THE ELECTRICITY TRANSMISSION CODE

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C O N T E N T S

PREFACE 1

CHAPTER 1 - GLOSSARY AND DEFINITIONS (GD) 4

CHAPTER 2 - PLANNING CODE 45

1. INTRODUCTION 45
2. OBJECTIVE 45
3. SCOPE 46
4. PLANNING PROCEDURES 46
5. PLANNING DATA STATUS 49
6. PLANNING STANDARDS 50

APPENDIX A - STANDARD PLANNING DATA 51

1. DEMAND AND ACTIVE ENERGY DATA 51
2. GENERATING UNIT DATA 53
3. USER SYSTEM DATA 55

APPENDIX B - DETAILED PLANNING DATA 58

4. GENERATING UNIT DATA 58
5. USERS SYSTEM DATA 65
6. SIMULATION MODELS 67

APPENDIX C - NETWORK DATA 69

7. SYSTEM MODEL 69
8. SHORT CIRCUIT CALCULATIONS 69

CHAPTER 3 - CONNECTION CONDITIONS 70

1. INTRODUCTION 70
2. OBJECTIVE 70
3. SCOPE 70
4. PROCEDURE 70
5. CONNECTION 70
6. TECHNICAL, DESIGN AND OPERATIONAL CRITERIA 72
7. SITE RELATED CONDITIONS 106
8. ANCILLARY SERVICES 110

APPENDIX A - FORMAT, PRINCIPLES AND BASIC PROCEDURE TRANSMISSION OWNER BE USED IN THE PREPARATION OF SITE RESPONSIBILITY SCHEDULES 112

9. PRINCIPLES 112
10. ALTERATIONS TRANSMISSION OWNER EXISTING SITE RESPONSIBILITY SCHEDULES 113
11. RESPONSIBLE MANAGERS 113

ATTACHMENT Transmission Owner APPENDIX A - PROFORMA FOR SITE RESPONSIBILITY SCHEDULE 114

COMPANY: _ SCHEDULE: 114

CONNECTION SITE: 114

APPENDIX B - SYMBOLS FOR OPERATION DIAGRAMS 115

APPENDIX C - APPARATUS TO BE INCLUDED ON OPERATION DIAGRAMS 116

12. BASIC PRINCIPLES 116
13. APPARATUS TRANSMISSION OWNER BE SHOWN ON OPERATION DIAGRAM 116

APPENDIX D - SCADA OUTSTATION INTERFACING 118

14. INTRODUCTION 118
15. GENERAL REQUIREMENTS 118

APPENDIX E - TECHNICAL REQUIREMENTS FOR UNDER FREQUENCY RELAYS FOR THE AUTOMATIC DISCONNECTION OF SUPPLIES AT LOW FREQUENCY 120

16. UNDER FREQUENCY RELAYS 120

APPENDIX F - HARMONIC DISTORTION ON THE TRANSMISSION SYSTEM 122
PLANNING LEVELS AND COMPATIBILITY LEVELS 122

CHAPTER 4 - OPERATING CODE "A" 124

1. INTRODUCTION 124
2. SCOPE 124
3. DEMAND FORECASTS 124
4. OPERATIONAL PLANNING AND DATA PROVISION 128
5. OPERATING MARGIN 145
6. DEMAND CONTROL 150
7. DEMAND SIDE RESPONSE 155

APPENDIX A 157
1) - SYNCHRONOUS GENERATOR PERFORMANCE CHART 157
APPENDIX B - GENERATION PLANNING PARAMETERS 159

8. STEAM TURBINE GENERATING UNITS 159
9. GAS TURBINE GENERATING UNITS 159
10. COMBINED CYCLE GAS TURBINE (CCGT) MODULES 159
11. POWER PARK MODULES 159

APPENDIX C - OPERATING MARGIN DATA REQUIREMENTS 161

12. PRIMARY RESPONSE CHARACTERISTICS 161
13. PRIMARY CONTROLLER DROOP CHARACTERISTIC AND DEAD BAND 162
14. PRIMARY CONTROLLER DEAD BAND 162

APPENDIX D - EMERGENCY MANUAL DEMAND REDUCTION/DISCONNECTION SUMMARY SHEET 163

APPENDIX E - INTERMITTENT POWER SOURCE PLANNING MATRIX WIND POWER PARK MODULES 164

CHAPTER 5 - OPERATING CODE "B" 165

1. INTRODUCTION 165
2. SCOPE 165
3. SAFETY CO-ORDINATION 165
4. CONTINGENCY PLANNING 172
5. INCIDENT INFORMATION SUPPLY 179
6. OPERATIONAL LIAISON 181
7. NUMBERING AND NOMENCLATURE OF HIGH VOLTAGE APPARATUS 185
8. SYSTEM TESTS 188
9. TESTING, MONITORING AND INVESTIGATION 190

APPENDIX A - MATTERS APPLICABLE TO THE SIGNIFICANT INCIDENT TO BE INCLUDED IN A WRITTEN REPORT 205
APPENDIX B - SYSTEM TESTS UNDER TEST PANEL SUPERVISION 206

10. PRELIMINARY NOTICE 206
11. TEST PANEL 206
12. PROPOSAL REPORT 207
13. TEST PROGRAMME 208
14. FINAL REPORT 208

APPENDIX C 209

CHAPTER 6 - SCHEDULING AND DESPATCH CODE 211

1. SCOPE 211
2. GENERATION AND DESALINATION SCHEDULING 211
3. GENERATION AND DESALINATION DESPATCH 217

4. FREQUENCY CONTROL MANAGEMENT 225
1. AVAILABILITY NOTICE 228
2. SCHEDULING AND DESPATCH PARAMETERS 228
APPENDIX B - DESPATCH INSTRUCTIONS 230
1. FORM OF DESPATCH INSTRUCTION 230
2. DESPATCHING INSTRUCTION TO INCREASE OR DECREASE OUTPUT 230
3. GENERATING UNIT SYNCHRONISING 230
4. GENERATING UNIT DE-SYNCHRONISING 231
5. FREQUENCY CONTROL 231
6. TERTIARY RESERVE 231
7. BLACK START 231
8. EMERGENCY INSTRUCTION 231
9. VOLTAGE CONTROL INSTRUCTION 232
CHAPTER 7 - DATA REGISTRATION CODE 233
1. INTRODUCTION 233
2. OBJECTIVE 233
3. SCOPE 233
4. DATA CATEGORIES AND STAGES IN REGISTRATION 233
5. PROCEDURES AND RESPONSIBILITIES 234
6. DATA TO BE REGISTERED 235
CHAPTER 8 - GENERAL CONDITIONS 269
1. INTRODUCTION 269
2. SCOPE 269
3. UNFORESEEN CIRCUMSTANCES 269
4. THE ELECTRICITY TRANSMISSION CODE REVIEW PANEL 269
5. DUTY OF GOOD FAITH AND STANDARD OF CONDUCT 270
6. COMMUNICATION WITH SYSTEM OPERATOR BY TRANSMISSION OWNER AND USERS . 270
7. COMMUNICATION WITH TRANSMISSION OWNER BY SYSTEM OPERATOR AND USERS . 271
8. MISCELLANEOUS 272
9. OWNERSHIP OF PLANT AND/OR APPARATUS 273
10. SYSTEM CONTROL 273
11. COMPLIANCE WITH REVISIONS 273
CHAPTER 9 - TRANSMISSION OWNER AND SYSTEM OPERATOR CODE 274
1. INTRODUCTION 274
2. MUTUAL OBLIGATIONS 274
3. SYSTEM OPERATOR OBLIGATIONS 277
4. TRANSMISSION OWNER OBLIGATIONS 278

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 **System Operator** and **Transmission Owner.**

9. The operating procedures and principles governing **System Operator** and **Transmission Owner** 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 **Transmission Owner**, **System Operator** and all **Users** 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 **Transmission Owner** 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 **Transmission Owner** 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 **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 **Transmission**

Owner and **System Operator** from **Users**, and by **Users** from **Transmission Owner** and **System Operator**, under the **Transmission Code General Conditions.**

vii) The **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; and

viii) a **Transmission Owner and System Operator Code** which sets out arrangements between **Transmission Owner** and **System Operator** that are required for the safe, secure and efficient operation of the **Transmission System**, and which are not covered elsewhere in the **Electricity Transmission Code**.

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
AC/DC Converter	Any **Apparatus** used to convert alternating current electricity to direct current electricity, or vice versa i.e. a facility to interface an AC system with a DC system e.g. **HVDC Converter Station** or power-electronic converters used in **Power Park Modules**
AC/DC Converter Station	An installation comprising one or more **AC/DC Converters** connecting an **External Interconnection** to the **Transmission System** or connecting a **Wind Turbine Generating Unit (WTGU)** or **Photovoltaic Generating Unit (PVGU)** or **Power Farm** to the **Transmission System**.
Active Energy	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 Wh = 1 kWh 1000 kWh = 1 MWh 1000 MWh = 1 GWh 1000 GWh = 1 TWh
Active Power	The product of voltage and the in-phase component of alternating current measured in units of watts and standard multiples thereof, i.e.: 1000 Watts = 1 kW 1000 kW = 1 MW 1000 MW = 1 GW 1000 GW = 1 TW
Active Power Excursion	A change in the level of **Active Power**.

Terms	Definitions
AGC Response	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
Alarm	An alert or event notification indicating a problem with **Plant** or **Apparatus**
Amber Warning	A warning issued by **System Operator** to **Users** who may be affected when **System Operator** knows there is a risk of widespread and serious disturbance to the whole, or a part of, the **Transmission System**.
Ancillary Service	**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.**
Annual Maximum Demand (MD) Conditions	A particular combination of weather elements which gives rise to a level of peak **Demand** within a **Transmission Owner Financial Year** which has a 50% chance of being exceeded as a result of weather variation alone.
Apparatus	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**.
Apparent Power	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

Terms	Definitions
Authority for Access	An authority which grants the holder the right to unaccompanied access to a site containing **HV** conductors.
Automatic Generation Control (AGC)	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.
Automatic Voltage Regulator (AVR)	A continuously acting automatic excitation system to control a **Generating Unit** terminal voltage.
Auxiliaries	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.
Available or **Availability**	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.
Availability Notice	A submission by each **GENCO** in respect of each of its **Generating Units** and **Desalination Units** or **Self-Supply User** in respect of its excess production capacity to **System Operator,** stating whether or not such units/excess capacity are **Available** for generation or desalination.
Average Conditions	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.
Average Load-Related Steady-State Primary Control Droop	The total average droop of the primary control system as defined in Chapter 4, **Operating Code 'A',** Section 5.1.2.1.5
Back-Up Protection	**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.

Terms	Definitions
Battery Storage	A type of energy storage power station that uses a group of batteries to store electrical energy/to provide electrical energy back to the network, which could be a part of **Power Park Module** as well as standalone installation.
Black Start	The procedure necessary for a recovery from a **Total Shutdown** or **Partial Shutdown**.
Black Start Capability	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 **System Operator**, within two hours, without an external electrical power supply.
Black Start Stations	**Power Stations** which are registered, pursuant to the **Power and Water Purchase Agreement**, as having a **Black Start Capability**.
Black Start Test	A **Black Start Test** carried out by a **GENCO or Self-Supply User** with a **Black Start Station**, on the instructions of **System Operator**, in order to demonstrate that a **Black Start Station** has a **Black Start Capability**.
Business Day	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.
Cancelled Start	A response by a **GENCO** to an instruction from **System Operator** cancelling a previous instruction to **Synchronise** to the **System** or come to **Hot Standby**, before **Synchronisation** has been completed or **Hot Standby** reached.
Caution Notice	A notice conveying a warning against interference to the device to which the notice is attached.
Central Despatch	The process of **Scheduling** and issuing direct instructions by **System Operator** referred to in Condition 22 of the **Transmission Licence**.

Terms	Definitions
Cogeneration Module	A collection of **Generating Units** and **Desalination Units** operating in combined cycle.
Combined Cycle Gas Turbine Module or **CCGT Module**	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.
Committed Project Planning Data	Data relating to a **User Development** once the offer for a **Connection** is accepted.
Completion Date	Has the meaning set out in the **Connection Agreement** with each **User**.
Complex	A **Connection Site** together with the associated **Power Station** and/or **User** substation and/or associated **Plant** and/or **Apparatus**, as appropriate.
Compensating Ramp Rate	A ramp rate setting of **Battery Storages** that may be used to reduce the impact of **Active Power** ramps of the **Power Park Modules.**
Computer Scheduling Programme	A computer programme used in the preparation of a **Generation Schedule** and **Subsequent Schedules**.
Concentrating Solar Thermal Unit (CSTU)	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.

Terms	Definitions
Connected Planning Data	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**.
Connection Agreement	The agreement for connection envisaged in Condition 14 of the **Transmission Licence.**
Connection Point	A **Transmission Supply Point** or **Transmission Entry Point**.
Connection Site	A **Transmission Owner Site** or **User Site**.
Contingency Reserve	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.
Control Call	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.
Control Centre	A location used for the purpose of control and operation of the **Transmission System** or a **User System**.
Control Phase	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.
Control Telephony	The method by which a **Transmission Owner Coordination Engineer**, **System Operator Control Engineer(s)** and **User Responsible Engineer/Operator** speak to one another for the purposes of control of the **Total System** in both normal and emergency operating conditions.
Converter Station	A type of substation which forms the terminal equipment for a **HVDC** transmission line. It converts direct current (DC) to alternating current (AC) or the reverse.

Terms	Definitions
Critical Fault Clearing Time	The maximum time during which a disturbance can be applied without the system losing its stability.
Customer	A person to whom electricity is provided.
Customer Demand Management	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**.
Customer Generating Plant	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**.
DC Network	All items of **Plant** and **Apparatus** connected together on the direct current side of an **AC/DC Converter.**
De-Load	The condition in which a **Generating Unit** has reduced or is not delivering electrical power to the **System** to which it is **Synchronised**.
Demand	The demand of **MW** and **MVAr** of electricity or the demand in m^3/h of desalinated water.
Demand Control	Any or all of the following methods of achieving a **Demand** reduction: (a) **Customer Demand Management** initiated by **Users**; (b) **Customer Demand** reduction by **Disconnection** initiated by **Users**; (c) **Customer Demand** reduction instructed by **System Operator**; (d) automatic low frequency **Demand Disconnection**; and (e) emergency manual **Demand Disconnection**.
Demand Control Imminent Warning	A warning relating to a **Demand** reduction which will be issued by **System Operator** to those **DISCOs** and to **GENCOs** at their **Generating Plant** and to **Non-Embedded Customers** and relating to Export reduction to **Self-Supply Users**.

Terms	Definitions
Demand Parameters	Those parameters relating to **Demand Reduction Blocks** listed in the **SDC** under the heading **Demand Parameters.**
Demand Side Response	Control of Active power demand by any **User** for modulation as required by **System Operator** within the specified time.
Desalinated Water	Distilled water with a total dissolved solid content of less than 500 parts per million.
Desalination Unit	Any apparatus which produces **Desalinated Water**.
Despatch	The issue by **System Operator** of instructions for **Generating Plant** and/or **Desalination Plant** to achieve specific levels within their **Scheduling and Despatch Parameters**.
De-Synchronise	The action of taking a **Generating Unit** off a **System** to which it has been **Synchronised**, by opening any connecting circuit breaker.
Detailed Planning Data	Detailed additional data which **Transmission Owner** and **System Operator** require under the **PC** in support of **Standard Planning Data**.
Discrimination	The characteristic of electrical protection equipment enabling faulty protected equipment to be identified and disconnected.
Disconnection	The physical separation of **Users** (or **Customers**) from the **Transmission System** or a **Distribution System**.
Distorting Load	**Load** which results in the non-sinusoidal shape of the voltage or current waveform.
Distribution Code	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**.
Distribution Company or **DISCO**	A holder of a **Distribution Licence**.

Terms	Definitions
Distribution System	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**.
Distribution System Entry Point	A point at which a **Generating Unit** which is **Embedded** connects to the **Distribution System**.
DoE	Department of Energy (the legal successor of the Regulation and Supervision Bureau)
Earth Fault Factor	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.
Earthing	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 **Transmission Owner** or that **User**.
Electricity Transmission Code	The document referred to in Condition 3 of the **Transmission Licence**.
Electricity Transmission Code Review Panel	The "**Panel**" with the functions set out in the General Conditions.
Electromagnetic Compatibility Level	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
Embedded	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 **Transmission Owner** (but with no other connection to the **Transmission System**).

Terms	Definitions
Emergency Instruction	A **Despatch** instruction issued by **System Operator** which may require an action or response which is outside **Generation Scheduling and Despatch Parameters**.
Emergency Return to Service Time	The period of time required for **Transmission Owner** to make available the part(s) of the **Transmission System** affected by an **Outage** so that such part(s) or any other relevant parts of the **Transmission System** can again be made operational, to the extent identified in the **Outage Plan**, for the purpose of conveying and affecting the flow of electricity;
Emergency System Condition	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"
Event	An unscheduled or unplanned (although it may be anticipated) occurrence on, or relating to, the **Transmission System** (including **Embedded Power Station**) including faults, incidents, breakdowns and adverse weather conditions
Exciter	The source of the electrical power providing the field current of a synchronous machine.
Excitation System	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.
External Interconnection	**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.
External System	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.**

Terms	Definitions
External System Operator	A person who owns or operates an **External System**.
Fault Clearance Times	Fault clearance time is the total time taken from the fault current inception to arc extinction, which includes relay operation time (set time delay in the relay + time taken for relay to arrive at a tripping decision + relay output trip contact time + trip relay operating time, if applicable) + circuit breaker break time + telecommunication signalling time, if applicable. .
Fault Ride Through (FRT)	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.
Final Outage Programme	The final **Outage** programme in respect of **Generating Units** and the **Transmission System** prepared by **System Operator** for Year 1 pursuant to **Operating Code 'A'**.
Final Report	A report prepared by the **Test Proposer** at the conclusion of a **System Test** for submission to **System Operator** and other members of the **Test Panel**.
Flexible Planned Outage	A **Planned Outage** which can at the request of **System Operator** be deferred or advanced by a period.
Flicker Severity (Long Term)	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.
Flicker Severity (Short Term)	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.

Terms	Definitions
Forced Outage	An **Outage** of a **Generating Unit** for which no notice can be given by the **GENCO** to **System Operator**, or an **Outage** of a **Transmission Component** for which no notice can be given by **Transmission Owner** to **System Operator**
Forecast Data	Those items of **Standard Planning Data** and **Detailed Planning Data** which will always be forecast.
Frequency Control	The control of the **System Frequency** on the **Total System**.
Frequency Deviation	An absolute value of **System Frequency** that varies from the set point value (49.95 Hz - 50.05 Hz).
Frequency Sensitive Mode	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**.**
Frequency Response Ramp Rate	A ramp rate setting of **Power Park Modules, HVDC** and/or **Battery Storages** used for **Primary Response** purpose.
Gas (SF_6) Zone Diagram	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**.
GENCO	An entity which generates electricity and/or produces water under licence or exemption under the **Law.**
Generating Plant	A **Power Station** subject to **Central Despatch**.
Generating Unit	Any **Apparatus** that produces electricity.

Terms	Definitions
Generation and/or Desalination Licence	The licence granted to a **GENCO** pursuant to Article 82 of the **Law**.
Generation and Desalination Schedule	A statement, prepared and issued by **System Operator** 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 **Transmission System Demand** at all times together with an appropriate margin of reserve.
Generation Outage Programme	An outage programme as agreed by **System Operator** with each **GENCO** at various stages through the **Operational Planning Phase** and **Programming Phase**.
Generation Prices	A set of prices calculated by **System Operator** in accordance with the relevant **Power and Water Purchase Agreement** in respect of each **GENCO Generating Unit** and **Desalination Unit** which may include: 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 m^3 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. 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**.
Generator Performance Chart	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
Good Industry Practice	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.
Governor Dead-band	The total magnitude of the change in steady state speed (expressed as a range of Hz (± 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.
Governor Droop	The ratio of the per unit steady state change in speed or in frequency to the per unit steady state change in output.
Harmonic Voltage Compatibility Level	A maximum level under which the power grid can operate normally considering the impact from nonlinear characteristics of equipment connected to the **Transmission System**. It represents a statistical measure of the overall condition of the **Power System** from a harmonic performance point of view.
Harmonic Voltage Planning Level	A maximum allowable voltage harmonic level at a specific point of connection and is relevant for the determination of any new **User** apportion.
High Voltage or **HV**	A voltage exceeding **Low Voltage**.
Hot Standby	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**.
HV Connections	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**.
HVDC	High-Voltage Direct Current. A **Transmission System** to transfer power using direct current (**DC**).

Terms	Definitions
HVDC System	A **Transmission System** comprising all equipment to transmit power via **HVDC**, including **Converter Station**(s) and **HVDC** overhead line and/or cable systems.
HVDC USER	An entity who owns/operates an **HVDC System** connected to **the** AC **Transmission System** grid.
IEC	International Electrotechnical Commission.
IEC Standard	A standard published by the International Electrotechnical Commission.
Implementing Safety Co-ordinator	The **Safety Co-ordinator** implementing **Safety Precautions**.
Incident	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.
Incident Centre	A centre established by **Transmission Owner**, **System Operator** or a **User** as the focal point in **Transmission Owner**, **System Operator** or in that **User** for the communication and dissemination of information between the senior management representatives of **Transmission Owner**, **System Operator,** or of that **User** and the relevant other parties during a **Joint System Incident** in order to avoid overloading **Transmission Owner's, System Operator's**, or that **User's**, existing operational/control arrangements.
Independent Generating Unit	A **Power Station** not subject to **Central Despatch**.
Infeed Loss Risk	A value set for the Transmission System and as defined in the Electricity Transmission System Security Standard.
Inflexible Planned Outage	A **Planned Outage** the start date and start time of which cannot be moved by **System Operator** under **Operating Code 'A'**.

Terms	Definitions
Interconnection Agreement	An agreement made between **System Operator** and an **External System Operator** and/or other relevant person for the **External Interconnection** relating to the operation of an **External Interconnection**.
Interface Agreement	An agreement between a **User** and **Transmission Owner** 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.
Intermittent Power Source	The primary source of power for a **Generating Unit** that cannot be considered as controllable, e.g. wind or solar.
Intertripping	The tripping of circuit-breaker(s) by commands initiated from **Protection** at a remote location independent of the state of the local **Protection**.
Intertrip Apparatus	**Apparatus** which performs **Intertripping**.
ISO	International Standards Organisation.
Island operation	The capability of a **Generating Unit** to supply an isolated load area under stable operation conditions.
Isolating Device	A device for achieving **Isolation**.

Terms	Definitions
Isolation	The disconnection **of HV Apparatus** from the remainder of the system in which that **HV Apparatus** is situated by either of the following: (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 **Transmission Owner** or the **User;** (b) an adequate physical separation which must be in accordance with and maintained by the method set out in the **Local Safety Instructions** of **Transmission Owner** or the **User**.
Joint System Incident	An **Incident** which, in the opinion of **Transmission Owner**, **System Operator** or a **User**, has or may have a serious and/or widespread effect on the **Transmission System** or on a **User System**.
Law	Law No 2 of 1998 Concerning the Regulation of the Water and Electricity Sector in the Emirate of Abu Dhabi, as amended.
LCC - HVDC	**Line-Commutated Converter HVDC:** An **HVDC** topology using conventional thyristor-based valves.
LFC	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
Licence	Any licence granted to **Transmission Owner, System Operator** or a **User**, under Article 82 of the **Law**.
Licensed Electricity Operator	Any person (other than **System Operator** in its capacity as operator of the **Transmission System** or **Transmission Owner** in its capacity as owner of the **Transmission System**) who is licensed under the **Law** to generate, transmit or supply electricity.

Terms	Definitions
Licence Standards	Those standards set out or referred to in Condition 19 of the **Transmission Licence**.
Limited Frequency Sensitive Mode	A mode whereby the operation of the **Non-Synchronous Generating Unit (Power Park Modules** and **HVDC)** is frequency insensitive except when the **System Frequency** exceeds the predefined frequency threshold, from which point limited frequency response shall be provided. For **Non-synchronous Generating Units (Power Park Modules and HVDC)** operation in **Limited Frequency Sensitive Mode** would require **Limited Frequency Sensitive Mode – Over frequency (LFSM-O)** capability and **Limited Frequency Sensitive Mode – Underfrequency (LFSM-U)** capability.
Limited Frequency Sensitive Mode - Over frequency (LFSM-O)	A **Non-Synchronous Generating Unit (Power Park Modules** and **HVDC)** operating mode which will result in **Active Power** output reduction in response to a change in **System Frequency** above a certain value.
Limited Frequency Sensitive Mode - Underfrequency (LFSM-U)	A **Non-synchronous Generating Unit** (**Power Park Modules** and **HVDC**) operating mode which will result in **Active Power** output increase in response to a change in **System Frequency** below a certain value.
Load	The **Active**, **Reactive** or **Apparent Power**, as the context requires, generated, transmitted or distributed.
Load Control	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.
Load Factor	The ratio of the actual output of a **Generating Unit** to the possible maximum output of that **Generating Unit**.
Loaded	Supplying electrical power to the **System**.

Terms	Definitions
Local Safety Instructions	Instructions on each **User Site** and **Transmission Owner Site**, approved by the relevant **Transmission Owner** or **User** manager, setting down the methods of achieving the objectives of **Transmission Owner** 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.
Location	A place where **Safety Precautions** are to be applied.
Low Voltage or **LV**	A voltage exceeding 50 volts **AC** but not exceeding 1000 volts **AC**.
Main Protection	**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.
Manoeuvring Sheet	A plan prepared by the **System Operator** in accordance with the **System Safety Rules** setting out the switching operations sequence to accommodate an **Outage** of **Plant** or **Apparatus** that form part of that **Transmission System.**
Material Effect	An effect causing a **User** or **Transmission Owner** 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 **Transmission Owner**, as the case may be, in expenditure of more than [50,000] Dirhams.
Maximum Demand	The maximum expected value of **Demand.**
Minimum Demand Regulation	The margin of **Active Power** to provide a sufficient regulating margin for adequate frequency control.
Minimum Generation	The minimum output in **MW** which a **Generating Unit** can generate, as registered with **System Operator** under the **Scheduling and Despatch Code**.

Terms	Definitions
Modification	Any actual or proposed replacement, renovation, modification, alteration or construction by or on behalf of a **User** or **Transmission Owner** to either that **User's Plant** or **Apparatus** or **Transmission Owner's Plant** or **Apparatus** or the manner of its operation which has or may have a **Material Effect** on **Transmission Owner** or a **User** at a particular **Connection Site**.
Monitoring Notice	A notice issued by **System Operator** to a **GENCO** informing the **GENCO** that **System Operator** is monitoring one of its **Generating Units**.
Net Dependable Power Capacity	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**.
Net Dependable Water Capacity	The capacity of a **Desalinating Unit** as notified by the **GENCO** expressed as a whole number of m^3/h.
Network Data	The data to be provided by **Transmission Owner** to **Users** in accordance with the **Planning Code**.
Non-Embedded Customer	A **Customer**, except for a **DISCO**, receiving electricity direct from the **Transmission System** irrespective of from whom it is supplied.
Non-Synchronous Generating Units	Generating units connected to network through power electronic inverters including **Power Park Modules** and **Battery Storage**.
Normalized Primary Response Characteristic	The **Primary Response** pattern on the basis of a normalized input signal as defined in Chapter 4, **Operating Code 'A'**, Section 5.1.2.
Normal Operating Condition	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
Notice to Synchronise	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 **System Operator**.
Notification of Inadequate System Margin (NISM**)**	The notification of anticipated inadequate **System Margin** given by **System Operator** to certain **Users** pursuant to the relevant provisions of the **Scheduling and Despatch Code.**
Operating Code Demand	The demand of MW and MVAr of electricity relating to each **Transmission Supply Point** plus that to be met by **Embedded Generating Plant**.
Operating Margin	**Contingency Reserve** plus **Operating Reserve**.
Operating Reserve	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**.
Operation	Operation of **Plant** and/or **Apparatus** to the instruction of the relevant **System Operator Control Engineer**, **Transmission Owner Safety Coordinator** and **User Responsible Engineer** /Operator.
Operation Diagrams	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.
Operational Data	Data required under the **Operating Codes** and/or **Scheduling and Despatch Code**.
Operational Effect	Any effect on the operation of a **System** which causes the **Systems** of **Transmission Owner** or **Users** to operate differently to the way in which they would have normally operated in the absence of that effect.

Terms	Definitions
Operational Planning	Planning through various timescales the matching of generation output with forecast **Transmission System 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**.
Operational Planning Phase	The period from 8 weeks to the end of the 3rd year ahead of real time operation.
Operational Procedures	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**.
Other Network Operator	A **User** with a **User System** directly connected to the **Transmission System** to which **Customers** and/or **Power Stations** are connected.
Outage	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 **Transmission Owner** and a **DISCO** the removal for repair or maintenance, or as a result of failure or breakdown, of any part of the **Transmission System** or **DISCO Distribution System**.
Outage Programme	An outage programme as agreed by **System Operator** with **Transmission Owner** and each **GENCO** at various stages through the **Operational Planning Phase** and **Programming Phase**.
Out of Synchronism	The condition where a **System** or **Generating Unit** cannot meet the requirements to enable it to be **Synchronised**.

