

DRAFT GUJARAT ELECTRICITY GRID CODE, 2013

GUJARAT ELECTRICITY REGULATORY COMMISSION

PREAMBLE

The Gujarat Electricity Grid Code (GEGC) is a regulation made by the Gujarat Electricity Regulatory Commission in exercise of powers conferred under Section 86(h) of the Electricity Act, 2003 (Act 36 of 2003) and under Section 42 (b) of the Gujarat Electricity Industry (Reorganisation and Regulation) Act, 2003 (Gujarat Act 24 of 2003) and all powers enabling it in that behalf. The GEGC also lays down the rules, guidelines and standards to be followed by various persons and participants in the system to plan, develop, maintain and operate the power system, in the most secure, reliable, economic and efficient manner, while facilitating healthy competition in the generation and supply of electricity.

NOTIFICATION

In exercise of the powers conferred under Section 86(h) of the Electricity Act, 2003 (Act 36 of 2003) and under Section 42 (b) of the Gujarat Electricity Industry (Reorganisation and Regulation) Act, 2003 (Gujarat Act 24 of 2003), and all powers enabling it in that behalf, the Gujarat Electricity Regulatory Commission hereby compiles this 'GUJARAT ELECTRICITY GRID CODE-2013' hereafter called the Grid Code. This Grid Code is applicable for the Gujarat power grid only. For inter-state transmission, the Indian Electricity Grid Code shall be applicable.

Short title, extent and commencement

- (1) These regulations may be called the Gujarat Electricity Regulatory Commission (Gujarat Electricity Grid Code) Regulations, 2013;
- (2) These regulations shall come into force from date of their publication in the official gazette;
- (3) These regulations shall supersede the Gujarat Electricity Grid Code, 2004, which came into effect from 25-8-2004;

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ABBREVIATIONS

A	
A	Ampere
AAAC	All Aluminium Alloy Conductor
ABCB	Air Brake Circuit Breaker
ABT	Availability Based Tariff
AC	Alternating Current
ACSR	Aluminium Conductor Steel Reinforced
ALDC	Area Load Despatch Centre
APM	Administered Pricing Mechanism
ATC	Available Transfer Capability
AVR	Automatic Voltage Regulator
B	
BIS	Bureau of Indian Standards
C	
CBIP	Central Board of Irrigation and Power
CCGT	Combined Cycle Gas Turbine
CEA	Central Electricity Authority
CERC	Central Electricity Regulatory Commission
CGP	Central Generation Plant
CPP	Captive Power Plant
CT	Current Transformer
CTU	Central Transmission Utility
CVT	Capacitive Voltage Transformer
D	
D/C	Double Circuit
DGVCL	Dakshin Gujarat Vij Company Limited
DISCOMs	Distribution Companies
DSM	Demand Side Management
E	
EFR	Earth Fault Relay
EHT	Extra High Tension
EHV	Extra High Voltage equal to and greater than 66 kV
EMPT	Electro Magnetic Potential Transformer
F	
FACTS	Flexible AC Transmission System
G	
GEDA	Gujarat Energy Development Agency is the nodal agency for development of renewable energy sources in Gujarat
GEGC	Gujarat Electricity Grid Code

GERC	Gujarat Electricity Regulatory Commission
GETCO	Gujarat Energy Transmission Corporation Limited
GoG	Government of Gujarat
GPS	Geographical Positioning System
GSECL	Gujarat State Electricity Corporation Limited
H	
HV	High Voltage
HVDC	High Voltage Direct Current
I	
ICT	Inter Connecting Transformer
ID	Induced Draft
IDMT	Inverse Definite Minimum Time
IEC	International Electro-Technical Commission
IEC Standard	Standard approved by International Electro-technical Commission
IEEE	Institution of Electrical and Electronic Engineers Inc. USA
IEGC	Indian Electricity Grid Code
IPP	Independent Power Producer
IS	Indian Standards
ISGS	Inter State Generating Station
ISTS	Inter State Transmission System
K	
KHPS	Kadana Hydro Power Station
kV	Kilo Volt
kVA	Kilo Volt Ampere
kVAh	Kilo Volt Ampere Hour
kVAr	Kilo Volt Ampere Reactive
kVArh	Kilo Volt Ampere Reactive Hour
kWh	Kilo Watt Hour
L	
LBB	Local Breaker Backup
LCP	Line Clear Permit
LCR	Line Clear Requisition
LTOA	Long-Term Open Access
M	
MCR	Maximum Continuous Rating
MGVCL	Madhya Gujarat Vij Company Limited
MNRE	Ministry of New and Renewable Energy Sources
MOCB	Minimum Oil Circuit Breaker
MPP	Mega Power Project
MU	Million Unit
MVA	Mega Volt Ampere

MVAh	Mega Volt Ampere Hour
MVAr	Mega Volt Ampere Reactive
MVArh	Mega Volt Ampere Reactive Hour
MW	Mega Watt
MWH	Mega Watt Hour
N	
NLDC	National Load Despatch Centre
NPCL	Nuclear Power Corporation Limited
NPC	Nuclear Power Corporation
NTPC	National Thermal Power Corporation
O	
OA	Open Access
OCC	Operation Coordination Sub-Committee
OCR	Over Current Relay
P	
PD	Planning Date
PDC	Phasor Data Concentrator
PGCIL	Power Grid Corporation of India Limited
PGVCL	Paschim Gujarat Vij Company Limited
PLCC	Power Line Carrier Communication
PLF	Plant Load Factor
PMU	Phasor Measurement Unit
PPA	Power Purchase Agreement
PT	Potential Transformer
PTCC	Power and Telecommunication Co-ordination
R	
REA	Regional Energy Account
RLDC	Regional Load Despatch Centre
RLNG	Re-liquefied Natural Gas
RPC	Regional Power Committee
RRF	Renewable Regulatory Fund
S	
S/C	Single Circuit
SCADA	Supervisory Control and Data Acquisition
SEA	State Energy Account
SF6	Sulphur Hexa Fluoride
SGS	State Generating Station
SOCC	State Operation Coordination Committee
SSP	Sardar Sarovar Project
STOA	Short-Term Open Access

STU	State Transmission Utility
SVC	Static VAr Compensator
T	
TCC	Technical Coordination Committee
TPL-A	Torrent Power Limited-Ahmedabad
TPL-S	Torrent Power Limited-Surat
TRM	Transmission Reliability Margin
TTC	Total Transfer Capability
U	
UGVCL	Uttar Gujarat Viji Company Limited
UHPS	Ukai Hydro Power Station
UI	Unscheduled Interchange
UMPP	Ultra Mega Power Project
V	
VT	Voltage Transformer
W	
WAMS	Wide Area Measurement System
WRLDC	Western Regional Load Despatch Centre

1. Introduction

Overview

1.1 The Gujarat Government, in exercise of powers conferred by sub-section (1) of section (39) of the Electricity Act, 2003 notified the Gujarat Energy Transmission Corporation Ltd. as the State Transmission Utility (STU) with effect from 1st June 2004 as per GoG Notification No. GHU-2004-31-GEB-1104-2946-K dated 29th May 2004. Accordingly, Gujarat Energy Transmission Corporation Limited (GETCO) undertakes transmission activities and business as STU. As per Section 39(2) of the Electricity Act, 2003, following are the functions of the State Transmission Utility:

- (a) To undertake transmission of energy through the intra-state transmission system
- (b) To discharge all functions of planning and coordination relating to intra-state transmission system with
 - (i) Central Transmission Utility
 - (ii) State Governments
 - (iii) Generating Companies
 - (iv) Regional Power Committee
 - (v) Authority
 - (vi) Licensees
 - (vii) Any other person notified by the State Government in this behalf.
- (c) To ensure development of an efficient, coordinated and economical system of intra-state transmission lines for smooth flow of electricity from a generating station to load centres;
- (d) To provide non-discriminatory open access to its transmission system for use by-
 - (i) any licensee or generating company on payment of the transmission charges;Or
 - (ii) any consumer as and when such open access is provided by the State Commission under sub-section (2) of section 42, on payment of the transmission charges and a surcharge thereon, as may be specified by the State Commission.

1.2 As per Section 31 (2) of the Electricity Act, 2003, the State Load Despatch Centre shall be operated by a government company/ any authority or corporation established or constituted by or under any State Act, as may be notified by the State Government. Until a government company or any authority or corporation is notified by the State government, the State Transmission Utility shall operate the State Load Despatch Centre. As per Section 32 (2) of the Electricity Act, 2003, the following are the functions of State Load Despatch Centre, which shall:

- (a) Be responsible for optimum scheduling and despatch of electricity within a state, in accordance with the contracts entered into with the licensees or the generating companies operating in that state;
- (b) Monitor the grid operations;
- (c) Keep accounts of the quantity of electricity transmitted through the state grid;
- (d) Exercise supervision and control over the intra-state transmission system;

- (e) be responsible for carrying out real time operations for grid control and despatch of electricity within the state through secure and economic operation of the state grid in accordance with the grid standards and the state Grid Code.
 - (f) Further, the SLDC and licensees shall comply and ensure compliances of directions the Regional Load Despatch Centre may give from time to time in connection with the integrated grid operation of the power system or otherwise in regard to matter which affect the operation of the Inter State Transmission System.
 - (g) The hydro electric generating stations of GSECL (KHPS and UHPS) shall be treated in a very special manner for scheduling and despatch (as these plants are operated in coordination with the irrigational requirements).
- 1.3 In order to perform the above task as well as the requirements as stipulated in Clause 86(h) of the Electricity Act, 2003 and Clause 42 (b) of Gujarat Act No. 24 of 2003; viz. Gujarat Electricity Industry (Reorganization and Regulation) Act 2003, the Gujarat Electricity Regulatory Commission has formulated the GUJARAT ELECTRICITY GRID CODE; hereafter called the Grid Code. This Grid Code is applicable for the Gujarat power grid only and for the inter-state transmission, Indian Electricity Grid Code shall be applicable.
- 1.4 Scope of Grid Code: The Grid Code is designed to facilitate the development, operation and maintenance of an efficient, coordinated and economical Gujarat power grid by specifying to STU/ transmission licensees and all the users connected to that system for their technical and procedural obligations. It seeks to be non-discriminatory and ensure that interfaces are not areas of weakness in the supply chain.

1.5 Structure of the Grid Code

The structure of the Grid Code is as follows:

1. **Introduction:** This section outlines the broad features of the Grid Code.
2. **Definitions:** The various terms used in the Grid Code are defined under this section.
3. **Management of Grid Code and role of various organizations:** The Grid Code is a live document and has to be periodically reviewed by a competent panel, as and when required, in the light of experience gained. This section formulates the procedures for the same.
4. **System planning code:** This section specifies the technical and design criteria and the procedures to be applied by the State Transmission Utility and other users for planning and development of the power system.
5. **Connectivity Conditions:** This section specifies the technical criteria and standards to be complied with by STU, transmission licensees, the generating companies, distribution licensees and other users connected or seeking connection to the transmission system.

6. System Operation Code

- 6.1 **Operation Planning and Security:** This section specifies the process by which STU has to carry out the planning of intra-state transmission system, including interface coordination with the users, for a satisfactory grid operation and system integrity.
- 6.2 **System Operation, Metering and Protection Code:** This section specifies the procedure to be adopted for the scheduling of despatch of the generating units to meet the demand and drawal allocations. This section also covers the management of frequency and voltages in the transmission system, the minimum requirement of protection levels and metering specifications for various components of the system.
- 6.3 **Monitoring of generation and drawal:** This section formulates the procedure to be followed by the State Load Despatch Centre for monitoring the generation output, active and reactive reserve capacity required for evaluation of the performance of generating stations. The monitoring of scheduled drawal is important to ensure that SLDC contributes towards improving the regional performance, by observing grid discipline.
- 6.4 **Contingency Planning:** This section formulates the recovery and normalisation of the power supply process to be followed by all in the event of the failure of Gujarat power grid, or the western grid, resulting in total or partial collapse of the system, causing blackouts.

