System** voltage, an instruction to maximum **MVar** absorption at instructed **MW** output ("minimum excitation") may be given, and a **GENCO** should take appropriate actions to maximise **MVar** absorption unless constrained by plant operational limits or safety grounds (relating to personnel or plant).

In addition:

- vi) The issue of **Despatch** instructions for **Active Power** at the **Transmission Entry Point** will be made with due regard to any resulting change in **Reactive Power** capability and may include instruction for reduction in **Active Power** generation to enable an increase in **Reactive Power** capability;
- vii) The excitation system, unless otherwise agreed with **TRANSCO**, must be operated only in its constant terminal voltage mode of operation with **VAr** limiters in service, with any constant **Reactive Power** output control mode or constant **Power Factor** output control mode always disabled, unless agreed otherwise with **TRANSCO**. In the event of any change in **System** voltage, a **GENCO** must not take any action to override automatic **MVar** response which is produced as a result of constant terminal voltage mode of operation unless instructed otherwise by **TRANSCO** or unless immediate action is necessary to comply with stability limits or unless constrained by plant operational limits or safety grounds (relating to personnel or plant);
- viii) A **Despatch** instruction relating to **Reactive Power** will be implemented without delay and will be achieved not later than [2 minutes] after the instruction time, or such longer period as **TRANSCO** may instruct;
- ix) On receiving a new **MW Despatch** instruction, no tap changing or generator terminal voltage adjustment shall be carried out to change the **MVar** output unless there is a new **MVar Despatch** instruction;
- x) Where an instruction to **Synchronise** is given, or where a **Generating Unit** is **Synchronised** and a **MW Despatch** instruction is given, a **MVar Despatch** instruction consistent with the **Generating Unit** relevant parameters may be given. In the absence of a **MVar Despatch** instruction with an instruction to **Synchronise**, the **MVar** output should be 0 **MVar**; and
- xi) Where an instruction to **De-Synchronise** is given, a **MVar Despatch** instruction, compatible with shutdown, may be given prior to **De-Synchronisation** being achieved. In the absence of a separate **MVar Despatch** instruction, it is implicit in the instruction

to **De-Synchronise** that **MVA**r output should at the point of synchronism be 0 **MVA**r at **De-Synchronisation**.

3.2.4.5 Secondary Control Mode

A requirement for change to or from **Secondary Control Mode** for each **Generating Unit**.

3.2.4.6 Tests

An instruction to carry out tests as required under **Operating Code 'B'**.

3.2.5 Nature of Dispatch Instructions

In the case of **Generating Units**, **Dispatch** instructions will indicate the target **MW** (at **Target Frequency**) to be provided at the **Transmission Entry Point**, and to be achieved in accordance with the respective registered **Generating Unit Scheduling and Dispatch Parameters**. In the case of an **Embedded Generating Unit** the figure instructed will be the **MW** at the **Distribution System Entry Point** of the relevant **Embedded Generating Unit**.

In the case of **Desalination Units** **Dispatch** instructions will indicate target m^3/h to be provided at the **Desalination Unit** output and to be achieved in accordance with the respective registered **Desalinating Unit Scheduling and Dispatch Parameters**

The form of and terms to be used by **TRANSCO** in issuing instructions together with their meanings are set out in Appendix B as a non-exhaustive list of examples.

3.2.6 Communication with GENCOs

Dispatch instructions will be given by telephone or any available electronic means such as an EDL (electronic dispatch logger) and will include an exchange of operator names.

Dispatch instructions must be formally acknowledged by telephone or any available electronic means such as EDL (electronic dispatch logger) immediately by the **GENCO** at the **Generating** and/or **Desalination Plant** or a reason given immediately for non-acceptance, which may only be on safety grounds (relating to personnel or plant) or because they are not in accordance with the applicable **Availability Notice** or **Scheduling and Dispatch Parameters**.

In the event that in carrying out the **Dispatch** instructions, an unforeseen problem arises, caused on safety grounds (relating to personnel or plant), **TRANSCO** must be notified without delay by telephone.

3.2.6.1 Action Required from GENCOs

Each **GENCO** will comply with all **Dispatch** instructions properly given by **TRANSCO** unless the **GENCO** has given notice to **TRANSCO** under the provisions of the **Scheduling and Dispatch Code** regarding non-acceptance of **Dispatch** instructions.

Each **GENCO** must utilise the relevant run-up or run-down rate and loading or de-loading rate in accordance with the registered **Scheduling and Dispatch Parameters**.

To preserve **Transmission System** integrity under emergency circumstances **TRANSCO** may issue **Emergency Instructions**. Such **Emergency Instructions** will be issued by **TRANSCO** direct to the **GENCO** at the **Generating Plant** and may require an action or response which is outside **Scheduling and Despatch Parameters**.

3.2.6.2 Synchronise/De-synchronise

GENCOs will only **Synchronise** or **De-Synchronise Generating Units** to the **Despatch** instructions of **TRANSCO** or unless that occurs automatically as a result of inter-trip schemes or **Generating Unit** protection operations. **De-Synchronisation** may take place without **TRANSCO's** prior agreement if it is done purely on safety grounds (relating to personnel or plant).

3.2.6.3 No Instructions

[Where **TRANSCO** and a **GENCO** have agreed the remote **Automatic Generator Control (AGC)** by **TRANSCO** of a **Generating Unit**, **TRANSCO** will not be required to give **Despatch** instructions in accordance with the **Electricity Transmission Code** in relation to that **Generating Unit**.]

3.2.6.4 Generating and/or Desalination Plant Changes

Each **GENCO** at its **Generating** and/or **Desalination Plant** will without delay notify **TRANSCO** by telephone of any change or loss (temporary or otherwise) to the operational capability including any changes to the **Scheduling and Despatch Parameters** of each **Generating Unit** which is **Synchronised** or has been instructed to **Synchronise** within 3 hours and for each **Desalination Unit** in production.

3.2.6.5 Parameter Changes

If, for any reason, including a change of **Availability** or **Scheduling and Despatch Parameters** made by the **GENCO** the prevailing **Despatch** instruction in respect of any **Generating Unit** and/or **Desalination Unit** is no longer within the applicable **Availability** or **Scheduling and Despatch Parameters** then:

- i) the **GENCO** will use reasonable endeavours to secure that a revised **Despatch** instruction be given by **TRANSCO** such that the new **Despatch** instruction is within the now applicable **Availability** and/or **Scheduling and Despatch Parameters**; and
- ii) if **TRANSCO** fails to issue such a new **Despatch** instruction within a reasonable time then the relevant **GENCO** shall be entitled to change the operation of such **Generating Unit** and/or **Desalination Unit** to bring its operation within the applicable **Availability** and/or **Scheduling and Despatch Parameters** until **TRANSCO** issues a new **Despatch** instruction within the applicable **Availability** and/or **Scheduling and Despatch Parameters**. Prior to making such a change in operation, the **GENCO** will use reasonable endeavours to advise **TRANSCO** (by telephone and then confirmed by facsimile transmission) of its intended action and its timing.

3.2.6.6 Request for Operation Under Risk

A **GENCO** at its **Generating** and/or **Desalination Plant** may request **TRANSCO** agreement for one of the **Generating Units** and/or **Desalination Units** at that **Plant** to be operated under

a risk of trip. **TRANSCO** agreement will be dependent on the risk to the **Transmission System** that a trip of the **Generating Unit** would constitute.

3.2.6.7 Excitation Control System Mode of Operation

A **GENCO** may request **TRANSCO** agreement for **Generating Units** to be operated with the **AVR** in manual mode, or **Power System Stabiliser** switched out, or **VAR** limiter switched out. **TRANSCO's** agreement will be dependent on the risk that would be imposed on the **Transmission System** and any **Distribution System**. A **GENCO** may take such action as is reasonably necessary on safety grounds (relating to personnel or plant).

3.2.7 DISCO Instructions

Instructions to **DISCOs** relating to the **Schedule Day** will normally be issued at any time during the period beginning immediately after the issue of the **Generation and Desalination Schedule** as a list of special actions in respect of that **Schedule Day**.

TRANSCO will issue instructions direct to the **DISCO** at each **Control Centre** in relation to special actions and **Demand Control**. Instructions may include:

- i) a requirement for **Demand** reduction and disconnection or restoration;
- ii) an instruction to effect a load transfer between **Transmission Supply Points**; and
- iii) an instruction to switch in a **System** to **Demand Intertripping Scheme**.

3.2.7.1 Communications with DISCOs

Instructions to a **DISCO** will be given by telephone or any available electronic means (and will include an exchange of operator names) and must be formally accepted by the **DISCO** by telephone. Each **DISCO** must comply without delay with all instructions received by it. In the event that in carrying out the instructions, an unforeseen problem arises (caused by safety reasons) **TRANSCO** must be notified without delay by telephone.

3.2.8 Despatch of External Interconnections

The procedures for the **Despatch of External Interconnections** will be in accordance with the appropriate **Interconnection** or **Trading Agreement**.