Terms	Definitions
Part Load	The condition of a **Centrally Despatched Generating Unit** or **Desalination Unit** which is **Loaded** but is not running at **Net Dependable Capacity**.
Partial Shutdown	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 **System Operator's** directions relating to a **Black Start**.
Photovoltaic Generating Unit (PVGU)	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.
Photovoltaic Power Station (PVPS)	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**.
Planned Outage	An outage of **Generating Plant** or of part of the **Transmission System**, or of part of a **Distribution System**, co-ordinated by **System Operator** under the **Operating Code 'A'**.
Plant	Fixed and movable items used in the generation and/or supply and/or transmission of electricity and/or water, other than **Apparatus**.
Point of Common Coupling	That point on the **Transmission System** electrically nearest to the **User** installation at which either **Demands** or **Loads** are connected.
Point of Isolation	The point on **Apparatus** at which **Isolation** is achieved as defined in **Operating Code 'B'**.
Post-Control Phase	The period following real-time operation.
Post Event Notice	A notice issued by **System Operator** to a **GENCO** re-declaring the **Availability** or **Scheduling and Despatch Parameter** of a **Generating Unit**.

Terms	Definitions
Potable Water	Drinking water with an organic and non-organic content prescribed by the **Bureau**.
Power and Water Purchase Agreement (PWPA)	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.
Power Factor	The ratio of **Active Power** to **Apparent Power**.
Power Farm (PF)	Multiple interconnected **Generating Units** that have a common **Connection Point** and utilise renewable energy as the primary energy source.
Power Farm Generating Unit	A **Generating Unit** associated with a **Power Farm**
Power Island	An isolated **Power Station**, or groups of isolated **Power Stations**, together with complementary local **Demand**.
Power Park Module	Multiple interconnected **Generating Units** (**PVGU** or **WTGU**) that have a common **Connection Point** and utilize renewable energy as the primary energy source.
Power Purchase Agreement	An agreement between a **GENCO** and the **Procurer** covering the sale and purchase of Electricity.
Power Station	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**.
Power Supply Agreement (PSA)	An agreement between a **Self-Supply User** and the **DISCO** covering the Electricity purchase by **Self-Supply User**
Power System	The **Transmission System** and all **User Systems** within the Emirate of Abu Dhabi.

Terms	Definitions
Power System Stabiliser (PSS)	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).
Preliminary Notice	A notice in writing, sent by **System Operator** to all **Users** identified by it under **Operating Code 'B'** and to **Transmission Owner** and the **Test Proposer**, notifying them of a proposed **System Test**.
Preliminary Project Planning Data	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.
Preliminary Red Warning	A warning which may be issued by **System Operator to DISCOS, GENCOs and Non-Embedded Customers,** to give as much notice as possible whenever **System Operator** anticipates that a protracted period of generation shortage may exist**. (**For further clarity see **Red Warning.**)
Primary Control	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**.
Primary Reserve	A certain amount of **Active Power** that must be available for stabilizing the **System Frequency** after the occurrence of an imbalance

Terms	Definitions
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** 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).
Primary Response Performance Index	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.
Primary Response Test Procedures	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.
Procurer	The Emirates Water and Electricity Company.
Programming Phase	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
Proposal Notice	A notice submitted to **System Operator** by a **User** which would like to undertake a **System Test**.
Proposal Report	A report submitted by the **Test Panel** which contains: (a) proposals for carrying out a **System Test** (including the manner in which the **System Test** is to be monitored); (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 (c) such other matters as the **Test Panel** considers appropriate.
Protection	The provisions for detecting abnormal conditions on a **System** and initiating fault clearance or actuating signals or indications.
Protection Apparatus	A group of one or more **Protection** relays and/or logic elements designated to perform a specified **Protection** function.
Provisional Outage Programme	The provisional **Outage** programme in respect of **Generating Units** and **Transmission Components** prepared by **System Operator** for Years 2 and 3 pursuant to **Operating Code 'A'**.
Rated MW	The "rating-plate" MW output of a **Generating Unit,** being that output up to which the **Generating Unit** was designed to operate.
Reactive Energy	The integral with respect to time of the **Reactive Power**.
Reactive Power (VAr)	The product of voltage and current and the sine of the phase angle between them measured in units of volt-amperes reactive or var and standard multiples thereof, i.e.: 1000 var = 1 kVArr 1000 kvar = 1 MVAr
Record of Inter-System Safety Precautions (RISSP)	A written record of inter-system **Safety Precautions** to be compiled in accordance with the provisions of **Operating Code 'B'**.

Terms	Definitions
Red Warning	A warning that will be issued by **System Operator** 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.
Reference Incident	Maximum positive or negative power deviation occurring instantaneously between generation and demand in a synchronous area, considered in dimensioning of **Primary Reserve**
Registered Capacity	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.
Registered Data	Those items of **Standard Planning Data** and **Detailed Planning Data** which upon connection become fixed.
Requesting Safety Co-ordinator	The **Safety Co-ordinator** requesting **Safety Precautions**.
Responsible Engineer/Operator	A person nominated by a **User** to be responsible for **System** control.
Responsible Manager	A manager who has been duly authorised by a **User** or **Transmission Owner** to sign **Site Responsibility Schedules** on behalf of that **User** or **Transmission Owner**.
Re-synchronisation	The bringing of parts of a **System** which have become **Out of Synchronism** with each other back into **Synchronism,**.
Resource Following Ramp Rate	A ramp rate setting of **Power Park Modules** used during Start-Up and normal operation.

Terms	Definitions
Safety Co-ordinator	A person or persons nominated by **Transmission Owner** 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'**.
Safety From The System	That condition which safeguards persons when work is to be carried out on a **System** from the dangers which are inherent in the **System**.
Safety Log	A chronological record of messages relating to safety co-ordination sent and received by each **Safety Co-ordinator** under **Operating Code 'B'**.
Safety Precautions	**Isolation** and/or **Earthing**.
Safety Rules	The rules of **Transmission Owner** 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**.
Schedule	Either a **Generation and Desalination Schedule** or a **Subsequent Schedule**.
Scheduling and Despatch Parameters	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**.
Schedule Day	The period from 0500 hours in the **Settlement Day** until 0500 hours in the next following **Settlement Day**.
Scheduling	The process of compiling and issuing a **Generation and Desalination Schedule**, as set out in the **Scheduling and Despatch Code**.

Terms	Definitions
Secondary Control	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=ftarget) 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.
Secondary Reserve	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.
Secondary 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 **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.
Secured Events	This shall have the meaning assigned to it under the Electricity Transmission System Security Standards (ETSSS)
Secondary Response Performance Index	A relative figure for the determination of the capability of a unit to provide **Secondary Response**
Self-Supply User	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
Set-Point Ramp Rate	A ramp rate setting of **Power Park Modules, HVDC** and/or **Battery Storages** used for **Active Power** control during **AGC** control process.
Settlement Day	The period from 0000 to 2400 hours in each day.

Terms	Definitions
Settlement Period	A period of 60 minutes ending on the hour in each hour during a **Schedule Day**.
Seven Year Planning Statement	A statement, prepared by **Transmission Owner** in accordance with the terms of Condition 15 of the **Transmission Licence**, as amended, showing for each of the seven succeeding **Transmission Owner 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.
SF_6 Gas Zone	A segregated zone surrounding electrical conductors within a casing containing SF_6 gas.
Short-Circuit Ratio (SCR)	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.

Terms	Definitions
Significant Incident	An **Incident** which either: (a) was notified by a **User** to **System Operator** under **Operating Code 'B'**, and which **System Operator** or **Transmission Owner** considers has had a significant effect on the **Transmission System**, and **System Operator** requires the **User** to report that **Incident** in writing in accordance with **Operating Code 'B'**; (b) was notified by **System Operator** to **Transmission Owner** and a **User** under **Operating Code 'B'**, and which **Transmission Owner** or that **User** considers has had a significant effect on the **Transmission System** or that **User's System**, requiring **System Operator** to report that **Incident** in writing to **Transmission Owner** and that **User** in accordance with the provisions of **Operating Code 'B'**; or (c) was notified by **Transmission Owner** to **System Operator** under **Operating Code 'B'**, and which **System Operator** or an impacted **User** considers has had a significant effect on the **Transmission System** or that **User's System**, requiring **Transmission Owner** to report that **Incident** in writing to **System Operator**, and **System Operator** to copy that report to **User** in accordance with the provisions of **Operating Code 'B'**.
Single Line Diagram	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.
Site Common Drawings	Drawings prepared for each **Connection Site** which incorporates **Connection Site** layout drawings, electrical layout drawings, common protection/ control drawings and common services drawings.

Terms	Definitions
Site Responsibility Schedule	A schedule containing the information and prepared on the basis of the provisions set out in the **Connection Conditions**.
System Operator	The **System Operator**, being the party holding a [SO] Licence for Abu Dhabi
System Operator Control Engineer	An employee of **System Operator** who is appropriately trained and authorised to carry out and oversee safety critical switching of the **Transmission System**
System Operator Licence	[To be defined by lawyers]
System Safety Rules	A set of rules and procedures prepared and governed by the **Transmission Owner** for safe access to sub-stations and related **Plant** or **Apparatus** covering the rules for safe work on or near Plant or Apparatus which include steps taken by **System Operator** and **Transmission Owner** such that **Outages** of **Plant** and **Apparatus** that form the **Transmission System** can be managed safely.
Speed Control	The mode of operation to maintain speed according to a speed droop characteristic.
Stability Limits	The point beyond which a **Generating Unit** is liable to instability.
Standard Planning Data	The general data required by **Transmission Owner** under the **Planning Code**. It is generally also the data which **Transmission Owner** requires from a new **User** in an application for a **Connection Agreement**, as reflected in the **Planning Code**.
Start Time	The time named as such in an instruction issued by **System Operator** pursuant to the **Scheduling and Despatch Code**.
Start-Up Price	The start-Up price component for a **Generating Unit** or a **Desalination Unit**.
Station Board	A switchboard through which electrical power is supplied to the **Auxiliaries** of a **Power Station**, which may be interconnected with a **Unit Board.**

Terms	Definitions
Steady State Primary Response Coefficient	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
Subsequent Schedule	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.
Supplier	A **DISCO, Self-Supply User** or any other **Licenced Electricity Operator** authorised to supply electricity.
Synchronised	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.
Synchronising Generation	The amount of **MW** produced at the moment of synchronising.
Synchronous Generating Unit	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**.
Synchronous Speed	That speed required by a **Generating Unit** to enable it to be **Synchronised** to a **System**.
System	Any **User System** or the **Transmission System**.
System Constraint	A limitation on the use of a **System** due to lack of transmission capacity or other **System** conditions.
System Constraint Group	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.

Terms	Definitions
System Frequency	Actual level of frequency of synchronous area in a certain moment
System Tests	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.
Synthetic Inertia	A facility or system service provided by a **Power Park Module** or **HVDC** system to replicate the effect of inertia of a **Synchronous Generating Unit** to a prescribed level of performance during a frequency deviation.
System Short Circuit Ratio (SSCR)	A measure of AC system strength at an interconnection point. It is typically defined as the ratio of the rated power of a piece of equipment (e.g. **HVDC Converter Station**, **Power Park Module** or **Synchronous Generating Unit**) to the short circuit power at the point of interconnection.
Target Frequency	That frequency determined by **System Operator** 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 **System Operator**.
Tariff Customer	Any **Customer** who has not entered into a specific contract with the **DISCO** for the supply of electricity.
Telecoms Network	The infrastructure used to communicate data and information between the **System Operator's** Supervisory Control and Data Acquisition (SCADA) and devices on the **Transmission System** or **User Site**
Tertiary Control	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
Tertiary Reserve	**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.
Test Co-ordinator	A person who co-ordinates **System Tests**.
Test Panel	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**.
Test Programme	A programme submitted by the **Test Panel** to **System Operator**, the **Test Proposer**, and each **User** identified by **System Operator** 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.
Test Proposer	The person who submits a **Proposal Notice**.
Transmission Owner Coordination Centre	A centre established and operated by the **Transmission Owner** to facilitate **Transmission Owner** staff engagement with **System Operator** and **Users**.
Total Harmonic Distortion	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.

Terms	Definitions
Total Shutdown	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 **System Operator's** directions relating to a **Black Start**.
Total Speed/Load-Related Dead Band	The total dead band of the **Primary Control** system as defined in Chapter 4, **Operating Code 'A'**, Section 5.1.2.
Total System	The **Transmission System** and all **User Systems** in the Emirate of Abu Dhabi.
Transmission Capability Information	The data required by **System Operator** from **Transmission Owner** in accordance with the **Transmission Owner and System Operator Code** to represent the capabilities of the **Transmission System** to transport electricity.
Transmission Owner	The Abu Dhabi Transmission and Despatch Company.
Transmission Owner Coordination Engineer,	The nominated person employed by **Transmission Owner** to coordinate the field activities on the **Transmission System**
Transmission System Demand	The amount of electricity to be supplied from the **Transmission Supply Points** plus: • 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**.
Transmission Owner Financial Year	The period referred to in Condition 8 of the **Transmission Licence**.
Transmission Owner Site	Means a site owned (or occupied pursuant to a lease, licence or other agreement) by **Transmission Owner** in which there is a **Connection Point**.

Terms	Definitions
Transient Primary Response Coefficient (TPRC)	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.
Transmission Component	**Plant** and/or **Apparatus** that form part of the **Transmission System** and that may be subject to an **Outage**, or reflected in **Transmission Capability Information**
Transmission Entry Point	A point at which a **Generating Unit** which is directly connected to the **Transmission System** connects to the **Transmission System.**
Transmission Licence	A licence issued pursuant to Article 82 of the **Law** authorising the Abu Dhabi Transmission and Despatch Company to transmit water and electricity.
Transmission Supply Point	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**.
Transmission System	The system consisting of **HV** overhead lines and underground cables owned by **Transmission Owner** and/or operated by **System Operator** 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 by **Transmission Owner** or operated by **System Operator** in connection with the transmission of electricity.
Transmission System Losses	The losses of electricity incurred on the **Transmission System**.
Unbalanced Load	The situation where the **Load** on each phase is not equal.
Under Frequency Relay	An electrical measuring relay intended to operate when its characteristic quantity (frequency) reaches the relay settings by decrease in **System Frequency**.

Terms	Definitions
Unit Board	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**.
Unit Controller	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.)
User	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.
User Control Engineer	An individual who is appropriately trained and authorised by a **User** to carry out and oversee safety critical switching of that **User's** system.
User Site	A site owned (or occupied pursuant to a lease, licence or other agreement) by a **User** in which there is a **Connection Point**.
User System	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**.
Voltage Sourced Converter	A type of **AC/DC Converter** technology based on Forced Commutated Valves such as IGBT (Insulated-Gate Bipolar Transistor).
VSC - HVDC	**Voltage-Sourced Converter HVDC:** An **HVDC** topology using **Voltage-Sourced Converter** technology with forced-commutated valves.
Warning Notice	A notice issued by **System Operator** 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.

Terms	Definitions
Weekly Maximum Demand (MD) Conditions	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**.
Weekly Operational Policy	A statement issued by **System Operator** each week to **GENCOs** as set out in the **Operating Code 'A'** of specific requirements to enable **System Operator** to operate the **Transmission System** within the requirements of the System Operator **Transmission Licence**.
Wind Turbine Generating Unit (WTGU)	A **Generating Unit** that produces electricity from a wind.
Zonal Availability	The generation declared available contained within the boundary circuits defining the zone.
Zonal System Security Requirements	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 **Transmission Owner's** or **System Operator'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 **Transmission Owner** and **System Operator** 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 **Transmission Owner**, and information to be supplied by **Transmission Owner** to **Users** and **System Operator**.

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 **Transmission Owner**, **System Operator** and **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 **Transmission Owner** from **System Operator** and **Users** in order for **Transmission Owner** 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 **Transmission Owner** to **System Operator** and

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 **Transmission Owner** 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 **Transmission Owner**, **System Operator** and **Users**.

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

The **Planning Code** applies to **Transmission Owner** and **System Operator** in respect to provision of data between **Transmission Owner** and **System Operator** and interface arrangements.

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 **Transmission Owner** under the **Transmission Owner Transmission Licence**, showing for each of the 7 (seven) succeeding **Transmission Owner 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 **Transmission Owner** 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 Transmission Owner Seven Year Statement

To enable **Transmission Owner** and the **Procurer (EWEC)** to prepare their respective **Seven Year Statement** in Year 0 (Y), each **User** is required to submit to **Transmission Owner** 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 **Transmission Owner 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 **Transmission Owner 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 **Transmission Owner** by week 52 of Year 0-1 (Y-1).

Transmission Owner 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, **Transmission Owner** and **Users** the final coordinated long term demand.

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

Transmission Owner shall make all data provided to it for years 1 to 3 under this sub-section 4.1.1, , available to **System Operator** as soon as reasonably practicable following receipt.

Transmission Owner 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**, **Transmission Owner** 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 **Transmission Owner Financial Year**;

ii) provided by **Transmission Owner** 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, **Transmission Owner** 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 **Transmission Owner** 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 **Transmission Owner** 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. **Transmission Owner** will ensure this data is available to **System Operator** as soon as reasonably practicable following receipt

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 **Transmission Owner**, 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 Power Station** ; and

iv) upon the request of **Transmission Owner**, the relevant **Detailed Planning Data** as listed in Appendix B.

4.2.4 System Operator Role in Connection Offers

Transmission Owner shall consult **System Operator** with respect to all applications for a **Connection and Interface Agreement** and ensure the specific and legitimate requirements of **System Operator** are reflected in any **Connection and Interface Agreement**. These legitimate requirements include, but are not limited to:

i) Requirements for **Black Start Capability** from a **GENCO;**
ii) Requirements for **Power System Stabilisers;**
iii) Requirements for the provision of **Primary Control** and **Secondary Control;**
iv) Agreement to any relaxation of the standard Electricity Transmission Code requirements relating to **Fault Clearance Times**; and
v) Requirements for specific substation and network arrangements.

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 **Transmission Owner** in consultation with **System Operator** 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 **Transmission Owner** 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 **Transmission Owner** to carry out any of the above mentioned necessary detailed system studies, the **User** may, at the request of **Transmission Owner**, 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 **Transmission Owner** 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 **Transmission Owner**, will become **Committed Project Planning Data**. This data, together with other data held by **Transmission Owner** 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 **Transmission Owner** 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 **Transmission Owner** or **System Operator**:

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 operational planning purposes.

6. PLANNING STANDARDS

Transmission Owner 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 **Transmission Owner** 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** (summated 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 **Transmission System Demand** (**Active Power**) which, for planning purposes will be as specified from time to time by **Transmission Owner**; and

iii) day of minimum **Transmission System** Demand (**Active Power**) which, for planning purposes will be as specified from time to time by **Transmission Owner**;

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 **System Operator**; 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 **Transmission System Demand** which, for planning purposes will be as specified from time to time by **Transmission Owner**; and

iii) the **Demand** (**Active Power**) at the time of minimum **Transmission System Demand** which, for planning purposes will be specified from time to time by **Transmission Owner**.

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 **Transmission Owner**;

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 **Transmission Owner**:

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 **Transmission Owner** 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**, e.g. 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 **Transmission Owner**, 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 **HVDC Converter Station** or within **Power Park Module** connecting a **PVGU** or **WTGU**.

- **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 **Transmission Owner** 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 **Transmission Owner'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 (e.g. 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 Station**s 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 **Transmission Owner** 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** or with all **Power Park Modules** connected to that **User System** through **AC/DC Converter Station**. 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 Park Module** and by each **PVGU** and **WTGU**;

vii) The **Power Factor** of the **Power Park Module** 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 **Transmission Owner** 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 (e.g. 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 Transmission Owner including on behalf of System Operator:

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 **Transmission Owner** 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 **Transmission Owner** 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 **Transmission System Demand**; and

iii) the **Demand** at the time of minimum **Transmission System 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 MVAr 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 an **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 **Transmission Owner**. 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 **Transmission Owner** 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 **Transmission Owner** to evaluate the production of flicker and harmonics on **Transmission System** and **User's System**. At **Transmission Owner'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 **Transmission Owner** 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 **Transmission Owner** 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 **Transmission Owner**, 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 **Transmission Owner** will need to conduct transient overvoltage assessments. When requested by **Transmission Owner,** 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 **Transmission Owner** 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, **Transmission Owner** (including on behalf of **System Operator)** may reasonably request additional data to represent correctly **User Systems Plant** and **Apparatus** for the purpose of carrying out studies.

6. SIMULATION MODELS

The **Power Park Module** or the **HVDC USER** shall provide the models that accurately represent the dynamic response of the plant. The model shall include all site specific protection, control and other parameter settings as applicable. Both RMS-type and EMT-type models shall be in software formats specified by **Transmission Owner** (ex. PSS®E and PSCAD™/EMTDC™ formats, for RMS and EMT respectively).

The models shall have the flexibility to change parameters and select options that **Transmission Owner** will have access to with the field equipment. However, the model may be provided in 'closed (black-box)' form to protect proprietary information of the **Power Park Module** or **HVDC** Manufacturer that are included in the details of the model.

The **HVDC** or **Power Park Module** shall provide the model validation and system compliance study results for review and agreement by **Transmission Owner** who shall consult **System Operator** with regard to that agreement. Those simulation studies shall be revised based on the actual system and **HVDC System** or **Power Park Module** tests and adhere to the requirements of the **Transmission System** and **HVDC** System or **Power Park Module** per the Technical Specifications, as well as the following requirements:

For the purpose of dynamic simulations, the models provided shall contain at least, but not limited to, the following sub-models, depending on the existence of the mentioned components:

(a) **HVDC** or **AC/DC** converter unit models;

(b) AC component models;

(c) DC system models;

(d) Voltage and power controller;

(e) Special control features if applicable (e.g. power oscillation damping (POD) function, sub-synchronous torsional interaction (SSTI) control);

(f) Multi terminal control, if applicable;

(g) **HVDC system** protection models as agreed between **Transmission Owner** and the

HVDC USER.

The **HVDC USER** shall verify the models against the results of compliance tests carried out and a report of this verification shall be submitted to **Transmission Owner** and **System Operator**. The models shall then be used for the purpose of verifying compliance with the requirements of this code including, but not limited to, compliance simulations and used in studies for continuous evaluation in system planning and operation.

The **HVDC USER** shall submit **HVDC** recordings to **Transmission Owner** and/or **System Operator**, if requested, in order to compare the response of the models with these recordings.

Similarly, the owner/operator of the **Power Park Modules** shall submit the recordings to **Transmission Owner** and/or **System Operator**, if requested, in order to compare the response of the models with these recordings.

APPENDIX C - NETWORK DATA

7. SYSTEM MODEL

Transmission Owner will provide **System Operator**, **Users** and potential **Users**, through the **Procurer** 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 **Transmission System** and the dynamic model data corresponding to generators and other dynamic devices as determined by **Transmission Owner** as necessary for the **User** to perform design verification studies.

Each connection between a **Generating Unit** and the **Transmission System** must be associated with the minimum **System Short Circuit Ratio** at the point of connection as determined by **Transmission Owner** and specified within the **Connection and Interface Agreement, or Power (and Water) Purchase Agreement.**

This data will be validated by **Transmission Owner** in consultation with **System Operator** in accordance with **Good Industry Practice**.

8. SHORT CIRCUIT CALCULATIONS

To allow those **Users** who only need to model the **Transmission System** for the purpose of short circuit calculations, **Transmission Owner** 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 (I_1") at the instant of fault from the **Transmission System**;

ii) symmetrical three-phase short circuit current (I_1') from the **Transmission System** after the sub-transient fault current contribution has substantially decayed;

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, Transmission Owner** 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 **Transmission Owner** and **System Operator** 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 **Transmission Owner** and **System Operator** to comply with their statutory and [**Transmission Owner** and SO] **Transmission Licence** obligations.

3. SCOPE

The **Connection Conditions** applies to **Transmission Owner** and **System Operator** and the following **Users**:

i) **GENCOs (**including **Power Park Modules** and **Battery Storages)**

ii) **AC/DC (HVDC) Converter Station**

iii) **DISCOs**

iv) **Non-Embedded Customers**

v) **Self-Supply Users**

vi) **User Systems**

The obligations within the Connection Conditions that are expressed as to be applicable to **GENCO**s 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 **System Operator** 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 **Transmission Owner /User** interface;

iv) information to enable **Transmission Owner** and **System Operator** 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 **Transmission Owner 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 **Transmission Owner** 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 **Transmission Owner** 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 **Transmission Owner Site** or of any other **User Site**).

6. TECHNICAL, DESIGN AND OPERATIONAL CRITERIA

6.1 Transmission System Performance Characteristics

Transmission Owner and **System Operator** 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 ±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 ±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 **Harmonic Voltage Compatibility Level** 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 **Harmonic Voltage Planning Level** which **Transmission Owner** will apply for the determination of any new **User** apportion to the **Transmission System**, and which may result in harmonic emission limits, both in individual harmonic distortion as well as in **Total Harmonic Distortion** limits, being specified for these loads in the relevant **Connection and Interface Agreement**.

A Harmonic Distortion caused by any new User will be calculated by **Transmission Owner** and specified within **Connection and Interface Agreement**, according to the following equation:

$$V_{hr}^{h} = \sqrt[\alpha]{(V_{pl}^{h})^{\alpha} - (V_{bg}^{h})^{\alpha}} \times k$$

Where:
V_{hr}^{h}- Max allowed contribution of new **User** for each harmonic order h
V_{pl}^{h} - the **Harmonic Voltage Planning Level** for harmonic h
V_{bg}^{h}- the measured background harmonic voltage distortion for harmonic h
k- Allotment factor which depends on number and the size (MVA rating) of **Users** connecting the electrical vicinity of point of connection and is exclusively under the **Transmission Owner** discretion. **Transmission Owner** will calculate the Allotment factor case by case, taking into consideration a harmonic planning margin.
α- Summation exponent as per the following table

Harmonic order	α
h<5	1
5<h<10	1.4
h>10	2

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 **Transmission Owner** 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 **System Operator** '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 **Transmission System** and **Distribution Systems** during the summer period. **System Operator** 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 **Transmission System** and **Non-Embedded Customers.**

For **Self-Supply Users**, the actual reactive power range specified by the **System Operator** 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 **System Operator**; 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 **System Operator**

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

Obligations should apply to both parties, **System Operator** 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/Transmission System Connection Site

The following requirements apply to **Plant** and **Apparatus** relating to the **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) AC/DC (HVDC) Converter Station

iii) any **Distribution** or **User System**

iv) **Self-Supply User**, or

v) **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**/**Transmission System 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 **Transmission Owner** and **System Operator** 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 ISO 9001 or equivalent.

6.2.2 GENCO/Transmission System 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 **Transmission Owner**.

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 Time** for faults on the **GENCO** equipment directly connected to the **Transmission System** or for faults on the **Transmission System** directly connected to the **GENCO** equipment shall be set out in accordance with the **Connection and Interface Agreement.** The times specified in accordance with the **Connection and Interface Agreement** shall not exceed the following unless otherwise agreed in the **Connection and Interface Agreement**:

i) 80ms for faults cleared by the main protection at 400kV and 220kV; and

ii) 100ms for fault cleared by the main protection at 132kV[1]

Slower **Fault Clearance Time** may be specified in accordance with the **Connection and Interface Agreement** for faults on **the Transmission System**. Slower **Fault Clearance Time** for faults on the **GENCO** equipment may be agreed in accordance with the **Connection and Interface Agreement** but only if **System** requirements permit in the view of **Transmission Owner** following consultation with **System Operator**. The probability that the slower **Fault Clearance Times** stated in accordance with the **Connection and Interface Agreement** by any given fault shall not exceed 5% based on the test samples over a period of 5 years.

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**. **Transmission Owner** shall also provide **Back-Up Protection** and these **Back-Up Protections** shall be coordinated, in consultation with **System Operator**, to provide **Discrimination** and protect equipment from damage with a safety margin of at least 20% with the respective equipment damage curves.

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 and Interface Agreement** and shall follow the provisions of Clause 6.2.2.3 as above

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 **Transmission Owner**, circuit breaker fail **Protection** shall be provided by the **GENCO** or **Transmission Owner** 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 Clearance Time**, the circuit breaker fail **Protection** is required. The circuit breaker fail **Protection** shall initiate tripping of all the necessary electrically adjacent circuit breakers including remote ends to interrupt the fault current within the next 300ms.

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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

1 For close to Generator applications, it shall not exceed 80ms

Where **System** requirements dictate, **Transmission Owner** 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 **Transmission Owner** who shall be there as instructed by **System Operator**.

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**.