7. Safety

- 7.1 **Cross Boundary Safety:** This section specifies the requirements for safe working practices for maintenance of equipment associated with cross-boundary operations and also the procedure to be followed when the work is carried out on electrical equipment connected to another user's system.
- 7.2 **Safety and Line Clear Permits:** This section sets out the procedure for recording of Line Clear Permits and guidelines for ensuring safety from electrical hazards to the consumers, general public and working personnel.
8. **Communication and Data Acquisition:** This section specifies the minimum requirements of communication and data acquisition facilities to be provided by each user at connection points/ interface points and cross-boundary circuits.
9. **Operational Event and Incident/Accident Reporting:** This section specifies the details of minimum requirement for the exchange of information relating to operations and/or events in the total system, including the Western Grid, which may have an operational effect.

10. **Data Registration:** This section specifies a list of all the data required by STU/ Transmission Licensee which is to be provided by the users and the data required by the users to be provided by the STU/ Transmission Licensee at the required time specified in the various sections of the Grid Code.
11. **Schedule and Despatch Code:** This section deals with the procedure to be adopted for scheduling and despatch of generation of the state generating stations and scheduling for other transactions through long-term access, medium-term and short-term open access; including complementary commercial mechanisms, on a day-ahead and intra-day basis with the process of the flow of information between the ISGS/SGS, National Load Despatch Centre (NLDC), Regional Load Despatch Centre (RLDC), power exchanges and the State Load Despatch Centre (SLDC), and other persons concerned.

Implementation and Operation of the Grid Code:

- 1.6 The State Transmission Utility/ Transmission Licensee shall be responsible for implementation of the Grid Code. All users shall comply with the Grid Code and assist the State Transmission Utility/ Transmission Licensee in this regard. The users must provide all the required information and reasonable rights of access, service and facilities, necessary for implementation of the code.
- 1.7 If any user has any difficulty in complying with any of the provisions of the Grid Code, he shall immediately, without delay, inform the same to the State Transmission Utility as well as the Transmission Licensee concerned, if any, and shall remedy his non-compliance promptly.
- 1.8 Consistent failure in compliance with the Grid Code may lead to disconnection of the user's plant or apparatus. The responsibility for the consequences of disconnection including payment of damages and compensation to consumers rests, with the user who consistently violates the Grid Code.
- 1.9 The operation of the Grid Code shall be reviewed regularly by the Grid Code Review Panel in accordance with the provisions of the relevant section of the code.
- 1.10 Notwithstanding anything contained in these regulations, the Commission may also take *suo-motu* action against any person, in case of non-compliance of any provisions of GEGC.

Limitations of the Grid Code:

- 1.11 The Grid Code contains procedures for the management of day-to-day technical situations in the power grid, taking into account a wide range of operational conditions likely to be encountered under both, normal and abnormal conditions. The Grid Code cannot foresee all the possible operating conditions. Users must therefore understand and accept that the SLDC/ STU/Transmission Licensee, in such unforeseen

circumstances, may be required to act decisively to discharge his obligations, as well as maintain the security of the system. Users shall provide such reasonable cooperation and assistance as the STU/Transmission Licensee may require in such circumstances. The STU/Transmission Licensee / SLDC shall however refer all such cases for ratification in the next meeting of the panel.

Confidentiality

- 1.12 Under the terms of Grid Code, the STU/ Transmission Licensee will receive information from users relating to their intentions in respect of their generation or supply businesses. The STU/ Transmission Licensee shall not, other than as required by the Grid Code, disclose such information to any other person without the prior written consent of such informant, unless required by central/state government departments or any authority.

Procedures to settle disputes

- 1.13 In the event of any dispute regarding interpretation between any user and STU, the matter shall be referred to Gujarat Electricity Regulatory Commission. In the event of any conflict between the parties regarding any provision of the Grid Code, the Gujarat Electricity Regulatory Commission will proceed to settle the issue.

Communication between STU/Transmission Licensee and Users

- 1.14 All communications between STU/ Transmission Licensee and users shall be in accordance with the provision of the Grid Code. Unless otherwise specifically required by the Grid Code, all communication shall be in writing, except where operation time scales require oral communication, in which case, these communications shall be confirmed in writing, as soon as practicable. All the users shall establish and maintain a reliable communication infrastructure and network for this purpose.

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2. Definitions

The following words and expressions in the Grid Code shall, unless the subject matter or context otherwise requires or is inconsistent therewith, bear the following meanings:

- 1) **‘Act’** refers to the Electricity Act, 2003 and Gujarat Electricity Industry (Reorganisation and Regulation) Act, 2003, read together.
- 2) **‘Active Energy’** refers to 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.
- 3) **‘Active Power’** refers to 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.
- 4) **‘Apparatus refers to’** refers to all the electrical apparatus like machines, fittings, accessories and appliances, in which electrical conductors are used.
- 5) **‘Apparent Power’** refers to the product of voltage and alternating current measured in units of volt-amperes and standard multiples thereof; i.e., 1000 VA = 1 kVA; 1000 kVA = 1 MVA.
- 6) **‘ALDC’** refers to the Area Load Management Centre of the Distribution Licensee concerned.
- 7) **‘Area of Supply’** refers to area within which a Distribution Licensee is authorised by his license to supply electricity.
- 8) **‘Automatic Voltage Regulator’ (AVR)** refers to a continuously acting automatic excitation system to control a generating unit terminal voltage.
- 9) **‘Auxiliaries’** refers to all the plant and machinery required for the generating unit's functional operations that do not form part of the generating unit.
- 10) **‘Availability’** refers to the availability in relation to a transmission system for a given period means the time in hours during that period the transmission system is capable of transmitting electricity at its rated voltage expressed in percentage of total hours in the given period and shall be calculated as provided in GERC (Multi Year Tariff) Regulations, 2011;
- 11) **‘Available Transfer Capability’ (ATC)** refers to the transfer capability of the inter-control area transmission system available for scheduling commercial transactions

(through long term access, medium-term open access and short-term open access) in a specific direction, taking into account the network security. Mathematically, ATC is the Total Transfer Capability less Transmission Reliability Margin.

- 12) **‘Backing Down’** refers to reduction of generation on instructions from SLDC/WRLDC by a generating unit under abnormal conditions.
- 13) **‘Black Start’** refers to the procedure necessary for recovery from a total shutdown or partial shutdown without the availability of electricity from external sources.
- 14) **‘Black Start Capability’** refers to an ability in respect of a Black Start Station, for at least one of its generating units or CCGT units to start-up from shutdown and to energise a part of the system and be synchronized to the system upon instruction from the State Load Despatch Centre, within two hours, without any external supply.
- 15) **‘Black Start Stations’** refers to generating stations having Black Start Capability.
- 16) **‘Beneficiary’** refers to a person who has a share in an ISGS/SGS or any generating stations
- 17) **‘Bilateral Transaction’** refers to a transaction for exchange of energy (MWh) between a specified buyer and a specified seller, directly or through a trading licensee or through a power exchange from a specified point of injection to a specified point of drawal for a fixed or varying quantum of power (MW), for any time period during a month.
- 18) **‘Bulk Consumer’** refers to any consumer who avails of supply at voltage of 33 kV or above.
- 19) **‘Capacitor’** refers to an electrical facility provided for generation of reactive power.
- 20) **‘Central Generating Station’** refers to the generating stations owned by the companies owned or controlled by the Central Government.
- 21) **‘Connection Agreement’** refers to an agreement between STU, intra-state transmission licensee other than STU (if any) and any person setting out the terms relating to a connection to and/or use of the intra-state transmission system.
- 22) **‘Captive Power Plant (CPP)’** refers to a power plant set up by any person to generate electricity for his use and includes a power plant set up by any cooperative society or association of persons for generating electricity primarily for use of members of such a cooperative society or association.
- 23) **‘Caution Notice’** refers to a notice conveying a warning against interference.
- 24) **‘Central Transmission Utility (CTU)’** refers to any government company, which the

Central Government may notify under sub section (1) of section 38 of the Electricity Act, 2003.

- 25) **‘Connection’** refers to the electric power lines and electrical equipment used to effect a connection of a user's system to the transmission system.
- 26) **‘Connection Conditions’** refers to those conditions mentioned in Section 5 (Connection Conditions) which have to be fulfilled before the user's system is connected to the grid.
- 27) **‘Connection Point/ Interface Point’** refers to an electrical point of connection between the transmission system and the user's system.
- 28) **‘Consumer’** refers to any person who is supplied with electricity for his own use by a licensee or the government or by any other person engaged in the business of supplying electricity to public under the Electricity Act 2003, or any other law for the time being in force and includes any person whose premises are for the time being, connected for the purpose of receiving electricity with the works of a licensee, the government or such other person, as the case may be.
- 29) **‘Control Person’** refers to a person identified as having technical capability and responsibility for cross boundary safety under section 7, Cross-Boundary Safety of the Grid Code.
- 30) **‘Collective Transaction’** refers to a set of transactions discovered in power exchange through anonymous, simultaneous competitive bidding by buyers and sellers.
- 31) **‘Commission’** refers to the Gujarat Electricity Regulatory Commission.
- 32) **‘Congestion’** refers to a situation where the demand for transmission capacity exceeds the Available Transfer Capability.
- 33) **‘Connectivity’** refers to the state of getting connected to the inter-state transmission system / intra-state transmission system by a generating station, including a captive generating plant, a bulk consumer or an intra-state transmission licensee/distribution licensees.
- 34) **‘Control Area’** refers to an electrical system bounded by interconnections (tie lines), metering and telemetry, which controls its generation and/or load to maintain its interchange schedule with other control areas whenever required and contributes to frequency regulation of the synchronously operating system.
- 35) **‘Demand’** refers to the demand for an active power in MW and reactive power in MVar of electricity, unless otherwise specified.

- 36) **‘Demand Control’** refers to any of the following methods of achieving a Load reduction:
- (a) Consumer Load Management initiated by users
 - (b) Consumer Load Reduction by disconnection initiated by users (other than following an instruction from Load Despatch Centre)
 - (c) Consumer Load Reduction instructed by the Load Despatch Centre
 - (d) Automatic Under-frequency Load Disconnection
 - (e) Emergency Manual Load Disconnection
- 37) **‘Despatch’** refers to operational control of an integrated electricity system involving operations such as:
- Assignment of levels of output to specific generating plant or load control devices to effect the most reliable and economical supply as the loads vary;
 - The control of the operation of Extra High Voltage lines, associated substations and equipment;
 - The scheduling of various types of transactions with the electric utilities over the interconnecting transmission lines
- 38) **‘De-synchronize’** refers to the act of taking a generating unit off a system, to which it has been synchronized.
- 39) **‘Disconnection’** refers to the physical separation of users or consumers from the system.
- 40) **‘Discrimination’** refers to the quality where a relay or protective system is enabled to pick out and cause to be disconnected only the faulty apparatus.
- 41) **‘Distribution Licensees’** refers to a Licensee authorised to operate and maintain a distribution system for supplying electricity to the consumer in his area of supply.
- 42) **‘Distribution System’** refers to the system of wires and associated facilities between the delivery points on the transmission lines or the generating station connection and the point of connection to the installation of the consumers.
- 43) **‘Demand Response’** refers to reduction in electricity usage by end customers from their normal consumption pattern, manually or automatically, in response to high UI charges being incurred by the state due to over-drawal by the state at low frequency, or in response to congestion charges being incurred by the state for creating transmission congestion, or for alleviating a system contingency, for which such consumers could be given a financial incentive or lower tariff.
- 44) **‘Despatch Schedule’** refers to the ex-power plant net MW and MWh output of a generating station, scheduled to be exported to the grid, from time to time.
- 45) **‘Drawal Schedule’** refers to the summation of the station-wise ex-power plant drawal schedules from all ISGS/SGS and other stations drawl from/injection to the regional

grid, consequent to other long-term access, medium-term and short-term open access transactions.