3.2.9 Despatch of Self-Supply User connection

The procedures for the **Despatch of Self-Supply User connections** will be in accordance with the appropriate **Connection and Interface Agreement** or any other Agreement

4. FREQUENCY CONTROL MANAGEMENT

4.1 Introduction

This section of the Scheduling and Despatch Code sets out the procedure which **TRANSCO** will use in relation to **Users** to direct **Frequency Control**. The **Frequency** of the **Transmission System** will be controlled by:

- i) automatic response from **Generating Units** operating in **Frequency Sensitive Mode**, including **Unit Controller** operation;

- ii) the manual Despatch of **Generating Units**;
- iii) **Generating Units** operating in **AGC** mode under a centralized acting integral **Secondary Controller**.
- iv) Response from **Self-Supply Users**;
- v) response from **External Interconnections**; and
- vi) **Demand Control**.

The requirements for **Frequency Control** are determined by the consequences and effectiveness of Scheduling and Despatch and by the effect of transfers across any connection to **Self-Supply Users** and **External Interconnection** and therefore this section 4 is complementary to sections 2 and 3 of the Scheduling and Despatch Code.

As set out in **Connection Conditions** Section 8, the provision of dedicated **Primary Response**, **Frequency Control** by means of **Demand** reduction and **Secondary Control** by **Automatic Generation Control** are **System Ancillary Services** and are governed by the relevant **Power and Water Purchase Agreement** or **Connection and Interface Agreement**.

4.2 Frequency Sensitive Mode

Unless relieved of the obligation by **TRANSCO**, all Synchronous **Generating Units** and **Power Farms WTGU** shall operate at all times in **Frequency Sensitive Mode** (including, where applicable, with the **Unit Controller** in operation) which term means an automatic incremental or decremental generation response (**Primary Response**) to contain the initial **System Frequency** change together with a sustained generation response (**Secondary Response**) which can contribute to containing and correcting the **System Frequency** within the requirements for **Frequency Control**. **WTGU Power Farms** shall provide **Primary** and **Secondary Response** within the intermittent capability of their primary energy input, if required by **TRANSCO**.

4.2.1 Generating Units, WTGU and PVPS in Primary Control Mode

A **System Frequency** induced change in **Active Power** output by the operation of the **Primary Controller** must not be countermanded by a **GENCO** except where it is done purely on safety grounds (relating to either personnel or plant) or, where necessary to ensure the integrity of the **Generating Plant**.

4.2.2 Generating Units in AGC Control Mode

In accordance with the respective **Power and Water Purchase Agreement** a **Generating Unit** shall be able to operate in **AGC** mode with adjustable **Secondary Control** contribution factor. If the **System** frequency is at or above 51 Hz, or at or below 49 Hz the **AGC** mode should automatically be switched off.

4.3 Actions by External System Operators

TRANSCO shall agree with **External System Operators** plans of action in the event of abnormal **System Frequency** that could occur due to events on either **System**. Where possible, adjacent **External Systems** shall endeavour to provide mutual support but the over-riding priority shall be to maintain their own **Systems** in operation.

4.4 Actions by DISCOs and Non-Embedded Customers including any Self-Supply User

DISCOs, User Systems and Non-Embedded Customers shall follow the requirements of **Operating Code 'A' Section 6 – Demand Control** that sets out the procedures that may be instructed by **TRANSCO** in the event of low **Frequency**.

The situations relevant to action in the event of low **Frequency** include:

- i) Planned manual de-energisation or emergency manual de-energisation of **Demand** initiated by **TRANSCO**; and
- ii) De-energisation of **Demand** by automatic **Frequency Sensitive** relays.

4.5 TRANSCO Despatch Instructions

TRANSCO will issue **Despatch** instructions to regulate the **Frequency** of the **Total System** to meet the requirements of **Frequency Control**.

TRANSCO will issue **Despatch** instructions as to which **Generating Unit** shall participate in **Secondary Control** by means of **AGC** mode activation and participation factor settings.

4.6 Plant Operation to below Minimum Generation

If the **System Frequency** is below the 53 Hz, **Generating Units, PVPS** and **WTGU** which have provided Negative **Primary Response** shall not trip for the periods of time defined in Clause 6.3.1 of Chapter-3, Connection Conditions and the **Generating Unit, PVPS** or **WTGU** loading is above **Minimum Generation**.

If the **System** frequency is at or above 53 Hz, the requirement to make all reasonable efforts to avoid tripping does not apply and the **GENCO** is required to take action to protect the **Generating Plant**.

In the event of the **System Frequency** becoming stable above 50.50 Hz, after all **Generating Plant** action has taken place, **TRANSCO** will issue **Despatch** instructions to trip appropriate **Generating Units, PVPS** or **WFPS** to bring the **System Frequency** to below 50.5 Hz and follow this with appropriate **Despatch** instructions to return the **System Frequency** to **Target Frequency** by enabling **Secondary Control**.

APPENDIX A - GENERATING BLOCK/UNIT DECLARATION

5. AVAILABILITY NOTICE

1. **Generating and/or Desalinating Unit Availability**, (start time and date).
2. **Generating and/or Desalinating Unit** regime unavailability, (day, start time, end time).
3. **Generating and/or Desalination Unit** initial conditions (time required for **Notice to Synchronise** and/or Start-up).
4. **Maximum Generation** and/or **Desalination** increase in output above declared **Availability**.
5. Any changes to **Primary Response** and **Secondary Response** characteristics.
6. The potential available **Active Power** from a **WTGU, CSTU** or **Power Farms** that can be delivered at the **Transmission Entry Point** (or **Distribution System Entry Point** for an **Embedded WTGU, CSTU** or **Power Farm**) taking into consideration the number of such units in operation and the prevailing average energy source (e.g. wind speed) at the site over the sampling period.
7. The **Procurer** shall provide the available transfer capacity and the import/export schedules of each **External Interconnection** and each **Self Supply User**.

6. SCHEDULING AND DESPATCH PARAMETERS

1. **Generating and/or Desalinating Unit** inflexibility (inflexibility description, start date and time, end date and time, MW, m³/h).
2. **Generating Unit Synchronising** intervals (hot time interval, off-load time interval).
3. **Desalinating Unit** start-up intervals (hot time interval, off-load time interval).
4. Station **Generating Unit De-Synchronising** intervals.
5. Station **Desalinating Unit** shut-down intervals.
6. **Generating Unit** basic data:
 - i) **Minimum Generation**;
 - ii) Minimum shutdown time;
7. **Desalination Unit** basic data:
 - i) Minimum production
 - ii) Maximum production
8. **Generating Unit** two shifting limitation;
9. **Generating Unit** minimum on time;
10. **Generating Unit Synchronising Generation** MW or in the case of **WTGU Power Farm** the block load on start up;
11. **Generating Unit Synchronising** groups;
12. **Generating Unit** run-up rates with MW breakpoints
13. **Generating Unit** run-down rates with MW breakpoints.
14. **Generating Unit** loading rates covering the range from **Minimum Generation** to **Net Dependable Power Capacity**.

15. **Generating Unit** de-loading rates covering the range from **Net Dependable Power Capacity** to **Minimum Generation**
16. In the case of connection points to **Self-Supply Users** and **External Interconnections** the maximum transfer ramping rates.

APPENDIX B - DESPATCH INSTRUCTIONS

7. FORM OF DESPATCH INSTRUCTION

All run-up/run-down rates and loading/de-loading rates will be assumed to be constant and in accordance with **Scheduling and Despatch Parameters**. Each instruction will, wherever possible, be kept simple, drawing as necessary from the following forms.

The **Despatch** instructions will normally follow the form:

- i) an exchange of operator names;
- ii) the specific **Generating** and/or **Desalination Unit** to which the instruction applies;
- iii) the output to which it is instructed;
- iv) if the start time is different from the time the instruction is issued, the start time will be included;
- v) where specific run-up/run-down rates or loading/de-loading rates are concerned, a specific target time;
- vi) the issue time of the instruction.

8. DESPATCHING INSTRUCTION TO INCREASE OR DECREASE OUTPUT

If the time of the instruction is 1400 hours, the Unit is Unit 1 and the output to be achieved is 25MW, the relevant part of the instruction would be, for example:

"Unit 1 to 25MW instruction timed at 1400"

If the start time is 1415 hours, it would be, for example:

"Unit 1 to 30MW start at 1415 hours instruction timed at 1400"

9. GENERATING UNIT SYNCHRONISING

In this instance for **Generating Units** the instruction issue time will always have due regard for the time of **Notice to Synchronise** declared to **TRANSCO** by the **GENCO**.

The instruction will follow the form, for example:

Unit 1 **Synchronise** at 1600 hours instruction timed at 1300 hours.

Unless a loading programme is also given at the same time it will be assumed that the **Generating Unit(s)** are to be brought to **Minimum Generation** and (at the point of synchronism) 0 MVAR output, and on the **GENCO** reporting that the **Generating Unit** has **Synchronised** a further **Despatch** instruction will be issued.

When a **Despatch** instruction for a **Generating Unit** to **Synchronise** is cancelled before the Unit or Module is **Synchronised**, the instruction will follow the form, for example:

Unit 1 cancel **Synchronising** instruction, instruction timed at 1400 hours.

10. GENERATING UNIT DE-SYNCHRONISING

The instruction will normally follow the form, for example:

Unit 1 **Shutdown** instruction timed at 1300 hours.

If the instruction start time is for 1400 hours the form will be, for example:

Unit 1 **Shutdown** start at 1400 hours, instructions timed at 1300 hours

Both the above assume a run-down rate at declared **Generation Scheduling and Dispatch Parameters**.