6.2.2.5 System Short Circuit Ratio

Each connection between a **Generating Unit** and the **Transmission System** must be associated with the minimum **System Short Circuit Ratio** at the point of connection as determined by **Transmission Owner** and specified within the **Connection and Interface Agreement, or Power (and Water) Purchase Agreement.**

6.2.3 DISCO Connection Points

6.2.3.1 Protection Arrangements

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

6.2.3.2 Fault Clearance Times at DISCO Interface

The **Fault Clearance Time** for faults on **DISCO** equipment directly connected to the **Transmission System**, or for faults on the **Transmission System** directly connected to the **DISCO** equipment shall be set out in accordance with each **Connection and Interface Agreement**. The times specified in accordance with the **Connection & Interface Agreement** shall not exceed the following at the **Transmission System/DISCO** interfaces unless otherwise agreed in the **Connection and Interface Agreement**:

(i) 100ms for faults cleared by main protection at 220kV, 132kV, 33kV, 22kV, and 11kV.

Slower **Fault Clearance Times** may be specified in accordance with the **Connection and Interface Agreement** for faults on the **Transmission System**. Slower **Fault Clearance Times** for faults on the **DISCO** equipment may be agreed in accordance with the terms of the **Connection and Interface Agreement** but only if the **DISCO System** requirements permit

and, in **Transmission Owner's** and **System Operator's** view **Transmission System** requirements permit. The probability that the slower **Fault Clearance Times** stated in accordance with the **Connection and Interface Agreement** by any given fault shall not exceed 5% based on the test samples over a period of 5 years.

6.2.3.3 Protection Equipment to be provided at DISCO Interfaces

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** and shall follow the provisions of Clause 6.2.3.2.

6.2.3.4 Backup Fault Clearance Times at DISCOs Interfaces

For connections with the **Transmission System**, the **Back-up Protection** shall be provided by the **DISCO** at the **Connection Point** (viz., transformer incomer) with a **Fault Clearance Time** that shall NOT exceed 1100ms for any faults on the **DISCO** Apparatus connected to the **Transmission System** interface transformers with maximum short circuit withstand duration of 2s. In case of **Transmission System** interface transformers with maximum short circuit withstand duration of 3s, the **Fault Clearance Time** at the connection point shall NOT exceed 1250ms for any faults on the **DISCO** apparatus.

Slower **Back-up Protection Fault Clearance Time** for the faults on the **DISCO** equipment may be agreed with **Transmission Owner** in accordance with the terms of the **Connection and Interface Agreement** but only if the **System** requirements in **Transmission Owner's** and **System Operator's** view permit. For such exceptional cases **Transmission Owner** may, subject to approval from **System Operator**, agree to extend up to 1200ms on case-to-case basis at those **Transmission System** interface transformers with maximum short circuit withstand duration of 2s. Similarly, for exceptional cases **Transmission Owner** may, subject to approval from **System Operator**, agree to extend up to 1400ms on case to case basis at those **Transmission System** interface transformers with maximum short circuit withstand duration of 3s.

6.2.3.5 Signals for Tariff Metering

DISCOs shall install current and voltage transformers supplying all tariff meters at a voltage to be specified, and in accordance with the **Connection and Interface Agreement**
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6.2.3.6 Fault Disconnection Facilities

Where no **Transmission Owner** circuit breaker is provided at the **User** connection voltage, the **User** must provide **Transmission Owner** 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 **Transmission Owner** circuit breakers. These tripping facilities shall be in accordance with the requirements specified in the **Connection Agreement**.

6.2.3.7 Automatic Switching Equipment

Where automatic reclosure of **Transmission Owner** 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**.

6.2.3.8 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**.

6.2.3.9 Work on Protection equipment

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

6.2.3.10 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.

6.2.3.11 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 Non-Embedded Customers

6.2.4.1 Protection Arrangements

Protection of **Systems** of **Non-Embedded Customers** must meet the minimum requirements referred to below.

6.2.4.2 Fault Clearance Times at Non-Embedded Customer Interfaces

The **Fault Clearance Time** for faults on the **Non-Embedded Customer** equipment directly connected to the **Transmission System** or for faults on the **Transmission System** directly connected to the **Non-Embedded Customer** equipment, shall be set out in accordance with the **Connection and Interface Agreement.** The times specified in accordance with the **Connection and Interface Agreement** shall not exceed the following unless otherwise agreed in the **Connection and Interface Agreement**:

(i) 80ms for faults cleared by the main protection at 400kV and 220kV;

(ii) 100ms for fault cleared by the main protection at 132kV[2]

Slower **Fault Clearance Time** may be specified in accordance with the **Connection and Interface Agreement** for faults on the **Transmission System**. Slower **Fault Clearance Time** for faults on the **Non-Embedded Customer** equipment may be agreed in accordance with the **Connection and Interface Agreement** but only if **System** requirements permit. The probability that the slower **Fault Clearance Times** stated in accordance with the **Connection and Interface Agreement** by any given fault shall not exceed 5% based on the test samples over a period of 5 years.

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 **Non-Embedded Customer** shall provide **Back-Up Protection**. **Transmission Owner** shall also provide **Back-Up Protection** and these **Back-Up Protections** shall be coordinated to provide **Discrimination** and protect equipment from damage with a safety margin of at least 20% with the respective equipment damage curves.

6.2.4.3 Protection Equipment to be provided for Non-Embedded Customers

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** and shall follow the provisions of Clause 6.2.4.2.

Circuit-breaker fail Protection

When the **Non-Embedded Customer** equipment is connected to the **Transmission System** at 400kV, 220kV or 132kV and a circuit breaker is provided by the **Non-Embedded Customer** or **Transmission Owner**, circuit breaker fail **Protection** shall be provided by the **Non-Embedded Customer** or **Transmission Owner** 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 Clearance Time**, the circuit breaker fail **Protection** is required. The circuit breaker fail **Protection** shall initiate tripping of all the necessary electrically adjacent circuit breakers including remote ends to interrupt the fault current within the next 300ms.

6.2.4.4 Signals for Tariff Metering

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

6.2.4.5 Fault Disconnection Facilities

Where no **Transmission Owner** circuit breaker is provided at the **User** connection voltage, the **User** must provide **Transmission Owner** 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 **Transmission Owner** circuit breakers. These tripping facilities shall be in accordance with the requirements specified in the **Connection Agreement**.

6.2.4.6 Automatic Switching Equipment

[2] For close to Generator applications, it shall not exceed 80ms

Where automatic reclosure of **Transmission Owner** 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**.

6.2.4.7 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**.

6.2.4.8 Work on Protection equipment

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

6.2.4.9 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.

6.2.4.10 Under Frequency Relays

As required under **Operating Code 'A' Section 6.4**, each **Non-Embedded Customer** 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.

6.2.5 Self-Supply User Connection Points

6.2.5.1 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 **Connection Point** as determined by **Transmission Owner**.

6.2.5.2 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.**

6.2.5.3 Fault Clearance Times

The **Fault Clearance Time** for faults on the **Self-Supply User** equipment directly connected to the **Transmission System** or for faults on the **Transmission System** directly connected to the **Self-Supply User** equipment shall be set out in accordance with the **Connection and**

Interface Agreement. The times specified in accordance with the **Connection and Interface Agreement** shall not exceed the following unless otherwise agreed in the **Connection and Interface Agreement**:

(i) 80ms for faults cleared by the main protection at 400kV and 220kV;

(ii) 100ms for fault cleared by the main protection at 132kV[3]

Slower **Fault Clearance Time** may be specified in accordance with the **Connection and Interface Agreement** for faults on **the Transmission System**. Slower **Fault Clearance Time** for faults on the **Self-Supply User** equipment may be agreed in accordance with the **Connection and Interface Agreement** but only if **System** requirements permit. The probability that the slower **Fault Clearance Times** stated in accordance with the **Connection and Interface Agreement** by any given fault shall not exceed 5% based on the test samples over a period of 5 years.

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 **Self-Supply User** shall provide **Back-Up Protection**. **Transmission Owner** shall also provide **Back-Up Protection** and these **Back-Up Protections** shall be coordinated to provide **Discrimination** and protect equipment from damage with a safety margin of at least 20% with the respective equipment damage curves.

6.2.5.4 Protection Equipment to be provided

Self-Supply User and **Transmission Owner** 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 **Transmission Owner**, circuit breaker fail **Protection** shall be provided by the **Self-Supply User** or **Transmission Owner** 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 Clearance Time**, the circuit breaker fail **Protection** is required. The circuit breaker fail **Protection** shall initiate tripping of all the necessary electrically adjacent circuit breakers including remote ends so as to interrupt the fault current within the next 300ms.

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

[3] For close to Generator applications, it shall not exceed 80ms

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 **Transmission Owner**.

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**

6.2.5.5 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

6.3.1.1 Active and Reactive power Capability

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.

The **Power Park Module** as well as **Battery Storage** which is connected with the **System** through the **AC/DC converter station and HVDC** systems connected to the AC **Transmission System** shall comply with the following plant performance requirements:

a) The **Power Park Module, HVDC systems** as well as **Battery Storage** 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. 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.

b) The **Power Park Module, HVDC systems** as well as **Battery Storage** must allow the reactive power utilisation to the greatest possible extent, but at least as per P-Q capability diagram presented in Figure 6.1 where the **Reactive Power** capability at the **Transmission Entry Point** shall not be less than the ±33% of the rated power (that corresponds to the power factor of 0.95 leading/lagging) at:

- Any level of **Active Power** output, including zero **Active Power** level
- Any voltage at the connection point within the limits 0.9-1.1 p.u

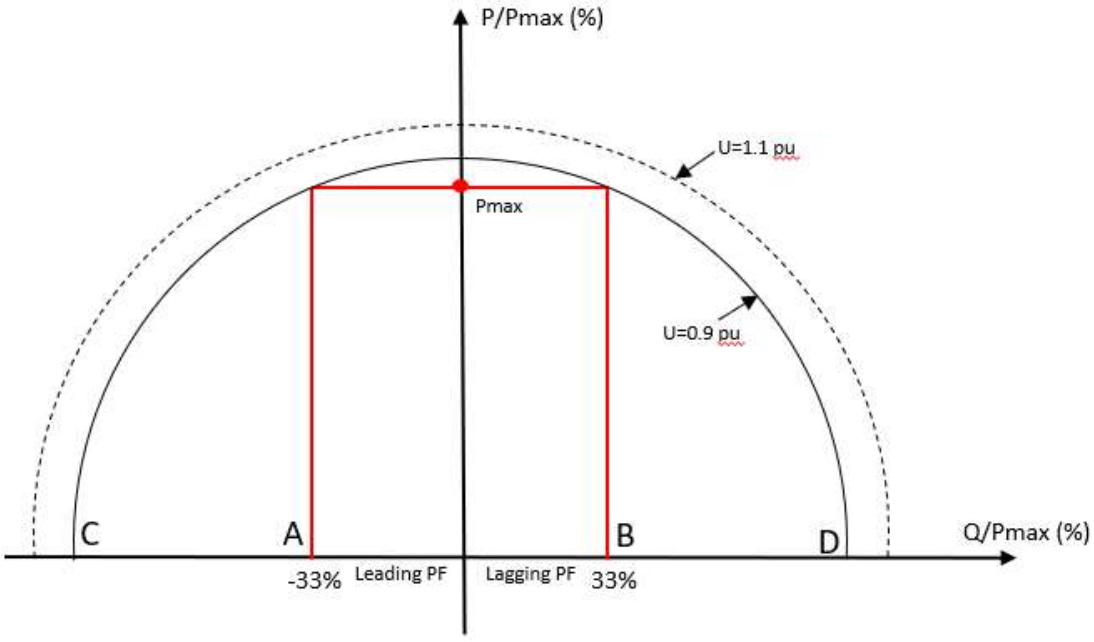


Figure 6.1: P-Q capability of the Non-synchronous Power Park Module and uni-directional HVDC

- Point A is equivalent to leading 0.95 **Power Factor** at rated MW output
- Point B is equivalent to lagging 0.95 **Power Factor** at rated MW output
- Point C represents theoretical inverter limit (leading) at zero MW output
- Point D represents theoretical inverter limit (lagging) at zero MW output

(capability between A and C and between B and D may be required in separate bilateral agreement depend on the internal constraints, but it does not belong to standard capabilities)

c) The **Battery Storage** must allow the reactive power utilisation to the greatest possible extent, but at least as per P-Q capability diagram presented in Figure 6.2. This maybe

applicable to **HVDC systems** connecting two systems and required to be capable of bi-directional power flow.

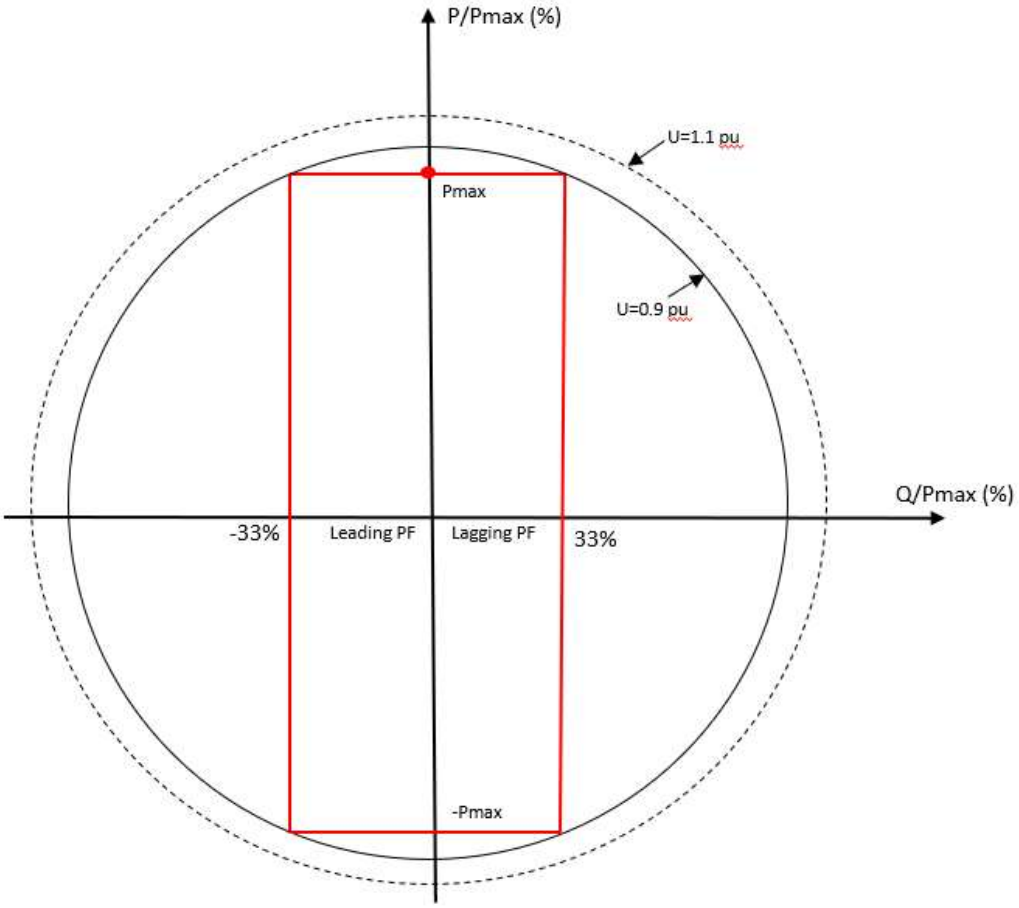


Figure 6.2: P-Q capability of the Battery Storage and Bi-directional HVDC systems

If the **Power Park Module, HVDC** or the **Battery Storage** is not capable of the level of performance established under previous paragraphs, **Power Park Module, HVDC** as well as **Battery Storage** must install additional equipment connecting at the connection point, to provide the deficit of **Reactive Power** (supply and absorption), and such equipment is deemed to be part of the **Power Park Module**, **HVDC system** or **Battery Storage** System.

The **HVDC USER** shall ensure that the **Reactive Power** of its **HVDC** converter station exchanged with the **Transmission System** at the **Connection point** is limited to the values specified by **Transmission Owner**. The **Reactive Power** variation caused by the **Reactive Power** control operation mode of the **HVDC** system, shall not result in a voltage step exceeding the allowed value at the **Connection point**. **Transmission Owner** shall specify this maximum tolerable voltage step value.

Any exemption to the **Reactive Power** capability shall be agreed between **Transmission**

Owner, subject to **Transmission Owner** agreeing that exemption with **System Operator,** and the **USER** and stated in a separate bilateral agreement.

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** of **Power Park Module**, 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 ± 5% at 400kV, 220kV, 132kV and lower voltages.

6.3.1.2 Frequency Capability for HVDC System

a) The **HVDC system** shall be capable of staying connected to the **Transmission System** and remain operable within the **System Frequency** range 49 to 51Hz". Decrease of output **Active Power** is permitted in the frequency range of 47 to 49.5 Hz. Any decrease of output **Active Power** occurring in the frequency range of 47 to 49.5 Hz should not be more than pro-rata with **System Frequency**.

b) Minimum time period an **HVDC System** shall be able to operate for different frequencies deviating from a nominal value without disconnecting from the **Transmission**

System is as follows:

Frequency Range	Requirement
47 - 47.5Hz	Operation for a period of at least 1 continuous minute is required each time the **System Frequency** is below 47.5Hz.
47.5 - 49Hz	Operation for a period of at least 90 continuous minutes is required each time the **System Frequency** is below 49Hz.
49 - 51Hz	Continuous operation is required. Any decrease of output power occurring in the frequency range of 47 to 49.5 Hz should not be more than pro-rata with **System Frequency.**
51- 51.5 Hz	Operation for a period of at least 90 continuous minutes is required each time the **System Frequency** is above 51 Hz. Decrease of output power is not permitted.
51.5 – 52 Hz	Operation for a period of at least 20 continuous minutes is required each time the **System Frequency** is above 51.5Hz. Decrease of output power is not permitted.
52 – 53 Hz	Operation for a period of at least 20 continuous seconds is required each time the **System Frequency** is above 52Hz. Decrease of output power is not permitted.

The proposed requirements for **HVDC** are depicted in the above Table and Figure 6.3 below.

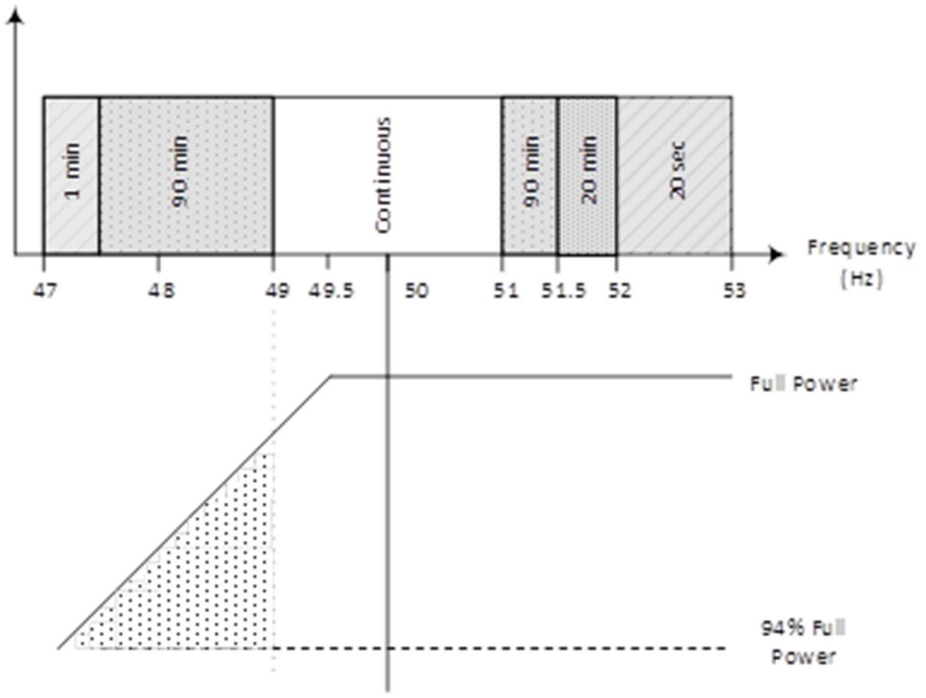


Figure 6.3 Expected withstand durations and expected real power capacity during system frequency deviations.

The **Transmission Owner** may specify a maximum admissible **Active Power** output reduction from its operating point if the **System Frequency** falls within 49.5 Hz to 47 Hz. This reduction shall not be more than pro-rata with **System Frequency** (e.g. maximum reduction allowed at 47 Hz is 6% of the rated power).

The **HVDC USER** shall communicate their technical duration capability (over and above what has been stated above) to **Transmission Owner** when the frequency is above 51.5 Hz.

The protection settings of the **HVDC** equipment connecting to the **Transmission System** should not violate the frequency limits provided above.

Without prejudice to the requirements above, an **HVDC** system shall be capable of automatic disconnection at frequencies specified by **Transmission Owner**.

Transmission Owner, in consultation with **System Operator,** may agree with **HVDC USER** on wider frequency ranges or longer minimum times for operation if needed to preserve or to restore system security. If wider frequency ranges or longer minimum times for operation are economically and technically feasible, the **HVDC USER** shall not unreasonably withhold consent. This needs to be defined in the **Connection and Interface Agreement** between **Transmission Owner** and the **HVDC USER**, while ensuring that all the Regulations required by the DoE are also met.

6.3.1.3 Rate of Change of Frequency

All synchronous **Generating Units** shall be capable of withstanding any Rate Of Change Of Frequency up to 1 Hz/s without disconnection from the network The rate of change of frequency shall be measured over a sliding 500ms time period.

All **Power Park Modules, HVDC** as well as **Battery Storages** shall be capable of withstanding any Rate Of Change Of Frequency up to 2.5 Hz/s without disconnection from the network. The rate of change of frequency shall be measured over a sliding 500ms time period.

The requirements stated in Clause 6.3.1.3 above is the minimum requirement and **Transmission Owner** may list additional requirements for specific connections if system studies indicate a need. Such requirements shall be specified in a **Connection and Interface Agreement** or **Power Purchase Agreement (PPA).**

6.3.1.4 Black Start

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 System Operator** shall determine whether **Black Start Capability** is required, and notify the **Transmission Owner**, the **Transmission Owner** shall then state in the **Connection Agreement** whether or not a **Black Start Capability** is required.

Black start is not a mandatory service. If any **Generating Unit** (including non-synchronous) is able to provide **Black Start** service and wish to offer that service to the **System Operator**, it will be specified within the **Power (and Water) Purchase Agreement** or **Ancillary Service** Agreement or any other Agreement. The following requirements shall apply:

- **Generating unit** shall be capable of starting from shutdown without any external electrical energy supply within a time frame specified by **System Operator**.
- **Generating unit** shall be able to synchronise within the frequency and voltage limits defined in ETC.
- **Generating unit** shall be capable of automatically regulating dips in voltage caused by connection of demand.
- **Generating unit** shall be capable of operating in **Normal Frequency Sensitive** mode.
- **Generating unit** shall be capable of parallel operation of a few Generating units (including non-synchronous) within an isolated part of the **Total System**.

6.3.2 Control Arrangements

Each **Generating Unit** (including **Power Park Module, HVDC** and **Battery Storage),** 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 and Secondary Response** capabilities as set out in the **Power and Water Purchase Agreement** or the **Connection and Interface Agreement**.

The capability of **Generating Units** (including **Power Park Module**), **HVDC** and **Battery Storage** for contributing to **Secondary Control** (**AGC** and **LFC**) shall be as set out in the **Power and Water Purchase Agreement** or the **Connection and Interface Agreement**. The required participation shall be determined by **System Operator** and communicated to the **Transmission Owner** or **Procurer** as appropriate for inclusion in the relevant agreement.

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**).

Synchronous Generating Units

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**.

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 all **Generating Units** the **Frequency Control** device (or speed governor) deadband should be no greater than 0.04Hz (for the avoidance of doubt, ±0.02Hz).
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%.

Non-synchronous Generating Units

A **Unit Controller** of each **Power Park Module or HVDC** must be capable of providing frequency response under the following modes:

- **Normal Frequency Sensitive Mode**
- **Limited Frequency Sensitive Mode - Over frequency**
- **Limited Frequency Sensitive Mode - Under frequency**

The **Unit Controller** or equivalent control device(s) may be on the **Power Park Module** or on each individual **AC/DC converter**. **Power Park Module or HVDC** will only be expected to deliver response as per their **Power Purchase Agreement**.

A **Unit Controller** of each **Battery Storage** must be capable of providing frequency response under the **Normal Frequency Sensitive Mode.**

The following shall apply for **Power Park Module, HVDC** (see Figure 6.4) and/or **Battery Storage** (see Figure 6.5) operating in **Normal Frequency Sensitive Mode**:

- A **Frequency Deadband** of no greater than +/- 20mHz may be applied. The design, implementation and operation of the **Frequency Deadband** shall be agreed with the system operator prior to the **Commissioning.**
- The **Active Power Frequency Response** shall be capable of having a **Governor Droop** between 3% and 5%.
- In response to low frequency events, **Power Park Module, HVDC** and/or **Battery Storage** shall be capable of providing a power increase up to **Available Active Power**. Stable operation in response to low frequency events shall be ensured.

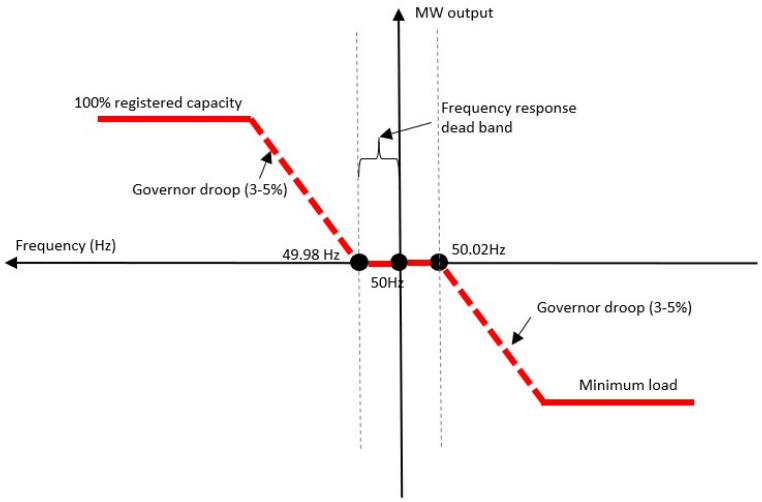


Figure 6.4: Normal Frequency Sensitive Mode

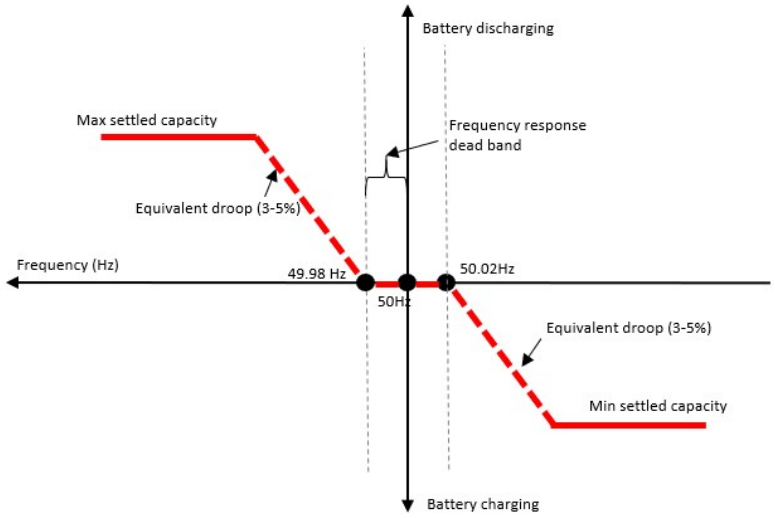


Figure 6.5: Normal Frequency Sensitive Mode for Battery Storage

The following shall apply for **Power Park Module** or **HVDC** operating in **Limited Frequency Sensitive Mode – Over Frequency** (see Figure 6.6):

- **Power Park Module** or **HVDC** shall be capable of providing **Active Power Frequency Response** when the **Transmission System Frequency** rises to or above threshold which should be set in range 50.2 – 50.5 Hz.
- The **Active Power Frequency Response** shall be capable of having a **Governor Droop** between 3% and 5%.
- **Power Park Module** or **HVDC** shall be capable of providing a power decrease down to **Minimum Load**. Stable operation shall be ensured.
- **Power Park Module** or **HVDC** shall be capable of continuous stable operation when

MW Output is reduced to **Minimum Load**. This response will prevail over any other **Active Power** control mode.