- 46) **‘Disturbance Recorder’ (DR)** refers to a device provided to record the behaviour of the pre-selected digital and analogue values of the system parameters during an event.
- 47) **‘Data Acquisition System’ (DAS)** refers to a system provided to record the sequence of operation in time, of the relays/equipments, as well as the measurement of pre-selected system parameters.
- 48) **‘Earthing’** refers to connecting the conducting parts of an equipment or machinery with the general mass of earth, in such a manner ensuring at all times an immediate discharge of energy without danger, by maintaining the same efficiency at earth's potential.
- 49) **‘Earthing Device’** refers to a means of providing connection between a conductor and earth being of adequate strength and capability.
- 50) **‘Exciter’** refers to the source of electrical power providing the field current of a synchronous machine.
- 51) **‘Entitlement’** refers to a share of a beneficiary (in MW / MWh) in the installed capacity/output capability of an ISGS / SGS.
- 52) **‘Entity’** refers to such persons who are in the control area of SLDC and whose metering and energy accounting is done at the state level.
- 53) **‘Event’** refers to an unscheduled or unplanned occurrence on a grid, including faults, incidents and breakdowns.
- 54) **‘Event Logging Facilities’** refers to a device provided to record the chronological sequence of operations, of the relays and other equipment.
- 55) **‘Ex-Power Plant’** refers to net MW/MWh output of a generating station, after deducting auxiliary consumption and transformation losses.
- 56) **‘Frequency’** refers to the number of alternating current cycles per second (expressed in Hertz) at which the system is operating.
- 57) **‘Flexible Alternating Current Transmission System’ (FACTS)** refers to a power electronics based system and other static equipment that provide control of one or more AC transmission system parameters to enhance controllability and increase power transfer capability.
- 58) **‘Forced Outage’** refers to an outage of a generating unit or transmission facility due to a fault or reasons not planned.

- 59) **‘Fault Locator’ (FL)** refers to a device provided at the end of a transmission line to measure/ indicate the distance at which a line fault may have occurred.
- 60) **‘Force Majeure’** refers to any event which is beyond the control of the persons involved, which they could not foresee or with a reasonable amount of diligence, could not have foreseen or which could not be prevented and which substantially affects the performance by person such being the following including but not limited to:-
- a) Acts of God, natural phenomena, floods, droughts, earthquakes and epidemics;
 - b) Enemy acts of any government, domestic or foreign, war declared or undeclared, hostilities, priorities, quarantines, embargoes;
 - c) Riot or civil commotion;
 - d) Grid failure not attributable to a person.
- 61) **‘Grid Standards’** refers to the standards specified by the authority under clause (d) of the Section 73 of the Act.
- 62) **‘Generating Company’** refers to any company or body corporate or association or body of individuals, whether incorporated or not, or artificial juridical person, which owns or operates or maintains a generating station.
- 63) **‘Generating Station’** refers to any station for generating electricity, including any building and plant with step-up transformer, switchyard, switch gear, cables or other appurtenant equipment, if any used for that purpose and the site thereof, a site intended to be used for a generating station, and any building used for housing the operating staff of a generating station, and where electricity is generated by water – power, includes penstocks, head and tail works, main and regulatory reservoirs, dams and other hydraulic works, but does not in any case include any substation.
- 64) **‘Generating Unit’** refers to the combination of an electric power generator and its prime mover and all of its associated equipment, which together constitutes a single generating machine.
- 65) **‘Generation Schedule’** refers to the despatch schedule of a generating station.
- 66) **‘Generator Capability Curve’** refers to a diagram, which shows the MW and MVA capability limits within which a generating unit will be expected to operate under steady state conditions.
- 67) **‘Grid’** refers to high voltage backbone system of inter-connected transmission lines, substations and generating stations.
- 68) **‘Grid Code’** refers to Gujarat Electricity Grid Code – a document describing the procedures and the responsibilities for planning and operation of the Gujarat Grid.

- 69) **‘Grid Code Review Panel’ or ‘Panel’** refers to the panel with the functions set out in the Grid Code.
- 70) **‘Governor Droop’** is used in relation to the operation of the governor of a generating unit, the percentage drop in system frequency, which would cause the generating unit under restricted/free governor action to change its output from zero to full load.
- 71) **‘Indian Standards’ (IS)** refers to those standards and specifications approved by the Bureau of Indian Standards.
- 72) **‘Inter-State Generating Station’ (ISGS)** refers to a generating station in which, two or more states have a share and whose scheduling is to be coordinated by Regional Load Despatch Centre.
- 73) **‘Inter-State Transmission System’ (ISTS)** refers to Inter-state Transmission System, which includes:
Any system for the conveyance of electricity by refers to of a main Transmission Line from the territory of one state to another;

The conveyance of electricity across the territory of an intervening state as well as conveyance within a state, which is incidental to such inter-state transmission of electricity;

The transmission of electricity within the territory of a state; built, owned, operated, maintained or controlled by the Central Transmission Utility;
- 74) **‘Interconnecting Transformer’ (ICT)** refers to a transformer connecting EHV lines of different voltage systems.
- 75) **‘Inter tripping’** refers to the tripping of circuit-breaker(s) by commands initiated from Protection at a remote location independent of the state of local Protection; or operational inter tripping.
- 76) **‘Intra-state Transmission System’** refers to any system for transmission of electricity other than an Inter-State Transmission System.
- 77) **‘Isolation’** refers to the disconnection of EHV/ HV apparatus from the remainder of the system in which that EHV/ HV Apparatus is situated.
- 78) **‘Independent Power Producer’ (IPP)** refers to a generating company not owned/ controlled by the Central/State Government.
- 79) **‘Lean Period’** refers to that period in a day when the electrical power demand is low.
- 80) **‘Licence’** refers to any licence granted by GERC under provisions of the relevant laws in force.

- 81) **‘Licensee’** refers to a person who has been granted a licence under Section 14 of the Act.
- 82) **‘Load’** refers to the Active, Reactive or Apparent Power as the context requires, generated, transmitted or distributed.
- 83) **‘Low Voltage’ or ‘LV’** refers to voltage not exceeding 440 volts.
- 84) **‘Load Factor’** refers to the ratio of the average power to the maximum demand. The load factor depends on the interval of time of the maximum demand and the period over which the average is taken.

$$\text{Load Factor} = \frac{\text{Units consumed in a given period}}{\text{Maximum Demand} \times \text{No. of hours in the period}}$$

- 85) **‘Long –term Access’** refers to the right to use the intra-state transmission system for a period exceeding 12 years but not exceeding 25 years.
- 86) **‘Main Protection’** refers to protection equipment or system expected to have priority in initiating either a fault clearance or an action to terminate an abnormal condition in the power system.
- 87) **‘Medium-term Open Access’** refers to the right to use the intra-state transmission system for a period exceeding three months but not exceeding three years.
- 88) **‘Medium-term customer’** refers to a person who has been granted medium-term open access.
- 89) **‘Maximum Continuous Rating’** refers to the maximum continuous output in MW at the generator terminals, guaranteed by the manufacturer at rated parameters.
- 90) **‘National Grid’** means the entire inter-connected electric power network of the country.
- 91) **‘NLDC’** refers to the centre established under sub-section (1) of Section 26 of the Act.
- 92) **‘Notice to Synchronize’** refers to the amount of time (expressed in minutes) that is declared by a generating company in relation to a Generator to enable it to be synchronized following the receipt of an instruction to synchronize.
- 93) **‘Net Drawal Schedule’** refers to the drawal schedule of an entity after deducting the apportioned transmission losses.

- 94) **‘Operating Margin’** refers to aggregate available capacity of a generating station in the system on real time basis, which is over and above the operating level to the maximum capacity of the generating units limited by technical parameters for short duration.
- 95) **‘Operation’** refers to a scheduled or planned action, relating to the operation of a system.
- 96) **‘Operational Procedures’** refers to management instructions and procedures both, for 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 connecting site.
- 97) **‘Out of Synchronism’** refers to the condition where a system or generating unit cannot meet the requirements to enable it to be synchronized.
- 98) **‘Outage’** refers to a total or partial reduction in availability due to repair and maintenance of the transmission or distribution or generation facility or defect in the Auxiliary System.
- 99) **‘Operation Coordination Sub-committee’ (OCC)** refers to a sub-committee of RPC with members from all regional entities, which decide the operational aspects of the regional grid.
- 100) **‘Operating Range’** refers to the operating range of frequency and voltage as specified under the operating code (part-5).
- 101) **‘Power System’** refers to all aspects of generation, transmission, distribution and supply of electricity and includes one or more of the following; namely:
- (a) generating stations
 - (b) transmission or main transmission lines
 - (c) sub-stations
 - (d) tie-lines
 - (e) load despatch activities
 - (f) mains or distribution mains
 - (g) electric supply lines
 - (h) overhead lines
 - (i) service lines
 - (j) works
- 102) **‘Protection Coordination Sub-committee’** refers to a sub-committee of RPC with members from all the regional entities, which decides on the protection aspects of the regional grid.
- 103) **‘Part Load’** refers to the condition of a generating station which is loaded, but is not

running at its declared availability.

- 104) **‘Partial Shutdown’** refers to a shutdown of part of the system, resulting in failure of power supply, either from external connections or from the healthy part of the system.
- 105) **‘Peak Period’** refers to that period in the day when the electrical power demand is high.
- 106) **‘Person’** refers to any company or body corporate or association or body of individuals, whether incorporated or not, or artificial juridical person.
- 107) **‘Planned Outage’** refers to an outage of generating plant or part of the transmission system, or part of a user's system coordinated by SLDC.
- 108) **‘Power Factor’** refers to the ratio of Active Power (kW) to Apparent Power (kVA).
- 109) **‘Premises’** refers to any land, building or structure.
- 110) **‘Protection’** refers to the schemes and apparatus for detecting abnormal conditions on a system and initiating fault clearance or actuating signals or indications.
- 111) **‘Protection Apparatus’** refers to a group of one or more Protection Relays and/or logic elements designated to perform a specified protection function.
- 112) **‘Power Exchange’** refers to the power exchange which has been granted registration in accordance with CERC (Power Market Regulations), 2010, as amended from time to time.
- 113) **‘Rated MW’** refers to the rating plate MW output of a generating unit, being that output up to which the generating unit is designed to operate.
- 114) **‘Reactive Power’** refers to the product of voltage and current and the sine of the phase angle between them, measured in units of volt-amperes reactive and standard multiples thereof; i.e. 1000 VAr = 1kVAr, 1000 kVAr = 1 MVar.
- 115) **‘Regional Power Committee’** refers to committee established by resolution by the Central Government for a specified region, for facilitating the integrated operation of the power system in the region.
- 116) **‘Regulating Margin’** refers to the system voltage and frequency, beyond which the system should not be operated.
- 117) **‘Responsible Engineer/ Operator’** refers to a person nominated by a user to be responsible for system control.