Unless a separate **MVAr Dispatch** instruction is given, it will be assumed that the **Generating Unit** will be brought to 0 **MVAr** (at the point of synchronism) at **De-Synchronisation**.

11. FREQUENCY CONTROL

All the above **Dispatch** instructions will be deemed to be at the instructed **Target Frequency**.

Frequency control instructions may be issued in conjunction with, or separate from, a **Dispatch** instruction for ordinary **Active Power** output.

12. TERTIARY RESERVE

Tertiary Reserve will be specifically instructed as required and will normally be given with a loading instruction as an additional item in the form, for example:

Unit 1 to 40MW **Tertiary Reserve**, instruction timed at 1400 hours

13. BLACK START

The instruction will normally follow the form, for example:

Initiate **Black Start** procedure, instruction timed at 1900 hours

14. EMERGENCY INSTRUCTION

The instruction will be prefixed with the words "This is an **Emergency Instruction**". It may be in a pre-arranged format and normally follow the form, for example:

This is an **Emergency Instruction**. Reduce output to "X" MW in "Y" minutes, instruction timed at 2000 hours

15. VOLTAGE CONTROL INSTRUCTION

In order that adequate **System** voltage profiles and **Reactive Power** reserves are maintained under normal and fault conditions a range of voltage control instructions will be utilised from time to time, for example:

- i) Increase/decrease **Reactive Power** to 10MVA_r export or import;
- ii) Maximum MVA_r output (or "maximum excitation");
- iii) Maximum MVA_r absorption (or "minimum excitation");
- iv) Increase **Generating Unit** generator step-up transformer tap position by one tap or go to tap position x;
- v) Achieve a target voltage of 405kV and then allow to vary with **System** conditions;
- vi) Maintain a target voltage of 405kV until otherwise instructed. Tap change (or adjust generator terminal voltage) as necessary.

In relation to **MVA_r Despatch** matters, **MVA_r** generation/output is an export onto the **System** and is referred to as "lagging MVA_r", and **MVA_r** absorption is an import from the **System** and is referred to as "leading MVA_r";

CHAPTER 7 - DATA REGISTRATION CODE

1. INTRODUCTION

The **Data Registration Code (DRC)** sets out a unified listing of all data required by **TRANSCO** from **Users** and by **Users** from **TRANSCO**.

Where there is any inconsistency in the data requirements under any particular section of the **Electricity Transmission Code** and the **Data Registration Code** the provisions of the particular Chapter of the **Electricity Transmission Code** shall prevail.

The Code under which any item of data is required specifies the procedures and timing for the supply of data, for routine updating and for recording temporary or permanent changes to data.

2. OBJECTIVE

The objective of the **DRC** is to:

- i) List and collate all the data to be provided by each category of **User** to **TRANSCO** under the **Electricity Transmission Code**; and
- ii) List all data to be provided by **TRANSCO** to each category of **User** under the **Electricity Transmission Code**.

3. SCOPE

The **Users** to which the **DRC** applies are:

- i) **GENCOs**;
- ii) **DISCOs**;
- iii) **Non-Embedded Customers**;
- iv) **User Systems**;
- v) **Self-Supply Users**; and
- vi) **External System Operators**.

4. DATA CATEGORIES AND STAGES IN REGISTRATION

Within the **DRC** each item of data is allocated to one of the following three categories:

- i) **Standard Planning Data (SPD)**;
- ii) **Detailed Planning Data (DPD)**; and
- iii) **Operational Data (OD)**.

The **Standard Planning Data** is required in accordance with Appendix A of the **Planning Code**. The **Detailed Planning Data** is required in accordance with Appendix B of the **Planning Code**. The **Operational Data** is required in accordance with **Operating Codes** and **Scheduling and Despatch Codes**. Within the **Data Registration Code**, **Operational Data** is sub-categorised according to the Code under which it is required, i.e. **OC'A**, **OC'B** and **SDC**.

5. PROCEDURES AND RESPONSIBILITIES

5.1 Responsibility for submission and updating of data

In accordance with the provisions of the various Sections of the **Electricity Transmission Code**, each **User** must submit data as summarised, listed and collated in the attached Schedules.

5.2 Methods of submitting data

The data must be submitted to the **TRANSCO Control Engineer**. The name of the person at the **User** who is submitting each Schedule of data must be included.

The data may be submitted via a computer link if such a data link exists between a **User** and **TRANSCO** or utilising a data transfer media, such as floppy diskette, magnetic tape, CD ROM, memory stick etc. after obtaining the prior written consent from **TRANSCO**. Such data files and media shall first be checked and certified by the **User** as free from any viruses or malicious programmes prior to submission.

5.3 Changes to Users data

The **User** must notify **TRANSCO** of any change to data which is already submitted and registered with **TRANSCO** in accordance with each section of the **Electricity Transmission Code**.

5.4 Data not supplied

If a **User** fails to supply data when required by any Chapter of the **Electricity Transmission Code**, **TRANSCO** will estimate such data if and when, in the view of **TRANSCO**, it is necessary to do so.

If **TRANSCO** fails to supply data when required by any Section of the **Electricity Transmission Code**, the **User** to whom that data ought to have been supplied, will estimate such data if and when, in the view of that **User**, it is necessary to do so.

Such estimates will, in each case be based upon data supplied previously for the same **Plant** or **Apparatus** or upon corresponding data for similar **Plant** and/or **Apparatus** or upon such other information as **TRANSCO** or that **User**, as the case may be, deems appropriate.

TRANSCO will advise a **User** in writing of any estimated data it intends to use relating directly to that **User Plant** and/or **Apparatus** in the event of data not being supplied.

User will advise **TRANSCO** in writing of any estimated data it intends to use in the event of data not being supplied.

6. DATA TO BE REGISTERED

The attached Schedules A to L cover the following data:

6.1 Data supplied by Users to TRANSCO

- SCHEDULE A GENERATING AND DESALINATION UNIT TECHNICAL DATA. Comprises **Generating Unit**, **Desalination Unit** and **Power Station** fixed parameters.
- SCHEDULE B GENERATION/OPERATIONAL PLANNING DATA. Comprises **Generating Plant** parameters required for **Operational Planning**.
- SCHEDULE C SCHEDULING AND DESPATCH DATA. Comprises parameters required for **Scheduling** and **Despatch** of electricity.
- SCHEDULE D NON-SYNCHRONOUS GENERATION SCHEDULE DATA
- SCHEDULE E GENERATION PLANT OUTAGE DATA. Comprises **Generating Unit** and **Power Station** equipment **Outage** planning data.
- SCHEDULE F USER SYSTEM DATA. Comprises electrical parameters relating to **Plant** and **Apparatus** connected to **TRANSCO Transmission System**
- SCHEDULE G LOAD CHARACTERISTICS DATA. Comprises the estimated parameters of **Loads** in respect of harmonic content, sensitivity etc.
- SCHEDULE H USER DEMAND PROFILES AND ACTIVE ENERGY DATA. Comprises data related to **Demand** profiles.
- SCHEDULE I CONNECTION POINT DATA. Comprises data related to **Demand** and **Demand** transfer capability.
- SCHEDULE J DEMAND CONTROL DATA. Comprises data related **Demand Control**.
- SCHEDULE K FAULT INFEED DATA. Comprises data related to short circuit contribution to **TRANSCO Transmission System**.

6.2 Data supplied by TRANSCO to Users

SCHEDULE L - DATA SUPPLIED TO USERS BY TRANSCO.

The Schedules applicable to each class of **User** are shown in the following table:

User	Schedule											
	A	B	C	D	E	F	G	H	I	J	K	L
1. GENCOS with Generating and Desalination Plant	✓	✓	✓	✓	✓							✓
2. DISCOs with Distribution Systems										✓		✓
3. Non Embedded Customers												✓
4. All Users connected directly to TRANSCO Transmission System						✓					✓	
5. All Users connected directly to TRANSCO Transmission System other than GENCOS								✓				
6. All Users connected directly to TRANSCO Transmission System with Demand (including GENCOS with respect to Demand at directly connected Power Stations)							✓		✓			

SCHEDULE A - GENERATING AND DESALINATION UNIT TECHNICAL DATA

POWER AND DESALINATION STATION NAME: _____

The following details are required from each User with existing or proposed Generating Plant directly connected, or to be directly connected, to the Transmission System and/or with existing, or proposed, Embedded Generating Plant.