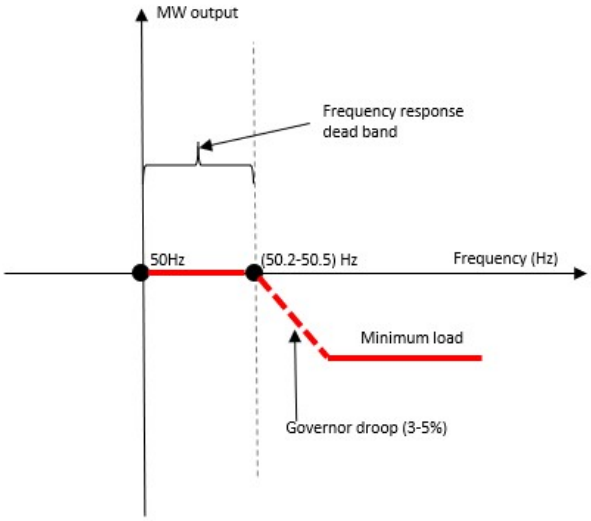


Figure 6.6: Limited Frequency Sensitive Mode – Over Frequency

The following shall apply for **Power Park Module** or **HVDC** operating in **Limited Frequency Sensitive Mode** – **Under Frequency** (see Figure 6.7):

- The mode should be activated under curtailed conditions (solar and/or wind).
- **Power Park Module** or **HVDC** shall be capable of providing **Active Power Frequency Response** when the **System Frequency** falls to or below the threshold which should be set in range 49.5 – 49.98 Hz.
- A **Frequency Deadband** of no greater than +/- 20mHz may be applied. The design, implementation and operation of the **Frequency Deadband** shall be agreed with the **Transmission Owner**, who shall confirm its agreement with **System Operator,** prior to the **Commissioning.**
- The **Active Power Frequency Response** shall be capable of having a **Governor Droop** between 3% and 5%.
- **Power Park Module** or **HVDC** shall be capable of providing a power increase up to **Available Active Power**. Stable operation shall be ensured.

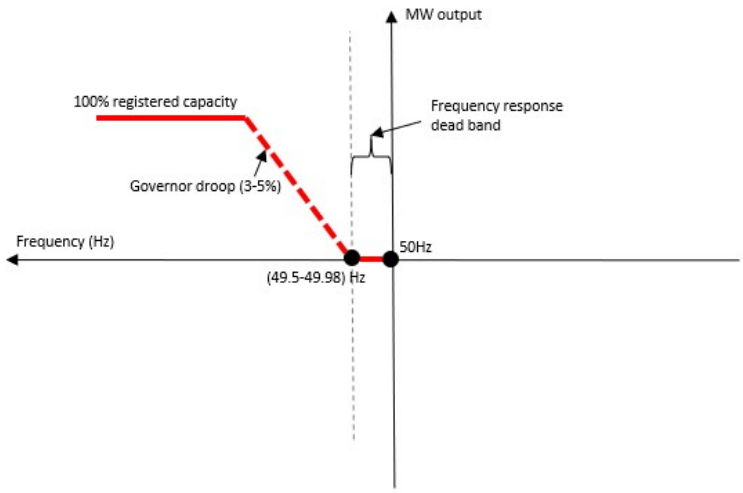


Figure 6.7: Limited Frequency Sensitive Mode – Under Frequency

Power Park Module, HVDC and/or **Battery Storage** must ensure that:

- The connection of the **Power Park Module, HVDC** and/or **Battery Storage** system shall not negatively impact the operation of other dynamic devices in its close vicinity. The stable operation shall be demonstrated through appropriate RMS (ex. PSS®E) and electromagnetic-transients-type (EMT) (ex. PSCAD/EMTDC) simulation tools.
- The connection of the **Power Park Module, HVDC** and/or **Battery Storage** system shall not lead to unstable or poorly damped system conditions (commonly referred to as control interactions).
- The connection of the **HVDC system** shall not result in transient and temporary over voltages that will impact existing generation, transmission and distribution equipment.
- The connection of the **Power Park Module**, **HVDC** and/or **Battery Storage** shall not adversely impact the torsional oscillations (sub-synchronous torsional oscillations and interactions (SSO/SSTI). Regarding the sub-synchronous torsional interaction (SSTI) damping control, the **HVDC system** shall be capable of contributing to electrical damping at torsional oscillation frequencies. The SSTI studies shall be undertaken by the **HVDC USER**. The studies shall identify the conditions, if any, where SSTI exists and propose any necessary mitigation measures. Any necessary mitigating actions identified by the studies shall be reviewed by **Transmission Owner** in consultation with **System Operator** The mitigating actions shall be undertaken by the **USER** as part of the connection of the new **HVDC system** or the **Power Park Module**. The **USER** shall provide all relevant data and models that allow such study to be performed by **Transmission Owner** and **System Operator**.
- The **Power Park Module, HVDC** and/or **Battery Storage** controls shall be equipped

with inputs that can be used to facilitate power oscillation damping (POD) and sub-synchronous torsional interaction (SSTI) damping.

- Any other identified additional control facilities for oscillation damping shall be required by **Transmission Owner,** having agreed those requirements with **System Operator,** and shall be specified within **Connection and Interface Agreement.**

Ramping Control – Power Park Modules

The **Power Park Module** shall be capable of controlling the ramp rate of its **Active Power** output. There shall be three ramp rate capabilities:

1) **Resource Following Ramp Rate**
2) **Set-Point Ramp Rate**
3) **Frequency Response Ramp Rate**

The **Resource Following Ramp Rate** shall be used during Start-Up and normal operation.

The **Set-Point Ramp Rate** shall be used for active power control during AGC control process.

The **Resource Following Ramp Rate** and the **Set-Point Ramp Rate** shall be set each independently over a range up to 10% of registered capacity per minute.

The **Frequency Response Ramp Rate** shall be the maximum possible ramp rate of the **Power Park Module** agreed with the **Transmission Owner.**

The **Power Park Module** shall operate the ramp rates with the following order of priority (high to low): **Frequency Response Ramp Rate; Set-Point Ramp Rate; Resource Following Ramp Rate.**

The **Battery Storage** shall be capable of controlling the ramp rate of its **Active Power** output**.** There shall be three ramp rate capabilities:

1) **Set-Point Ramp Rate**
2) **Frequency Response Ramp Rate**
3) **Compensating Ramp Rate**

The **Compensating Ramp Rate** may be used to reduce the impact **Active Power** ramps of the **Power Park Modules**

The ramp rate settings may need to be changed from time to time depending on system needs. The **System Operator** shall give a prior notice, if change is required.

Ramping Control - HVDC Systems

An **HVDC** system shall be capable of adjusting the ramping rate of **Active Power** variations within its technical capabilities in accordance with instructions sent by **HVDC USER** (or as requested by **System Operator**). In cases where fast modification of **Active Power** required (according to points (b) and (c) of paragraph below), this should supersede the ramp rate set for normal operation.

a. An **HVDC System** shall be capable of adjusting the transmitted **Active Power** up to its maximum **HVDC** active power transmission capacity in each direction following an instruction from **System Operator**:
   - Shall specify a maximum and minimum power step size for adjusting the transmitted **Active Power**. This is determined based on system requirements (to maintain system security and stability), and **HVDC USER** shall comply with the request within the power ramping capacity of the **HVDC** system.
   - Shall specify a minimum **HVDC Active Power** transmission capacity for each direction, below which active power transmission capability is not requested.
   - Shall specify the maximum delay within which the **HVDC** system shall be capable of activating the adjustment of the transmitted **Active Power** upon receipt of request from **System Operator**. This delay shall not exceed 100 ms.

b. **Transmission Owner** shall specify how an **HVDC** system shall be capable of modifying the transmitted **Active Power** infeed in case of disturbances into one or more of the AC networks to which it is connected. If the initial delay prior to the start of the change is greater than 100 milliseconds from receiving the triggering signal sent by **System Operator**, it shall be reasonably justified by the **HVDC USER** to**Transmission Owner**.

c. **Transmission Owner** may specify that an **HVDC** system be capable of fast **Active Power** reversal. The power reversal shall be possible from the maximum **Active Power** transmission capacity in one direction to the maximum **Active Power** transmission capacity in the other direction as fast as technically feasible. If the power reversal duration is greater than 2 seconds, **HVDC USER** shall demonstrate and obtain approval from the **Transmission Owner** that longer power reversal times are required due to technical considerations.

d. The **HVDC** system shall be equipped with control functions to support system **Frequency Control**. Upon receiving a signal, the **HVDC** system shall be capable of modulating the power output within 100 ms.

e. As applicable, the **HVDC** system shall be equipped with control functions enabling the **HVDC USER** (upon request from **System Operator**) to modify the transmitted **Active Power** for the purpose of cross-border balancing.

If specified by **Transmission Owner**, the control functions of an **HVDC system** shall be capable of taking remedial action including, but not limited to, stopping the ramping and blocking **FSM**, **LFSM-O**, **LFSM-U** and **Frequency Control**. The triggering and blocking criteria shall be specified by **Transmission Owner**. The modalities of that notification shall be determined and agreed between the **HVDC USER** and **Transmission Owner**.

Operational Robustness

The **HVDC** system, shall be capable of finding stable operation points with a minimum change in **Active Power** flow and voltage level, during and after any planned or unplanned change in the **HVDC** system or AC **Transmission System** to which it is connected.

The **HVDC USER** shall ensure that the tripping or disconnection of an **HVDC** converter station, as part of any multi-terminal or embedded **HVDC** system, does not result in transients at the connection point beyond the limit specified by **Transmission Owner**.

The **HVDC** system shall withstand transient faults on HVAC lines in the network adjacent or close to the **HVDC system**. Such events shall not cause any of the equipment in the **HVDC system** to disconnect due to auto-reclosing of lines in the network.

Automatic Generation Control (AGC)

An **HVDC** System shall be designed to accept ramp up and ramp down signals from **AGC** controllers.

The ramp rates shall be adjustable in a range specified by **Transmission Owner** (determined based on system requirements and values specified within the technical capability of the **HVDC** system).

An **HVDC** system shall be designed in such a way that its loss of **Active Power** injection in a synchronous area shall be limited to a value specified by **Transmission Owner** for their respective load frequency control area, based on the **HVDC** system's impact on the **Power System**.

Where an **HVDC** system connects two or more control areas, **Transmission Owner** shall set a coordinated value of the maximum loss of **Active Power**, taking into account requirements

for interconnected operation of the areas.

Synthetic Inertia

Power Park Module and/or Battery Storage being inherently incapable of contributing to the system inertia, may be required to provide **Synthetic Inertia** by supplying additional **Active Power** to the system in order to limit the Rate Of Change Of Frequency (RoCof) following the sudden system imbalance.
A specific control setting, response characteristics, maximum response level will be specified within **Connection and Interface Agreement** or **Power Purchase Agreement** and justified with an appropriate study.

If identified by **Transmission Owner** as a requirement, the **HVDC** system shall be capable of providing **Synthetic Inertia** in response to frequency changes by rapidly adjusting the **Active Power** injected to or withdrawn from the AC network in order to limit the Rate Of Change Of Frequency.

6.3.3 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.

Power Park Modules, HVDC as well as **Battery Storages** shall be capable of providing automatic voltage control at the connection point by following control modes in normal operation:

- **voltage control mode**, when the **Power Park Module, HVDC** or **Battery Storage** shall be capable of receiving the voltage setpoint within the range specified in clause 6.1.2 of the **ETC** (chapter 3) in steps no greater than 0.01 pu. Voltage control is ensured by continuous modulation of the **Reactive Power** output with the speed of response specified in **Connection and Interface Agreement** or any other Agreement. Voltage Regulation Set-point shall be operated with a deadband selectable in a range from zero to ±5% of reference 1 p.u. **Transmission System**.

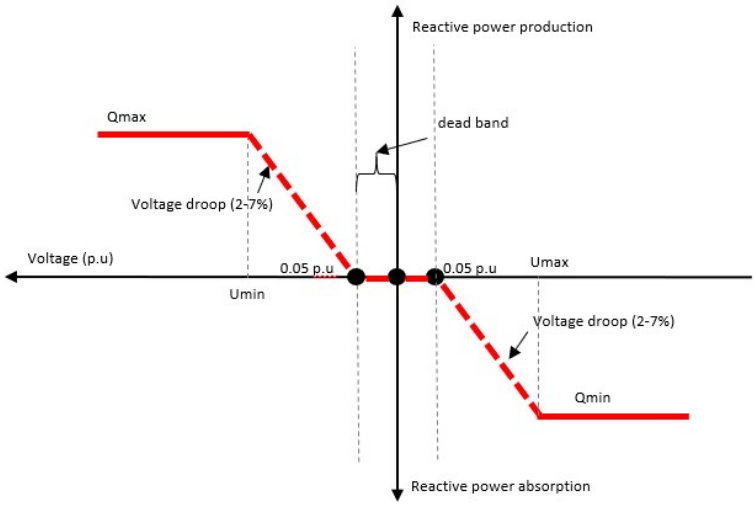


Figure 6.8– Voltage control slope

- **reactive power control mode** when the **Power Park Module, HVDC** or **Battery Storage** shall be capable of receiving the **Reactive Power** setpoint anywhere in the reactive power range specified in clause 6.3.1 of the **ETC** (chapter 3), with setting steps no greater than 5 Mvar or 5 % (whichever is smaller) of maximum **Reactive Power**, controlling the **Reactive Power** at the Transmission Entry Point to an accuracy within ± 5 Mvar or ± 5 % (whichever is smaller) of the maximum **Reactive Power.**
- **power factor control mode** when the **Power Park Module, HVDC** or **Battery Storage** shall be capable of receiving the **Power Factor** setpoint anywhere inside the mandatory or agreed **Reactive Power** capability region with setting steps no greater than 0.01 pu. The **Power Factor** shall be maintained within a tolerance of ± 0.5 %. The tolerance will be measured with reference to the maximum **Reactive Power** at the **Connection Point.**

System Operator shall specify which of the above three control modes and associated setpoints is to apply. Any change of the control mode and the set point shall be implemented by the **Power Park Module, HVDC** or **Battery Storage** upon receipt of the appropriate signal from **System Operator.**
The specific requirements for automatic excitation control facilities, including **Power System Stabilizers (**Power Oscillation Damping controls**),** 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.**

6.3.4 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**.

6.3.5 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**.

6.3.6 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.

6.3.7 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 **Transmission Owner** 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 **Transmission Owner** and recorded in the **Connection and Interface Agreement**.

6.3.8 Fault Ride Through

The following **Fault Ride Through** requirements are applicable to **Generating Units** (including for the avoidance of doubt **WTGU, PVGU, Battery Storage** and **AC/DC (HVDC) 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 **Synchronous Generating Unit**, the Unit shall:

(a) Remain connected to the system for any dip-duration on or above the blue line of Figure 6.9 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.

iii) In addition, for voltage dips greater than 140msec in the vicinity of the **Power Park Module, HVDC**, and/or **Battery Storage**, the **Power Park Module, HVDC** and **Battery Storage** shall:

a) Remain connected to the system for any dip-duration on or above the red dotted line of Figure 6.9 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) Inject the reactive current as fast as possible in proportion to the voltage dip or otherwise agreed with **Transmission Owner** under the **Connection and Interface Agreement.**
d) Assign the priority to reactive current injection over the active current
e) Retain **Active Power** output to the extent of the remaining transient rated capacity after the **Reactive Power** is utilised.
f) be capable of providing its transient reactive response irrespective of the control mode in which it was operating at the time of the Voltage Dip. The **Power Park Module, HVDC** and **Battery Storage** shall revert to its pre-fault control mode and setpoint within 500ms of the voltage recovering to its normal operating range.
g) Inject the inductive reactive current in case of over-voltages during the fault recovery.

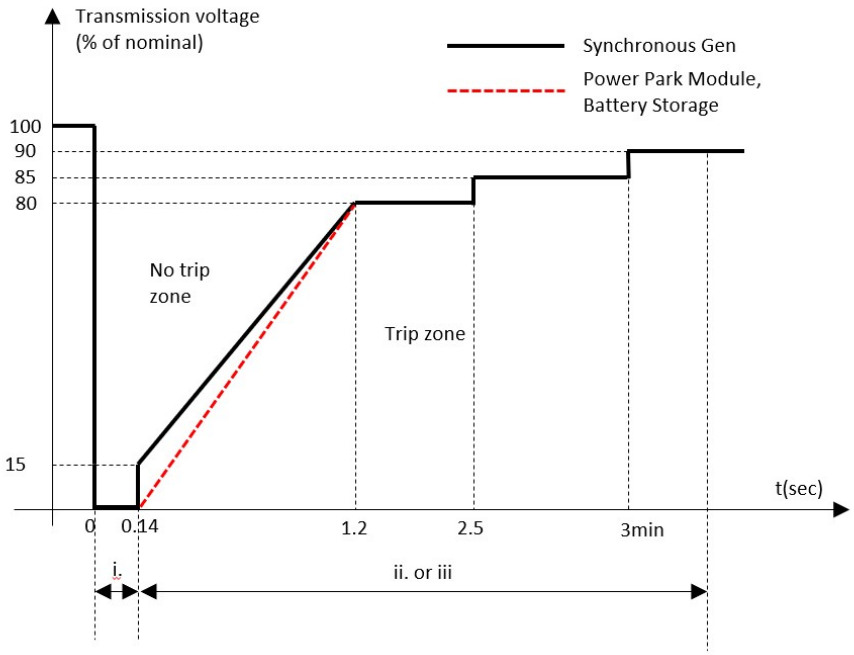


Figure 6.9. Voltage Duration Envelope

Recovery from DC faults

HVDC systems with overhead line DC transmission shall be capable of auto-restarting from DC faults on the overhead line sections. The maximum time duration, number of auto-restart attempts and the restart voltage shall be specified by **Transmission Owner**.
Auto-restart is not applicable to **HVDC** systems with DC cables.

6.3.9 Dynamic Reactive Current Control

In addition to the requirements stated in CC 6.3.3.(ETC) and CC 6.3.8.(ETC) above and for any balanced fault which results in the voltage falling below the voltage levels specified in CC.6.1.2 at the point of connection, each **Non-Synchronous Generating Unit (**including **Battery Storage** that connects to **Transmission System)** shall, as a minimum, be required to inject a reactive current above the heavy red line shown in Figure 6.10:

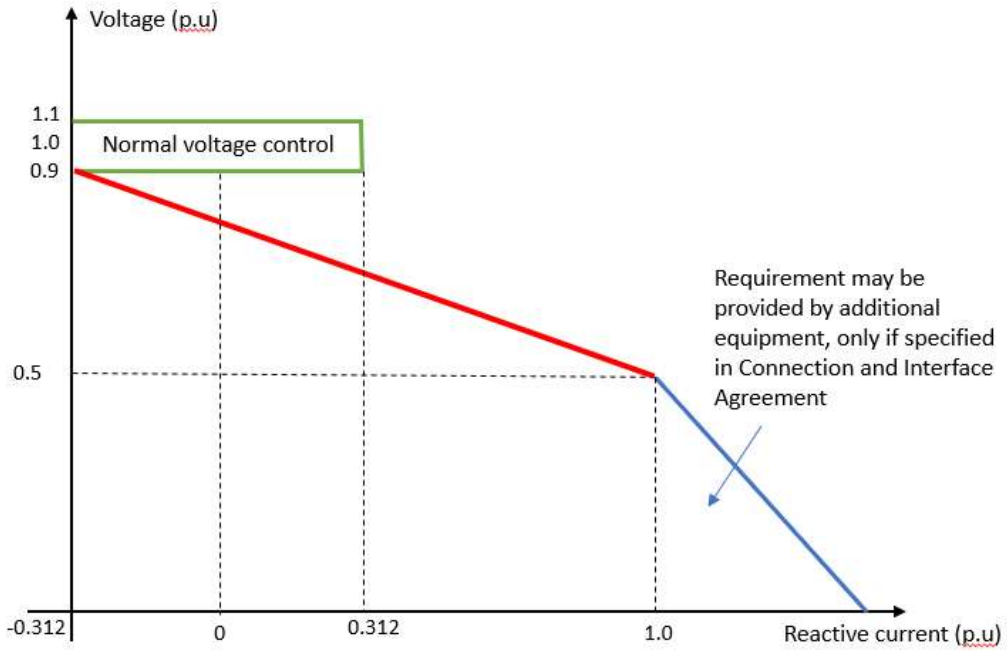


Figure 6.10 – Dynamic reactive current for **Generating Unit** (including **Battery Storage**)

In addition, each non-synchronous **Generating Unit** (including **Battery Storage** that connects to **Transmission System**) shall be required to inject at least 2/3 of nominal reactive current, decreased by pre-fault level, in 60ms after the voltage dip, with 20ms of control response time.

HVDC system shall be capable of injecting reactive current at its connection point if specified by **Transmission Owner**. The amount of reactive current injection shall be specified by the **Transmission Owner**.

The fault conditions shall be identified, for instance, through the detection of a low voltage at the point of connection. The specific short circuit contribution shall be agreed as part of the connection process. **Transmission Owner** may request the contribution of positive, negative and zero sequence currents depending on the requirements of fault detection near the Connection point.

When a specific **HVDC** system is required to provide short circuit current contribution, the following parameters shall be defined as part of the connection process.

- Voltage threshold for activation (e.g. 85 % - 90% of rated nominal voltage).
- The characteristics (magnitude in relation to voltage dip) of the injected current in time domain
    - As a minimum, the reactive current injection shall be in proportion to the available voltage at the connection point.

- The injected current shall utilize (up to) the full current rating of the **HVDC** system.

- Allowable activation delays (20 ms - 40 ms : in order for ac protection systems to detect faults without undue delays).

The fault current contribution compliance shall be verified through EMT simulations using a simplified AC network representation.

The control priority shall be given to reactive current injection over the active, with any residual capability being supplied as active current.

Under any faulted condition, a transient or steady state current must not exceed the maximum rated value (1.0 p.u). See Figure 6.11.

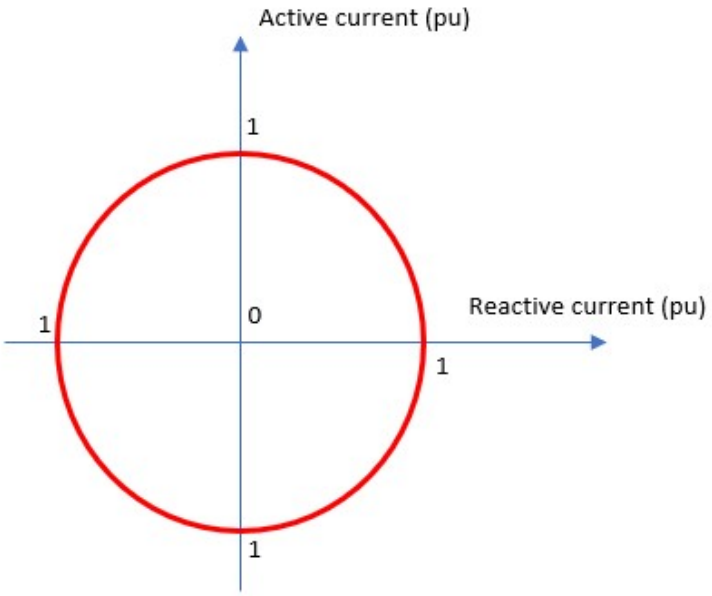


Figure 6.11 – Active/reactive current capability of inverters

Each equipment of **Non-Synchronous Generating Unit (**including **Battery Storage)** and **HVDC** should be designed to ensure a smooth transition between voltage control mode and **Fault Ride Through** mode.

6.4 Communications Equipment

In order to ensure control of the **Transmission System**, telecommunications between **Users, Transmission Owner** and **System Operator** must, if required by **System Operator**, 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 **System Operator Control Engineers** and **Transmission Owner** 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.**

Transmission Owner 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 **Transmission Owner Control Telephony**. Details of and relating to the **Control Telephony** required are contained in the **Connection Agreement**.

6.5 Operational Metering

Transmission Owner 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 **Transmission Owner** SCADA outstation interface equipment as required by **Transmission Owner** in accordance with the terms of the **Connection Agreement**. These requirements will be consistent with the **Sensing Data Requirements**

Active Power and **Reactive Power** measurements, circuit breaker and disconnector status indications from **Generating Units** as required by **System Operator** must be provided to **Transmission Owner** on an individual **Generating Unit** basis.

In the case of an **Intermittent Power Source** an energy input signal (e.g. wind speed or insolation) as required by **System Operator**. 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 inform **System Operator** with advanced warning of excess wind speed shutdown. All signals will be provided by the **Intermittent Power Source** to the **Transmission Owner**.

Where required by **System Operator** a User shall provide measurements of power quality such as harmonics, voltage flicker and power factor to the **Transmission Owner** outstation interface.

The manner in which information is required to be presented to the outstation equipment by **Transmission Owner** or **Users** is set out in Appendix D.

6.6 Facsimile Machines

Each **User** and **System Operator** and **Transmission Owner** shall provide a facsimile machine or machines:

i) in the case of **GENCOs,** at each **Power Station**;

ii) in the case of **System Operator** 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**

v) in the case of **Transmission Owner,** at the **Transmission Owner Coordination Centre**

Each **User** shall, prior to connection to the **System** of the **User Plant and Apparatus** notify **Transmission Owner** of its telephone number or numbers. **Transmission Owner** will notify the **System Operator** accordingly of the telephone numbers discussed in the preceding sentence. The **User** shall notify **Transmission Owner** of any changes and **Transmission Owner** shall notify the **System Operator**.
Prior to connection to the **System** of the **User Plant** and **Apparatus System Operator** shall notify **Transmission Owner** of the telephone number or numbers of its facsimile machine or machines. **Transmission Owner** shall notify the **User** of the telephone numbers discussed in the preceding sentence**.** Any change the **System Operator** shall notify **Transmission Owner**, and **Transmission Owner** shall notify the **User.**

6.6.1 Busbar Voltage

Transmission Owner 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 **System Operator** to monitor the **System** dynamic performance. To allow the monitoring of individual **Generating Unit System Operator** 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 **Transmission Owner Site** shall work to the **Transmission Owner Safety Rules**.

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

Transmission Owner may apply to a **User** for permission to work according to **Transmission**

Owner Safety Rules when working on its **Plant** and/or **Apparatus** on that **User Sites**. If the **User** is of the opinion that **Transmission Owner Safety Rules** provide for a level of safety commensurate with that of that **User Safety Rules**, it shall notify **Transmission Owner**, in writing, that **Transmission Owner** 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 **Transmission Owner Engineers** of agreed responsibilities for **Plant** and/or **Apparatus** at the operational interface, a **Site Responsibility Schedule** shall be produced for **Transmission Owner** 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 SF_6 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 SF_6 gas-insulated metal enclosed switchgear and/or other SF_6 gas-insulated **HV Apparatus** is installed, those items must be depicted within an area delineated by a chain dotted line which intersects SF_6 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 SF_6 Gas Zone Diagrams

An SF_6 **Gas Zone Diagram** shall be prepared for each **Connection Site** at which a **Connection Point** exists where SF_6 gas-insulated switchgear and/or other SF_6 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 SF_6 Gas Zone Diagrams for User Sites

In the case of a **User Site**, the **User** shall prepare and submit to **Transmission Owner**, an **Operation Diagram** for all **HV Apparatus** on the **User** side of the **Connection Point** and **Transmission Owner** shall provide the **User** with an **Operation Diagram** for all **HV Apparatus** on the **Transmission Owner** 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 **Transmission Owner 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 SF_6 Gas Zone Diagrams for Transmission Owner Sites

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

Transmission Owner 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 SF_6 Gas Zone Diagrams

When **Transmission Owner** 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 **Transmission Owner Site**, **Transmission Owner** shall one month prior to the installation or change, send to each such **User** a revised **Operation Diagram** of that **Transmission Owner Site**, incorporating the new **Transmission Owner 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 **Transmission Owner** 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 **Transmission Owner** 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 **Transmission Owner** 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**, **Transmission Owner** shall prepare and submit to the **User**, **Site Common Drawings** for the **Transmission Owner** 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 **Transmission Owner**, **Site Common Drawings** for the complete **Connection Site** in accordance with the requirements of the **Connection and Interface Agreement**.

7.4.2 Preparation of Site Common Drawings for a Transmission Owner Site

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

Transmission Owner 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 and Interface 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 **Transmission Owner Site** prepare and submit to **Transmission Owner** revised **Site Common Drawings** for the **User** side of the **Connection Point** and **Transmission Owner** 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 **Transmission Owner** 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 Transmission Owner Changes to Site Common Drawings

When **Transmission Owner** 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 **Transmission Owner 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 **Transmission Owner** side of the **Connection Point** and the **User** shall then prepare, produce and distribute, using the information submitted in by **Transmission Owner**, revised **Site Common Drawings** for the complete **Connection Site**.

If the **Transmission Owner** 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 **Transmission Owner** 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 **Transmission Owner**, 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 **Transmission Owner** and the **User**, to endeavour to

resolve the matters in dispute.

7.5 Access

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

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

7.6 Maintenance Standards

It is a requirement that all **User Plant** and **Apparatus** on **Transmission Owner 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 **Transmission Owner Plant, Apparatus** or personnel on the **Transmission Owner Site**. **Transmission Owner** 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 **Transmission Owner 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

Transmission Owner and **Users** with an interface with the **Transmission System**, 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

Ancillary Services as may be required by the **System Operator** for the next 7 years will be communicated annually by calendar week 12 by the **System Operator** to the **Procurer** and **Transmission Owner**.