- 118) **‘Re-synchronization’** refers to the bringing of parts of the system which have gone out of synchronism with each other, back into synchronism.
- 119) **‘Regional Energy Account’ (REA)** refers to a regional energy account prepared on monthly basis by the RPC Secretariat for the billing and settlement of ‘Capacity Charge,’ ‘Energy Charge and Transmission Charges.’
- 120) **‘Reactor’** refers to an electrical facility specifically designed to absorb Reactive Power.
- 121) **‘Regional Entity’** refers to such persons who are in the RLDC control area and whose metering and energy accounting is done at the regional level.
- 122) **‘RPC Secretariat’** refers to the Secretariat of the RPC.
- 123) **‘Regional Grid’** refers to the entire synchronously connected electric power network of the concerned region.
- 124) **‘Regional Load Despatch Centre (RLDC)’** refers to the centre established under sub-section (1) of Section 27 of the Act.
- 125) **‘Standing Instructions’** refers to an instruction issued by SLDC to a generating company, whereby in specified circumstances, the generating company should take specified action, as though a valid despatch instruction has been issued by SLDC.
- 126) **‘Start-up’** refers to the action of bringing a generating unit from shut-down to synchronous speed.
- 127) **‘State Transmission Utility (STU)’** refers to the utility notified by the government under Sub-Section (1) of Section 39 of the Electricity Act, 2003, and whose functions have been outlined under Sub-Section (2) of Section 39 of the Electricity Act, 2003.
- 128) **‘Station Transformer’** refers to a transformer supplying electrical power to the auxiliaries of a generating station, which is not directly connected to a generating unit terminal.
- 129) **‘Substation’** refers to the station for transforming or converting electricity for the transmission or distribution thereof and includes transformers, converters, switchgears, capacitors, synchronous condensers, structures, cable and other appurtenant equipment and any buildings used for that purpose and the site thereof.
- 130) **‘Supervisory Control and Data Acquisition’ (SCADA)** refers to the communication links and data processing systems, which provide information to enable implementation of requisite supervisory and control actions.

- 131) **‘Synchronized’** refers to those conditions where an incoming generating unit or system is connected to the busbars of another system so that the frequencies and phase relationships of that generating unit or system as the case may be, and the system to which it is connected are identical.
- 132) **‘System’** refers to any Transmission and Distribution System and/or Transmission System, as the case may be.
- 133) **‘State Pool Account’** refers to the State Pool account for (i) payments regarding Unscheduled Interchanges (UI Account) or (ii) Reactive Energy exchanges (Reactive Energy Account) (iii) Congestion Charge (iv) Renewable Regulatory fund and other charges as determined by appropriate commission time to time, as the case may be.
- 134) **‘State Energy Account’ (SEA)** refers to a state energy account prepared on monthly basis by the SLDC for the billing and settlement of Capacity Charge and Energy Charge.
- 135) **‘Short-term Open Access’** refers to open access for a period up to one month at a time, but not exceeding a period of six months in a calendar year.
- 136) **‘Spinning Reserve’** refers to a part loaded generating capacity with some reserve margin that is synchronized to the system and is ready to provide increased generation at short notice pursuant to despatch instruction or instantaneously in response to a frequency drop.
- 137) **‘Share’** refers to a percentage share of a beneficiary in an ISGS/SGS, either notified by the Government of India or agreed through contracts and implemented through long-term access.
- 138) **‘Standing Committee for Transmission Planning’** refers to a committee constituted by the CEA to discuss, review and finalise the proposals for expansion or modification in the ISTS and associated intra-state systems.
- 139) **‘Static VAR Compensator’ (SVC)** refers to an electrical facility designed for the purpose of generating or absorbing Reactive Power.
- 140) **‘Shift In-charge of SLDC and Substation’** refers to he/ she who is in-charge of his/her shift for carrying out real-time power system operations and control within the state/ jurisdiction to maintain grid discipline/ stability during the shift.
- 141) **‘SLDC’** refers to the State Load Despatch Centre that the Centre established under subsection (1) of Section 31 of the Act.
- 142) **‘Sub- SLDC’** refers to one of the three stations in Gujarat state being established under Western Region System Unified Load Despatch Scheme, having as main functions, data acquisition and transfer to SLDC; and supervisory control of load

centre in their respective area.

- 143) **‘Total System’** refers to the Transmission System and all user systems in Gujarat.
- 144) **‘Transmission Licensee’** refers to a licensee authorised to establish and operate transmission lines. (A license granted under Section 14 of the Act to transmit electricity).
- 145) **‘Transmission Line’** refers to all high pressure cables and overhead lines (not being an essential part of the distribution system of a licensee) transmitting electricity from a generating station to another generating station or a substation, together with any step-up and step-down transformers, switch-gear and other works necessary to and used for the control of such cables or overhead lines, and such buildings or part thereof as may be required to accommodate such transformers, switch-gear and other works.
- 146) **‘Transmission System’** refers to the system consisting of high pressure cables and overhead lines of the Transmission Licensee for transmission of electrical power from the generating station up to Connection Point/ Interface Point with the distribution system. This shall not include any part of the distribution system.
- 147) **‘Time Block’** refers to block(s) of 15 minutes each, for which special energy meters record values of specified electrical parameters with the first time block starting at 00.00 hours.
- 148) **‘Total Transfer Capability’ (TTC)** refers to the amount of electric power that can be transferred reliably over the inter-control area transmission system under a given set of operating conditions considering the effect of occurrence of the worst credible contingency.
- 149) **‘Transmission Reliability Margin’ (TRM)** refers to the amount of margin kept in the total transfer capability necessary to ensure that the interconnected transmission network is secure under a reasonable range of uncertainties in system conditions.
- 150) **‘Technical Coordination Committee’ (TCC)** refers to the committee set up by RPC to coordinate the technical and commercial aspects of the operation of the regional grid.
- 151) **‘Transmission Planning Criteria’** refers to the policy, standards and guidelines issued by the CEA for the planning and design of the transmission system.
- 152) **‘Under Frequency Relay’** refers to an electrical measuring relay intended to operate when its characteristic quantity reaches the relay settings by decrease in frequency.
- 153) **‘User’** refers to a person such as a generating company including captive generating plant or transmission licensees (other than STU) or distributor licenses or bulk customers whose electrical plant is connected to the state grid at voltage level 33kV

and above.

- 154) **‘Unscheduled Interchange’ (UI)** refers to in a time block for a generating station or a seller means its actual generation minus its total scheduled generation for a beneficiary or buyer means its total actual drawl minus its total scheduled drawl.

Words and expressions used and not defined in this code but defined in the Acts shall have the meanings assigned to them in the said Acts. Expressions used herein, but not specifically defined in this code or in the said Acts but defined under any law passed by a competent legislature and applicable to the electricity industry in the state shall have the meaning assigned to them in such law. Subject to the above, expressions used herein but not specifically defined in this code or in the Acts or any law passed by a competent legislature shall have the meaning as is generally assigned in the electricity industry.

Interpretation

In the interpretation of this Code, unless the context otherwise requires:

- Words in the singular or plural term, as the case may be, shall also be deemed to include the plural or singular term, respectively;
- the terms include or including shall be deemed to be followed by without limitation or but not limited to regardless of whether such terms are followed by such phrases or words like ‘import’;
- References herein to the code shall be construed as a reference to this code, as amended or modified by the GERC, from time to time, in accordance with the applicable laws in force;
- The headings are inserted for convenience and may not be taken into account for the purpose of interpretation of this code;
- References to any statutes, regulations or guidelines shall be construed as including all statutory provisions consolidating, amending or replacing such statutes, regulations or guidelines, as the case may be, referred to.

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3. Management of Grid Code and Role of Various Organizations

Introduction:

The STU/ Transmission Licensee is required to implement and comply with the Gujarat Electricity Grid Code (GEGC) and to carry out periodic review and amendments of the same with the approval of Gujarat Electricity Regulatory Commission (GERC). A Review Panel shall be constituted by STU, as required in this section, comprising of the representatives of the users of the Transmission System.

No change in this Grid Code, however small or big, shall be made without being deliberated upon and agreed to by the Grid Code Review Panel and thereafter approved by GERC. However, in an unusual situation, where normal day-to-day operations are not possible without revision of some clauses of the Grid Code, a provisional revision may be implemented before approval of GERC is received, but only after discussion at a special Review Panel meeting convened on an emergency basis. GERC should promptly be intimated about the provisional revision. GERC may issue directions requiring STU to revise the Grid Code accordingly, as may be specified in those directions and STU shall promptly comply with any such directions.

STU/ Transmission Licensee will be responsible for managing and implementing the Grid Code for discharging its obligations with the users. STU/ Transmission Licensee will not be, however, required to incur any expenditure on account of travel etc. of any member of the panel other than its own representative.

Objective:

The objective of this section is to define the method of management of Grid Code documents, implementing any changes/modifications required and the responsibilities of the constituents (users) to affect the change.

Grid Code Review Panel

- 3.1 The Chairperson of the Grid Code Review Panel shall be an engineer of the STU, not below the rank of Chief Engineer. The Member Secretary of the panel shall also be nominated by STU. The panel shall consist of the following members on the recommendation of the heads of the respective organisations:
- (a) One Chief Engineer or General Manager of Gujarat State Electricity Corporation Limited (GSECL)
 - (b) One representative at senior executive level from each of the state's own Distribution Licensees; viz. PGVCL, UGVCL, DGVCL and MGVL
 - (c) One representative at senior executive level of Torrent Power Ltd-Ahmedabad (TPL-Ahmedabad)

- (d) One representative at senior executive level of Torrent Power Limited-Surat(TPL-Surat)
 - (e) One representative at senior executive level from National Thermal Power Corporation Limited (NTPC)
 - (f) One representative at senior executive level from Western Regional Load Despatch Centre (WRLDC)
 - (g) One representative at senior executive level from Western Regional Power Committee
 - (h) One representative at senior executive level from each of the generating companies other than GSECL, feeding the Gujarat Grid, feeding not less than 100 MW
 - (i) One representative from all CPPs, which are in parallel operation with the Gujarat Grid on rotational basis
 - (j) One representative from all the generating companies of small generating stations of less than 100 MW capacity on rotational basis
 - (k) One member from Gujarat Energy Development Agency (GEDA)
 - (l) Chief Engineer of State Load Despatch Centre (SLDC)
 - (m) One representative at senior executive level from Special Economic Zone (SEZ) including KPT on rotational basis
 - (n) One representative at senior executive level from Ultra Mega Power Project (UMPP) located in Gujarat
 - (o) One representative at senior executive level from wind developers, having capacity of 300MW or more, on rotational basis.
 - (p) One representative at senior executive level from solar developers, having capacity of 25 MW or more, on rotational basis
- 3.2 Any other member can be co-opted as a member of the panel, when directed by GERC.
- 3.3 The functioning of the panel shall be coordinated by STU. The Member Secretary nominated by STU shall be the convenor.
- 3.4 STU shall inform all users, about the names and addresses of the Review Panel Chairperson and the Member Secretary, at least seven days before the first Review Panel meeting. Any subsequent changes shall also be informed to all the users by STU. Similarly, each user shall inform the names and designations of their representatives to the Member Secretary of the Review Panel, at least three days before the first panel meeting, and shall inform the Member Secretary in writing, regarding any subsequent changes.
- 3.5 The Member Secretary shall keep informed the name and designation of all Members of Gujarat Grid Code Review Panel to the Commission.
- 3.6 Functions of the Review Panel:
- The functions of the Review Panel are as follows:*
- (a) Maintenance of the Grid Code and its working under continuous scrutiny and review
 - (b) Consideration of all requests for review made by any user and publication of their recommendations for changes in the Grid Code, together with reasons for such changes

- (c) Provide guidance on interpretation and implementation of the Grid Code
- (d) Examination of problems raised by any user, as well as resolution of the problems
- (e) Ensuring that the changes/modifications proposed in the Grid Code are consistent and compatible with Indian Electricity Grid Code (IEGC)
- (f) Analysis of major disturbances in the Gujarat Grid soon after their occurrence and constitution of the sub-committee to investigate the reasons thereof