Data description	Units	Data Category	Generating and Desalination Unit or Station Data					
			U1	U2	U3	U4	U5	U6
<u>POWER STATION DEMAND:</u>								
Demand associated with the Power Station supplied through Transmission System or GENCO's User System in addition to Demand supplied through unit transformer:								
1. Maximum Demand that could occur	MW MVAr	DPD						
2. Demand at the time of peak TRANSCO Demand	MW MVAr	DPD						
3. Demand at the time of minimum TRANSCO Demand	MW MVAr	DPD						
<u>UNIT DEMAND:</u>								
Demand supplied through unit transformer when Generating Unit is at Rated MW output	MW MVAr	DPD						
<u>SYNCHRONOUS GENERATING UNIT PERFORMANCE AND PARAMETERS:</u>								
<u>General</u>								
1. Details of point of connection to the Transmission System of the Generating Unit (in terms of geographical and electrical location and system voltage)	Text	SPD+						
2. Type of Generating Unit (e.g. Steam Turbine Unit, Gas Turbine Unit, Cogeneration Unit , etc.)	Text	SPD						
3. Expected running regime(s)	Text	SPD						
4. Registered Capacity	MW	SPD						
5. System Constrained Capacity (for Embedded Generating Units only)	MW	SPD						
6. Active Power obtained in excess of Registered Capacity	MW	SPD						

Data description	Units	Data Category	Generating and Desalination Unit or Station Data					
			U1	U2	U3	U4	U5	U6
7. Minimum Generation	MW	SPD DPD						
8. Rated Active Power	MW	SPD+ DPD						
9. Rated Apparent Power	MVA	SPD+ DPD						
10. Rated terminal voltage	kV	DPD						
11. Generator Performance Chart at stator terminals	Chart	SPD						
12. Net Dependable Power Capacity (on a monthly basis)	MW	SPD						
13. Short circuit ratio		SPD+						
14. Turbo-generator inertia constant (alternator plus prime mover)	MWs/MVA	SPD+ DPD						
15. Rated field current at Rated MW and MVA _r output and at rated terminal voltage	A	DPD						
16. Field current open circuit saturation curve (as derived from appropriate manufacture's test certificate)								
• 120% rated terminal voltage	Graph	DPD						
• 110% rated terminal voltage	Graph	DPD						
• 100% rated terminal voltage	Graph	DPD						
• 90% rated terminal voltage	Graph	DPD						
• 80% rated terminal voltage	Graph	DPD						
• 70% rated terminal voltage	Graph	DPD						
• 60% rated terminal voltage	Graph	DPD						
• 50% rated terminal voltage	Graph	DPD						
<u>Impedances:</u>								
1. Direct axis synchronous reactance	% on m/c MVA base	DPD						
2. Direct axis transient reactance	% on m/c MVA base	SPD+ DPD						
3. Direct axis sub-transient reactance	% on m/c MVA base	DPD						
4. Quadrature axis synchronous reactance	% on m/c MVA base	DPD						

Data description	Units	Data Category	Generating and Desalination Unit or Station Data					
			U1	U2	U3	U4	U5	U6
5. Quadrature axis sub-transient reactance	% on MVA	DPD						
6. Stator leakage reactance	% on m/c MVA base	DPD						
7. Armature winding direct-current resistance	% on m/c MVA base	DPD						
<u>Time Constants:</u>								
1. Direct axis short-circuit transient time constant	S	DPD						
2. Direct axis short-circuit sub-transient time constant	S	DPD						
3. Quadrature axis short-circuit sub-transient time constant	S	DPD						
4. Stator time constant	S	DPD						
<u>GENERATING UNIT STEP-UP TRANSFORMER:</u>								
1. Transformer Rating	MVA	SPD+ DPD						
2. Rated voltage ratio		DPD						
3. Winding arrangement		DPD						
4. Vector group		DPD						
5. Positive sequence resistance								
• @ maximum tap	% on transformer MVA base	DPD						
• @ minimum tap	% on transformer MVA base	DPD						
• @ nominal tap	% on transformer MVA base	DPD						
6. Positive sequence reactance								
• @ maximum tap	% on transformer MVA base	SPD+ DPD						
• @ minimum tap	% on transformer MVA base	SPD+ DPD						

Data description	Units	Data Category	Generating and Desalination Unit or Station Data					
			U1	U2	U3	U4	U5	U6
• @ nominal tap	% on transformer MVA base	SPD+ DPD						
7. Zero phase sequence reactance	% on transformer MVA base	DPD						
8. Tap changer range	±%	DPD						
9. Tap changer step size	%	DPD						
10. Tap changer type (i.e. on-load or off-circuit)	On/Off							
<u>EXCITATION CONTROL SYSTEM PARAMETERS:</u>								
<u>(ALL SYNCHRONOUSLY CONNECTED GENERATING UNITS):</u>								
1. Exciter category (e.g. rotating or static)	Text	SPD+						
2. Details of Excitation System described in block diagram showing transfer functions of individual elements (including PSS if fitted)	Diagram	DPD						
3. Rated field voltage	V	DPD						
4. Generator no-load field voltage	V	DPD						
5. Excitation System on-load positive ceiling voltage	V	DPD						
6. Excitation System no-load negative ceiling voltage	V	DPD						
7. Power System Stabiliser fitted?	Yes/No	SPD+						
8. Details of over excitation limiter described in block diagram showing transfer functions of individual elements	Diagram	DPD						
9. Details of under excitation limiter described in block diagram showing transfer functions of individual elements	Diagram	DPD						
<u>GOVERNOR PARAMETERS</u>								
<u>(ALL SYNCHRONOUSLY CONNECTED GENERATING UNITS):</u>								
Governor system block diagram showing transfer function of individual elements	Diagram	DPD						

Data description	Units	Data Category	Generating and Desalination Unit or Station Data					
			U1	U2	U3	U4	U5	U6
<u>PRIME MOVER PARAMETERS</u>								
<u>(STEAM TURBINE UNITS):</u>								
Prime mover system block diagram showing transfer function of individual elements and controllers	Diagram	DPD						
<u>PRIME MOVER PARAMETERS</u>								
<u>(GAS TURBINE UNITS):</u>								
Prime mover system block diagram showing transfer function of individual elements and controllers	Diagram	DPD						
<u>DESALINATION UNIT PARAMETERS</u>								
Registered Capacity	MIGPD	SPD						
Desalination Unit Auxiliary Power	MW	SPD						
<u>PLANT FLEXIBILITY PERFORMANCE:</u>								
Details required with respect to Generating Plant:								
1. Rate of loading following a weekend shut-down (Generating Unit and Power Station)	MW/Min	DPD						
2. Rate of loading following an overnight shut-down (Generating Unit and Power Station)	MW/Min	DPD						
3. Block load following Synchronising	MW	DPD						
4. Rate of De-loading from Rated MW	MW/Min	DPD						
5. Regulating range	MW	DPD						
6. Load rejection capability while still Synchronised and able to supply Load	MW	DPD						

ABBREVIATIONS: **SPD Standard Planning Data**
DPD Detailed Planning Data

Note: The data marked with "+" is required with an application for a **Connection Agreement** (to facilitate an early assessment by **TRANSCO** of the need for more detailed studies).

SCHEDULE B - GENERATION OPERATIONAL PLANNING DATA

POWER STATION NAME: _____

The following details are required from each **User** in respect of each **Generating Unit, CGGT Module** and **Desalination Unit**.

Data description	Units	Data	Generating Unit, Desalination Unit CCGT Modules and Station Data						
			Category	U1	U2	U3	U4	U5	U6
<u>STEAM TURBINE GENERATING UNITS:</u>									
1. Minimum notice required to synchronise under following conditions:									
• Hot start	Minutes	OCA							
• Warm start	Minutes	OCA							
• Cold start	Minutes	OCA							
2. Minimum time between synchronising different Generating Units at a Power Station	Minutes	OCA							
3. Minimum block Load requirement on synchronising	MW	OCA							
4. Maximum Generating Unit loading rates from synchronising under following conditions:									
• Hot start	MW/ Minute	OCA							
• Warm start	MW/ Minute	OCA							
• Cold start	MW/ Minute	OCA							
5. Maximum Generating Unit de-loading rate	MW/ Minute	OCA							
6. Minimum interval between de-synchronising and synchronising a Generating Unit	Minutes	OCA							
<u>GAS TURBINE GENERATING UNITS</u>									
1. Minimum notice required to synchronise	Minutes	OCA							

Data description	Units	Data	Generating Unit, Desalination Unit CCGT Modules and Station Data						
			Category	U1	U2	U3	U4	U5	U6
2. Minimum time between synchronising different Generating Units at a Power Station	Minutes	OCA							
3. Minimum block Load requirement on synchronising	MW	OCA							
4. Maximum Generating Unit loading rates from synchronising for									
• Fast start	MW/ Minute	OCA							
• Slow start	MW/ Minute	OCA							
5. Maximum Generating Unit de-loading rate	MW/ Minute	OCA							
6. Minimum interval between de-synchronising and synchronising a Generating Unit	Minutes	OCA							
<u>COMBINED CYCLE GAS TURBINE (CCGT) MODULES:</u>									
1. Minimum notice required to synchronise under following conditions									
• Hot start	Minutes	OCA							
• Warm start	Minutes	OCA							
• Cold Start	Minutes	OCA							
2. Minimum time between synchronising different CCGT Modules at a Power Station	Minutes	OCA							
3. Minimum block Load requirement on synchronising	MW	OCA							
4. Maximum CCGT Module loading rates from synchronising under following conditions:									
• Hot start	MW/ Minute	OCA							
• Warm start	MW/ Minute	OCA							
• Cold Start	MW/ Minute	OCA							
5. Maximum CCGT Module de-loading rate	MW/ Minute	OCA							

Data description	Units	Data	Generating Unit, Desalination Unit CCGT Modules and Station Data						
			Category	U1	U2	U3	U4	U5	U6
6. Minimum interval between de-synchronising and synchronising a CCGT Module	Minutes	OCA							
<u>Note:</u> For CCGT power stations that can also run in open cycle mode, data for both modes of operation shall be provided.		OCA							

ABBREVIATIONS: OCA Operating Code ‘A’

SCHEDULE C - SCHEDULING AND DESPATCH DATA

POWER STATION NAME: _____

The following details are required from each **User** in respect of each **Generating Unit**.