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 **Transmission Owner**, **System Operator** 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

1) Provision of dedicated **Primary Response**;
2) Provision of **Synthetic Inertia**
3) **Frequency** control by means of **Demand** reduction;
4) **Black Start Capability**;
5) **Hot Standby**;
6) **Secondary Control** (**Automatic Generation Control(AGC)** of generating unit **Active Power** from the **Load Despatch Center** for Load Frequency Control (**LFC**) purposes);
7) **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 **Transmission Owner** 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 **Transmission Owner** 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 **Transmission Owner** 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 **Transmission Owner** to the **Users** involved for confirmation of its accuracy.

The **Site Responsibility Schedule** shall then be signed on behalf of **Transmission Owner** 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 **Transmission Owner**, 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 **Transmission Owner** immediately and in any event 8 weeks prior to any change taking effect.

Where **Transmission Owner** 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 **Transmission Owner**, 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 **Transmission Owner**, or **Transmission Owner** 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**.

Transmission Owner 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 **Transmission Owner** 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 **Transmission Owner** a list of managers who have been duly authorised to sign **Site Responsibility Schedules** on behalf of the **User** and **Transmission Owner** 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.

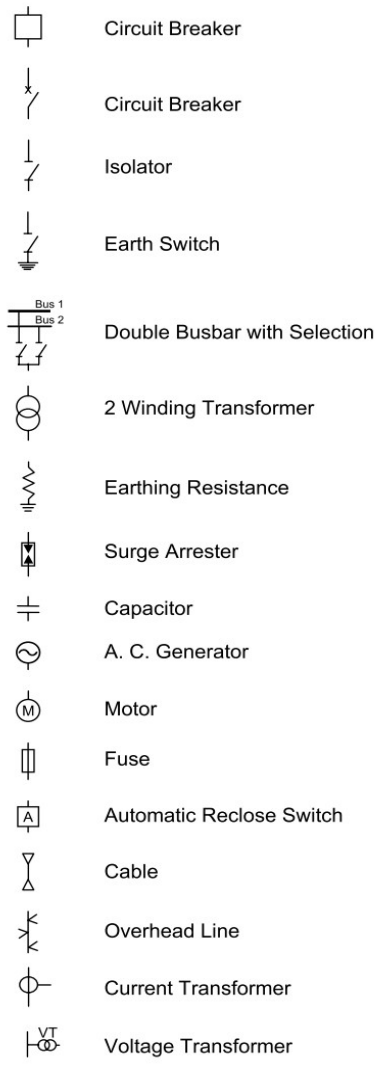
ATTACHMENT TO APPENDIX A - PROFORMA FOR SITE RESPONSIBILITY SCHEDULE

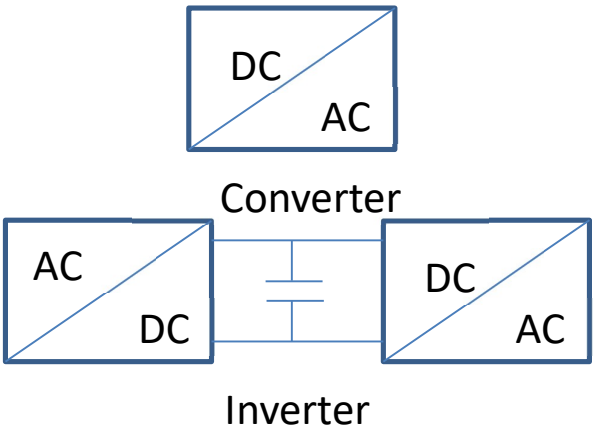
COMPANY: _____ SCHEDULE: _____

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





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** e.g. 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 **Transmission Owner**.

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. SF_6 Gas Zones

APPENDIX D - SCADA OUTSTATION INTERFACING

14. INTRODUCTION

This Appendix sets out the technical requirements for connections to the **Transmission Owner** 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 **Transmission Owner** 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 **Transmission Owner** 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 **Transmission Owner** 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 **TO**)

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 **Transmission Owner** 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 **Transmission Owner** 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 the **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 **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 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 **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 **Transmission Owner**, **System Operator** and the following **Users**:

i) **GENCOs (**including **Power Park Modules)**;

ii) **Battery Storages**

iii) **HVDC users**

iv) **DISCOs**;

v) **Non-Embedded Customers;**

vi) **Self-Supply Users;**

vii) **User System**; and

viii) **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** (**MVAr**).

This Section specifies procedures to be followed and the data to be supplied to **System Operator** and **Transmission Owner** to enable the forecasting of **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**; **Programming Phase**;

ii) **Control Phase**; and

iii) **Post Control Phase**.

In the **Operational Planning Phase**, **Demand** forecasting shall be conducted by **System Operator** 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**, **System Operator** 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 **System Operator** and **Transmission Owner** to enable **System Operator** to maintain a sufficient margin during **Operational Planning Phase, Programming Phase, Control Phase** and **Post Control Phase**, and **Transmission Owner** in preparing its **Seven Year Statement** and to specify factors which will be taken into consideration by **System Operator** and **Transmission Owner** when conducting **Demand** forecasting.

3.4 Data Required by System Operator and Transmission Owner

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 **Transmission Owner** 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** (summated 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 **Transmission System Demand**, both at **Annual MD Conditions**.

b) For each **DISCO** (summated 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** (summated over all **Transmission Supply Points**) and **Non-Embedded Customer** the hourly **Active** forecast **Demand** profile for the specified day of minimum **Transmission System 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 **Transmission System 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 **Transmission System Demand**.

f) For each **Self-Supply User** its anticipated import or export requirements for the specified day of **Transmission System Maximum Demand**

g) For each **Self-Supply User** its anticipated import or export requirements for the specified day of **Transmission System Minimum Demand**

h) For each **External System Operator** its anticipated import or export requirements for the specified day of **Transmission System Maximum Demand**.

i) For each **External System Operator** its anticipated import or export requirements for the specified day of **Transmission System 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 **Transmission Owner** and the **Procurer**.

Transmission Owner will provide **System Operator** with access to all data received in accordance with this sub-section 3.4.1 as soon as reasonably practicable following receipt

Transmission Owner , System Operator 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 **System Operator's Operational Planning**.

No later than calendar week 41 each year of Year 0-1 (Y-1), **System Operator** 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 **Transmission System Demand** at **Annual MD Conditions**; and

ii) the date and time of the annual minimum **Transmission System Demand** at **Average Conditions**.

3.4.2 Programming Phase

For the period of 1 to 8 weeks ahead the following shall be supplied to **System Operator** 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 **System Operator** 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 **System Operator** prior to 10:00 hours as soon as possible after the formulation of the new plans.

ii) Each **Self-Supply User** shall notify **System Operator** 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 **System Operator** 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 **System Operator** 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 System Operator Forecasts

The following factors will be taken into account by **System Operator** 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 **System Operator** in advance;

iv) **Generating Plant Schedules**;

v) **Demand Control** of 10 MW or more proposed to be exercised by **DISCOs** and of which **System Operator** has been informed;

vi) Anticipated flows to/from **Self-Supply Users**

vii) Anticipated flows across **External Interconnections**; and

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

System Operator will produce forecasts of **Transmission System 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 **System Operator** 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 System Operator **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 **System Operator** from **GENCOs** in order to conduct the **Operational Planning** process, and the procedures to be adopted by **System Operator** 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 **System Operator** co-ordinates, optimises and approves **Outages** of **Generating Units**, **Transmission Components** 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 **System Operator** 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, Non-Embedded Customer** and **Transmission Owner** must act reasonably and in good faith.

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

4.3 Transmission Owner Communications Regarding Outage Planning

Transmission Owner shall confirm to **System Operator** who within **Transmission Owner** is authorised for each of the following and how they will be identified to **System Operator:**

provide data on outages as required under this section 4; and
agree to revisions to **Transmission Outage Programmes**

Transmission Owner shall ensure that this information is kept up to date with **System Operator**, and any event will reconfirm by the end of each February

4.4 Planning of Generating Unit and Transmission Component 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.

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

4.4.1.1 GENCO submissions by the end of March

Each **GENCO** will provide **System Operator** 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 **System Operator**, 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 **System Operator**, which period shall be not less than 10 days in length.

In relation to sub-paragraph (e) above, the **GENCO** must provide **System Operator** 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 **System Operator** 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.

4.4.1.2 Transmission Owner submissions by the end of March

Transmission Owner will draw up a draft **Transmission System Outage** plan covering the period Years 2 and 3. **Transmission Owner** will notify **System Operator** in writing with a suggested **Provisional Outage Programme** for Years 2 and 3 which will contain the following information in respect to each proposed **Planned Outage** in the suggest **Provisional Outage Plan:**

a) the identity of the relevant **Transmission Components**, where possible, using the nomenclature agreed with **System Operator** for the identification of such assets;
   sufficient information for **System Operator** to understand the impact on **Transmission Capability Information;**
b) required duration of **Outage**;
c) preferred start date and start time or range of start dates and start times;

d) whether the **Outage** is a **Flexible Planned Outage** or an **Inflexible Planned Outage**, provided that **Transmission Owner** 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**;
e) if it is a **Flexible Planned Outage**:
    i) the period for which the **Outage** could be deferred at the request of **System Operator**, 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 **System Operator**, which period shall be not less than 10 days in length.

In relation to sub-paragraph (e) above, **Transmission Owner** must provide **System Operator** with such evidence as it may reasonably require in order to substantiate the declaration as an **Inflexible Planned Outage** and, if **Transmission Owner** fails to establish to **System Operator** 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 **Transmission Owner** 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.

4.4.1.3 Between the end of March and the end of September

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

a) **Demand Forecasts**;

b) **System Operator** estimate of **Customer Demand Management**;

c) the **Operating Margin** as set by **System Operator**;

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 **System Operator** may, as appropriate, contact **Transmission Owner** and each **User** or **User System** which has supplied information to seek clarification on information received or such additional relevant information as is reasonable.

4.4.1.4 By the end of September – Share Plans for Years 2 and 3

System Operator will, having taken into account the information notified to it and, having discussed it with **Transmission Owner** and **Users** if appropriate, provide **Transmission Owner** and each **GENCO** and **DISCO** in writing with a **Provisional Outage Programme** showing the **Generating Units** and **Transmission Components** 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 **Transmission Owner** or 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 **System Operator** or for reasons relating to the proper operation of the **Transmission System**. When dealing with Year 2, **System Operator** will give priority to including proposed **Inflexible Planned Outages** for the dates proposed by **Transmission Owner** or 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 **System Operator** the **Licence Standards** could not otherwise be met, **System Operator** 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 **Transmission Owner**; or

   (ii) planning for Year 2 was shown in the **Provisional Outage Programme** for such year or is newly requested by the **GENCO** or **Transmission Owner**; or

b) that an **Inflexible Planned Outage** which was proposed by the **GENCO** be re-designated as a **Flexible Planned Outage**.

4.4.1.5 By the End of September – Transmission System Outages

System Operator shall notify:

a) each **User** and **External System Operator** in writing of those aspects of the **Transmission Owner Provisional Outage Programm**e which may operationally affect such **User** including, in particular, proposed start dates and end dates of relevant **Transmission System Outages**. **System Operator** 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 [SO] **Licence Standards**.

b) **Transmission Owner** of the **GENCO Provisional Outage Programmes**

4.4.1.6 By the End of October

Where **Transmission Owner**, 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 **System Operator** to explain its concerns and **System Operator** and **Transmission Owner** or that **GENCO** or **DISCO** will then discuss the problem and seek to resolve it.

The resolution of the problem may require **System Operator** to contact **Transmission Owner** or other **GENCOs** or **DISCOs** and joint meetings of parties may be convened by **System Operator**. **Transmission Owner** or a **GENCO** or **DISCO** which notifies **System Operator** of its objections may request that such a meeting be convened and **System Operator** 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, **System Operator** will determine the **Provisional Outage Programme**.

4.4.2 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.

4.4.2.1 By the end of March

Each **GENCO** will provide **System Operator** 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 **System**

Operator, 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 **System Operator**, which period shall be not less than 10 days in length.

In relation to sub-paragraph (e) above, the **GENCO** must provide **System Operator** 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 **System Operator** 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.

4.4.2.2 Transmission Owner submissions by the end of March

The **Transmission Owner Provisional Outage Programme** will become the **Transmission Owner** suggested **Final Outage Programme** for Year 1 when, by the passage of time, Year 2 becomes Year 1. Each calendar year **Transmission Owner** shall update its **Provisional Outage Programme** and shall, in addition, take into account **Outages** required as a result of maintenance work. **Transmission Owner** will notify **System Operator** in writing with a suggested **Final Outage Programme** for Years 2 and 3 which will contain the following information in respect to each proposed **Planned Outage** in the suggest **Final Outage Plan:**

a) the identity of the relevant **Transmission Components**, where possible, using the nomenclature agreed with **System Operator** for the identification of such assets;
b) sufficient information for **System Operator** to understand the impact on **Transmission Capability Information**;
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 **System Operator**, 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 **System Operator**, which period shall be not less than 10 days in length.

In relation to sub-paragraph (e) above, **Transmission Owner** must provide **System Operator** with such evidence as it may reasonably require in order to substantiate the declaration as an **Inflexible Planned Outage** and, if **Transmission Owner** fails to establish to **System Operator** 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.

4.4.2.3 Between the end of March and the end of June

System Operator will be considering the suggested **Final Outage Programme** in the light of the factors set out in subsection 4.4.1.3 and the requirement for **Minimum Demand Regulation** and will be analysing whether the **Operating Margin** for the period can be met.

4.4.2.4 By the end of June – Transmission Owner and Genco Final Outage Programmes

System Operator will provide **Transmission Owner**, each **GENCO** and **DISCO** in writing, with a draft **Final Outage Programme** showing the **Transmission Components** or **Generating Units,** as the case may be, 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 **System Operator** 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 **System Operator** the [SO] **Licence Standards** could not otherwise be met, **System Operator** may, by giving to **Transmission Owner** or 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.

4.4.2.5 By end of June – Impact of Final Outage Programmes

System Operator will inform **Transmission Owner** and each **User** and **External System Operator** of any potential restrictions which may affect it and generally the impact on the **Transmission System** in Year 1

4.4.2.6 By the end of July

Where **Transmission Owner**, 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 4.3.1.6 will apply.

4.4.2.7 Between the end July and the end of September

System Operator will be considering the draft **Final Outage Programme** in the light of the factors set out in subsection 4.3.1.3, any changes as a result of subsection 4.3.2.6 and the requirement for **Minimum Demand Regulation** and will be analysing whether the **Operating Margin** for the period can be met.

4.4.2.8 By the end of September

System Operator will notify **Transmission Owner**, 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 Year1 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 **System Operator** 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 **System Operator** the [SO] **Licence Standards** could not otherwise be met, **System Operator** 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.

4.4.3 Short Term Operational Planning - Planning for Year 0

Throughout each calendar year and from 1st October of the preceding year **System Operator** 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**.

4.4.3.1 Flexible Planned Outage Movements

In the case of a **Flexible Planned Outage**, **System Operator** may, upon giving the relevant party of **Transmission Owner** or 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.

4.4.3.2 Amendments to Planned Outages

In the case of:

a) a **Flexible Planned Outage** which **System Operator** would like to move outside the **Flexible Planned Outage Period**;

b) a **Flexible Planned Outage** which **System Operator** would like to move within the **Flexible Planned Outage Period** on less than seven days notice; or

c) an **Inflexible Planned Outage** which **System Operator** would like to move.

The party **(Transmission Owner** or a **GENCO)** who's outage is being considered shall become the Relevant Party for the purpose of the following sentence. **System Operator** may, upon giving the Relevant Party written notice, request that the start date or start time of a **Planned Outage** be advanced or deferred. If the Relevant Party agrees to such advancement or deferral, or **System Operator** and the Relevant Party agree to some other advancement or deferral, the Relevant Party will take the **Outage** in accordance with that agreement.

4.4.3.3 Outage Substitution

Transmission Owner or a **GENCO** may, on reasonable grounds, by notice in writing or through a Computerised Maintenance Management System submitted to **System Operator** at any time during Year 0, request an outage substitution as follows:

a) A **GENCO** may 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. **System Operator** shall not unreasonably withhold its consent to such substitution and, if **System Operator** does consent, the **Final Outage Programme** shall be amended and the **GENCO** shall be entitled to take the **Outage** accordingly.

b) **Transmission Owner** may request that a set of **Transmission Components** 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 another set of **Transmission Components** in the same area of the **Transmission System** (having substantially the same impact on **Transmission Capability Information)** be permitted to be taken out of service during the period for which such **Flexible Planned Outage** or **Inflexible Planned Outage** has been planned. **System Operator** shall not unreasonably withhold its consent to such substitution and, if **System Operator** does consent, the **Final Outage Programme** shall be amended and the **Transmission Owner** shall be entitled to take the **Outage** accordingly.

4.4.3.4 GENCO Short Term Planned Maintenance Outage

A **GENCO** may at any time in Year 0 request **System Operator**, 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 **System Operator** 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 **System Operator** has accepted the request, the STPM Outage, if taken, must be taken by the **GENCO** in accordance with the request. If **System Operator** has indicated an alternative start time and/or duration, **System Operator** 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 **System Operator** or if agreement is not reached then the **Outage** may not be taken by the **GENCO**.

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

a) the [SO] **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, **System Operator** 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

the start date and start time.

4.4.3.5 Transmission Owner Short Term Planned Maintenance Outage

Transmission Owner may at any time in Year 0 request **System Operator** 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) the identity of the relevant **Transmission Components**, where possible, using the nomenclature agreed with **System Operator** for the identification of such assets;
b) sufficient information for **System Operator** to understand the impact on **Transmission Capability Information;**

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 **System Operator** shall consider the request and shall, having discussed the position with **Transmission Owner**, 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 **System Operator** has accepted the request, the STPM Outage, if taken, must be taken by **Transmission Owner** in accordance with the request. If **System Operator** has indicated an alternative start time and/or duration, **System Operator** and **Transmission Owner** 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 **Transmission Owner** in accordance with the agreement. If the request is refused by **System Operator** or if agreement is not reached then the **Outage** may not be taken by the **Transmission Owner**.

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

a) the [SO] **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, **System Operator** 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 **Transmission Component**(s) concerned;

b) duration of the **Outage**; and

c) the start date and start time.

4.4.4 Notified Unplanned Outages

Transmission Owner or a **GENCO** must notify unplanned outages as follows:

a) 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 **System Operator** 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). **System Operator** must acknowledge such notification as soon as reasonably possible after the notification was received by **System Operator**.
b) **Transmission Owner** must, if it considers that one or a set of **Transmission Components** 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 **System Operator** as much notice as is reasonably possible. Such notice must include an identification of the relevant **Transmission Component**(s), sufficient information for **System Operator** to understand the impact on **Transmission Capability Information,** the expected start date and start time and duration of the **Unplanned Outage** and the nature of the **Outage**. **System Operator** must acknowledge such notification as soon as reasonably possible after the notification was received by **System Operator**.

Where **Transmission Owner** or a **GENCO** notify an unplanned outage in accordance with (a) or (b) above, it shall become the Relevant Party for the purpose of the following sentence. **System Operator** may request the Relevant Party to advance or defer the **Outage** and if the Relevant Party agrees to such a request, the Relevant Party shall send **System Operator** a written notice confirming this agreement, which **System Operator** will acknowledge, and **Transmission Owner** or the Relevant Party must then (subject to any intervening **Outage**) take the **Outage** in accordance with that agreement.

4.4.5 Forced Outages

In the event that a **Generating Unit** suffers a **Forced Outage**, the relevant **GENCO** become the Relevant Party for this sub-section 4.4.5.

In the event that one or more **Transmission Components** suffers a **Forced Outage**, the **Transmission Owner** shall become the Relevant Party for this sub-section 4.4.5

The Relevant Party shall, as soon as possible after the commencement of the **Outage** inform **System Operator** by written notice of the Relevant Party's best estimate of the date and time by which the **Generating Unit** is, or **Transmission Component**s are, likely to have been repaired and restored to its full level of availability. If the Relevant Party is unable for any reason to comply with this requirement, the Relevant Party shall not later than 48 hours after the commencement of the **Forced Outage**, provide **System Operator** such information as is then known to the Relevant Party regarding the date and time of return from such **Outage** and shall provide such updates thereafter as **System Operator** may reasonably require. The Relevant Party shall as soon as the Relevant Party is able inform **System Operator** by written notice of the Relevant Party's best estimate of the date and time by which the **Generating Unit** is, or **Transmission Components** are, likely to have been repaired and restored to its full level of availability.

The Relevant Party shall use all reasonable endeavours to ensure that, following a **Forced Outage**, the **Generating Unit** is, or **Transmission Component**s are, repaired and restored to its full level of availability as soon as possible and in accordance with **Good Industry Practice**.

4.4.6 Release of Generating Units and Transmission Components

For this sub-section 4.4.6, Relevant Party shall be **Transmission Owner** or a **GENCO**

Relevant Parties may only undertake **Planned Outages** with **System Operator** agreement in accordance with **Outage** programmes produced pursuant to this **Operating Code 'A'**.

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

If the Relevant Party is a **GENCO, System Operator** 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.

If the Relevant Party is a **Transmission Owner**, **System Operator** express formal permission shall specify:

a) the identity of the **Transmission Component(s)** concerned;

b) the duration of the **Outage**; and

c) the start date and start time.

System Operator may withhold its permission for the release of **Transmission Components** or 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 **System Operator's** reasonable opinion (were such **Outage** not to be deferred):

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

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

c) There is insufficient transmission capacity on the network for the standards set out in the **Electricity Transmission System Security Standards**.

System Operator may require **Transmission Owner**, 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.

4.4.7 GENCO 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 **System Operator** 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 **System Operator**, 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 **System Operator**, 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 **System Operator** 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**.

4.4.8 Transmission Owner 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, **Transmission Owner** must notify **System Operator** either that its **Transmission Component**(s) 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 **Transmission Component** is not expected to be fully available upon its return to service, **Transmission Owner** shall ensure the **Transmission Capability Information** provided to **System Operator** correctly reflects this reduced availability.

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 **Transmission Component**(s) to service and **Transmission Owner** best estimate of the date and time at which the **Transmission Component**(s) will return to service.

Transmission Owner must use all reasonable endeavours to ensure that, in respect of each **Planned Outage** of the **Transmission Component(s)**, 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**, **Transmission Owner** must inform **System Operator**, as far in advance as reasonably possible that its **Transmission Component**(s) is returning to service. **Transmission Owner** must, in addition, give update Transmission Capability Information as required by the [**Transmission Owner and System Operator Code]**

If at any time during an **Outage,** the **Transmission Owner** becomes aware that its **Transmission Component**(s) 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**, **Transmission Owner** shall notify **System Operator** immediately in writing stating

the reason for the delay and **Transmission Owner's** best estimate of the date and time by which the **Transmission Component**(s) will actually have been maintained, repaired or restored to be available.

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4.4.9 Programming Phase

4.4.9.1 By 11.00 hours each Thursday

System Operator shall update its **Final Outage Programme** plan for the following one week period beginning on the Friday.

System Operator will notify **Transmission Owner** and 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**. **System Operator** 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**.

4.4.9.2 During the Programming Phase

Transmission Owner and each **User** will inform **System Operator** immediately if there is any unavoidable requirement to depart from the **Outages** and actions determined and notified under subsection 4.4.4.1 above. As soon as reasonably practicable following receipt of such notification, **System Operator** shall share the information received with **Transmission Owner** and each impacted **User**

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 **System Operator** 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'**. **System Operator** shall provide to **Transmission Owner** during week 49 such data. The Generation Planning Parameters shall be used by **System Operator and Transmission Owner** for **Operational Planning** purposes 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 **System Operator**, 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 Park Module** 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 Park Module** 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 **System Operator** 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 Park Module Generating Units** are shown in Appendix A.

Each **GENCO** with a **WTGU**, **PVPS** or **CSTU** shall submit to **System Operator** 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**, **PVGU** 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**, **PVGU** 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 **System Operator** for **Operational Planning** purposes only and not in connection with the operation of Scheduling and Despatch.

5. OPERATING MARGIN

This Section of **Operating Code 'A'** sets out the different types of reserve which make up the **Operating Margin** that **System Operator** 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:

$$PRPI = TPRC * SSPRC$$

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:

$$TPRC = \Sigma_{ti} RES_{ti} * a_{ti}$$

where: ti = 1 to 10 with the consideration of the corresponding weighting factors $\mathbf{a_{xi}}$ 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:

$$SSPRC = \Sigma_{ti} RES_{ti} * b_{ti}$$

where: ti = 11 to 30 with the consideration of the corresponding weighting factors $\mathbf{b_{xi}}$ 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** (ლ, Load-related steady-state regulation) of the governing system is defined as the ratio of the governor input (Ↄ**n**) related

to the rated speed nn to the equally related value (ↄ$\mathbf{P_G}$) of the generator power output $\mathbf{P_G}$.

$$ᔓ = \text{abs}\ (\Delta n / \Delta P_{G)}) * P_n / n_n$$

*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 (**$\Delta \mathbf{P_G}$**) from one direction into the opposite direction, according to:

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

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.

5.1.2.2.2.1 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 **System Operator** 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 **System Operator** will include in the **Generation Schedule** the length of time from **System Operator** 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 **System Operator** 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. **System Operator** will allocate the **Operating Reserve** to the various classes of **Generating Plant, Battery Storage, 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 **System Operator** 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 **System Operator**.

5.3 Instruction of Operating Margin

System Operator will instruct sufficient individual **Generating Units, Battery Storages** 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 **System Operator** 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 **System Operator**, 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 **System Operator**;

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 **System Operator**.

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

6.3 Procedure for Demand Control on the Instructions of System Operator

A **Red Warning** will be, where possible, issued by **System Operator** 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 **System Operator** 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 **System Operator**.

ii) Each **DISCO** must notify **System Operator** 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 **System Operator** 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 **System Operator** 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 **System Operator** may want to instruct the reduction of more than 20 per cent of its **Demand**.

v) If **System Operator** 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 **System Operator** 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 **System Operator** 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) **System Operator** 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 **System Operator** to be prolonged, **System Operator** will notify the **DISCO** of the expected duration.

x) **System Operator** 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 **System Operator** in writing that it has complied with **System Operator'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 **System Operator** 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 **System Operator**.

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 **System Operator.** 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 **System Operator** by week 48 in each calendar year following discussion with the **DISCO** and will be reviewed annually by **System Operator**.

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, **System Operator** 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 **System Operator** instructs that **DISCO** to do so.

vii) Once the **System Frequency** has recovered, each **DISCO** shall abide by the instructions of **System Operator** 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 **System Operator**.

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 **Transmission Owner** through its **Connection Agreement,** or separately with **System Operator** following connection to the **Transmission System**. The number and size of blocks and the associated low frequency settings will be as specified by **System Operator** 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 **System Operator** 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. **System Operator** will provide this data to **Transmission Owner** as soon as reasonably practicable following receipt.

6.5 Emergency Manual Demand Disconnection

i) Each **DISCO** shall make arrangements that will enable it, following an instruction from **System Operator**, 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 **System Operator**.

ii) Each **DISCO** shall provide **System Operator** 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 **System Operator** with regard to **Disconnection** without delay, and the **Disconnection** must be achieved as soon as possible after the instruction being given by **System Operator**. The instruction may relate to an individual **Transmission Supply Point** and/or groups of **Transmission Supply Points**.

v) **System Operator** 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 **System Operator**, that **DISCO** shall not reconnect until **System Operator** instructs it to do so.

vii) Each **DISCO** shall abide by the instructions of **System Operator** 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 **System Operator**.

viii) **System Operator** 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 **System Operator**, to reduce the import up to zero on its **System** under emergency conditions.

x) If **System Operator** determines that emergency manual **Disconnection** is inadequate, **System Operator** 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 **System Operator** details of the amount of **Demand** reduction or restoration actually achieved.

6.6 Warning System

The following system of warnings will be adopted by **System Operator**. 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 **System Operator** and will remain in force from the stated time of commencement until the cancellation, amendment or re-issue is notified by **System Operator**, 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 **System Operator**. 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 **System Operator** prior to its implementation.

6.6.1 Red Warning

i) A **Red Warning** will be issued by **System Operator** 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 **System Operator** 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 **System Operator** 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 **System Operator** after 2 hours from issue.

6.6.3 Preliminary Red Warning

i) A **Preliminary Red Warning** may be issued by **System Operator**, 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 **System Operator** 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 **System Operator** so decides.

7. DEMAND SIDE RESPONSE

Demand Response services may be provided by each **Non-Embedded Customer** or **Self-Supply User** if agreed with **System Operator** 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 **Transmission Owner** 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 **System Operator**. 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 **System Operator**. in consultation with the TSOs in the synchronous area
iv) be equipped with a controller that measures the actual **System Frequency**.