The Review Panel may hold any number of meetings as required, subject to the condition that at least one meeting shall be held in every three months. Sub-meetings may be held by STU with the user to discuss individual requirements and with groups of users to prepare proposals for the panel's consideration

Review and Revisions

- 3.7 Users seeking any amendment to the Grid Code shall send written requests to the Member Secretary of the Review Panel with a copy to GERC. If the request is sent to GERC directly, the same shall be forwarded to STU who shall, in consultation with the Distribution Licensees, Generating Companies, Central Transmission Utility (CTU) and such other persons as GERC may direct or STU may decide to consult, review the Grid Code provisions. STU shall examine the proposed changes/modifications in line with IEGC stipulations and circulate the same, along with its comments to all the Review Panel members for their written comments within a reasonable time frame. Whenever it is observed that a certain clause of the Grid Code is not consistent with the IEGC, then the same will be discussed in the Review Panel and the clause will be revised to make it consistent with IEGC.
- 3.8 All the comments received shall be scrutinised and compiled by STU. These, along with STU's comments shall be sent to all the members for their response, for the proposed change/modification. If necessary, STU shall convene a meeting of the Review Panel for deliberations. The Member Secretary shall present all the proposed revisions of the Grid Code to the Review Panel for its consideration.
- 3.9 Based on the response received, STU shall finalize its recommendation regarding the proposed modification / amendment and submit the same, along with all the related correspondence to GERC for approval.
- 3.10 STU shall send the following reports to the GERC at the conclusion of each review meeting of the panel:
 - 1. Reports on the outcome of such review
 - 2. Any proposed revision to the Grid Code as STU reasonably thinks necessary for achievement of the objectives referred to in the relevant paragraphs of the Transmission

Licence

3. All written representations and objections submitted by the users at the time of review
- 3.11 All revisions to the Grid Code require the approval of GERC. STU shall intimate all users about the revisions to the Grid Code, after the approval of GERC. STU may submit proposals for relaxation in such cases where users have difficulties in meeting the requirements of the Grid Code.
- 3.12 Any change from the previous version shall be clearly marked in the margin. In addition, a revision sheet shall be placed at the front of the revised version, noting the number of each changed sub-section, together with reasons for the change.
- 3.13 STU shall maintain copies of the Grid Code with the latest amendments and shall make it available at a reasonable cost to any person requiring it. This may also be made available on the website. The STU/ Transmission Licensee shall keep an up-to-date list of recipients of all copies of the Grid Code, if found necessary to ensure that the latest version of Grid Code has reached all the relevant recipients.
- 3.14 The Commission, may, on the application of the users or otherwise, call the emergency meeting of the Review Panel as and when the situation so dictates and make such alterations and amendments in the Grid Code as it deems fit.

Role of Various Organizations

3.15 Role of STU

1. Section 39 of the Electricity Act, 2003, outlines that the functions of the State Transmission Utility (STU) shall be:
 - (a) To undertake transmission of electricity through the intra-state transmission system;
 - (b) To discharge all functions of planning and coordination relating to intra-state transmission system with
 - i) Central Transmission Utility
 - ii) State Government
 - iii) Generating companies
 - iv) Regional Power Committees
 - v) Authority
 - vi) Licensees
 - vii) Any other person notified by the state in this behalf;
 - (c) To ensure development of an efficient, coordinated and economical system of intra-state transmission lines for smooth flow of electricity from a generating station to the load centres

- (d) To provide non-discriminatory open access to its transmission system for use by
 - (i) Any licensee or generating company on payment of the transmission charges; or
 - (ii) Any consumer as and when such open access is provided by the State Commission under sub-section (2) of section 42 of the Act, on payment of the transmission charges and a surcharge thereon, as may be specified by the State Commission.
- 2. Until a government company or any authority or corporation is notified by the State Government, the State Transmission Utility shall operate the State Load Despatch Centre.

3.16 **Role of SLDC**

1. In accordance with section 32 of Electricity Act, 2003, the State Load Despatch Centre (SLDC) shall have following functions:
 - (1) The State Load Despatch Centre shall be the apex body to ensure integrated operation of the power system in a State.
 - (2) The State Load Despatch Centre shall -
 - (a) be responsible for optimum scheduling and despatch of electricity within a state, in accordance with the contracts entered into with the licensees or generating companies operating in that state;
 - (b) Monitor grid operations;
 - (c) Keep accounts of the quantity of electricity transmitted through the state grid;
 - (d) Exercise supervision and control over the intra-state transmission system;
 - (e) Be responsible for carrying out real time operations for grid control and despatch of electricity within the state through secure and economic operation of the state grid in accordance with the grid standards and the state Grid Code.
 - (3) The following are contemplated as exclusive functions of SLDC:
 - (a) System operation and control of the state grid covering contingency analysis and operational planning on real time basis;
 - (b) Scheduling / re-scheduling of generation;
 - (c) System restoration following grid disturbances;
 - (d) Metering and data collection;

- (e) Compiling and furnishing data pertaining to system operation;
 - (f) Operation of State UI pool account, State Reactive Energy account and other functions as directed by the Commission.
2. In accordance with section 33 of the Electricity Act, 2003, the State Load Despatch Centre in a state may give such directions and exercise such supervision and control as may be required for ensuring the integrated grid operations and for achieving the maximum economy and efficiency in the operation of power system in that state. Every licensee, generating company, generating station, substation and any other person connected with the operation of the power system shall comply with the directions issued by the State Load Despatch Centre under subsection (1) of Section 33 of the Electricity Act, 2003. The State Load Despatch Centre shall comply with the directions of the Regional Load Despatch Centre.
 3. In case of inter-state bilateral and collective short-term open access transactions having a state utility or an intra-state entity as a buyer or seller, SLDC shall accord concurrence or no objection or a prior standing clearance, as the case may be, in accordance with the Central Electricity Regulatory Commission (Open Access in inter-state Transmission) Regulations, 2008 & GERC (Terms and conditions of Intra-state Open Access) Regulations, 2011, notification No.3 of 2011 and amended from time to time.

3.17 **Role of Sub-SLDC**

Three stations in Gujarat State have been established under Western Region System Unified Load Despatch Scheme, having main functions of data acquisition & transfer to SLDC, supervisory control of load centre in their respective area, as well as the following:

- (1) The Sub-SLDC shall assist SLDC to ensure integrated operation of the power system in a state;
- (2) The Sub-SLDC shall assist SLDC for monitoring grid operations;
- (3) The Sub-SLDC shall assist SLDC for supervision and control over the intra-state transmission system within their area.

3.18 **Role and Responsibility of Shift In-charge of SLDC**

- Carrying out real time power system operation and control within the state to maintain grid discipline during the shift
- Coordination with WRLDC, CTU, State Generating Stations and Distribution Licensees for smooth and reliable grid operations
- Ensuring the adherence to maintain the injection / drawl as per schedule for maintaining grid

stability

- Recording the major activities performed during the shift in the log book
- Approving declaration of generator and requisition of DISCOMs and revisions thereof in real time operation
- Permitting EHV line / equipment outages and operation thereof
- Preparation of various reports during the shift
- Reviewing demand / availability in real time, forecasting and proposing for taking machine ON / OFF bar as per system requirement and merit order in consultation with higher officers
- Updating unit outage and ensuring real time data on web site.

3.19 Role and Responsibility of Shift In-charge of Substation:

- Monitoring real time power system key operational parameters (i.e. Voltage, Current, Power Factor, Active Power, Reactive Power etc.)
- During the shift in case of abnormal operation parameters, he/she has to take corrective action under intimation to his/her s/s in-charge
- Recording abnormalities / observed and corrective action taken in log sheet/ computer
- Recording abnormalities not attended immediately in defect register as mechanism to inform s/s in-charge for early rectification
- Issuance of LCP (Line Clear Permit) ensuring isolation for safety and equipments & maintenance personals

3.20 Role and Responsibility of State Grid Operation Coordination Committee (SOCC)

1. Objective:

Day by day, the grid operation is becoming more and more challenging as the complexity of grid is increasing enormously, coupled with a rapidly increasing generation from renewable sources, portfolio of high capacity generator units, wide variation in demand, planning of outages for generating units and transmission elements, real time incorporation of voluminous revisions from generators and Discoms.

For secure, smooth, reliable and economical grid operation of the State, formation of a State Grid Operation Coordination Committee is essential for carrying out operation analysis for improving grid performance.

2. Formation:

The Chairperson of the State Grid Operation Coordination Committee shall be Chief Engineer of the SLDC. The State Grid Operation Coordination Committee shall consist of following members:

- (a) One representative at senior executive level from each Discom; viz. DGVCL, MGVCL, UGVCL, PGVCL, TPL-Ahmedabad and TPL-Surat.

- (b) One representative at senior executive level from each power station and Corporate Office of Gujarat State Electricity Corporation Limited (GSECL).
- (c) One representative at senior executive level from each IPP.
- (d) One representative at senior executive level from STU.
- (e) One representative at senior executive level from SSP.
- (f) One representative at senior executive level from UMPP / MPP connected to Gujarat network with Gujarat as control area.
- (g) One representative at senior executive level from SLDC as Member Secretary.

In addition to the above, the following shall be invitees to the above forum:

- (i) One representative at senior executive level from GUVNL
- (ii) One representative at senior executive level from NTPC / NPC power stations connected to Gujarat network.
- (iii) One representative at senior executive level from UMPP / MPP connected to Gujarat network with control area outside Gujarat.

3. Function:

The Committee will coordinate planning of maintenance of generating units of various generating companies and review the maintenance programme on a quarterly basis. The committee will discuss and attain consensus on all issues relating to economy and efficiency in the operation of power system in the state. Also, the committee will endeavour for a dispute-free and unbiased operation of power system in the state.

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4. System Planning Code

Introduction

System Planning specifies the technical and design criteria and procedures to be adopted by STU for the planning and development of the Transmission System. The users shall take it into account for planning and development of their own system.

Reinforcements and extensions to the system arise due to many reasons of which, a few are mentioned below:

- (a) Development on a user's system already connected to the Transmission System as a user development
- (b) Introduction of a new Connection Point/ Interface Point between a user's system and the Transmission System
- (c) Need to increase the system capacity, removal of operational constraints, maintenance of security standards and meeting general increases in demand
- (d) Steady state and transient stability considerations

The work of such reinforcement and extension to the Transmission System may also involve work at a Connection Point / Interface Point of a generating company/Distribution Licensee to the Transmission System.

Development of the Transmission System must be planned in advance, duly allowing sufficient lead time, considering the following:

- (a) Time required for detailed engineering, design and construction work to be carried out. This system planning therefore enforces the time scale for exchange of information between the STU and user(s). All the concerned parties, wherever appropriate, shall have due regard to the confidentiality of such information;
- (b) Time required for obtaining all the necessary statutory approvals like notification in government gazette and leading newspapers, Power and Telecommunication Co-ordination Committee (PTCC) clearance, forest clearance, railway clearance, clearance from aviation authorities, national highways, state highways etc. and the right-of-way permissions wherever required.

Objective:

This section formulates the standards and procedures for the system planning to enable STU in consultation with the users, to evolve an efficient, coordinated, secure and economical intra-state transmission system in order to satisfy the requirements of demand and generation.