Data Description	Units	Data Category	Generating Unit, Desalination Unit and Station Data						
			U1	U2	U3	U4	U5	U6	Station
<u>GENERATING BLOCK/UNIT DECLARATION</u>									
<u>AVAILABILITY NOTICE</u>									
1. Generating Unit and/or Desalination Unit Availability									
• Net Dependable Power Capacity	MW	SDC							
• Start time	date/time	SDC							
• Net Dependable Water Capacity	m ³ /h								
• Start Time	date/time								
2. Generating Unit unavailability									
• Start time	date/time	SDC							
• End time	date/time	SDC							
3. Desalination Unit unavailability									
• Start time	date/time	SDC							
• End time	date/time	SDC							
4. Generating Unit and/or Desalination Unit initial conditions									
• Time required for Notice to Synchronise	hrs	SDC							
• Time required for start-up	hrs	SDC							
5. Maximum Generation and/or Desalination increase in output above declared Availability									
		SDC							
6. Any changes to Primary Response and Secondary Response characteristics									
		SDC							
<u>SCHEDULING AND DESPATCH PARAMETERS</u>									
1. Generating Unit inflexibility									
• Description	Text	SDC							
• Start date	date/time	SDC							

Data Description	Units	Data	Generating Unit, Desalination Unit and Station Data							
			Category	U1	U2	U3	U4	U5	U6	Station
• End date	date/time	SDC								
• Active Power	MW	SDC								
2. Generating Unit synchronising intervals										
• Hot time interval	hrs	SDC								
• Off-load time interval	hrs	SDC								
3. Desalination Unit start-up intervals										
• Hot time interval	hrs	SDC								
• Off-load time interval	hrs	SDC								
4. Station Generating Unit de-synchronising intervals	hrs	SDC								
5. Station Desalination Unit shutdown intervals	hrs	SDC								
6. Generating Unit basic data										
• Minimum Generation	MW	SDC								
• Minimum shutdown time	hrs	SDC								
7. Desalination Unit basic data										
• Minimum production	m ³ /h	SDC								
• Maximum production	m ³ /h	SDC								
8. Generating Unit two shifting limitation	Text	SDC								
9. Generating Unit minimum on time	hrs	SDC								
10. Generating Unit Synchronising Generation	MW	SDC								
11. Generating Unit Synchronising groups		SDC								
12. Generating Unit run-up rates with breakpoints	MW/ minute	SDC								
13. Generating Unit run-down rates with breakpoints	MW/ minute	SDC								
14. Generating Unit loading rates covering the range from Minimum Generation to Net Dependable Power Capacity	MW/ minute	SDC								
15. Generating Unit de-loading rates covering the range from Net Dependable Power Capacity to Minimum Generation	MW/ minute	SDC								

ABBREVIATIONS: SDC Scheduling and Despatch Code

SCHEDULE D - NON-SYNCHRONOUS GENERATION SCHEDULE DATA

Data Description	Units	Data Category	Generating and Desalination Unit or Station Data					
			U1	U2	U3	U4	U5	U6
<u>NON-SYNCHRONOUS GENERATING UNIT PERFORMANCE AND PARAMETERS:</u>								
1. General Detail of point of connection to the Transmission System of the Generating Unit (in terms of geographical location and system voltage level)	Text	SPD+						
2. Single line diagram showing all HV equipment and connections together with equipment ratings	Text	SPD						
3. Type of Generating Unit (e.g. Wind Turbine, Solar P.V etc.)	Text	SPD						
4. Expected running regime(s)	MW	SPD						
5. Registered Capacity of Power Farm (either Solar or Wind) at the Transmission Entry Point (or User System Entry Point if Embedded)	MVA	SPD						
6. Rated Apparent Power	Chart	DPD						
7. Power Farm reactive capability (either Solar or Wind) at the Transmission Entry Point (or User System Entry Point if Embedded)		DPD						
8. Number of generating units		DPD						
9. Operating voltage of the park		DPD						
<u>DC Converter at a DC Converter Station or PV or Wind Farm</u>								
1. DC Converter type (e.g. current/voltage sourced)		DPD						
2. Rated MW per pole import and export	MW	DPD						
3. Number of poles and pole arrangement		DPD						
4. Rated DC voltage/pole	kV	DPD						
5. Return path arrangement		DPD						
6. Active Power independent of System Frequency between 49.5Hz and 50.5Hz	YES/NO	DPD						

Data Description	Units	Data Category	Generating and Desalination Unit or Station Data					
			U1	U2	U3	U4	U5	U6
7. Active Power does not fall more than 5% of the Active Power output over the Frequency range 49.5Hz to 47Hz	YES/NO	DPD						
8. Frequency Control speed droop setting	%	DPD						
<u>Non-Synchronously Connected Generating Units</u>								
<u>General</u>								
1. Type of generator (e.g. Doubly Fed Induction Generator, Fixed Speed Induction Generator etc.)		DPD						
2. Rated MVA		DPD						
3. Rated Power		DPD						
4. Terminal Voltage		DPD						
5. Inertia constant		DPD						
6. Stator resistance		DPD						
7. Magnetising reactance		DPD						
8. Rotor Resistance		DPD						
9. Rotor speed range (Doubly fed induction only)		DPD						
10. Converter MVA rating (Doubly fed induction only)		DPD						
11. The optimal power coefficient (CP) versus tip speed ratio (where applicable)		DPD						
12. Electrical Power versus wind speed, over a range of wind speeds		DPD						
13. Transfer function block diagram block diagram including parameters and description of the power electronic converter including torque/speed converter		DPD						
<u>Non-Synchronously Connected and AC/DC Converter Connected Generating Units</u>								
<u>Voltage / Reactive Power / Power Factor Control System Parameters</u>								
1. For WTGU details of voltage / Reactive Power / Power Factor controller (and PSS if fitted) described in Block Diagram form showing	Block diagram	DPD						

Data Description	Units	Data Category	Generating and Desalination Unit or Station Data						
			U1	U2	U3	U4	U5	U6	
transfer functions and parameters of individual elements									
<u>AC Filter or Reactive Compensation Equipment</u>	Block diagram	DPD							
2. Total number of filters									
3. Type of equipment (e.g. fixed or variable)	Block diagram	DPD							
4. Single line diagram of filter/reactive compensation equipment arrangement and connections	Single line diagram	DPD							
5. Reactive Power of each AC filter bank or reactive compensation equipment, at rated voltage		DPD							
<u>Non-Synchronously Connected and AC/DC Converter Connected Generating Units</u>									
<u>Frequency Control</u>									
1 For WTGU details of frequency controller described in Block Diagram form showing transfer functions and parameters of individual elements		DPD							
<u>Non-Synchronously Connected and AC/DC Converter Connected Generating Units</u>									
<u>Protection</u>									
<u>Details of settings for the following protection relays are required:</u>									
1. Under Frequency trip setting		DPD							
2. Over Frequency trip setting		DPD							
3. Over Voltage		DPD							
4. Rotor over current		DPD							
5. Stator over current		DPD							
6. High wind speed shut down		DPD							
<u>GENERATING UNIT STEP-UP TRANSFORMER:</u>									
Transformer Rating	MVA	SPD+ DPD							
Rated voltage ratio		DPD							
Winding arrangement		DPD							
Vector group		DPD							
Positive sequence resistance									

Data Description	Units	Data Category	Generating and Desalination Unit or Station Data					
			U1	U2	U3	U4	U5	U6
@ maximum tap	% on transformer MVA base	DPD						
@ minimum tap	% on transformer MVA base	DPD						
@ nominal tap	% on transformer MVA base	DPD						
Positive sequence reactance								
@ maximum tap	% on transformer MVA base	SPD+ DPD						
@ minimum tap	% on transformer MVA base	SPD+ DPD						
@ nominal tap	% on transformer MVA base	SPD+ DPD						
Zero phase sequence reactance	% on transformer MVA base	DPD						
Tap changer range	±%	DPD						
Tap changer step size	%	DPD						
Tap changer type (i.e. on-load or off-circuit)	On/Off							
<u>TRANSMISSION ENTRY POINT STEP-UP TRANSFORMER:</u>								
Transformer Rating	MVA	SPD+ DPD						
Rated voltage ratio		DPD						
Winding arrangement		DPD						
Vector group		DPD						
Positive sequence resistance								
@ maximum tap	% on transformer MVA base	DPD						
@ minimum tap	% on transformer MVA base	DPD						

Data Description	Units	Data Category	Generating and Desalination Unit or Station Data					
			U1	U2	U3	U4	U5	U6
@ nominal tap	% on transformer MVA base	DPD						
Positive sequence reactance								
@ maximum tap	% on transformer MVA base	SPD+ DPD						
@ minimum tap	% on transformer MVA base	SPD+ DPD						
@ nominal tap	% on transformer MVA base	SPD+ DPD						
Zero phase sequence reactance	% on transformer MVA base	DPD						
Tap changer range	±%	DPD						
Tap changer step size	%	DPD						
Tap changer type (i.e. on-load or off-circuit)	On/Off							
<u>Non-Synchronously Connected and AC/DC Converter Connected Generating Units</u>								
<u>Harmonic and Flicker Parameters</u>								
Each Power Farm is required to supply the following information;								
1.	Flicker coefficient for continuous operation	DPC						
2.	Flicker step factor							
3.	Number of switching operations in a 10 minute window	DPC						
4.	Number of switching operations in a 2 hour window	DPC						
5.	Voltage change factor	DPC						
6.	Harmonic current injection	A DPC						

ABBREVIATIONS: **SPD Standard Planning Data**
 DPD Detailed Planning Data

Note: The data marked with "+" is required with an application for a **Connection Agreement** (to facilitate an early assessment by **TRANSCO** of the need for more detailed studies).