System Operator 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

KEY

A) Practical Stability Limit
B) Rotor Heating Limit
C) Transformer Tap Limit
D) Transformer MVA Limit

GENERATOR

MW	200
MVA	235
PF	0.85
KV	15
Xd	2.50

TRANSFORMER

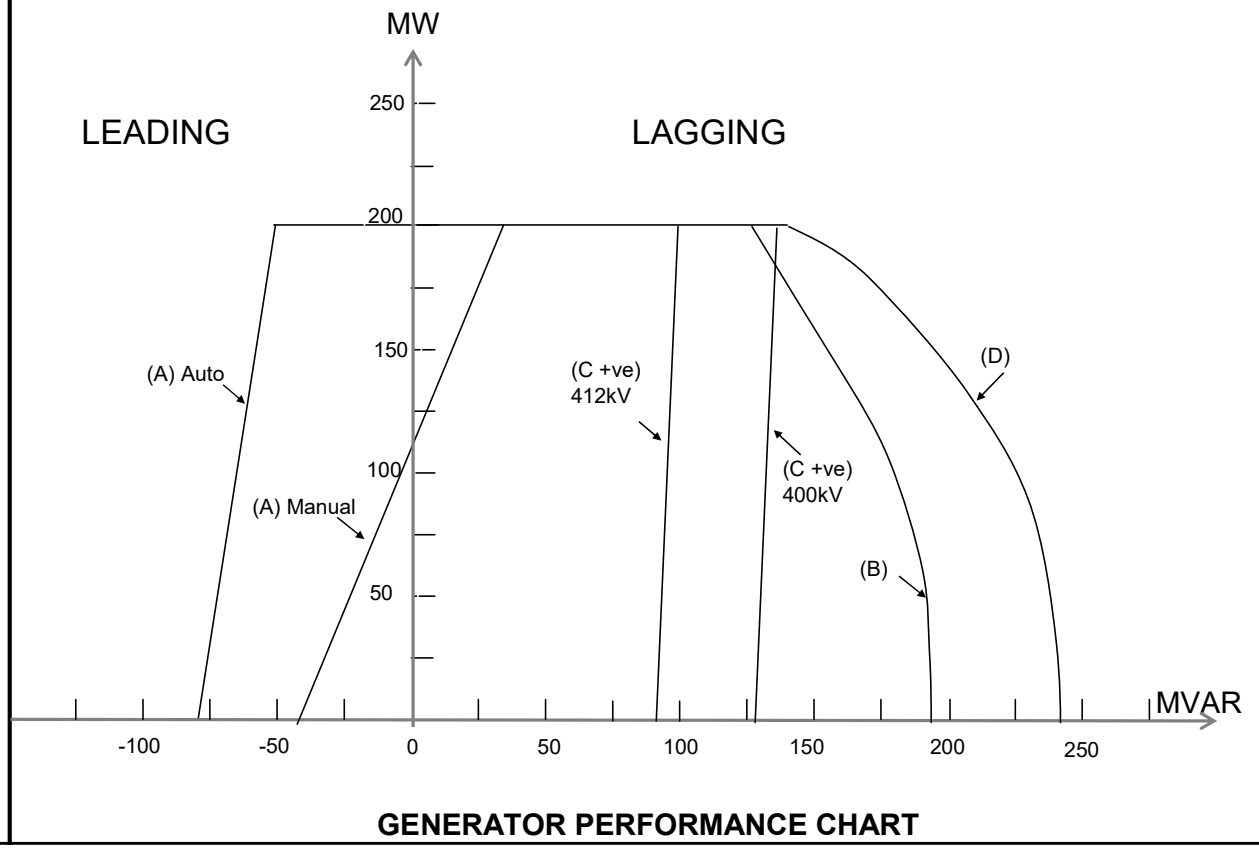
MVA	240
Xt	0.150

UNIT TRANSFORMER

MW Load	10
MVAR Load	7.5

SYSTEM VOLTAGE

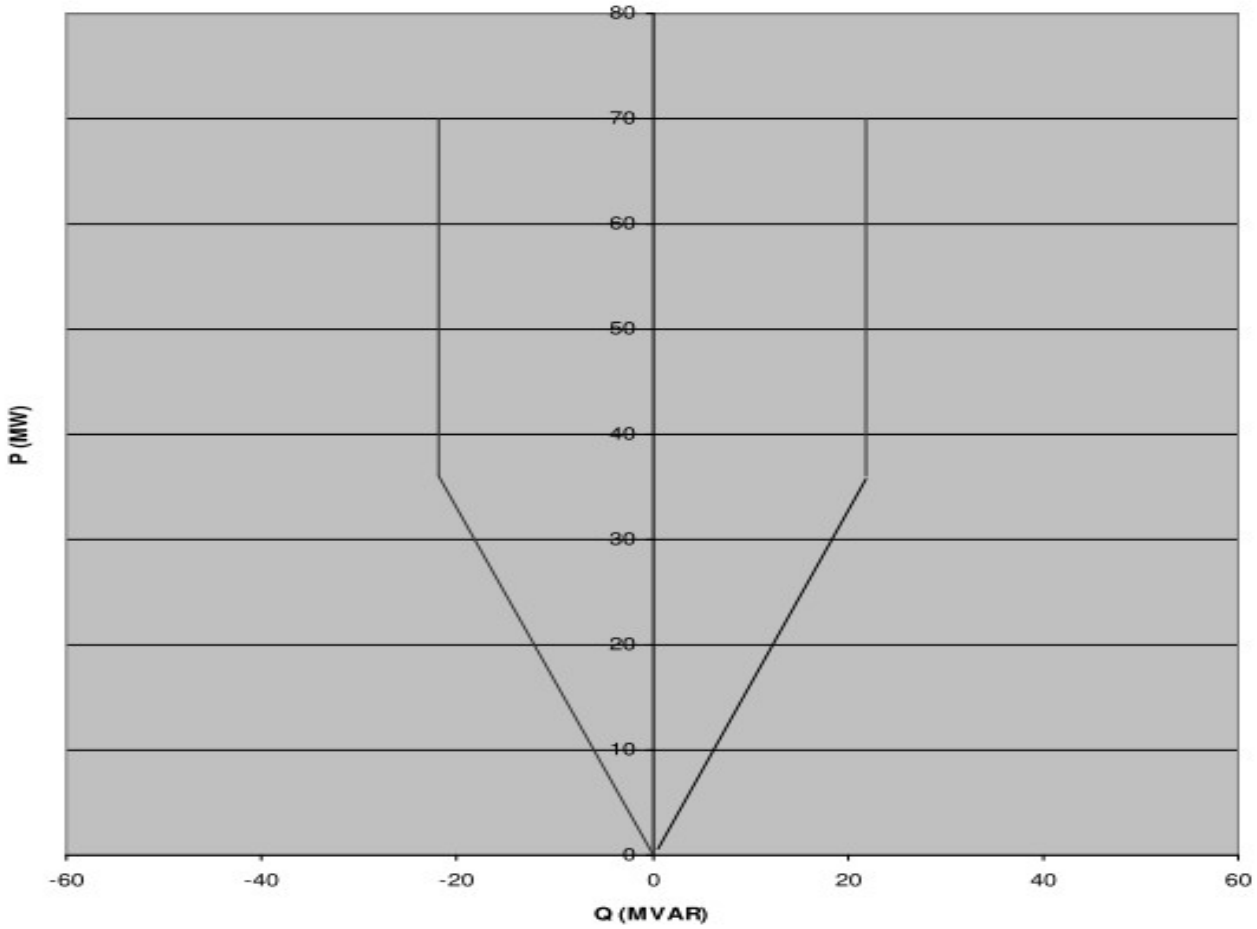
400kV Nominal
412kV High



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 PARK MODULES

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

i) the minimum time to connect or reconnect the **Power Park Module** (or part thereof) to the **Transmission System** following a **Despatch** instruction;

ii) the minimum time to connect or reconnect the **Power Park Module** (or part thereof) to the **Transmission System** automatically following a trip of the **Power Park Module** (or part thereof) that does not cause damage to the **Power Park Module** (or part thereof);

iii) the maximum rate at which **Load** can be increased following connection of the **Power Park Module** (or part thereof) to the **Transmission System**; and

iv) the minimum fault level or voltage at the **Connection Point** below which the **Power Park Module** cannot be connected.

APPENDIX C - OPERATING MARGIN DATA REQUIREMENTS

12. PRIMARY RESPONSE CHARACTERISTICS

The **Primary Response Characteristic** shall be given for each **Generation Unit** or **Battery Storage** or **HVDC** 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** or **Battery Storage** or **HVDC** 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 PARK MODULES

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

PHOTOVOLTAIC POWER PARK MODULES 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 **System Operator**, **Transmission Owner**, the Procurer and the following **Users**:

i) **GENCOs** (including **Power Park Modules**);

ii) **Battery Storages**

iii) **HVDC**

iv) **DISCOs**

v) **Non-Embedded Customers**;

vi) **Self-Supply Users**; and

vii) **User Systems**

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

The procedures for the establishment of **Safety Precautions** by **Transmission Owner** 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 **Transmission Owner** and **Users** for the co-ordination, establishment and maintenance of necessary **Safety Precautions** when work is to be carried out on the **Transmission System** and/or **User Systems**. Arrangements for safety when the safety implications of work on the **Transmission System** is entirely contained to the **Transmission System** is covered separately as part of Chapter 9 (**Transmission Owner and System Operator Code**)

This Section does not seek to impose a particular set of **Safety Rules** on **Transmission Owner**, **System Operator** and **Users** and the **Safety Rules** to be adopted and used by **Transmission Owner** 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 **Transmission Owner** 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 **Transmission Owner** 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 **Transmission Owner** 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 **Transmission Owner** a copy of its **Local Safety Instructions** relating to its side of the **Connection Point** at each **Connection Site**. **Transmission Owner** shall provide a copy of the **User's Local Safety Instructions** to **System Operator** as soon as reasonably practicable following receipt

Transmission Owner will supply to each **System Operator** and **User** a copy of its **Local Safety Instructions** relating to the **Transmission Owner** 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

Transmission Owner 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 **Transmission Owner** 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**. The **Transmission Owner** will provide to the **System Operator** such information as soon as reasonably practicable following receipt.

Transmission Owner 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 **System Operator** and the **User** by 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 **Transmission Owner** 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**").

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

ordinator. The **Transmission Owner** shall at times inform the **System Operator** of such exchange of detail.

Users may either adopt the **Transmission Owner** 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 **Transmission Owner** and a **User** within the same points of **Isolation**. Each of **Transmission Owner** 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 **Transmission Owner** 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 **Transmission Owner** 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 System Operator Planning of Remote Switching

The **Transmission Owner** shall inform the **System Operator** of the **HV Apparatus** on which **Safety from the System** is to be achieved.

The **System Operator** shall promptly then inform the **Transmission Owner** of the name of each **Transmission Component** that will be de-energised as a result of the **Switching**

Transmission Owner will confirm to **System Operator** the identity of the **Transmission Owner Safety Coordinator** for each relevant Site

3.4.4 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 **Transmission Owner** or that **User**.

The **Transmission Owner** shall inform **System Operator** of all communications between the **Requesting Safety Co-Ordinator** and **Implementing Safety Co-ordinator** in accordance with this sub-section 3.4.4. Following this communication, **System Operator** will either

i) confirm that the instructions it will issue to initiate the **Isolation**; or

ii) indicate its rejection of the proposed isolation – along with reasons. Such rejection would only be made if the proposed isolation would be inconsistent with the **System Operator Licence Conditions.**

3.4.5 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 **Transmission Owner** or that **User**.

The **Transmission Owner** shall inform **System Operator** of all communications between the **Requesting Safety Co-Ordinator** and **Implementing Safety Co-ordinator** in accordance with this sub-section 3.4.5. ~~Following this communication, **System Operator** will either~~

~~iii) confirm that the instructions it will issue to initiate the **Earthing**; or~~

~~iv) indicate its rejection of the proposed earthing – along with reasons. Such rejection would only be made if the proposed earthing would be inconsistent with the **System Operator Licence Conditions.**~~

3.4.6 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**.

3.4.7 Implementation of Remote Switching

Once **Remote Switching** is agreed in accordance with above Sections, the following procedure will apply:

i) **System Operator Control Engineer** will ensure the implementation of the **Switching**;

ii) the **System Operator Control Engineer** will confirm to the **Implementing Safety Co-ordinator** and the **User Control Engineer** that the **Switching** has been completed as agreed;

3.4.8 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).

3.4.9 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**.

3.4.10 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.

3.4.11 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

Transmission Owner, System Operator 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 **Transmission Owner**, **System Operator** 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 **System Operator's** or a **User**'s **Control Centre or Transmission Owner Network Coordination Centre** or communication facilities of the **Transmission Owner** or **User**.

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 **Transmission Owner**, **System Operator** and **Users**, who are authorised to make binding decisions on behalf of **Transmission Owner** or **System Operator** 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 any of:

a) **System Operator's, Control Centre;**

b) **Transmission Owner's Coordination Centre**

c) a **User**'s **Control Centre; or**

d) **Transmission Owner** operational telecoms**.**

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 **System Operator** 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 the **Transmission System**.

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 **System Operator** 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 **System Operator** 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 **System Operator** request, a part of total system (when the circumstances are such that **System Operator** 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.

Transmission Owner may specify a **System Black Start** restoration capability from the **HVDC system**. In that case, the **HVDC** system shall be capable of operating in an isolated network in accordance with **Black Start** operation requirements.

Transmission Owner and the **HVDC USER** shall agree on the capacity and availability of the **Black Start** capability.

The **HVDC** system shall also be able to synchronize with the AC system within the frequency limits and within the voltage limits specified.

Wider frequency and voltage ranges may be specified by **System Operator** where needed in order to restore the AC Network security.

4.3.2 Black Start Preparedness

Transmission Owner and **System Operator** shall develop, agree and maintain procedures setting out:

a) the information that will flow between the **Transmission Owner** and **System Operator** in the event of a black start,
b) the anticipated activities required of the **Transmission Owner** during a Black Start, and the procedure for initiating those actions.

This Transmission Code Procedure shall:

a) be established ~~within 3 months~~ by the date of the formal separation of **Transmission Owner** and **System Operator**; and
b) be changed and maintained subject to the sole governance of **Transmission Owner** and **System Operator**.

4.3.3 Black Start Situation

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

In the case the **Shutdown** commenced in **Self-Supply** System, **Self-Supply User** will inform **System Operator** 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 **System Operator** at the time. **Transmission Owner** and **Users** shall abide by **System Operator** instructions during a **Black Start** situation provided that the instructions are to operate within each **Generating Unit** declared operational capability.

System Operator instructions may be to **Transmission Owner**, 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 suppling 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.

4.3.3.1 Procedure

i) Where **System Operator** 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 **System Operator** 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 **System Operator** when it is ready to connect the **System** on **Connection point.**

iii) Following such confirmation, **System Operator** will endeavour to stabilise that **Generating Unit** by the establishment of appropriate **Demand**, following which **System Operator** 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 **System Operator** and **System Operator** 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) **System Operator** 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) **System Operator** 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 **System Operator** sustain and expand these islands and they will inform **System Operator** of their actions and will not **Re-Synchronise** to the **Transmission System** without **System Operator** agreement.

The conclusion of the **Black Start**, and the time of the return to normal operation of the **Total System,** will be determined by **System Operator** who shall inform **Transmission Owner** and **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**, **System Operator** will instruct **Users** to regulate generation or **Demand** to enable the **De-Synchronised Islands** to be **Re-Synchronised** and **System Operator** will inform those **Transmission Owner** and **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**, **System Operator** will instruct **Self- Supply User** to regulate frequency to enable the **De-Synchronised Islands** to be **Re-Synchronised** and **System Operator** will inform **Transmission Owner** and those **Self-Supply User** when **Re-Synchronisation** has taken place.

System Operator 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 **System Operator** or **Transmission Owner** or a **User**, has or may have a serious and/or widespread effect. This will include the loss of the **Transmission Owner Coordination Centre**, **System Operator** Control Centre or a **User** Control Centre.

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 **System Operator** or **Transmission Owner** or the relevant **User** can be contacted day or night when there is a **Joint System Incident** shall be provided by:

i) **Transmission Owner** and each **User** in writing to **System Operator**; and

ii) **System Operator** in writing to **Transmission Owner** and each **User**.

The lists of telephone numbers will be provided by all parties 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 System Operator** or **Transmission Owner** or a **User** will, if it considers necessary, telephone the **User** or **Transmission Owner** or **System Operator** to obtain such additional information as it requires.

Following notification of an **Incident** to **Transmission Owner** or a **User, the Transmission Owner** or **User** will, if it considers necessary, telephone the **System Operator** to obtain such additional information as it requires. Where required, the **System Operator** will, in turn, contact **Transmission Owner** or relevant **Users** to obtain the requested information

Following notification of an **Incident** and/or the receipt of any additional information if either of the **Transmission Owner** or User determine the **Incident** is a **Joint System Incident**, it shall inform the **System Operator** immediately**.** The **Incident** will become a **Joint System Incident** once the **Transmission Owner** or **User** notifies its determination of a **Joint System Incident** to the **System Operator**, or if the **System Operator** so determines. Once an **Incident** has been determined as a **Joint System Incident**, the **System Operator** will notify the **Transmission Owner** and any affected **Users** of its decision by telephone**.** If so, **System Operator** and the **Transmission Owner** and/or the **User** may set up an **Incident Centre** in order to avoid overloading the existing **System Operator** or **Transmission Owner** or that **User** operational/control arrangements.

Following notification of an **Incident** and/or the receipt of any additional information if either of the **Transmission Owner** or **User** determine the **Incident** is a **Joint System Incident**, it shall inform the **System Operator** immediately**.** The **Incident** will become a **Joint System Incident** once the **Transmission Owner** or **User** notifies its determination of a **Joint System Incident** to the **System Operator**, or if the **System Operator** so determines. Once an **Incident** has been determined as a **Joint System Incident**, **System Operator will** notify **Transmission Owner** and any affected **Users** of its decision by telephone**.**

If the **System Operator** establishes an **Incident Centre it** shall, as soon as possible, notify the **Transmission Owner** and any affected **Users** that it has been established and the telephone number(s) of its **Incident Centre** if different from those already supplied.

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

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

The **Transmission Owner Incident Centre**, **System Operator 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 **Transmission Owner** or **System Operator** or the **User** for the communication and dissemination of information between the senior management representatives of **Transmission Owner**, **System Operator** and/or **User(s)**;

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 and **Users** will continue to be used.

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

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

All communications between the senior management representatives of **Transmission Owner** or **System Operator** 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.

System Operator will decide when conditions no longer justify the need to use the **System Operator Incident Centre** and will inform **Transmission Owner** and all relevant **Users** of this decision by telephone.

Transmission Owner will decide when conditions no longer justify the need to use the **Transmission Owner Incident Centre** and will inform **System Operator** and all relevant **Users** of this decision by telephone.

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 **System Operator** of this decision by telephone.

4.6 Loss of the System Operator Control Centre

Following notification of the loss of the **System Operator Control Centre**, each **GENCO** shall continue to operate its **Generating Units** in accordance with the last **Despatch** instructions to have been issued by **System Operator** 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 **System Operator**.

Following notification of the loss of the **System Operator Control Centre**, each **Self-Supply**

User shall continue to operate its **Generating Units** in accordance with the pre-incident import / export level.

System Operator will have arrangements in place whereby, if the circumstances described above arise, **System Operator** may transfer the functions of its **Control Centre** to an alternative control facility whereupon **System Operator** will re-commence the issue of **Despatch** instructions in accordance with the **Scheduling** and **Despatch** Code and inform **Transmission Owner** and **Users** of the communications details for the new location. **System Operator** 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 **System Operator**, **Transmission Owner** or a **User** orally; and

ii) the mechanism for the joint investigation of a **Significant Incident** or a series of **Significant Incidents** if **System Operator**, **or Transmission Owner** and/or the relevant **Users** so request.

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 **System Operator**, or **Transmission Owner** and/or the relevant **Users** so request.

5.3 Procedure

5.3.1 Written Reporting of Incidents by Users to System Operator

In the case of an **Incident** which was initially reported by a **User** to **System Operator** orally and subsequently determined by **System Operator** to be a **Significant Incident** the **User** will give a written report to **System Operator**. **System Operator** will provide a copy of such written report to the **Transmission Owner** but 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 System Operator to Transmission Owner and Users

In the case of an **Incident** which was initially reported by the **System Operator** to a **User** or **Transmission Owner** orally and subsequently determined by the **User** or **Transmission Owner** to be a **Significant Incident** the **System Operator** will give a written report to **Transmission Owner**. If the incident was determined by the **User** to be a Significant Incident, **System Operator** will copy the written report to that **User**. Neither **Transmission Owner**,

System Operator or the **User** will 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 Written Reporting of Incidents by Transmission Owner to System Operator and Users

In the case of an **Incident** which was initially reported by the **Transmission Owner** to a **User** or **System Operator** orally and subsequently determined by the **User** or **System Operator** to be a **Significant Incident** the **Transmission Owner** will give a written report to the **System Operator**. If the incident was determined by the **User** to be a Significant Incident, the **System Operator** will copy the written report to that **User**. Neither **Transmission Owner**, **System Operator** nor the **User** will 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**.

5.3.1.3 Form of Report

A report shall be sent to **System Operator** or to a **User,** as the case may be, 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 Appendix A. The **System Operator**, **Transmission Owner** 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.

5.3.1.4 Timing of Report

A full written report must be received by **System Operator** or the **User** within 2 hours of **System Operator** or the **User** receiving oral notification. If this is not possible, the **User** or **System Operator or Transmission Owner** shall, within this period, submit a preliminary report setting out, as a minimum, those matters specified in Appendix A. As soon as reasonably practical thereafter, the **User** or **System Operator** shall submit a full written report. The **System Operator** shall upon receipt or release of a report, from or to the **Users**, provide a copy to the **Transmission Owner**.

5.3.2 Joint Investigations

Where a **Significant Incident** has been declared and a report submitted, the **System Operator** or **Transmission Owner** 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)**.

System Operator or **Transmission Owner** 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 the **System Operator** and **Transmission Owner** 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**, **System Operator** in reporting the event or operation on the **Transmission System** to **Transmission Owner** or 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 **Transmission System** or the **Systems** of the other **Users** to operate differently to the way in which they would or may have normally operated in the absence of that effect.

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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 **System Operator)** 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 Transmission System

In the case of an **Operation** on the **Transmission System,** which will have an **Operational Effect** on the **System** of a **User**, **System Operator** 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 **System Operator**. Following notification by the **User**, **System Operator** will notify **Transmission Owner** and 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 **System Operator** or **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**, **System Operator** will notify the **Transmission Owner** and **User** whose **System** has been affected. If **Transmission Owner** is aware of an incident on the Transmission System, and has not yet been notified of that by **System Operator**, it shall notify that incident to System Operator.

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 **System Operator**. The **System Operator** will upon receipt of a notification communicate the same to **Transmission Owner.**

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**.

System Operator 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 **System Operator** 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 **System Operator** of an **Incident** which **System Operator** considers has had or may have had a significant effect on the **Transmission System**, **System Operator** will require the **User** to report that **Incident** in writing and will notify that **User** accordingly. Once received from the user, **System Operator** will copy that written notification to the **Transmission Owner**

Where a **User** notifies **System Operator** of an **Incident** which the **Transmission Owner** considers has had a significant effect on the **Transmission System**, **Transmission Owner** will inform **System Operator**. **System Operator** will then require the **User** to report that **Incident** in writing and will notify that **User** accordingly. **System Operator** will copy that written notification to **Transmission Owner**.

Where **Transmission Owner** notifies the **System Operator** of an **Incident** which a **User** considers has had a significant impact on its system, or the **System Operator** considers has had a significant effect on the **Transmission System, System Operator** will require **Transmission Owner** to report that incident in writing and will notify **Transmission Owner** accordingly. Once received from **Transmission Owner**, **System Operator** will copy that written notification to the relevant **Users.**

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

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

Incidents which **System Operator** requires a **User** to report in writing and **Incidents** which a **User** requires **System Operator** 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 **System Operator** to **Transmission Owner** and **Users** who may be affected when **System Operator** 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 **System Operator** 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 **System Operator** requirements for numbering and nomenclature at:

i) **Transmission Owner HV Apparatus** on **Users Sites**; and

ii) **User HV Apparatus** on **Transmission Owner** Sites;

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**.

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 systems used b**y System Operator and Transmission Owner.**

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

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

7.3 Transmission Owner HV Apparatus on a User Site

i) **Transmission Owner HV Apparatus** on **User Sites** shall have numbering and nomenclature in accordance with the systems used by **System Operator** and **Transmission Owner**;

ii) when **Transmission Owner** is to install its **HV Apparatus** on a **User Site**, **Transmission Owner** 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 **Transmission Owner 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 **Transmission Owner** 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 **Transmission Owner**, or, to the extent that it does, that the relevant other numbering and/or nomenclature will be changed before installation of the **Transmission Owner 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 **Transmission Owner HV Apparatus** which is either already on that **User Site** or which **Transmission Owner** has notified that **User** will be installed on that **User Site**.

7.3.1 User HV Apparatus on Transmission Owner Sites

i) **User HV Apparatus** on **Transmission Owner Sites** shall have numbering and nomenclature in accordance with the system used by **Transmission Owner** and **System Operator**;

ii) when a **User** is to install its **HV Apparatus** on a **Transmission Owner Site,** or it wishes to replace existing **HV Apparatus** on a **Transmission Owner Site** and it wishes to adopt new numbering and nomenclature for such **HV Apparatus**, the **User** shall notify **Transmission Owner** 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 **Transmission Owner** 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) **U**pon receipt of the User's request:

a) **Transmission Owner** shall notify the **System Operator** and seek its decision on the **User** proposed change to numbering and nomenclature;

b) **System Operator** shall within fifteen (15) Business Days confirm to **Transmission Owner** its acceptance of the User proposed changed numbering and nomenclature or otherwise confirm its non-acceptance along with the reasons for that non acceptance.

c) **Transmission Owner** shall respond in writing to the **User** within one month of the receipt of the notification stating whether or not the proposal is agreed and, if they are not agreed, 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 **System Operator** and **Transmission Owner** current numbering and nomenclature systems in order to assist them in planning the numbering and nomenclature for their **HV Apparatus** on **Transmission Owner Sites**.

7.3.2 Changes

Where **Transmission Owner** has decided that it needs to change the existing numbering or nomenclature of **Transmission Owner HV Apparatus** on a **User Site** or of **User HV Apparatus** on a **Transmission Owner Site**:

i) the provisions of paragraph 7.4 shall apply to such change of numbering or nomenclature of **Transmission Owner 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 **Transmission Owner Site**, **Transmission Owner** 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 **Transmission Owner** within one month of the receipt of the notification, confirming receipt. The **Transmission Owner** will upon receipt of confirmation from the User notify the **System Operator**.

In either case the notification shall indicate the reason for the proposed change.

7.3.3 Labelling

When either **Transmission Owner** or a **User** installs **HV Apparatus Transmission Owner** 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 the numbering and/or nomenclature of the **Transmission Owner HV Apparatus** is required to be change **Transmission Owner** will be responsible for the provision and erection of clear and unambiguous labelling showing the numbering and nomenclature by the required date.

7.3.4 Transmission Owner and System Operator Alignment

It is essential for safety and the effective operation of the **Transmission System** that, at all times the numbering and nomenclature of each **Transmission Owner HV Apparatus** or **User HV Apparatus** is common across **Transmission Owner** and **System Operator**. To force this consistency, where **Transmission Owner** assigns, changes or otherwise agrees the numbering and nomenclature of **Transmission Owner HV Apparatus** or **User HV**

i) the actual numbering and nomenclature will be agreed between **Transmission Owner** and **System Operator** in accordance with the relevant **Electricity Transmission Code Procedure**; and

ii) no new naming and nomenclature will used until **Transmission Owner** and **System**

Operator have agreed the date and time from which that new naming and nomenclature will apply, and that it will be correctly represented in each of their systems.

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 **Transmission Owner** simulating conditions or the controlled application of irregular, unusual or extreme conditions, on the **User's System** or the **Transmission System** under the direction of **System Operator** 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 **Transmission Owner** simulating conditions or the controlled application of irregular, unusual or extreme conditions, on the **User's System** or the **Transmission System** under the direction of **System Operator**.

This section deals with the responsibilities and procedures for arranging and carrying out **System Tests** which have, or may have, an effect on the **Transmission System** and **Users' Systems** 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 **Transmission Owner** 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 **Transmission Owner** 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 **System Operator** prior to the test being carried out.

8.3 Procedure

8.3.1 Proposal Notice

Where a **Transmission Owner** or **User** has decided that it would like to undertake a **System Test** it shall submit a notice (a "**Proposal Notice**") to **System Operator** 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 **System Operator** 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.

System Operator 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 **System Operator** wishes to undertake the **System Test**, **System Operator** shall be deemed to have received a **Proposal Notice** for that **System Test**.