Perspective Plan

- 4.1 Load forecasting shall be the primary responsibility of the Distribution Licensee within his area of supply. The Distribution Licensees shall determine the peak load and energy forecasts of their areas for each of the succeeding 10 years and submit the same annually,

by 31st January to STU. These shall include the details of demand forecasts, data methodology and assumptions on which the forecasts are based. The peak load and energy forecasts shall be made for the overall area of supply. The annual peak load forecast shall also be made for each Connection Point / Interface Point with the Transmission System. The peak load requirement at each Connection Point / Interface Point will essentially ensure that the STU may determine the corrective measures to be taken to maintain the capacity adequacy in the Transmission System up to the Connection Point /Interface Point. This will facilitate the Transmission Licensee to develop the compatible Transmission System. However, if the Distribution Licensee receives power at a number of Connection Points / Interface Points in a compact area, which are interconnected in a ring, then such a Distribution Licensee shall forward the overall long term demand forecast for the overall Area of Supply as well as at each Connection Point / Interface Point with the variation or tolerance, as mutually discussed and agreed upon with the STU. These forecasts shall be updated annually and also whenever major changes are made in the existing system. Wherever these forecasts take into consideration demands for power exceeding 5 MW by a single consumer, the Distribution Licensee shall personally satisfy himself regarding the materialisation of such a demand.

- 4.2 The STU shall also review the methodology and assumptions used by the Distribution Licensees in making the load forecasts, in consultation with them. The resulting overall forecast will form the basis of planning for expansion of Transmission System, which will be carried out by STU. To maintain the reliability of the interconnected regional power systems, all participants must comply with the planning criteria/guidelines of CEA as updated from time to time.
- 4.3 The STU shall forecast the demand for power within the Area of Supply for each of the succeeding ten years and provide to the GERC, the details of demand forecasts, data, methodology and assumptions, on which the forecasts are based. Based on these forecasts and in coordination with the various agencies identified under section 39 (2) b of the Electricity Act 2003, STU shall be responsible to prepare and submit a long- term plan to GERC for the compatible intra-state transmission system expansion to meet the future demand. The planning shall be in conformity with the national perspective for Power Generation and Transmission plan prepared by the CEA. This compatible intra-state transmission plan shall also include provision for reactive compensation needed for the Transmission System.
- 4.4 The STU shall be responsible for integrating the load forecasts submitted by each of the Distribution Licensees and determining the five-year load forecast on long-term perspective basis load forecasts for the state. For determining the requirements for the entire state, an appropriate diversity factor from the data available for the previous years shall have to be chosen. STU shall satisfy itself regarding the probability of materialisation of bulk loads of consumers with demands above 5 MW in consultation with the Distribution Licensees concerned.
- 4.5 The STU shall extend full support to CTU to finalise the annual planning corresponding to a five-year forward term for identification of a major inter-state Transmission System

including inter-regional schemes, which shall fit in with the long-term plan developed by CEA.

- 4.6 The STU shall furnish the requisite planning data to CTU by 31st March every year, to enable CTU to formulate and finalise the plan by 30th September each year, for the next five years.

Planning Philosophy

- 4.7 CEA will formulate a perspective transmission plan for the Inter-State Transmission System, as well as the intra-state transmission system. These perspective plans would be continuously updated to take care of revisions in load projections and generation scenarios, considering the seasonal and daily variations. In formulating the perspective transmission plan, the transmission requirement for evacuating power from renewable energy sources shall also be taken care of. The Transmission System required for open access shall also be taken into account in accordance with the National Electricity Policy, so that congestion in system operation is minimised.
- 4.8 The STU shall carry out the planning process from time to time, as per the requirement for identification of the intra-state transmission system, including the transmission system associated with generation projects and system strengthening schemes, which shall fit in with the perspective plan developed by CEA. While planning schemes, the following shall be considered in addition to the data of authenticated nature collected from and in consultation with users by STU:
- i) Perspective plan formulated by CEA
 - ii) Electric Power Survey of India, published by the CEA
 - iii) Transmission Planning criteria and guidelines, issued by the CEA
 - iv) Operational feedback from SLDC
 - vi) Central Electricity Regulatory Commission (Grant of Connectivity, long-term access and medium-term open access in inter-state transmission and related matters) Regulations, 2009, Gujarat Electricity Regulation Commission (Terms and Conditions of Intra- state Open Access) Regulation, 2011
 - vii) Renewable Capacity Addition Plan issued by the Ministry of New and Renewable Energy Sources (MNRES), Govt of India, Gujarat Energy Development Association (GEDA), Govt of Gujarat.
- 4.9 In addition to the intra-state transmission system, the STU shall plan, from time to time, system strengthening schemes, the need of which may arise to overcome the constraints in power transfer and to improve the overall performance of the grid. The intra-state transmission proposals including system strengthening schemes identified on the basis of the planning studies would be discussed, reviewed and finalised in the meetings of Discoms,

- 4.10 All users will supply to the STU, the desired planning data (i.e. load growth, generation capacity addition, constraints in existing system, etc) from time to time to enable to formulate and finalise its plan.
- 4.11 As voltage management plays an important role in transmission of energy, special attention shall be accorded by STU for planning of capacitors, reactors, SVC and Flexible Alternating Current Transmission Systems (FACTS), etc. to optimise the utilisation of the integrated transmission network.
- 4.12 Based on plans prepared by the CTU, State Transmission Utilities (STU) shall have to plan their systems to further evacuate power from the ISTS and to optimise the use of the integrated transmission network.
- 4.13 The Inter State Transmission System and associated intra-state transmission system are complementary and inter-dependent and planning of one affects the other's planning and performance. Therefore, the associated intra-state transmission system shall also be discussed and reviewed before implementation during the discussion for finalising the ISTS proposal indicated in 4.11 above.

Planning Criterion

- 4.14 The following standard practice has been considered as per CEA Transmission Planning Criteria, for formulation of transmission plan, as well as Transmission System Planning and Security Standards, as per Annexure A (page 95).

General Philosophy

- 4.15 The security philosophy may be as per the Transmission Planning Criteria and other guidelines as given by CEA. The general policy shall be as detailed below:
1. As a general rule, the Intra State Transmission System shall be capable of withstanding and be secured against the following contingency outages
 - (a) Without necessitating load shedding or rescheduling of generation during Steady State Operation
 - Outage of a 132 kV D/C line
 - Outage of a 220 kV D/C line
 - Outage of a 400 kV S/C line
 - Outage of single Interconnecting Transformer
 - Outage of one pole of HVDC bipole line, or one pole of HVDC back-to-back station or
 - Outage of 765 kV S/C line
 - (b) Without necessitating load shedding but could be with rescheduling of generation during steady state operation

- Outage of a 400 kV S/C line with TCSC
 - Outage of a 400kV D/C line
 - Outage of both pole of HVDC bipole line or both poles of HVDC back to back station
 - Outage of a 765kV S/C line with series compensation.
2. The above contingencies shall be considered assuming a pre-contingency system depletion (planned outage) of another 220 kV D/C line or 400 kV S/C line in another corridor and not emanating from the same substation. The planning study would assume that all the generating units operate within their reactive capability curves and the network voltage profile are also maintained within voltage limits specified.
- 4.16 Any one of these events defined above shall not cause:
- Loss of supply
 - Prolonged operation of the system frequency below and above
 - Specified limits
 - Unacceptable high or low voltage
 - System instability
 - Unacceptable overloading of system elements
- 4.17 In all substations (132 kV and above), at least two transformers shall be provided.
- 4.18 STU shall carry out planning studies for Reactive Power compensation including reactive power compensation requirement at the existing generator's/ bulk consumers' switchyard and for connectivity of new generator's / bulk consumer to the intra-state transmission system.
- 4.19 The steady state voltage shall be maintained within the limits as shown in the operation planning and security code.
- 4.20 The surge impedance loading of AC transmission lines shall be considered as given below:

Sr. No	Voltage Class (kV)	Conductor Configuration	SIL (MW)	Thermal Capacity	
				Temp. Limits	Ampecity of conductor
1	400	Quad Moose	650	75	2380
2	400	Triple Snowbird	605	85	1625
3	400	Twin Moose	515	75	1190
4	220	Single Zebra	132	75	546
5	220	AL-59		95	1143

6	132	Single Panther	50	67	366
7	66	Single Dog	10	67	300

4.21 *Electrical Clearances:*

1. The following minimum safety working clearance shall be maintained for the bare conductors or live parts of any apparatus in outdoor substation, excluding overhead lines of HV and EHV installation. (As per CEA notification of 20th Sept, 2010, clause no. 44(2)-(iii)):

High System Voltage (kV)	Safety Working Clearance (in Metres)
12	2.6
36	2.8
72.5	3.1
145	3.7
High System Voltage (kV)	Safety Working Clearance (in Metres)
145	3.7
245	4.3
420	6.4
800	10.3

2. Clearance above ground of the lowest conductor (as per CEA notification of 20th Sept, 2010, clause no.58):

- (1) No conductor of an overhead line, including service lines, erected across a street shall at any part thereof be at a height of less than

(a)	For low and medium voltage lines:	5.8 metres
(b)	For high voltage lines	6.1 metres

- (2) No conductor of an overhead line, including service lines, erected along any street, shall at any part thereof be at a height less than

(a)	For low and medium voltage lines	5.5 metres
(b)	For high voltage lines	5.8 metres

- (3) No conductor of an overhead line including service lines, erected elsewhere than along or across any street shall be at a height less than –

(a)	For low, medium and high voltages lines up to and including 11kV, if bare	4.6 metres
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(b)	For low, medium and high voltage lines up to and including 11kV, if insulated	4.0 metres
(c)	For high voltage lines above 11kV	5.2 metres

- (4) For extra-high voltage lines, the clearance above ground shall not be less than 5.2 metres plus 0.3 metres for every 33,000 volts or part thereof, by which the voltage of the line exceeds 33,000 volts;

Provided that the minimum clearance along or across any street shall not be less than 6.1 metres

3. Clearance from building of high and extra-high voltage lines (as per CEA notification of 20th Sept, 2010, clause no. 61)

- (1) Where a high or extra-high voltage overhead line passes above or adjacent to any building or part of a building, it shall have on the basis of maximum sag, a vertical clearance above the highest part of the building immediately under such line, of not less than

(a)	For HV lines up to and including 33kV	3.7 metres
(b)	For EHV lines	3.7 metres plus 0.3 metres for every additional 33kV or part thereof

- (2) The horizontal clearance between the nearest conductor and any part of such building shall, on the basis of maximum deflection due to wind pressure, be not less than-

(a)	For HV lines up to and including 11kV	1.2 metres
(b)	For HV lines above 11kV and up to and including 33kV	2.0 metres
(c)	For EHV lines	2.0 metres plus 0.3 metres for every additional 33kV or part thereof

[Explanation: for the purpose of this rule, the expression “building” shall be deemed to include any structure, whether permanent or temporary.]

4. Various voltage class transmission line crossing or approaching each other.(As per CEA notification of 20th Sept,2010,Clause no. 69,(IV))

(in metres)

Sr. No.	Nominal System Voltage	11-66kV	110-132kV	220kV	400kV	800kV
1	Low and Medium	2.44	3.05	4.58	5.49	7.94
2	11-66kV	2.44	3.05	4.58	5.49	7.94
3	110-132kV	3.05	3.05	4.58	5.49	7.94
4	220kV	4.58	4.58	4.58	5.49	7.94
5	400kV	5.49	5.49	5.49	5.49	7.94
6	800kV	7.94	7.94	7.94	7.94	7.94

Transmission planning for renewable energy:

4.22 Connectivity

- (a) 50 MW capacity through 66 kV double circuit line of ACSR Dog conductor
- (b) 70 MW capacity through 66 kV double circuit line of ACSR Panther conductor
- (c) More than 70 MW capacity through 132kV/ 220kV/400kV (based on geographical location) double circuit line

4.23 Contingency

- (a) No contingency for less than 70MW capacity
- (b) N-1 contingency criteria is preferable for more than 70MW on 132kV/ 220kV/ 400kV voltage class.