SCHEDULE E - GENERATION PLANT OUTAGE DATA

POWER STATION NAME: _____

The following details are required from each **User** in respect of each **Generating Unit**.

Data Description	Units	Time Covered	Update Time	Data Category
<u>PROVISIONAL OUTAGE PROGRAMME</u>				
1. Generating Units concerned	ID	Year 2 to 3	End of March	OCA
2. Active Power not available as a result of Outage	MW	Year 2 to 3	End of March	OCA
3. Remaining Active Power of the Plant	MW	Year 2 to 3	End of March	OCA
4. Duration of Outage	Weeks	Year 2 to 3	End of March	OCA
5. Start date and time or a range of start dates and times	Date hrs	Year 2 to 3	End of March	OCA
6. Flexible or Inflexible Planned Outage	Flexible/ Inflexible	Year 2 to 3	End of March	OCA
7. Flexible Planned Outage				
• Period for which the Outage could be deferred (not less than 30 days in length)	Days	Year 2 to 3	End of March	OCA
• Period for which the Outage could be advanced (not less than 10 days in length)	Days	Year 2 to 3	End of March	OCA
TRANSCO issue Provisional Outage Programme to Users		Year 2 to 3	End of Sept	OCA
Agreement on Provisional Outage Programme	Text	Year 2 to 3	End of October	OCA
<u>FINAL OUTAGE PROGRAMME</u>				
1. Generating Units concerned	ID	Year 1 to 2	End of March	OCA
2. Active Power not available as a result of Outage	MW	Year 1 to 2	End of March	OCA
3. Remaining Active Power of the Plant	MW	Year 1 to 2	End of March	OCA
4. Duration of Outage	Weeks	Year 1 to 2	End of March	OCA

Data Description	Units	Time Covered	Update Time	Data Category
5. Start date and time or a range of start dates and times	Date hrs	Year 1 to 2	End of March	OCA
6. Flexible or Inflexible Planned Outage	Flexible/ Inflexible	Year 1 to 2	End of March	OCA
7. Flexible Planned Outage				
• Period for which the Outage could be deferred (not less than 30 days in length)	Days	Year 1 to 2	End of March	OCA
• Period for which the Outage could be advanced (not less than 10 days in length)	Days	Year 1 to 2	End of March	OCA
TRANSCO issue draft Final Outage Programme to Users	Text	Year 1 to 2	End of June	OCA
GENCO to provide objections to any changes suggested in the Final Outage Programme	Text	Year 1 to 2	End of July	OCA
TRANSCO issue Final Outage Programme to Users	Text	Year 1 to 2	End of Sept	OCA
<u>SHORT TERM PLANNED MAINTENANCE OUTAGE</u>				
1. Generating Units concerned	ID	Year 0	No less than 7 Days before	OCA
2. Active Power not available as a result of Outage	MW	Year 0	No less than 7 Days before	OCA
3. Remaining Active Power of the Plant	MW	Year 0	No less than 7 Days before	OCA
4. Duration of Outage (which must not exceed 72 hours)	hrs	Year 0	No less than 7 Days before	OCA
5. Start date and time or a range of start dates and times	Date hrs	Year 0	No less than 7 Days before	OCA

ABBREVIATIONS: OCA Operating Code ‘A’

SCHEDULE F - USER SYSTEM DATA

The following details are required from each **User** on its **User System** that relates to the **Connection Site** containing the **Connection Point** both current and forecast.

Data Description	Units	Data Category
<p><u>SINGLE LINE DIAGRAM (when requested by TRANSCO):</u></p> <p>Single line diagram showing all existing and proposed HV equipment and connections together with equipment ratings and any third party Embedded within its User System</p>	Drawing	SPD DPD
<p><u>REACTIVE COMPENSATION EQUIPMENT:</u></p> <p>For all reactive compensation equipment connected to the User System at 11 kV and above, other than power factor correction equipment associated directly with a Customer Plant and Apparatus, the following details:</p>		
1. Type of equipment (e.g. fixed or variable)	Text	SPD
2. Capacitive rating	MVAr	SPD
3. Inductive rating	MVAr	SPD
4. Operating range	MVAr	SPD
5. Details of any automatic control logic to enable operating characteristics to be determined	Text and/or Diagrams	SPD
6. Point of connection to the User System in terms of electrical location and System voltage	Text	SPD
<p><u>SWITCHGEAR:</u></p> <p>For all switchgear (i.e. circuit breakers, switch disconnectors and isolators) on all circuits directly connected to the Connection Point including those at Power Stations:</p>		
1. Rated voltage	kV	SPD
2. Operating voltage	kV	SPD
3. Rated short-circuit breaking current:		
• Single phase	kA	SPD
• Three phase	kA	SPD
4. Rated load breaking current:		
• Single phase	kA	SPD
• Three phase	kA	SPD
5. Rated peak short-circuit making current:		
• Single phase	kA	SPD

Data Description	Units	Data Category
<ul style="list-style-type: none"> Three phase 	kA	SPD
<p>USER HV CONNECTING SYSTEM DATA:</p> <p>For all Systems at 11 kV and above connecting the User System to the Transmission System, the following details are required relating to that HV Connection Point:</p> <p><u>Circuit Parameters (for all circuits), when requested by TRANSCO:</u></p>		
1. Rated voltage	kV	SPD
2. Operating voltage	kV	SPD
3. Positive phase sequence:		
<ul style="list-style-type: none"> resistance 	% on 100	SPD
<ul style="list-style-type: none"> reactance 	% on 100	SPD
<ul style="list-style-type: none"> susceptance 	% on 100	SPD
4. Zero phase sequence:		
<ul style="list-style-type: none"> resistance 	% on 100	SPD
<ul style="list-style-type: none"> reactance 	% on 100	SPD
<ul style="list-style-type: none"> susceptance 	% on 100	SPD
<p>INTERCONNECTING TRANSFORMERS:</p> <p>For transformers between the Transmission System and the User System, the following data is required</p>		
1. Transformer rating	MVA	SPD DPD
2. Rated voltage ratio (i.e. primary/secondary/tertiary)		SPD DPD
3. Winding arrangement		SPD DPD
4. Vector group		SPD DPD
5. Positive sequence resistance		
<ul style="list-style-type: none"> @ maximum tap 	% on transformer MVA base	DPD
<ul style="list-style-type: none"> @ minimum tap 	% on transformer MVA base	DPD
<ul style="list-style-type: none"> @ nominal tap 	% on transformer MVA base	DPD
6. Positive sequence reactance		

Data Description	Units	Data Category
• @ maximum tap	% on transformer MVA base	DPD
• @ minimum tap	% on transformer MVA base	DPD
• @ nominal tap	% on transformer MVA base	DPD
7. Zero phase sequence reactance	% on transformer MVA base	DPD
8. Tap changer type (e.g. on-load or off-load)	On/Off	SPD
9. Tap changer range		SPD
10. Tap changer step size		SPD
11. Impedance value (if not directly earthed)		SPD
<u>HV MOTOR DRIVES:</u>		
Following details are required for each HV motor drive connected to the User System :		
1. Rated Apparent Power	MVA	DPD
2. Rated Active Power	MW	DPD
3. Full Load current	kA	DPD
4. Means of starting	Text	DPD
5. Starting current	kA	DPD
6. Motor torque/speed characteristics		DPD
7. Driven Load torque/speed characteristics		DPD
8. Motor plus driven Load inertia constant	MWs/MVA	DPD
<u>USER PROTECTION DATA:</u>		
Following details relates only to protection equipment which can trip, inter-trip or close any Connection Point circuit breaker or any TRANSCO circuit breaker:		
1. A full description including estimated settings, for all relays and Protection systems installed or to be installed on the User System	Text	DPD
2. A full description of any auto-reclose facilities installed or to be on the User System , including type and time delays	Text	DPD
3. A full description including estimated settings, for all relays and Protection systems installed or to be installed on the generator, generator transformer, station transformer and their associated connections	Text	DPD