System Operator 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 [SO] **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 System Operator** will determine, in its reasonable estimation, which **Users** may be materially affected by the proposed **System Test** and will notify such **Users** and **Transmission Owner** accordingly.

System Operator 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 **System Operator** decides that a **Test Panel** is necessary, the provisions of Appendix B will apply.

8.3.3 System Operator Supervision

If **System Operator** 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 **System Operator** determines that the proposed **System Test** cannot take place it will notify the **Test Proposer** and **Transmission Owner** of the reasons for such a decision.

8.3.4 Transmission System Test Programme

If **System Operator** approves the proposed **System Test** taking place then **System Operator** 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 **System Operator** considers appropriate.

System Operator, Transmission Owner, 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 **System Operator** or **Transmission Owner** which arise after the issue of the **Test Programme** must be notified to the other parties as soon as possible in writing. If **System Operator** decides that these anticipated problems merit an amendment to, or postponement of, the **System Test**, it shall notify the **Test Proposer, Transmission Owner** and affected **Users** accordingly.

If on the day of the proposed **System Test**, operating conditions on the **Total System** are such that any of **System Operator**, **Transmission Owner,** 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. **System Operator** shall then postpone or cancel the **System Test,** inform **Transmission Owner** and relevant **Users**, 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 **System Operator** in carrying out:

(a) **Monitoring:**
   i. of the compliance of **Generating Units** and **Desalination Units** with **Despatch** instructions issued by **System Operator** 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 **Transmission System**, or **User Sites**.

9.2 Objectives

The objective of this **Operating Code** is to establish whether **Generating Units**, **Desalination Units** and **User Equipment** comply with **Scheduling and Despatch Parameters** and **Connection Conditions** and 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 **System Operator** 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 Agreements,** 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, **System Operator** shall in each case give due regard to operating conditions on the **Transmission System** and Water Trunk Main System. **System Operator** 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 **System Operator** 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 **System Operator** suspects that a **Generating Unit** or **Desalination Unit** has not complied, or is not complying, with a **Despatch** instruction, **System Operator** 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), **System Operator** 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**, **System Operator** 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 **System Operator** 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 System Operator** 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 **System Operator** 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**, **System Operator** 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, **System Operator** 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:

$$\Delta P = \frac{1}{\mathrm{X} * \delta_{gi}} * \Delta f * \frac{P_{ginom}}{f_0}$$

Where:

$$\Delta f = (f_0 - f_{st}) - f_{db}$$

Primary response Governor Droop Multiplier X is defined as:

$$\mathrm{X} = 1 + \alpha * \mathrm{e}^{-\beta \mathrm{t}}$$

Where: α, β – coefficient defined by **System Operator** (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** $\Delta \mathbf{f_{max}}$ 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:

$$\mathbf{PRIG = \Sigma_{x1} RESg_{x1} * a_{x1} * \Sigma_{x2} RESg_{x2} * b_{x2}}$$

where:

$\Sigma_{x1}RESg_{x1} * a_{x1}$ = 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

$\Sigma_{x2}RESg_{x2} * b_{x2}$ = 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

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:

$$\mathbf{PRIA = \Sigma_{x1}RESa_{x1}*a_{x1} * \Sigma_{x2}RESa_{x2}*b_{x2} * 1/(e^{\Delta lp*g1}) * 1/(e^{\Delta f / \sigma/g2})}$$

where:

$\Sigma_{x1}RESa_{x1} * a_{x1}$ = as previously defined

$\Sigma_{x2}RESa_{x2} * b_{x2}$ = as previously defined

$1/(e^{\Delta lp*g1})$ = 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

Δlp = 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.

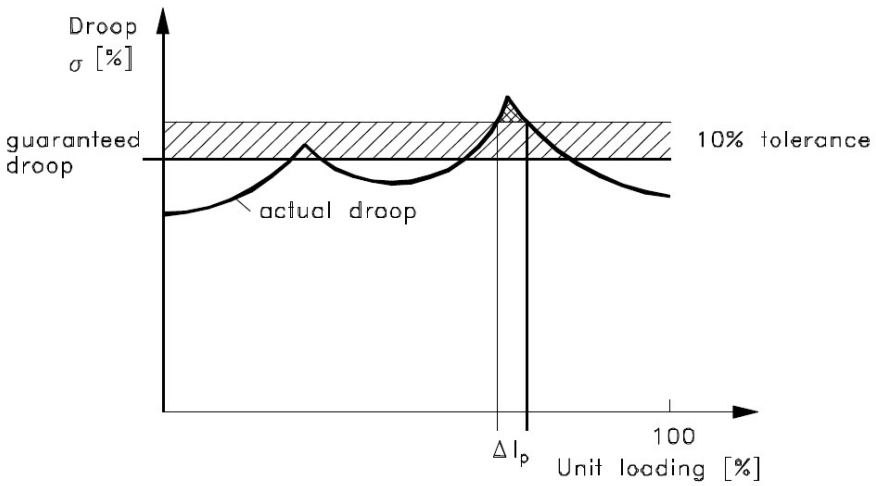

Fig. 1

Table F-3: Weighting Coefficients g_1 and g_2

Weighting Factor g_1	1
Weighting Factor g_2	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

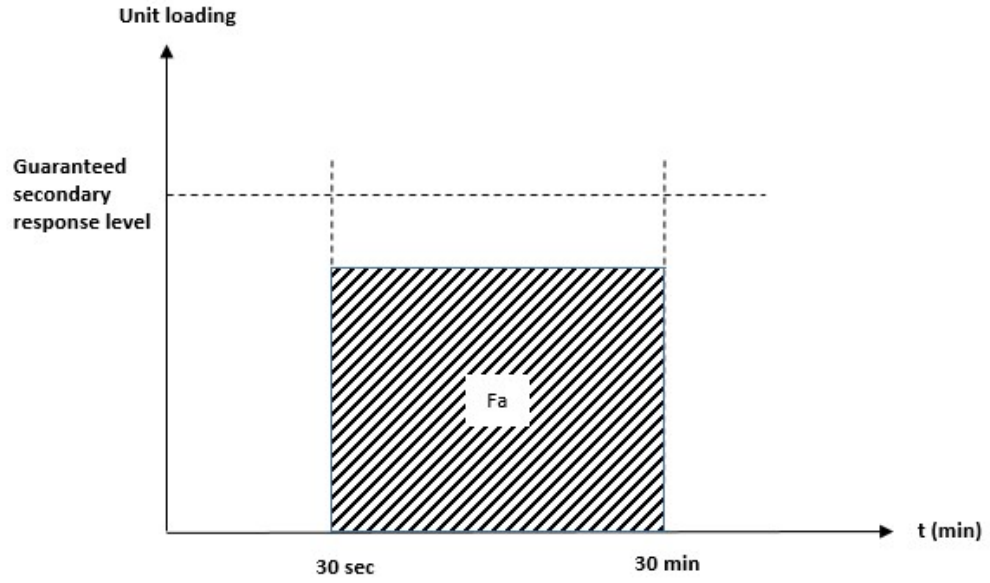

Fig. 2

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:

$$AGCRIA = \Delta lp_a/\Delta lp_g * (F1_a+F2_a)/(F1_g+F2_g)$$

where:

$\Delta lp_a/\Delta lp_g$ = 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

Δlp_g - Contracted ramp-up margin;

Δlp_a - Achieved Actual ramp-up margin;

F1g+F2g - Contracted **AGC Response** maintainability

F1a+F2a - Achieved **AGC Response** maintainability

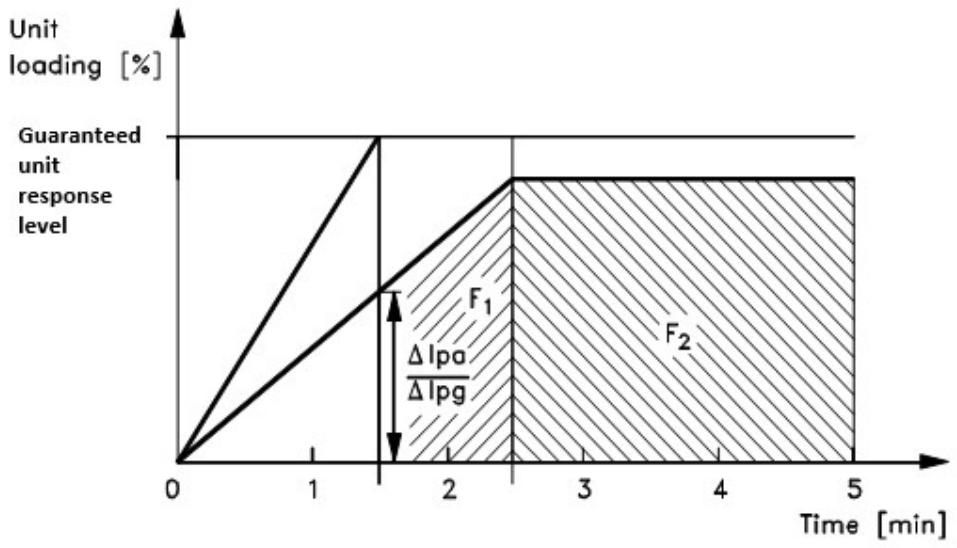

Fig. 3

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 **System Operator**, 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**, **System Operator** may require the **GENCO** to carry out a **Sustained Response Test** or a **Governor Droop Test** and if the test is failed, **System Operator** 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 Despatch Parameter** of one of its **Generating Units** re-registered as a result of non-compliance, notify **System Operator** when it has rectified the fault which caused that non-compliance by

submitting an **Availability Notice** to **System Operator** under the **Scheduling and Despatch Code**. Upon **System Operator** receiving such notification, the relevant **Scheduling and Despatch Parameter** will be deemed to be re-declared.

System Operator may then **Monitor** that re-declared value and may, if the **Generating Unit** fails to comply with the re-registered **Scheduling and Despatch 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 **System Operator** 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**, **System Operator** 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**.

If the **Transmission Owner or System Operator** suspects any non-compliance by a **User** with its Connection Conditions, it shall inform the other party of its suspicions, and cooperate with each other in providing the information it may require to progress testing undier this **Operating Code "B"**

9.4.2 Access

A **GENCO** or any other **User** must allow the **System Operator** 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 **System Operator** and the **GENCO** or other **User**, be as determined by **System Operator** 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 **System Operator** in carrying out the test.

If the procedure for the test, and the criteria for passing the test, are so determined by **System Operator** and, within 48 hours after completion of the test, the **User** notifies **System Operator** 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 **Transmission Owner** shall be informed accordingly.

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**. **System Operator** 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 **System Operator** 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 **System Operator** 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**. **Transmission Owner** shall be informed accordingly, and cooperate as necessary for the resolution of the dispute.

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) **System Operator** 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. **Transmission Owner** shall be informed accordingly, and cooperate as

necessary to give effect to the consequences arising under the relevant **Connection 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 **System Operator** 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 **System Operator**, on not less than 24 hours notice of the start of the test:

   (i) at any time, if **System Operator** 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 **System Operator** requests a test and the **Response Capability** determined from the test is lower than the value which had been re-declared by **System Operator**, the value determined from the test shall be applied retrospectively (from the **Settlement Period** in which **System Operator** 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 **System Operator**, on not less than 24 hours notice, at any time if **System Operator** has reasonable grounds to believe that the value of the indices for a Generating Unit is lower than the declared or guaranteed value.

System Operator 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 **System Operator** 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.

9.4.8 Black Start Testing

a) **System Operator** may require a **Generating Unit** (including **Power Park Module** and/or **Battery Storage) with a Black Start Station** to carry out a test (a **"Black Start Test"**) on a **Generating Unit** or **Power Park Module, HVDC** and/or **Battery Storage** in a **Black Start Station** in order to demonstrate that a **Black Start Station** has a **Black Start** capability.

b) **System Operator** may require a **Generating Unit** (including **Power Park Module** and/or **Battery Storage)** with a **Black Start Station** to carry out a **Black Start Test,** on each **Generating Unit or Power Park Module** and/or **Battery Storage,** which has **Black Start** capability**,** within such a **Black Start Station**, to demonstrate this capability at least once every three years, unless it can justify on reasonable grounds the necessity for more often tests.

c) When **System Operator** wishes a **Generating Unit** (including **Power Park Module, HVDC** and/or **Battery Storage)** with a **Black Start Station** to carry out a **Black-Start Test,** it shall notify the relevant **GENCO** at least 7 days prior to the time of the **Black Start Test** with details of the proposed **Black Start Test.**

d) Detailed procedure for **Black Start Test** will be established jointly by **User** and **System Operator.**

9.4.9 Ancillary Service Compliance

a) Compliance testing of mandatory **Ancillary Service** (Part I) shall be done once every three years, unless justified on reasonable grounds the necessity for more often tests.

b) The tests shall include, but not limited to:

- **Reactive Power** capability,
- **Voltage control**,
- **Frequency response**

9.5 Investigations

System Operator 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 **System Operator** to fulfil its obligations relating to the operation of the **Transmission System** (and where in the reasonable opinion of **System Operator** 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 **System Operator** 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 **System Operator)** for the investigation.

The scope of an investigation and the information and parts of the **Power Station** or **User Site** to which **System Operator** representative shall be entitled to access shall be limited to that required for the purposes of the investigation as specified in **System Operator** notice.

The **User** shall comply with the reasonable requests of **System Operator** in carrying out the investigation, and allow the **System Operator** 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 **System Operator** 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 **System Operator** 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

System Operator shall be entitled to refuse to conduct any test requested if, in **System Operator** 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 **System Operator** are not, in **System Operator** reasonable view, adequately covered by the **User**. **System Operator** may only continue to refuse to conduct the test for so long as these reasons continue.

If **System Operator** refuses to conduct the test **System Operator** 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 **System Operator** does not agree to the test taking place, then it will not take place, provided that **System Operator** 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 **System Operator** 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** and **Transmission Owner** accordingly.

If **System Operator** does not agree to the procedure for conducting the test, then if the test is to go ahead, **System Operator** requirements relating to the procedure will prevail.

If **System Operator** does not agree to the timing of the test, then if the test is to go ahead, **System Operator** requirements relating to timing will prevail.

9.6.3 Witnessing of Tests by System Operator

System Operator 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 **System Operator** witnessing the test, allow the **System Operator** witnesses access to all relevant parts of its **Power Station** or **User Site** in order to witness such a test.

System Operator 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**. **Transmission Owner** will inform **System Operator** of whether the **Commissioning/Acceptance Testing** was passed as soon as reasonably practicable.

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 **System Operator** determines pursuant to Section 8.3.2 of **Operating Code 'B'** that a **Test Panel** is required **System Operator** 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**.

System Operator will notify **Transmission Owner** and 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 **System Operator** representative whom **System Operator** 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 **System Operator** within one month of the date on which the **Preliminary Notice** was sent to **Transmission Owner** and the **User** by **System Operator**. Any **User** which has not replied within that period will not be entitled to be represented on the **Test Panel.** The **Transmission Owner** will always 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 **System Operator** will notify **Transmission Owner** all **Users** identified by it accordingly.

System Operator 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 **System Operator** has notified **Transmission Owner** and 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 **System Operator**, **Transmission Owner** 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.

Transmission Owner and **Users** identified by **System Operator** that may be affected by the **System Test**, the **Test Proposer** and **System Operator** 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 **System Operator**, the **Test Proposer** and to **Transmission Owner** as well as each **User** identified by **System Operator** 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 **System Operator**, **Transmission Owner,** the **Test Proposer** and each **User** identified by **System Operator** 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**, **System Operator**, **Transmission Owner** and each **User** identified by **System Operator** 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**, **System Operator**, **Transmission Owner** and all **Users** identified by **System Operator** 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 **System Operator** 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

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

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 m^3/h	±5% of Despatched Load	6 hours	Not Applicable	Not Applicable
Loading Rate $m^3/h/h$	±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 Despatch Code** (**SDC**) sets out the procedure for **System Operator** to:

i) **Schedule** and **Despatch Generating Units**;

ii) **Schedule** and **Despatch 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 Despatch Code** (**SDC**) applies to;

i) **System Operator;**

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 C**onnection 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 Despatch 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 **System Operator** 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 **Transmission System 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 **System Operator** 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.

4. Each **External System Operator** shall provide the available transfer capacity of each **External Interconnection** as defined in the appropriate **Interconnection Agreement**.

5. Such **Availability Notice** will replace any previous **Availability Notice**.

6. 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 **System Operator** 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 **System Operator** 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 **System Operator** 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

System Operator 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 **m^3** 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 **System Operator** revisions to the submitted data:

i) If revised **GENCO Data or Self-Supply User Data** is received by **System Operator** prior to 1300 hours on the day prior to the relevant **Schedule Day**, **System Operator** 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 **System Operator** at or after 1300 hours in each day but before the end of the next following **Schedule Day**, **System Operator** 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

System Operator 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 **System Operator** 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 **System Operator** 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**, **System Operator** will take account of and give due weight to the following factors:

i) **Total System** constraints as determined by **System Operator** and as advised by **Transmission Owner** and **Users** including **Zonal Availability** of **Generating Units**;

ii) In respect of **Generating Unit** and **Desalination Unit** parameters registered as **Scheduling and Despatch 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 **System Operator** and as advised by **Users**, for voltage control and **MVAr** reserves;

v) **Generating Unit** stability and **Desalination Unit** water quality as determined by **System Operator** after due consultation with the **GENCO**;

vi) the need to provide an **Operating Margin** as determined by **System Operator**;

vii) the requirements, as determined by **System Operator** 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**, **System Operator** 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 **System Operator** after the commencement of the **Scheduling** process;
2. changes to **Transmission System 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 **System Operator**, would impose increased risk to the **Total System** and would therefore require **System Operator** 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 **Transmission System 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 **System Operator 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 **System Operator** 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 System Operator **Licence Standards** and **System Operator 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 C**onnection 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**, **System Operator** reserve the right to extend the timescale for **Generation and Desalination Schedule** issue to the extent necessary as a result of such **Incidents**.

System Operator 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 **System Operator** 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. **System Operator** 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 **System Operator** 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 **System Operator**;
3. In the event that **System Operator** is unable to differentiate between **Generating Unit Costs**, **System Operator** 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 10:00 hours each day and in relation to the following **Schedule Day System Operator** 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, **System Operator** 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 **System Operator**, 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 **System Operator** reasonable opinion; and

vi) to issue instructions in relation to **Ancillary Services**.

vii) to issue instructions in relation to **Battery Storage** operational mode.

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 **System Operator**, is intended to enable **System Operator** to match continuously **Generating Unit** and **Desalination Unit** output, transfer to/from **Self-Supply Users** and **External System** transfer to **Transmission System 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 **System Operator** 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 **System Operator** to compile the **Generation and Desalination Schedule**.
Additional factors which **System Operator** 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 **System Operator** will select first for **Despatch** the one which in **System Operator's** reasonable judgement will give the highest reduction in transmission losses.

3.2.2 Re-optimisation of Generation and Desalination Schedules

System Operator will re-optimise 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 **System Operator** 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 **System Operator** 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 **System Operator** 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 **System Operator**. 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, **System Operator** 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 **System Operator**) by either:

   i) on load tap changing on the generator step-up transformer; or
   ii) adjusting the generator stator terminal voltage.
   iii) implementing the preferable control mode and set value for **Power Park Module**, **Battery Storage** or **HVDC**

   Once this has been achieved, the **GENCO** will not tap again or adjust terminal voltage again without prior consultation with and the agreement of **System Operator**, on the basis that MVAr output will be allowed to vary with **System** conditions;

ii) **MVAr** exchange on **connection points** to **Self-Supply User: System Operator** 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 **System Operator)** by either:

i) on load tap changing on the generator step-up transformer; or
ii) adjusting the generator stator terminal voltage.
iii) implementing the preferable control mode and set value for **Power Park Module**, **Battery Storage** and **HVDC**.

In relation to each **Generating Unit**, where there is no HV indication, **System Operator** 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, **System Operator**.

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 **System Operator**;

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 **System Operator**, 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 **System Operator**. 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 **System Operator** 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 **System Operator** 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 **MVAr** output should at the point of synchronism be 0 **MVAr** 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 Despatch Instructions

In the case of **Generating Units, Despatch** 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 Despatch 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 Despatch** 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 Despatch Parameters**

The form of and terms to be used by **System Operator** 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

Despatch instructions will be given by telephone or any available electronic means such as an EDL (electronic despatch logger) and will include an exchange of operator names.

Despatch instructions must be formally acknowledged by telephone or any available electronic means such as EDL (electronic despatch 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 Despatch Parameters**.

In the event that in carrying out the **Despatch** instructions, an unforeseen problem arises, caused on safety grounds (relating to personnel or plant), **System Operator** must be notified without delay by telephone.

3.2.6.1 Action Required from GENCOs

Each **GENCO** will comply with all **Despatch** instructions properly given by **System Operator** unless the **GENCO** has given notice to **System Operator** under the provisions of the **Scheduling and Despatch Code** regarding non-acceptance of **Despatch** 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 Despatch Parameters**.

To preserve **Transmission System** integrity under emergency circumstances **System Operator** may issue **Emergency Instructions**. Such **Emergency Instructions** will be issued by **System Operator** 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 **System Operator** or unless that occurs automatically as a result of inter-trip schemes or **Generating Unit** protection operations. **De-Synchronisation** may take place without **System Operator's** prior agreement if it is done purely on safety grounds (relating to personnel or plant).

3.2.6.3 No Instructions

Where **System Operator** and a **GENCO** have agreed the remote **Automatic Generator Control (AGC)** by **System Operator** of a **Generating Unit**, **System Operator** 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 **System Operator** 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 **System Operator** such that the new **Despatch** instruction is within the now applicable **Availability** and/or **Scheduling and Despatch Parameters**; and

ii) if **System Operator** 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 **System Operator** 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 **System Operator** (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 **System Operator** agreement for one of the **Generating Units** and/or **Desalination Units** at that **Plant** to be operated under a risk of trip. **System Operator** 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 **System Operator** agreement for **Generating Units** to be operated with the **AVR** in manual mode, or **Power System Stabiliser** switched out, or **VAr** limiter switched out. **System Operator'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**.

System Operator 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) **System Operator** 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 **System Operator** 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**, and **Battery Storage** operating in **Frequency Sensitive Mode**, by **Unit Controller** operation;

ii) automatic response from **Power Park Modules** and **HVDC** operating in **Frequency Sensitive Mode**, or **Limited Frequency Sensitive Mode (LFSM-O and/or LFSM-U)** by **Unit Controller** operation.

iii) the manual Despatch of **Generating Units**;

iv) **Generating Units** operating in **AGC** mode under a centralized acting integral **Secondary Controller**.

v) Response from **Self-Supply Users**;

vi) response from **External Interconnections**; and

vii) **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 **System Operator**, all Synchronous **Generating Units** shall operate at all times in **Frequency Sensitive Mode** (including, where applicable, with the **Unit Controller** in operation), while **Power Park Modules** and **HVDC** shall operate in **Limited Frequency Sensitive Mode and/or Frequency Sensitive Mode**, 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. Power Park Modules** shall provide **Primary** and **Secondary Response** if required by **System Operator**.

4.2.1 Generating Units, Battery Storage and HVDC 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 or HVDC user** 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, Battery Storages and HVDC in AGC Control Mode

In accordance with the respective **Power (and water) Purchase Agreement** a **Generating Unit**, **Battery Storage** or **HVDC** 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

System Operator 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 **System Operator** 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 **System Operator**; and
ii) De-energisation of **Demand** by automatic **Frequency Sensitive** relays.

4.5 System Operator Despatch Instructions

System Operator will issue **Despatch** instructions to regulate the **Frequency** of the **Total System** to meet the requirements of **Frequency Control**.

System Operator will issue **Despatch** instructions as to which **Generating Unit** shall participate in **Secondary Control** by means of **AGC** mode activation and participation factor settings.

System Operator will issue Despatch instructions as to which frequency control mode is to be set to **Power Park Modules**, **HVDC** and **Battery Storage**.

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, **System Operator** 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

1. 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.**

2. SCHEDULING AND DESPATCH PARAMETERS

1. **Generating** and/or **Desalinating Unit** inflexibility (inflexibility description, start date and time, end date and time, **MW,** m^3/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

1. 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.

2. 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"

3. 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 **System Operator** 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.

4. 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 Despatch Parameters**.

Unless a separate **MVAr Despatch** 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**.

5. FREQUENCY CONTROL

All the above **Despatch** instructions will be deemed to be at the instructed **Target Frequency.**

Frequency control instructions may be issued in conjunction with, or separate from, a **Despatch** instruction for ordinary **Active Power** output.

6. 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

7. BLACK START

The instruction will normally follow the form, for example:

Initiate **Black Start** procedure, instruction timed at 1900 hours

8. 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

9. 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 10**MVAr** export or import;

ii) Maximum **MVAr** output (or "maximum excitation");

iii) Maximum **MVAr** 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 **MVAr Despatch** matters, **MVAr** generation/output is an export onto the **System** and is referred to as "lagging **MVAr**", and **MVAr** absorption is an import from the **System** and is referred to as "leading **MVAr**";

CHAPTER 7 - DATA REGISTRATION CODE

1. INTRODUCTION

The **Data Registration Code** (**DRC**) sets out a unified listing of all data required by **Transmission Owner** and **System Operator** from **Users** and by **Users** from **Transmission Owner** and **System Operator.**

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 **Transmission Owner** or **System Operator** under the **Electricity Transmission Code**; and

ii) List all data to be provided by **Transmission Owner** or **System Operator** 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 to SO

The data must be submitted to the **System Operator 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 **System Operator** or utilising a data transfer media, such as floppy diskette, magnetic tape, CD ROM, memory stick etc. after obtaining the prior written consent from **System Operator**. 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 Methods of submitting data to Transmission Owner

The data must be submitted to the **Transmission Owner Coordination Centre**. 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 **Transmission Owner** or utilising a data transfer media, such as floppy diskette, magnetic tape, CD ROM, memory stick etc. after obtaining the prior written consent from **Transmission Owner**. 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

5.4 Changes to Users data

The **User** must notify **Transmission Owner** of any change to data which is already submitted and registered with **Transmission Owner** in accordance with each section of the **Electricity Transmission Code**.

The **User** must notify **System Operator** of any change to data which is already submitted and registered with **System Operator** in accordance with each section of the **Electricity Transmission Code**.

5.5 Data not supplied

If a **User** fails to supply **Transmission Owner** with data when required by any Chapter of the **Electricity Transmission Code**, **Transmission Owner** will estimate such data if and when, in the view of **Transmission Owner**, it is necessary to do so. **Transmission Owner** 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

If a **User** fails to supply **System Operator** with data when required by any Chapter of the **Electricity Transmission Code**, **System Operator** will estimate such data if and when, in the view of **System Operator**, it is necessary to do so. **System Operator** 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

If **Transmission Owner** 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. **User** will advise **Transmission Owner** in writing of any estimated data it intends to use in the event of data not being supplied

If **System Operator** 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. **User** will advise **System Operator** in writing of any estimated data it intends to use in the event of data not being supplied

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 **Transmission Owner**, **System Operator** or that **User**, as the case may be, deems appropriate.

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6. DATA TO BE REGISTERED

The attached Schedules A to M cover the following data:

6.1 Data supplied by Users to Transmission Owner

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 D NON-SYNCHRONOUS GENERATION SCHEDULE DATA

SCHEDULE F USER SYSTEM DATA. Comprises electrical parameters relating to **Plant** and **Apparatus** connected to **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 K FAULT INFEED DATA. Comprises data related to short circuit contribution to **Transmission System**.

6.2 Data supplied by Users to System Operator

SCHEDULE C SCHEDULING AND DESPATCH DATA. Comprises parameters required for **Scheduling** and **Despatch** of electricity.

SCHEDULE E GENERATION PLANT OUTAGE DATA. Comprises **Generating Unit** and **Power Station** equipment **Outage** planning data.

SCHEDULE J DEMAND CONTROL DATA. Comprises data related **Demand Control**.