Planning Data Requirement:

- 4.24 To enable STU to discharge its responsibilities under the Transmission Licence by conducting system studies and preparation of the perspective plans, all users shall furnish all the data to STU from time to time detailed under Data Registration Section and categorised as Planning Data Requirement from the generating and the distribution company, vide Annexure B (page 101). The data pertaining to the generating stations including CPPs and generating units owned by Distribution Licensee working in parallel with grid and Distribution Licensees, shall be updated upon any addition of generating unit/ modification of the distribution system.
- 4.25 To enable the users to coordinate planning, design and operation of their plants and systems with the Transmission System, they may seek certain salient data of the Transmission System as applicable to them. STU/ Transmission Licensee shall supply these data from time to time as detailed under Data Registration Section and categorised

as Planning Data Requirement by the user from STU/ Transmission Licensee vide Annexure C (page 111).

- 4.26 In addition to the above provisions, the planning code of Indian Electricity Grid Code, (IEGC) which calls for data exchange, shall also apply to the Generating Companies, CPPs, IPPs, Transmission Licensee, Utilities and Distribution Licensees, regarding generation / transmission of energy from Inter State Transmission Systems.
- 4.27 The one-time data shall be submitted within six months from the date the Grid Code comes into effect, by all the concerned to STU. The data other than this one-time data, shall be made available to STU on the first of April and first of October, every year.

Implementation of Transmission Plan

- 4.28 The actual program of implementation of transmission lines, interconnecting transformers, reactors/capacitors and other transmission elements will be in accordance with the detailed procedures mentioned in the Central Electricity Regulatory Commission (Grant of Connectivity, long-term access and medium-term Open Access in inter-state transmission and related matters) Regulations, 2009 and Gujarat Electricity Regulatory Commission (Terms and Conditions of Intra State Open Access) Regulations, 2011.

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5. Connection Code

Introduction

STU and Users connected to, or seeking connection to Gujarat Grid, shall comply with Central Electricity Authority (Technical Standards for connectivity to the Grid) Regulations, 2007 which specifies the minimum technical and design criteria and Gujarat Electricity Regulatory Commission (Terms and Conditions of Intra-state Open Access) Regulations, 2011.

Objective

The objective of the code is as given below:

- (a) To ensure the safe operation, integrity and reliability of the grid
- (b) That the basic rules for connectivity are complied with in order to treat all users in a non-discriminatory manner
- (c) Any new or modified connections, when established, shall neither suffer unacceptable effects due to its connectivity to the Gujarat Grid, nor impose unacceptable effects on the system of any other connected user or STU
- (d) Any person seeking a new connection to the grid is required to be aware, in advance, of the procedure for connectivity to the Gujarat Grid and also the standards and conditions (Copy enclosed Annexure D page 115) his system has to meet for being integrated into the grid.

Scope

- 5.1 The connection code applies to STU and all users connected to or seeking connection to the Gujarat Grid and embedded in the intra-state systems. Further, such entities shall abide by the CEA (Technical Standards for connectivity to the Grid) Regulations, 2007, in order to ensure that the integrated grid is not adversely affected.

Procedure for connection

- 5.2 A user seeking to establish new or modified arrangement of connection to or for use of Gujarat Grid, shall submit an application on standard format to STU in accordance with Gujarat Electricity Regulatory Commission (Terms and Conditions for Intra-state Open Access) Regulations, 2011. The STU shall process the application for grant of connectivity in accordance with these regulations.

Connection Agreement

- 5.3 A connection agreement shall be signed by the applicant with STU in accordance with the Gujarat Electricity Regulatory Commission (Terms and Conditions for Intra-state Open Access) Regulations, 2011.

Important Technical Requirements for Connectivity to the Grid

5.4 Reactive Power Compensation

- a) Reactive Power compensation and/or other facilities shall be provided by STUs, and users connected to Gujarat Grid as far as possible in the low voltage systems close to the load points, thereby avoiding the need for exchange of Reactive Power to/from Gujarat Grid and to maintain Gujarat Grid voltage within the specified range.
- b) The person already connected to the grid shall also provide additional reactive compensation as per the quantum and time frame decided by respective RPC in consultation with RLDC. The users and STUs shall provide information to RPC and RLDC regarding the installation and healthiness of the reactive compensation equipment on regular basis. RPC shall regularly monitor the status in this regard.

5.5 Data and Communication Facilities

Reliable and efficient speech and data communication systems shall be provided to facilitate necessary communication and data exchange, and supervision/control of the grid by the RLDC, under normal and abnormal conditions. All users, STUs and CTU shall provide systems to telemeter power system parameters such as flow, voltage and status of switches/ transformer taps etc. in line with interface requirements and other guideline made available by RLDC. The associated communication system to facilitate data flow up to appropriate data collection point on STU's system shall also be established by the concerned user or STU as specified by CTU in the Connection Agreement. All users/STUs in coordination with CTU shall provide the required facilities at their respective ends, as specified in the Connection Agreement.

5.6 System Recording Instruments

Recording instruments such as Data Acquisition System/Disturbance Recorder/Event Logging Facilities/Fault Locator (including time synchronization equipment) shall be provided and always kept in working condition in the Gujarat Grid for recording of dynamic performance of the system. All users and STUs shall provide all the requisite recording instruments and keep them in working condition.

5.7 Responsibilities for Safety

STU and the concerned users shall be responsible for safety in accordance with Central Electricity Authority (Technical Standards for connectivity to the Grid) Regulations, 2007, Gujarat Electricity Regulatory Commission (Terms and Conditions for Intra-state Open Access) Regulations, 2011 and CEA (Safety Requirements for construction, operation and maintenance of electrical and electric lines) Regulations, 2008 and amended time to time.

5.8 Cyber Security

All utilities shall have in place, a cyber security framework to identify the critical cyber assets and protect them so as to support reliable operation of the grid.

5.9 Wind generators and Solar Generating Station using Inverters

The connectivity standards specifying the technical requirements for wind generators and solar generating stations using inverters to be synchronized with the grid at 66 kV or above. They shall be capable of the following:

1. Wind generating stations connected at 66 kV and above shall be capable of supplying dynamically varying reactive power support, so as to maintain power factor within limits of 0.95 lagging to 0.95 leading. Similarly, solar generating stations have to maintain power factor within limits of 0.90 lagging to 0.90 leading.
2. Wind generating stations and solar generating stations shall have fault ride through capability of not less than 300 milli-seconds so that grid is not destabilized due to sudden outage of generation in the event of a grid disturbance.
3. The total harmonic distortion for voltage at the connection point shall not exceed 5% with no individual harmonic higher than 3% and the total harmonic distortion for current drawn from the transmission system at the connection point shall not exceed 8%. The above measurement of Harmonics Distortion has to be carried out every six monthly and shall be reported to STUs/ Licensees.

Schedule of Assets of State Grid

- 5.10 STU and other transmission licensees granted license by GERC shall submit annually to GERC by 30th September each year, a schedule of transmission assets, which constitute the state grid as on 31st March of that year indicating ownership on which SLDC has operational control and responsibility.

Metering for Open Access

- 5.11 The open access consumer, generating company, Distribution Licensee and traders shall provide meters, as may be specified by the Commission in Gujarat Electricity Regulatory Commission (Terms and Conditions for Intra-state Open Access) Regulation, 2011.

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6. System Operation Code

Operation Planning and Security

Introduction

This section contains the guidelines for STU/ Transmission Licensee to carry out the planning of power system operations, including interface co-ordination with the users, fixing the parameters for Operation Margin, contingency reserve, demand control etc. for a satisfactory grid operation and system integrity.

Objective

The objective of this section is to define the process, which will allow STU to minimise transmission outages by coordination with the generating companies and other user outages while maintaining system security to the extent possible. This section also provides guidelines for setting out reserves available from:

- (a) External connections
- (b) System operation
- (c) Demand control

Demand Estimation

- 6.1 The Distribution Licensee shall formulate a short-term demand forecast considering the previous financial year as base and projecting the demand for the succeeding five years. During this process, he shall review the status of loads materialising as per the previous load forecast. Energy sales in each tariff class shall be projected in the forecast period over the corresponding figures relating to the base year by adopting an appropriate statistical method. The projections shall take into account the assumed normal growth for non-specific Loads, specific and identified loads of 1 MW and above. The projections shall also take into account the effects of Demand Side Management, if any, and energy conservation. The peak load requirements at each Connection Point / Interface Point shall be estimated, taking into account the distribution losses. The peak load requirement at each Connection Point / Interface Point will essentially ensure that the STU/ Transmission Licensee may determine the corrective/ necessary measures to be taken to maintain the capacity adequacy in the Transmission System up to the Connection Point / Interface Point. This will facilitate the Transmission Licensee to develop the compatible Transmission System. However, if the Distribution Licensee receives power at a number of Connection Points / Interface Points in a compact area, which are interconnected in a ring, then such a Distribution Licensee shall forward the overall long-term demand forecast, as well as at each Connection Point / Interface Point with the variation or tolerance as mutually discussed and agreed upon with the STU/ Transmission Licensee. The aggregate energy and peak load requirements for the Area of Supply shall be estimated taking into account the distribution losses. The Distribution Licensee shall

forward the short-term demand forecast for each Connection Point / Interface Point for peak load requirement as well as aggregate energy and peak load demand for the Area of Supply on annual basis to the STU, Transmission Licensee and GERC along with the following details on the basis of which the forecast is made:

- (a) Data
- (b) Methodology
- (c) Assumptions

- 6.2 It shall be the responsibility of all the Distribution Licensees and Union Territories Diu, Daman and Dadra Nagar Haveli) to the extent it affects the Gujarat State Grid, to fully cooperate with STU in preparation of demand forecasts for the entire Gujarat state.
- 6.3 The Distribution Licensees shall provide their above mentioned estimates for the period from 1st April to 31st March by 31st January of each year on a 'financial year ahead' basis. This shall be updated for every month subsequently in the previous month on a 'month ahead basis,' and in the previous day on a day-ahead basis, as required by STU/ Transmission Licensee.
- 6.4 Based on the data furnished by the Distribution Licensees, STU shall make monthly peak and lean period demand estimates for the year ahead, and daily peak and lean period demand estimates for the month ahead.
- 6.5 The Distribution Licensees shall provide to SLDC, estimates of loads that may be shed, when required, in discrete blocks with details of arrangements of such load shedding.
- 6.6 All the data shall be collected in accordance with the procedures agreed to between STU and each user.
- 6.7 The SLDC shall maintain a database of the total demand for the state on an hourly basis.
- 6.8 The demand estimation is to be done by all users / Distribution Licensees on a daily/weekly/monthly /yearly basis for the current year for load - generation balance planning. The SLDC shall carry out system studies for operational planning and to access transfer capabilities for facilitating intra / inter-state open access, based on demand estimation.
- 6.9 While the demand estimation for operational purposes is to be done on a daily/weekly/monthly basis initially, mechanisms and facilities at SLDCs shall be created at the earliest to facilitate on-line estimation of demand for daily operational use, for each 15 minutes block
- 6.10 All users / Distribution licensee shall develop methodologies/mechanisms for daily/ weekly / monthly/ yearly demand estimation (MW, MVar and MWh) for operational purposes. Based on this demand estimate and the estimated availability from different sources, the demand management measures like load shedding, power cuts shall be

planned and shall ensure that the same is implemented by the Distribution Licensees. All users / Distribution Licensees shall provide relevant data to SLDC time to time. SLDC shall maintain historical database for demand estimation.

- 6.11 SLDC shall carry out its own demand estimation from the historical data and weather forecast data from time to time and the relevant data provided by the distribution licensees and other concerned persons. SLDC shall furnish the monthly estimated demand to WRLDC and WRPC for better operation planning.
- 6.12 The SLDC shall take into account the wind and solar energy forecasting to meet the active and reactive power requirement.