Data Description	Units	Data Category
4. For Generating Units having or intended to have a circuit breaker at the generator terminal voltage, clearance times for electrical faults within the Generating Unit zone	ms	DPD
5. The most probable fault clearance time for electrical faults on any part of the User System directly connected to the Transmission System	ms	DPD
<u>TRANSIENT OVER-VOLTAGE ASSESSMENT DATA</u>		
When requested by TRANSCO , each User is required to submit data with respect to the Connection Site as follows (undertaking insulation co-ordination studies):		
1. Busbar layout, including dimensions and geometry together with electrical parameters of any associated current transformers, voltage transformers, wall bushings, and support insulators	Diagram	DPD
2. 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 (for the purpose of calculating surge impedances).	Text	DPD
3. Specification details of all Apparatus connected directly or by lines and cables to the busbar including basic insulation levels	Text	DPD
4. Characteristics of overvoltage protection at the busbar and at the termination of lines and cables connected at the busbar	Text	DPD
5. The following Generating Unit or Power Station transformer data is required: three or five limb cores or single phase units to be specified, and operating peak flux density at nominal voltage	Text	DPD

ABBREVIATIONS: **SPD** **Standard Planning Data**
 DPD **Detailed Planning Data**

SCHEDULE G - LOAD CHARACTERISTICS DATA

The following information is required from each **User** regarding existing and future connections for each **Connection Point**:

Data Description	Units	Data for Future Years					
		FY0	FY1	FY2	FY3	FY4	FY5
1. Details of individual loads which have characteristics significantly different from the typical range of Domestic, Commercial or Industrial loads supplied							
2. Sensitivity of Demand to variations in voltage and frequency on the Transmission System at the peak Connection Point Demand (Active Power)							
• Voltage sensitivity	MW/kV MVar/kV						
• Frequency sensitivity	MW/Hz MVar/Hz						
3. Phase unbalance impose on the Transmission System							
• Maximum	%						
• Average	%						
4. Maximum harmonic content imposed on the Transmission System	%						
5. Details of loads which may cause Demand fluctuations greater than [1 MW] at a Point of Coupling							

SCHEDULE H - USER DEMAND PROFILES AND ACTIVE ENERGY DATA

The following information is required from each **User** who is directly connected to the **Transmission System** with **Demand**.

Data Description	FY0	FY1	FY2	FY3	FY4	FY5	Update Time	Data Category
Forecast daily Demand profiles in respect of each User System (sumated over all Transmission Supply Points for DISCO and at the Connection Point for Non Embedded Customers)	<ol style="list-style-type: none"> 1. Day of User maximum Demand (MW) at Annual MD Conditions 2. Day of peak TRANSCO Demand (MW) at Annual MD Conditions 3. Day of minimum TRANSCO Demand (MW) at Average Conditions <p><i>(delete as appropriate)</i></p>						Week 48	SPD OCA
0000 : 0100								
0100 : 0200								
0200 : 0300								
0300 : 0400								
0400 : 0500								
0500 : 0600								
0600 : 0700								
0700 : 0800								
0800 : 0900								
1000 : 1100								
1100 : 1200								
1200 : 1300								
1300 : 1400								
1400 : 1500								
1500 : 1600								
1600 : 1700								
1700 : 1800								
1800 : 1900								
1900 : 2000								
2000 : 2100								
2100 : 2200								
2200 : 2300								
2300 : 2400								

Data Description	FY0	FY1	FY2	FY3	FY4	FY5	Update Time	Data Category
The annual MWh requirements for each User System (summated over all Transmission Supply Points for DISCO and at the Connection Point for Non Embedded Customers) at Average Conditions :							Week 48	SPD OCA
1. Domestic 2. Agricultural 3. Commercial 4. Industrial 5. Municipality 6. Public Lighting 7. [Any other identifiable categories of Customers] 8. User System losses								
Applicable only to DISCOs and Non-Embedded Customers							Week 48	OCA
1. Total Demand (MW) on its System 2. Active Energy (MWh) requirement on its System								

ABBREVIATIONS: **SPD** **Standard Planning Data**
 DPD **Detailed Planning Data**
 OCA **Operating Code ‘A’**

Notes:

1. ‘FYx’ means **TRANSCO Financial Year** x. FY0 means the period from week 48 to the end of year.
2. All forecast **Demand (Active Power)** and **Active Energy** shall be that remaining after any deductions considered appropriate to take account of the output profile of all **Embedded Generating Plant** not despatched by **TRANSCO**.

SCHEDULE I - CONNECTION POINT DATA

The following information is required from each **User** who is directly connected to the **Transmission System** with **Demand**.

Data Description	Units	FY0	FY1	FY2	FY3	FY4	FY5	Update Time	Data Category
Forecast Demand and Power Factor related to each Connection Point									
1. Annual peak hour User Demand at Annual MD Conditions	MW pf							Week 48	SPD OCA
2. User Demand at TRANSCO peak hour Demand at Annual MD Conditions	MW pf							Week 48	SPD OCA
3. User Demand at minimum hour TRANSCO Demand at Average Conditions	MW pf							Week 48	SPD OCA
<u>DEMAND TRANSFER CAPABILITY</u>									
Where a User Demand or group of Demands may be fed by alternative Connection Point(s) , the following details should be provided:									
1. Name of the alternative Connection Point(s)									
2. Demand transferred	MW MVA _r								
3. Transfer arrangement (e.g. manual or automatic)									
4. Time to effect transfer	hrs								

ABBREVIATIONS: **SPD** **Standard Planning Data**
 OCA **Operating Code ‘A’**

Notes:

1. ‘FYx’ means **TRANSCO Financial Year** x. FY0 means the period from week 48 to the end of year.
2. In circumstances when the busbar arrangement at a **Transmission Supply Point** is expected to be operated in separate sections, separate sets of forecast information shall be supplied for each section.

3. All forecast **Demand** shall be that remaining after any deductions considered appropriate to take account of the output of all **Embedded Generating Plant** not despatched by **TRANSCO**.
4. All forecast **Demand** shall include any **User System** series reactive losses but exclude any reactive compensation equipment.

SCHEDULE J - DEMAND CONTROL DATA

The following information is required from each **User**:

Data Description	Units	Time Covered	Update Time	Data Category
PROGRAMMING PHASE:				
Demand Control which may result in a Demand change of 1 MW or more on an hourly and Transmission Supply Point basis				
1. Demand profile	MW	Weeks 1 to 8	10:00 Saturday	OCA
2. Duration of proposed Demand Control	hrs	Weeks 1 to 8	10:00 Saturday	OCA
CONTROL PHASE: (applicable to DISCO)				
1. Demand Control which may result in a Demand change of 1 MW or more averaged over any hour on any Transmission Supply Point which is planned after 10:00 hours		Now to 7 Days	Immediate	OCA
2. Any changes to planned Demand Control notified to TRANSCO prior to 10:00 hours		Now to 7 Days	Immediate	OCA
POST CONTROL PHASE (applicable to DISCO)				
Demand reduction achieved on previous calendar day of 1 MW or more averaged over any Transmission Supply Point , on an hourly and Transmission Supply Point basis				
1. Active Power profiles	MW	Previous Day	06:00 Daily	OCA
2. Duration	hrs	Previous Day	06:00 Daily	OCA

ABBREVIATIONS: OCA Operating Code 'A'

SCHEDULE K - FAULT INFEED DATA

The following information is required from each **User** who is connected to the **Transmission System** via a **Connection Point** and the **User System** contains **Generating Unit(s)** and/or motor loads.

Data Description	Units	FY0	FY1	FY2	FY3	FY4	FY5
SHORT CIRCUIT INFEED TO TRANSCO TRANSMISSION SYSTEM FROM USER SYSTEM AT A CONNECTION POINT							
Name of Connection Point : _____							
1. Symmetrical three-phase short circuit current infeed:							
• At instant of fault	kA						
• After sub-transient fault current contribution has substantially decayed	kA						
2. Zero sequence source impedance values as seen from the Point of Connection consistent with the maximum infeed above:							
• Resistance (R)	% on 100						
• Reactance (X)	% on 100						
3. Positive sequence X/R ratio at instance of fault							

SCHEDULE L - DATA SUPPLIED BY TRANSCO TO USERS

TRANSCO will provide **Users** and potential **Users** the following data related to the **TRANSCO Transmission System**.

Data Description	Data Category
Operation Diagram	OCB
TRANSCO will notify each User no later than week 41 of each calendar year, for the current calendar year and for each of the following 7 calendar years	
1. The date and time of annual peak of TRANSCO Demand at Annual MD Conditions	OCA
2. The date and time of annual minimum TRANSCO Demand at Average Conditions	OCA
<u>NETWORK DATA:</u>	
1. Transmission System date including	PC
<ul style="list-style-type: none"> • Network Topology and ratings of principal items of equipment • Positive, negative and zero sequence data of lines, cables, transformers etc. • Generating Unit electrical and mechanical parameters • Relay and protection data 	
2. Following Network Data as an equivalent 400kV, 220kV and 132kV source at the HV point of connection to the User System	
<ul style="list-style-type: none"> • Symmetrical three-phase short circuit current infeed at the instant of fault from the Transmission System(I1’) • Symmetrical three-phase short circuit current from the Transmission System after the sub-transient fault current contribution has substantially decayed (I1’) • Zero sequence source resistance and reactance values at the Point of Connection, consistent with the maximum infeed below • Pre-fault voltage magnitude at which the maximum fault currents were calculated • Positive sequence X/R ratio at the instant of fault • Appropriate interconnection transformer data 	PC PC PC PC PC PC
Names of Safety Co-ordinators , which will be updated in writing whenever there is change to the identity of its Safety Coordinators	OCB
Provisional Outage programme showing the Generating Units expected to be withdrawn from service during each week of Years 2 and 3 for Planned Outages	OCA
Draft Final Outage programme showing the Generating Units expected to be withdrawn from service during each week of Year 1 for Planned Outages	OCA

Abbreviations:

OCA	Operating Code 'A',
OCB	Operating Code 'B',
PC	Planning Code 'PC'

CHAPTER 8 - GENERAL CONDITIONS

1. INTRODUCTION

The General Conditions contain provisions which are of general application to all provisions of the **Electricity Transmission Code**. Their objective is to ensure, to the extent possible, that the various sections of the **Electricity Transmission Code** work together and work in practice for the benefit of all Users.