6.3 Data supplied by Transmission Owner to Users

SCHEDULE L DATA SUPPLIED TO **USERS** BY **TRANSMISSION OWNER**

6.4 Data Supplied by System Operator to Users

SCHEDULE M DATA SUPPLIED BY **SYSTEM OPERATOR** TO **USERS**

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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	M
1. **GENCOs** with **Generating** and **Desalination Plant**	✓	✓	✓	✓	✓							✓	✓
2. **DISCOs** with **Distribution Systems**										✓		✓	
3. **Non Embedded Customers**												✓	
4. All **Users** connected directly to **Transmission System**						✓					✓		
5. All **Users** connected directly to **Transmission System** other than **GENCOs**								✓					
6. All **Users** connected directly to **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
POWER STATION DEMAND:								
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 **Transmission System**	MW MVAr	DPD						
3. **Demand** at the time of minimum **Transmission System**	MW MVAr	DPD						
UNIT DEMAND:								
Demand supplied through unit transformer when **Generating Unit** is at **Rated MW** output	MW MVAr	DPD						
SYNCHRONOUS GENERATING UNIT PERFORMANCE AND PARAMETERS:								
General								
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	**Generating** and **Desalination Unit** or **Station** Data					
		Category	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 MVAr 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						
Time Constants:								
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						
GENERATING UNIT STEP-UP TRANSFORMER:								
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							
EXCITATION CONTROL SYSTEM PARAMETERS: **(ALL SYNCHRONOUSLY CONNECTED GENERATING UNITS)**:								
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						
GOVERNOR PARAMETERS **(ALL SYNCHRONOUSLY CONNECTED GENERATING UNITS)**:								
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
PRIME MOVER PARAMETERS (STEAM TURBINE UNITS):								
Prime mover system block diagram showing transfer function of individual elements and controllers	Diagram	DPD						
PRIME MOVER PARAMETERS (GAS TURBINE UNITS):								
Prime mover system block diagram showing transfer function of individual elements and controllers	Diagram	DPD						
DESALINATION UNIT PARAMETERS								
Registered Capacity	MIGPD	SPD						
Desalination Unit Auxiliary Power	MW	SPD						
PLANT FLEXIBILITY PERFORMANCE:								
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 **Transmission Owner** and **System Operator** 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 Category	**Generating Unit**, **Desalination Unit CCGT Modules** and **Station** Data						
			U1	U2	U3	U4	U5	U6	Station
STEAM TURBINE **GENERATING UNITS**:									
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							
GAS TURBINE **GENERATING UNITS**									
1. Minimum notice required to synchronise	Minutes	OCA							

Data description	Units	Data Category	**Generating Unit**, **Desalination Unit CCGT Modules** and **Station** Data						
			U1	U2	U3	U4	U5	U6	Station
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	MW/	OCA							

Data description	Units	Data	**Generating Unit**, **Desalination Unit CCGT Modules** and **Station** Data						
		Category	U1	U2	U3	U4	U5	U6	Station
rate	Minute								
6. Minimum interval between de-synchronising and synchronising a CCGT Module	Minutes	OCA							
Note: 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
GENERATING BLOCK/UNIT DECLARATION									
AVAILABILITY NOTICE									
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							
SCHEDULING AND **DESPATCH PARAMETERS**									
1. **Generating Unit** inflexibility									
• Description	Text	SDC							
• Start date	date/time	SDC							
• End date	date/time	SDC							

Data Description	Units	Data	**Generating Unit**, **Desalination Unit** and **Station** Data						
		Category	U1	U2	U3	U4	U5	U6	Station
• **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
NON-SYNCHRONOUS GENERATING UNIT PERFORMANCE AND PARAMETERS:								
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						
DC Convertor at a DC Convertor Station or PV or Wind Farm								
1. DC Convertor 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						
7. Active Power does not fall more than	YES/NO	DPD						

	Data Description	Units	Data Category	**Generating** and **Desalination Unit** or **Station** Data					
				U1	U2	U3	U4	U5	U6
	5% of the Active Power output over the Frequency range 49.5Hz to 47Hz								
8.	Frequency Control speed droop setting	%	DPD						
Non-Synchronously Connected Generating Units									
General									
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						
Non-Synchronously Connected and AC/DC Converter Connected Generating Units									
Voltage / Reactive Power / Power Factor Control System Parameters									
1.	For WTGU details of voltage / Reactive Power / Power Factor controller (and PSS if fitted) described in Block Diagram form showing transfer functions and parameters of	Block diagram	DPD						

Data Description	Units	Data Category	**Generating** and **Desalination Unit** or **Station** Data					
			U1	U2	U3	U4	U5	U6
individual elements								
AC Filter or Reactive Compensation Equipment	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						
Non-Synchronously Connected and AC/DC Converter Connected Generating Units								
Frequency Control								
1 For WTGU details of frequency controller described in Block Diagram form showing transfer functions and parameters of individual elements		DPD						
Non-Synchronously Connected and AC/DC Converter Connected Generating Units								
Protection								
Details of settings for the following protection relays are required;								
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						
GENERATING UNIT STEP-UP TRANSFORMER:								
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							
TRANSMISSION ENTRY POINT STEP-UP TRANSFORMER:								
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							
Non-Synchronously Connected and AC/DC Converter Connected Generating Units								
Harmonic and Flicker Parameters								
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 **Transmission Owner** and **System Operator** 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
PROVISIONAL OUTAGE PROGRAMME				
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
System Operator 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
FINAL OUTAGE PROGRAMME				
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
System Operator 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
System Operator issue **Final Outage Programme** to **Users**	Text	Year 1 to 2	End of Sept	OCA
SHORT TERM PLANNED MAINTENANCE OUTAGE				
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
SINGLE LINE DIAGRAM (when requested by Transmission Owner):		
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**	Drawing	SPD DPD
REACTIVE COMPENSATION EQUIPMENT:		
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:		
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
SWITCHGEAR:		
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**:		
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
• Three phase	kA	SPD
USER HV CONNECTING SYSTEM DATA:		
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**:		
Circuit Parameters (for all circuits), when requested by **Transmission Owner**:		
1. Rated voltage	kV	SPD
2. Operating voltage	kV	SPD
3. Positive phase sequence:		
• resistance	% on 100	SPD
• reactance	% on 100	SPD
• susceptance	% on 100	SPD
4. Zero phase sequence:		
• resistance	% on 100	SPD
• reactance	% on 100	SPD
• susceptance	% on 100	SPD
INTERCONNECTING TRANSFORMERS:		
For transformers between the **Transmission System** and the **User System**, the following data is required		
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		
• @ 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		

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 **Transmission Owner** 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
TRANSIENT OVER-VOLTAGE ASSESSMENT DATA When requested by **Transmission Owner**, 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					
		FY 0	FY1	FY 2	FY 3	FY 4	FY 5
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** (summated over all **Transmission Supply Points** for **DISCO** and at the **Connection Point** for **Non Embedded Customers**)	1. Day of **User** maximum **Demand (MW)** at **Annual MD Conditions** 2. Day of peak **Transmission System (MW)** at **Annual MD Conditions** 3. Day of minimum **Transmission System (MW)** at **Average Conditions** *(delete as appropriate)*						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 **Transmission Owner 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 **System Operator.**

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 **Transmission System** peak hour **Demand** at **Annual MD Conditions**	MW pf							Week 48	SPD OCA
3. **User Demand** at minimum hour **Transmission System Demand** at **Average Conditions**	MW pf							Week 48	SPD OCA
DEMAND TRANSFER CAPABILITY									
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 MVAr								
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 **Transmission Owner 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 **System Operator.**
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 **System Operator** 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 THE **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 TO **USERS** BY THE **Transmission Owner**

Transmission Owner will provide **Users** and potential **Users** the following data related to the **Transmission System**.

Data Description	Data Category
Operation Diagram **Transmission Owner** 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	OCB
NETWORK DATA:	
1. **Transmission System** date including • 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	PC
2. Following **Network Data** as an equivalent 400kV, 220kV and 132kV source at the HV point of connection to the **User System**	
• Symmetrical three-phase short circuit current infeed at the instant of fault from the **Transmission System(I1")**	PC
• Symmetrical three-phase short circuit current from the **Transmission System** after the sub-transient fault current contribution has substantially decayed (I1')	PC
• Zero sequence source resistance and reactance values at the **Point of Connection**, consistent with the maximum infeed below	PC
• Pre-fault voltage magnitude at which the maximum fault currents were calculated	PC
• Positive sequence X/R ratio at the instant of fault	PC
• Appropriate interconnection transformer data	PC
Names of **Safety Co-ordinators,** which will be updated in writing whenever there is change to the identity of its **Safety Coordinators**	OCB

Abbreviations:

OCA Operating Code 'A',
OCB Operating Code 'B',
PC Planning Code 'PC'

SCHEDULE M - DATA SUPPLIED BY **System Operator** TO **USERS**

System Operator will provide **Users** and potential **Users** the following data related to the **Transmission System**.

Data Description	Data Category
1. The date and time of annual peak of **Transmission System** at **Annual MD Conditions**	OCA
2. The date and time of annual minimum **Transmission System** at **Average Conditions**	OCA
3. **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
4. 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',

SCHEDULE M - DATA SUPPLIED BY **System Operator** TO **USERS**

System Operator will provide **Users** and potential **Users** the following data related to the **Transmission System**.

Data Description	Data Category
Provisional Outage programme showing the **Transmission Components** expected to be withdrawn from service during each week of Years 2 and 3 for **Planned Outages**	OCA
Draft **Final Outage programme** showing the **Transmission Components** 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',

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, **Transmission Owner** and **System Operator)**.

3. UNFORESEEN CIRCUMSTANCES

3.1 If circumstances arise which the provisions of the **Electricity Transmission Code** have not foreseen, **System Operator** shall, to the extent reasonably practicable in the circumstances, consult promptly and in good faith **Transmission Owner** and all affected **Users** in an effort to reach agreement as to what should be done. If agreement between **System Operator** and **Transmission Owner** and those **Users** as to what should be done cannot be reached in the time available, **System Operator** shall determine what is to be done. Wherever **System Operator** makes a determination, it shall do so having regard, wherever possible, to the views expressed by **Transmission Owner** and **Users** and, in any event, to what is reasonable in all the circumstances. Each **User** shall comply with all instructions given to it by **System Operator** 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**. **System Operator** shall promptly refer all such unforeseen circumstances and any such determination to the Panel for consideration in accordance with 4.2 v).

3.2 **Transmission Owner** shall use reasonable endeavours and work in good faith to support **System Operator** as required in carrying out its duties under this Section 3.

4. THE ELECTRICITY TRANSMISSION CODE REVIEW PANEL

4.1 **System Operator** 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, Transmission Owner** or any **User** may wish to submit to **System Operator** for consideration by the **Panel** from time to time;

iii) publish recommendations as to amendments to the **Electricity Transmission Code** that **System Operator** 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 **System Operator** under 3.

4.3 The **Panel** shall consist of:

i) a Chairman and up to 5 members appointed by System Operator

ii) up to 4 persons from **Transmission Owner;**

iii) a person appointed by the **Bureau**;

iv) a person appointed by the **Procurer**;

v) 6 persons representing the **GENCOs**;

vi) 2 persons representing the **DISCOs** and

vii) A person representing the **Non-Embedded Customers**.
each of whom shall be appointed according to the rules issued pursuant to 4.4.

viii) 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 **System Operator** 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 WITH SYSTEM OPERATOR AND USERS

6.1 Unless otherwise specified in the **Electricity Transmission Code**, all instructions given by **System Operator** and communications (other than relating to the submission of data and notices) between **System Operator** and **Users** (other than **GENCOs**) shall take place between the **System Operator** control engineer based at the **System Operator Control Centre** notified by **System Operator** 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 **System Operator** prior to connection.

6.2 Unless otherwise specified in the **Electricity Transmission Code** all instructions given by **System Operator** and communications (other than relating to the submission of data and notices) between **System Operator** and **GENCOs** shall take place between the **System Operator** control engineer based at the **System Operator Control Centre** notified by **System Operator** 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 **System Operator** and communications (other than relating to the submission of data and notices) between **System Operator** and **Self-Supply Users** shall take place between the **System Operator** control engineer based at the **System Operator Control Centre** notified by **System Operator** 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 **System Operator** and communications (other than relating to the submission of data and notices) between **System Operator** and **Users** will be given by means of the **Control Telephony** referred to in the **Connection Conditions**.

6.5 If the **System Operator Control Centre** notified by **System Operator** to each **User** prior to connection, or the **User Control Centre**, notified in the case of a **DISCO** to **System Operator** prior to connection, is moved to another location, whether due to an emergency or for any other reason, **System Operator** shall notify the relevant **User** or the **User** shall notify **System Operator** 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 **System Operator** and **Users** as evidence of those instructions or communications.

7. COMMUNICATION WITH TRANSMISSION OWNER AND USERS

7.1 Unless otherwise specified in the **Electricity Transmission Code**, all communications (other than relating to the submission of data and notices) between **Transmission Owner** and **Users** (other than **GENCOs**) shall take place between the **Transmission Owner Coordination Centre** notified by **Transmission Owner** 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 **Transmission Owner** prior to connection.

7.2 Unless otherwise specified in the **Electricity Transmission Code** all instructions given

by **Transmission Owner** and communications (other than relating to the submission of data and notices) between **Transmission Owner** and **GENCOs** shall take place between the **Transmission Owner Coordination Centre** notified by **Transmission Owner** to each **GENCO** prior to connection and the **GENCO Power Station**, as specified in each relevant section of the **Electricity Transmission Code**.

7.3 Unless otherwise specified in the **Electricity Transmission Code** all instructions given by **Transmission Owner** and communications (other than relating to the submission of data and notices) between **Transmission Owner** and **Self-Supply Users** shall take place between the **Transmission Owner Coordination Centre** notified by **Transmission Owner** 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**.

7.4 If the **Transmission Owner Coordination Centre** notified by **Transmission Owner**to each **User** prior to connection, or the **User Control Centre**, notified in the case of a **DISCO** to **Transmission Owner** prior to connection, is moved to another location, whether due to an emergency or for any other reason, **Transmission Owner** shall notify the relevant **User** or the **User** shall notify **Transmission Owner** of the new location and any changes to the **Control Telephony** necessitated by such move, as soon as practicable following the move.

8. MISCELLANEOUS

8.1 Data and notices to be submitted to **Transmission Owner**, **System Operator** 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 **Transmission Owner**, **System Operator** or the **Users**.

8.2 Data delivered pursuant to this Section 8, in the case of data being submitted to **System Operator**, shall be addressed to **System Operator National Control** at the address notified by **System Operator** to each **User** prior to connection, or to such other Department within **System Operator** or address, as **System Operator** 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 **System Operator** from time to time) at its address(es) notified by each **User** to **System Operator** 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).

8.3 Data delivered pursuant to this Section 7, in the case of data being submitted to **Transmission Owner**, shall be addressed to **Transmission Owner Coordination Centre** at the address notified by **Transmission Owner** to each **User** prior to connection, or to such other Department within **Transmission Owner** or address, as **Transmission Owner** 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 **Transmission Owner** from time to time) at its address(es) notified by each **User** to

Transmission Owner 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).

8.4 All data items, where applicable, will be referenced to nominal voltage and **Frequency** unless otherwise stated.

9. 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.

10. SYSTEM CONTROL

Where a **User** System (or part thereof) is, by agreement, under the control of **System Operator**, then for the purposes of communication and co-ordination in operational timescales **System Operator** can (for those purposes only) treat that **User System** (or part thereof) as part of the **Transmission System**, but, as between **System Operator**, **Transmission Owner** and **Users**, it shall remain to be treated as the **User System** (or part thereof).

11. COMPLIANCE WITH REVISIONS

11.1 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, Transmission Owner** and **System Operator)** 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.

11.2 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**.

11.3 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.

Chapter 9 - Transmission Owner and System Operator Code

1. INTRODUCTION

1.1 This Chapter covers arrangements between **Transmission Owner** and **System Operator** that are required for the safe, secure and efficient operation of the Transmission System, and which are not covered elsewhere in the Electricity Transmission Code

1.2 This chapter applies to the **Transmission Owner** and **System Operator**.

1.3 References to **Users** in this Chapter include:

(i) **GENCOs**;

(ii) **DISCOs**;

(iii) **Non-Embedded Customers**;

(iv) Self-Supply Users

(v) **External System Operators**; and

(vi) User Systems

2. MUTUAL OBLIGATIONS

2.1 Support licence obligations

2.1.1 Each of **Transmission Owner** and **System Operator** agrees and commits that, save where required by its own licence, safety or law, it will not act in a way to prevent the delivery of the other party's licence obligations.

2.1.2 Where the **Transmission Owner** or **System Operator** (the "Requestor") requires things from the other (the "Provider") to support the delivery of the Requestor's Licence:

2.1.3 Where the **Transmission Owner** or **System Operator** (the "Requestor") requires things from the other (the "Provider") to support the delivery of the Requestor's Licence:

(i) The Requestor will make the Provider aware of things it requires;

(ii) the **Transmission Owner** and **System Operator** will work together in good faith to agree the provision of the required things;

(iii) Where the things required from the Provider fall outside its licence, it shall be entitled to compensation to cover the legitimate additional costs of providing that support;

(iv) Any dispute between **Transmission Owner** and **System Operator** on the matters in this paragraph 2.1.3 that they are unable to resolve between

themselves shall be referred to the DoE whose decision shall be final and binding.

2.2 Cooperation on outages on the Transmission System

2.2.1 **System Operator** in relation to an **Outage** on the **Transmission System** contained in an **Outage Programme** is due to occur,

(i) **System Operator** shall prepare a **Manoeuvring Sheet** for such Outage accordance to **System Safety Rules**. This **Manoeuvring Sheet** shall be provided to Transmission Owner for information.

(ii) **System Operator** and **Transmission Owner** shall each comply with and undertake such actions as are required of them under and in accordance with **System Safety Rules**.

(iii) Where either **Transmission Owner** or **System Operator** becomes aware of any matter which may affect its ability to meet its obligations under **System Safety Rules** , it shall promptly notify the other Party and both shall agree a the changes necessary for the Outage to progress consistent with the **Transmission Owner** and **System Operator License Conditions** and the **System Safety Rules.**

2.2.2 In respect of any **Outage** of **Transmission Owner Plant** or **Apparatus**

(i) **System Operator** may at any time direct that **Transmission Owner** discontinue an **Outage** within the relevant **Emergency Return to Service Time**, whether or not expiry of the planned period of the Outage is otherwise imminent, by so notifying the relevant **Transmission Owner**, provided that:

(ii) **System Operator** shall consult with such **Transmission Owner** before issuing any such direction; and

(iii) **Transmission Owner** shall, if **System Operator** so requests, take the steps proposed in relation to such Outage pursuant to subparagraph 3.7.7 (or as otherwise agreed with **System Operator)** to restore the provision of Transmission Services.

2.2.3 A direction notified pursuant to paragraph 2.2.1 to 2.2.2 may be notified verbally where it is necessary and expedient to do so, provided that **System Operator** confirms such direction in writing as soon as reasonably practicable.

2.2.4 Where having worked together in good faith the **Transmission Owner** and **System Operator** fail to agree on any of the matters set out in paragraph 2.2.1 to 2.2.2:

(i) **Transmission Owner** will still comply with the directions of **System Operator** unless doing so would endanger the safety of people or plant; and

(ii) either **Transmission Owner** or **System Operator** will be able to raise the matter to the DoE as a dispute. The DoE decision on the matter will then be final and binding.

2.3 Response to Alarms

2.3.1 Where **Alarms** arise on the T**ransmission System Transmission Owner** and **System**

Operator will work together to understand and manage the impact of **Alarms** on the **Transmission System**. The type and level of response varies with the type of **Alarm**, with **Alarms** being classified as follows:

(i) **Priority 1 Alarm** means a breach of a limit on **Transmission Owner's** Plant and Apparatus created following an **Event** on the **Transmission System;**

(ii) **Priority 2 Alarm** means an asset integrity alarm on the **Transmission Owner's Plant** and **Apparatus,** including:

(a) Protection system fault or unavailability of protection;

(b) Faulty Equipment activating the relevant protection;

(c) Protection trip indication and showing what type of protection operated;

(d) Circuit Breaker trip indication;

(e) Low oil or Gas pressure alarms;

(f) Transformer oil or winding temperature alarm or trip;

(g) Communication or BCU fault alarms;

(h) Fire or HVAC system fault; and

(iii) **Priority 3 Alarm** means any alarm that is available to the Transmission Owner and is not a **Priority 1 Alarm** or a **Priority 2 Alarm**.

2.3.2 For each **Priority 2 Alarm, Transmission Owner** shall do each of the following as instructed by **System Operator** or as soon as reasonably practicable following the time of that **Alarm**:

(i) carry our initial appraisal to establish the impact that the **Event** that gave rise to the **Alarm** has, or may have, on any **Plant** and **Apparatus** that forms part of the **Transmission System**;

(ii) where necessary site attendance shall be carried out to seem to determine the cause of the **Alarm;**

(iii) conduct further investigations as required;

(iv) contact **System Operator** to confirm the **Alarm** and discuss the proposed course of action;

(v) provide **System Operator** with appropriate operational information. Where relevant, this shall include:

(a) any revisions to Transmission Capability Information;

(b) the location of any **Even**t associated with the **Alarm**;

(c) the estimated time for **Transmission Owner** to attend the appropriate

site; and

(d) confirm **Transmission Owner's** assessment of the risk of further service reduction; and

(vi) Provide a proposal for the return to service of affected **Plant** and **Apparatus**.

2.3.3 For each **Prioirity 2 Alarm, Transmission Owner** and **System Operator** shall do each of the following as soon as reasonably practicable following the time it becomes aware of that **Alarm**:

(i) Assess the impact of the **Alarm** and associated **Event** on the **Transmission System** and **User** Systems;

(ii) Raise and manage the **Event** as an **Incident** in line with the requirements of Operating Code "B"

2.3.4 For each **Priority 2 Alarm Transmission Owner** shall continue to monitor and assess the situation and provide **System Operator** with information and progress updates on each such **Alarm**.

2.3.5 For each **Priority 3 Alarm, Transmission Owner** shall notify **System Operator** if:

(i) there are, or **Transmission Owner** has any doubt as to whether there are, any operational implications to the Transmission System; or

(ii) the alarm condition develops (or may develop) such that there is a risk of reduced Transmission Network Capability, and hence future changes to **Transmission Capability Information.**

2.4 Cooperation required for preparation of Transmission Owner Seven Year Statement

2.4.1 **Transmission Owner** and **System Operator** shall work together in good faith to agree the cost of constraints to the extent required for development of the **Transmission Owner Seven Year Statement**

3. SYSTEM OPERATOR OBLIGATIONS

3.1 Operate Network Within Constraints

3.1.1 In co-ordinating and directing the flow of electricity onto and over the **Transmission System, System Operator** shall:

(i) take all reasonably practicable steps to determine, and shall ensure, that it does so in accordance with **System Operator** Licence Standards; and

(ii) in complying with Licence Standards, ensure that neither of the following are exceeded or would be exceeded on the occurrence of a **Secured Event**:

(a) Constraints and or limitations that are apparent or arise from analysis of **Transmission Capability Information** in accordance with good industry practice; nor

(b) such technical limits or other conditions as **System Operator** becomes aware are necessary and safe in accordance with Good Industry Practice.

3.1.2 **System Operator** shall not be in breach of paragraph 3.1.1 where an Unsecured Event causes or would cause constraints arising from Transmission Capability Information or other relevant limits to be exceeded.

3.2 Provide Access to SCADA data

3.2.1 **System Operator** will ensure that **Transmission Owner** has timely access to all real time data received by its Supervisory Control and Data Acquisition System (SCADA).

3.3 Provide Access to Non-SCADA Data

3.3.1 **System Operator** shall provide **Transmission Owner**

(i) Settlement metering data on a monthly basis

(ii) Network operational models reflecting the actual demand-generation background and network configuration realized in that particular operational year for typical days of **Transmission System Maximum Demand** and **Transmission System Minimum Demand**. This should include:

(a) steady state models; and

(b) dynamic models

(iii) Any other additional information or data as referred in the Commercial Engagement Agreement (CEA) - Data Transfer Catalogue between the System Operator and Transmission Owner

4. TRANSMISSION OWNER OBLIGATIONS

4.1 Provide Transmission Capability Information

4.1.1 The **Transmission Owner** shall provide all **Transmission Capability Information** (including **Network Data**) being that required for **System Operator** to plan and operate the **Transmission System**. This includes allowing **System Operator** to reproduce the constraints in its own planning software and to determine if there are any constraints identified whilst scheduling and despatching the system. Where the **Transmission Owner** and **System Operator** are using different planning software the format of the data for the **Transmission Capability Information** shall be mutually agreed.

4.1.2 The **Transmission Capability Information** provided shall enable **System Operator** to use their Energy Management System tools

4.1.3 The information provided in the **Transmission Capability Information** shall at least have the following:

(i) Name/identity of the plant or apparatus (The Name/Transmission Component id)

(ii) Equipment ratings for all equipment including admissible transitory overload limits, including:

(a) Short circuit thresholds of switchgear

(b) Through fault requirements of transformers

(c) Controller and model parameters for each power plant and flexible alternating current transmission system devices.

(iii) Protection schemes and settings

(iv) Sufficiently accurate static and dynamic model of each element of the system as used by **Transmission Owner** for planning. **Transmission Owner** should keep **System Operator** informed as to when assets so modelled become (or cease to be) part of the Transmission system.

(v) The definition of zones and areas that relate to zonal and area constraints

4.1.4 The **Transmission Capability Information** provided by **Transmission Owner** shall include a list of all known inter zonal and inter area constraints including but not limited to maximum/minimum power transfer from power stations, maximum/minimum transfer limit between zones within the **Transmission System**.,. The data provided should cover typical days of **Transmission System Maximum Demand** and **Transmission System Minimum Demand** for the next following calendar year

4.1.5 For each of the constraints covered in 4.1.4 the **Transmission Owner** shall provide the reason and conditions for the constraint with this information forming part of the **Transmission Capability Information**.

4.1.6 The **Transmission Owner** shall annually provide **System Operator** network planning models (e.g. power system modelling tool data sets-steady state and dynamic models) and **Transmission Owner's Seven Year Statement**. The data provided should at least cover typical summer and winter regimes for the next following calendar year.

4.1.7 The **Transmission Owner** shall, as soon as practically possible, provide the **System Operator** updated **Transmission Capability Information** (and any associated models) for any assets that have changed and when new assets that are added to the network. The **System Operator** shall incorporate such data into their existing operational planning data (and models) as soon as is practically possible.

4.1.8 **System Operator** shall immediately notify **Transmission Owner** of any additional constraints to those provided by **Transmission Owner**.

4.1.9 **System Operator** shall immediately notify the **Transmission Owner** of any errors or inaccuracies in the **Transmission Capability Information** provided. The **System Operator** shall provide the **Transmission Owner** with the current operational planning models. The **Transmission Owner**, with assistance from the **System Operator**, shall correct and verify the grid model/s and provide the **System Operator** with the updated **Transmission Capability Information**.

4.2 Provide other information as agreed.

4.2.1 The **Transmission Owner** shall provide to the **System Operator** and the **System Operator** to the **Transmission Owner** any other additional information or data as referred in the Transfer Report Data Transfer Catalogue between the **System Operator** and **Transmission Owner**

4.3 Allow control of network

4.3.1 **System Operator** may configure the **Transmission System** and parts of the **Transmission System** through automatic switching of or through instructing **Transmission Owner** to otherwise adjust the configuration through manual switching.

4.4 Provision of Telecoms

4.4.1 **Transmission Owner** shall at all times use reasonable endeavours to maintain the **Telecoms Network** necessary to communicate data that is required by the **System Operator's** Supervisory Control and Data Acquisition (SCADA) and / or to communicate data from the sensors and devices and devices required in 4.5.1 and 4.5.2

4.4.2 Where the **Telecoms Network** requires maintenance, which will lead to unavailability of part of that network:

(i) **Transmission Owner** will provide **System Operator** with at least 6 weeks' notice of the planned unavailability, including detail of

(a) why this unavailability is necessary and cannot be reasonably avoided;

(b) which sensors and devices will not have their normal communications path to **System Operator**; and

(c) plans or options to mitigate the telecoms unavailability;

(ii) **Transmission Owner** and **System Operator** will work in good faith to agree a plan to manage the proposed telecoms unavailability consistent with the Licence, statutory and Safety obligations of each.

4.4.3 If **Transmission Owner** is aware that all or part of the **Telecoms Network** becomes unavailable, it will:

(i) inform the **System Operator** as soon as reasonably practicable following it becoming aware of that unavailability;

(ii) use reasonable endeavours to secure the restoration of the part or parts of the **Telecoms Network**; and

(iii) keep the **System Operator** informed of the expected time at which the part or parts of the **Telecoms Network** will be restored, and any changes to that expected time.

4.5 Provision of sensors and devices

4.5.1 **Transmission Owner** shall at all times

(i) provide signals from the sensors and devices necessary to provide real time data as required by **System Operator** for apparatus of the **Transmission System**. The signals required by the **System Operator** shall be consistent with that detailed in the Transfer Report Data Transfer Catalogue and includes the Tele-Information Plan.

(ii) maintain the sensors and devices necessary to provide real time data as required

by **System Operator** for apparatus of the **Transmission System**; and

(iii) ensure that **Transmission Owner** or **Users** maintain the sensors and devices necessary for apparatus of the **Transmission System** at the **User Site** and **Connection Point**

4.5.2 The sensors required by the **System Operator** under 4.5.1 and the required level of availability of those sensors shall be agreed between **System Operator** and **Transmission Owner** in accordance with a procedure agreed between them.

4.5.3 The **Transmission Owner** ensure that all sensors and devices required under 4.5.1 are connected to the **Telecoms Network** and configured in a way that is consistent with communication to the **System Operator** as agreed between the **Transmission Owner** and **System Operator** from time to time.

4.5.4 The **Transmission Owner** can assign all or part of the requirements set out in 4.5.1 to 4.5.3 to a third party, including to **Users** through their **Connection Agreement**