2. SCOPE

The General Conditions apply to all Users (including, for the avoidance of doubt, **TRANSCO**).

3. UNFORESEEN CIRCUMSTANCES

3.1 If circumstances arise which the provisions of the **Electricity Transmission Code** have not foreseen, **TRANSCO** shall, to the extent reasonably practicable in the circumstances, consult promptly and in good faith all affected **Users** in an effort to reach agreement as to what should be done. If agreement between **TRANSCO** and those **Users** as to what should be done cannot be reached in the time available, **TRANSCO** shall determine what is to be done. Wherever **TRANSCO** makes a determination, it shall do so having regard, wherever possible, to the views expressed by **Users** and, in any event, to what is reasonable in all the circumstances. Each **User** shall comply with all instructions given to it by **TRANSCO** following such a determination provided that the instructions are consistent with the then current technical parameters of the particular **User's System** registered under the **Electricity Transmission Code**. **TRANSCO** shall promptly refer all such unforeseen circumstances and any such determination to the Panel for consideration in accordance with 4.2 v).

4. THE ELECTRICITY TRANSMISSION CODE REVIEW PANEL

4.1 **TRANSCO** shall establish and maintain the **Panel**, which shall be a standing body to carry out the functions referred to in paragraph 4.2.

4.2 The **Panel** shall:

- i) keep the **Electricity Transmission Code** and its working under review;
- ii) review all suggestions for amendments to the **Electricity Transmission Code** which the **Bureau** or any **User** may wish to submit to **TRANSCO** for consideration by the **Panel** from time to time;
- iii) publish recommendations as to amendments to the **Electricity Transmission Code** that **TRANSCO** or the **Panel** feels are necessary or desirable and the reasons for the recommendations;
- iv) issue guidance in relation to the **Electricity Transmission Code** and its implementation, performance and interpretation when asked to do so by any **User**; and
- v) consider what changes are necessary to the **Electricity Transmission Code** arising out of any unforeseen circumstances referred to it by **TRANSCO** under 3.

4.3 The **Panel** shall consist of:

- i) a Chairman and up to 5 members appointed by **TRANSCO**;
- ii) a person appointed by the **Bureau**;

- iii) a person appointed by the **Procurer**;
- iv) 6 persons representing the **GENCOS**;
- v) 2 persons representing the **DISCOs** and
- vi) A person representing the **Non-Embedded Customers**.
each of whom shall be appointed according to the rules issued pursuant to 4.4.
- vii) A person representing the **Self-Supply User**

4.4 The **Panel** shall establish and comply at all times with its own rules and procedures relating to the conduct of its business, which shall be approved by the **Bureau**.

4.5 **TRANSCO** shall consult in writing all **Users** which are liable to be materially affected in relation to all proposed amendments to the **Electricity Transmission Code** and shall submit all proposed amendments to the **Electricity Transmission Code** to the **Panel** for discussion prior to such consultation.

5. DUTY OF GOOD FAITH AND STANDARD OF CONDUCT

Each party to this Code shall at all times in its dealings with the other parties to this Code:

- (a) act in good faith;
- (b) act in accordance with **Good Industry Practice**.

6. COMMUNICATION BETWEEN TRANSCO AND USERS

6.1 Unless otherwise specified in the **Electricity Transmission Code**, all instructions given by **TRANSCO** and communications (other than relating to the submission of data and notices) between **TRANSCO** and **Users** (other than **GENCOS**) shall take place between the **TRANSCO** control engineer based at the **TRANSCO Control Centre** notified by **TRANSCO** to each **User** prior to connection, and the relevant **User Responsible Engineer/Operator**, who, in the case of a **DISCO**, will be based at the **Control Centre** notified by the **DISCO** to **TRANSCO** prior to connection.

6.2 Unless otherwise specified in the **Electricity Transmission Code** all instructions given by **TRANSCO** and communications (other than relating to the submission of data and notices) between **TRANSCO** and **GENCOS** shall take place between the **TRANSCO** control engineer based at the **TRANSCO Control Centre** notified by **TRANSCO** to each **GENCO** prior to connection and the **GENCO Power Station**, as specified in each relevant section of the **Electricity Transmission Code**.

6.3 Unless otherwise specified in the **Electricity Transmission Code** all instructions given by **TRANSCO** and communications (other than relating to the submission of data and notices) between **TRANSCO** and **Self-Supply Users** shall take place between the **TRANSCO** control engineer based at the **TRANSCO Control Centre** notified by **TRANSCO** to each **Self-Supply User** prior to connection and the **Self-Supply User Control Centre**, as specified in each relevant section of the **Electricity Transmission Code**.

6.4 Unless otherwise specified in the **Electricity Transmission Code**, all instructions given by **TRANSCO** and communications (other than relating to the submission of data and notices) between **TRANSCO** and **Users** will be given by means of the **Control Telephony** referred to in the **Connection Conditions**.

6.5 If the **TRANSCO Control Centre** notified by **TRANSCO** to each **User** prior to connection, or the **User Control Centre**, notified in the case of a **DISCO** to **TRANSCO** prior to connection, is moved to another location, whether due to an emergency or for any other reason, **TRANSCO** shall notify the relevant **User** or the **User** shall notify **TRANSCO** of the new location and any changes to the **Control Telephony** necessitated by such move, as soon as practicable following the move.

6.6 The recording (by whatever means) of instructions or communications given by means of **Control Telephony** will be accepted by **TRANSCO** and **Users** as evidence of those instructions or communications.

7. MISCELLANEOUS

Data and notices to be submitted either to **TRANSCO** or to **Users** under the **Electricity Transmission Code** (other than data which is the subject of a specific requirement of the **Electricity Transmission Code** as to the manner of its delivery) shall be delivered in writing either by hand or sent by registered post, or facsimile transfer or by electronic mail to a specified address or addresses previously supplied by **TRANSCO** or the **Users**.

Data delivered pursuant to this Section 7, in the case of data being submitted to **TRANSCO**, shall be addressed to **TRANSCO National Control** at the address notified by **TRANSCO** to each **User** prior to connection, or to such other Department within **TRANSCO** or address, as **TRANSCO** may notify each **User** from time to time, and in the case of notices to be submitted to **Users**, shall be addressed to the chief executive of the addressee (or such other person as may be notified by the **User** in writing to **TRANSCO** from time to time) at its address(es) notified by each **User** to **TRANSCO** in writing from time to time for the submission of data and service of notices under the **Electricity Transmission Code** (or failing which to the registered or principal office of the addressee).

All data items, where applicable, will be referenced to nominal voltage and **Frequency** unless otherwise stated.

8. OWNERSHIP OF PLANT AND/OR APPARATUS

References in the **Electricity Transmission Code** to **Plant** and/or **Apparatus** of a **User** include **Plant** and/or **Apparatus** used by a **User** under any agreement with a third party.

9. SYSTEM CONTROL

Where a **User System** (or part thereof) is, by agreement, under the control of **TRANSCO**, then for the purposes of communication and co-ordination in operational timescales **TRANSCO** can (for those purposes only) treat that **User System** (or part thereof) as part of the **TRANSCO Transmission System**, but, as between **TRANSCO** and **Users**, it shall remain to be treated as the **User System** (or part thereof).

10. COMPLIANCE WITH REVISIONS

10.1 The procedures and principles which are stipulated in the **Electricity Transmission Code** create binding obligations on **Licensed Electricity Operators** (specifically including **DISCOs**, **GENCOs** and **TRANSCO**) and any other **User** of the **Transmission System** through the application of **Law** and/or their respective **Licence** (or Exemption). Periodic

modifications to the **Electricity Transmission Code** may create scenarios where historic arrangements or activities which were compliant with an earlier version of the **Electricity Transmission Code** are non-compliant with the version (including revisions) of the **Electricity Transmission Code** which is currently applicable.

10.2 Accordingly, where a **User** which was in compliance with a previous version of the **Transmission Code** is non-compliant with the requirements of the current **Electricity Transmission Code**, the **Bureau** may, at its sole discretion and upon written request from the **User**, hold the current requirement(s) in abeyance and enforce the relevant requirement(s) in the previous version of the **Electricity Transmission Code**.

10.3 The considerations envisaged in this Clause 10 shall be without prejudice to the **Bureau's** powers and the **User's** obligations to ensure compliance (including the requirement for a derogation) with the current version of the **Electricity Transmission Code** nor shall such considerations undermine, compromise or in any way limit the **Bureau's** powers to take any remedial action allowed in the **Law** for non-compliance with the version of the **Electricity Transmission Code** which is in effect (or otherwise applicable to the **User**) at the time.