Data Requirements

- 6.13 The users and STU shall provide all the data indicated in the Annexure E (page 123) to the SLDC. Each generating company shall submit to the SLDC in writing during the month of March every year, the generation planning parameters and the performance chart of the generator to be applied from the beginning of April onwards, for the entire year. The Generator Performance chart shall be for each specific generating unit and include the details of the Generator Transformers and demonstrate the limitation of reactive capability of the generating unit at the Transmission System voltage of 10% above normal, as and when required by the SLDC.

Release of Circuits and Generator Units included in the Outage Plan

- 6.14 Notwithstanding provision in any approved outage plan, no cross boundary circuits or generating units of a generating company shall be removed from service without specific release from the SLDC. This restriction shall not apply to individual generating units of a CPP, which are operating in standalone mode. Once an outage has commenced, and if any change in restoration is apprehended, the SLDC or the user concerned shall inform the other party promptly together with the revised estimation of restoration time.

Transmission Outage Planning

- 6.15 The STU shall produce a yearly transmission outage programme for the period from 1st of April to 31st of March. All the generating companies and Distribution Licensees shall furnish their proposed outage programmes containing the identification of the unit, substation, etc., date of start of outage and duration of outage, in writing to the SLDC for the year ahead (from 1st of April to 31st of March) by 15th of October each year. In case the Distribution Licensee has planned their internal outage programme in such a way, which may induce a loss of load not exceeding 20 MW in his Area of Supply such an outage programme may not be required to be intimated to SLDC. The SLDC shall interact with all the above said agencies and prepare an optimum draft outage plan to minimise interruptions to consumers to the extent possible, if necessary by rescheduling any of the outages. The finally agreed transmission outage plan, taking into account the regional and

user requirements shall be prepared by the SLDC and furnished to all the users by the 15th of February every year.

- 6.16 The outage plan shall be reviewed by the SLDC quarterly and monthly basis in consultation with all the concerned agencies mentioned above, regarding any changes necessitated during the period and the revised outage plan shall be intimated to all users. The users' requests for additional outages, if any, shall be considered by the SLDC and accommodated to the extent possible. Such changes shall be informed by the SLDC promptly to all concerned. The Distribution Licensees shall also inform the consumers through publications in local newspapers whenever interruptions to power supply would affect them.
- 6.17 In case of emergency in the system; viz. loss of generation, breakdown of transmission line affecting the system, grid disturbances or system isolation, SLDC may conduct studies again before clearance of the planned outage.
- 6.18 SLDC is authorized to defer the planned outage in case of any of the following, taking into account the statutory requirements:
- Grid disturbances
 - System isolation
 - Partial blackout in a state
 - Any other event in the system that may have an adverse impact on the system security by the proposed outage
- 6.19 Each user and STU shall obtain the final approval from SLDC prior to availing an outage
- 6.20 The SLDC should report quarterly indicating deviation in outages from the plan along with reasons to State Operation Coordination Committee (SOCC). These reports shall also be put up on the SLDC website.

Operating Margin

- 6.21. Operating Margin comprises of contingency reserve and operating reserves required for satisfactory operation of the power system to cover uncertainties in variations in demand forecasts, loss of external connections, loss of generation, constraints in the Transmission System and all other factors.
- 6.22 The required contingency reserve shall be decided by the SLDC on the basis of historical trends in the reduction of availability of the generating companies, imports through inter-state tie lines and increases in demand forecast during real time operation.
- 6.23 Whenever the contingency reserve is to be held by a thermal power station, the SLDC shall include the same in the Indicative running notification and/or subsequent despatch

instructions by which the generating company is notified of and/or instructed, that the generating unit shall be operated in the contingency reserve mode.

Demand Control

- 6.24 Automatic load shedding shall be resorted to by means of installation of the Under Frequency Relays at the substations of the Transmission Licensee as per the directions of the SLDC to preserve the overall integrity of the power system. The number and size of the discrete blocks with the associated low frequency setting predetermined for automatic under frequency load shedding shall be determined on rotational basis in consultation with every Distribution Licensee. The frequency settings of these relays shall be coordinated in consultation with the Regional Power Committee.
- 6.25 Whenever restoration of large portions of the total demand disconnection effected by the automatic load shedding is not possible within a reasonable time, the SLDC shall implement additional disconnection manually, to restore an equivalent amount of demand disconnected automatically. Each Distribution Licensee shall help the SLDC in identifying such load blocks. Load shed by the operation of automatic load shedding devices shall not be restored without specific directions from the SLDC.
- 6.26 Planned manual disconnection shall be implemented by the SLDC when there is a shortfall in generation, or constraints in Transmission System, or reduction of imports through external connection etc. requiring demand control over prolonged period to control the overdrawal of power from ISGS/SGS when the system frequency falls below 49.5 Hz. In such cases, a rotational load shedding scheme shall be adopted to ensure equitable treatment for all consumers as far as practicable.
- 6.27 Emergency manual disconnection to deal with unacceptable voltage and frequency levels etc shall be implemented by the SLDC only when loss of generation, mismatch of generation with the demand or constraints in the Transmission System, as well as in case of over drawal from the grid in excess of respective schedule affecting the frequency of the regional grid below 49 Hz, result in an emergency situation, requiring load shedding at short notice or no notice, to maintain a regulating margin.
- 6.28 These control measures shall not be withdrawn till the system frequency improves and when the SLDC issues such instructions after review of the situation.

Demand Disconnection

- 6.29 Distribution licensee and bulk consumer shall initiate action to restrict the drawl of its control area, from the grid, within the net drawal schedule whenever the system frequency falls to 49.7 Hz.
- 6.30 The distribution licensee and bulk consumer shall ensure that requisite load shedding is carried out in its control area, so that there is no over drawl when frequency is 49.5 Hz. or below.

- 6.31 Each user / STU in coordination with SLDC shall formulate contingency procedures and make arrangements that will enable demand disconnection to take place, as instructed by the RLDC/SLDC, under normal and/or contingent conditions. These contingency procedures and arrangements shall regularly be / updated by the user/STU and monitored by SLDC. SLDC may direct any user/STU to modify the above procedures/arrangement, if required, in the interest of grid security and the concerned user/STU shall abide by these directions.
- 6.32 The SLDC, through the respective Distribution Licensees, shall also formulate and implement state-of-the-art demand management schemes for automatic demand management like rotational load shedding, demand response (which may include lower tariff for interruptible loads) etc. However, it shall be implemented in accordance with prevailing IEGC provisions to reduce over drawl in order to comply with para 6.29 & 6.30. A report detailing the scheme and periodic reports on progress of implementation of the schemes shall be sent to the State Commission by the concerned SLDC.
- 6.33 In order to maintain the frequency within the stipulated band and maintaining the network security, the interruptible loads shall be arranged in four groups of loads, for scheduled power cuts/load shedding, loads for unscheduled load shedding, loads to be shed through under frequency relays/ df/dt relays and loads to be shed under any system protection scheme identified at the RPC level. These loads shall be grouped in such a manner, that there is no overlapping between different groups of loads. In case of certain contingencies and/or threat to system security, the RLDC may direct any SLDC/ Distribution Licensee or bulk consumer connected to the ISTS to decrease drawl of its control area by a certain quantum. Such directions shall immediately be acted upon. SLDC shall send compliance report immediately after compliance of these directions to RLDC.
- 6.34 To comply with the direction of RLDC, SLDC may direct any Distribution Licensee/bulk consumer connected to the STU to curtail drawal from grid. SLDC shall monitor the action taken by the concerned entity and ensure the reduction of drawal from the grid as directed by RLDC.
- 6.35 SLDCs shall devise standard, instantaneous, message formats in order to give directions in case of contingencies and /or threat to the system security to reduce over drawl by the distribution licensee, bulk consumers at different overdraw conditions depending upon the severity of the over drawal. The concerned distribution licensee, bulk consumer shall ensure immediate compliance with these directions of SLDC and send a compliance report to the concerned SLDC. These control measures shall not be withdrawn till further instruction of SLDC after review of the situation.
- 6.36 All users, SLDC/ Distribution Licensees or bulk consumer shall comply with the directions of RLDC/SLDC and carry out requisite load shedding or backing down of generation in case of congestion in the Transmission System to ensure safety and reliability of the system. The procedure for application of measures to relieve congestion

in real time as well as provisions of withdrawal of congestion shall be in accordance with Central Electricity Regulatory Commission (Measures to relieve congestion in real time operation) Regulations, 2009.

System Security

- 6.37 All users shall cooperate with STU / Transmission Licensee so that the respective sections of the power system operate in synchronism with Gujarat power grid. STU/Transmission Licensee/ CTU shall operate the inter-state links and ensure smooth exchange of power in the western grid among the constituent state grids.
- 6.38 No part of the state grid shall be deliberately isolated from the rest of the national/regional grid, except
- (I) Under an emergency, and conditions in which such isolation would prevent a total grid collapse and/or would enable early restoration of power supply,
 - (II) For safety to human life,
 - (III) When serious damage to costly equipment is imminent and such isolation would prevent it,
 - (IV) When such isolation is specifically instructed by RLDC/SLDC. Complete synchronization of the grid shall be restored as soon as the conditions permit it. The restoration process shall be supervised by RLDC, in coordination with NLDC /SLDC in accordance with operating procedures separately formulated by NLDC/RLDC.
- 6.39 Complete synchronism shall be restored as soon as the conditions permit. The restoration process shall be supervised by the SLDC.
- 6.40 The transmission lines of 132 kV and above and 66 kV lines meant for connecting CPP with grid and the interconnecting power transformers should not be opened without instructions or prior clearance from the SLDC unless under emergencies when prior clearance is not possible. The SLDC shall also be informed and get the clearance, while bringing back these lines into service.
- 6.41 Any tripping of the transmission lines 132 kV and above or power transformers of 132 kV class (i.e. 132/66 kV etc.) and above and 50 MVA and above whether actuated by protective relays or manually, shall be promptly reported to the SLDC/Sub-ALDC by the Engineer in charge of the substation at the earliest along with the reasons for such tripping and the time required for restoration. The report shall accompany all the relevant information/data including the outputs of the disturbance recorder, sequential event recorder etc. required for the purpose of analysis. While the restoration of tripped equipment/ line, SLDC shall be informed and get the clearance.
- 6.42 The governors of all the generating units of capacity 50 MW and above, for hydro generating stations and 200MW and above for thermal generating stations except run of the river hydroelectric Generating Stations without pondage, steam turbines of combined cycle gas turbines and nuclear generating stations, shall be in free operation at all times

irrespective of ownership of generating unit. If for any reason, the governors are locked, the same should be intimated to the SLDC along with the reasons and duration of such operation. Based on the same, SLDC shall advise WRLDC about such an operation along with the reasons and duration thereof. The load limiter, automatic turbine run-up system (ATRS), turbine supervisory coordinated control system etc shall not be used to suppress the normal governor action in any manner. No dead bands and time delays shall be deliberately used. All governors shall have a droop of 3% to 6%.

- 6.43 All generating units shall be capable of and shall not be prevented from picking up 5% extra load, more than the declared Maximum Continuous Rating, for at least five minutes or within the technical limits specified by the manufacturers, when the frequency falls due to a system contingency. In case any Generating Unit of 50 MW and above does not meet this requirement for any period, the Generating Company should intimate the same to the SLDC along with reasons thereof.
- 6.44 In case the frequency falls below 49.7 Hz, all the partly loaded generating units shall pick up additional load at a faster rate, according to their capability. The SLDC, in consultation with the WRLDC and the Distribution Licensees, shall prepare a plan for automatic load relief during the low frequency conditions. In case the frequency rises to 50.2 Hz or higher, neither any generating unit, which is in stand-by mode shall be synchronised with the grid; nor shall Active Power generation at any generating station be increased irrespective of the type and ownership, unless advised by SLDC.
- 6.45 No generating company shall suddenly increase/decrease its generation by more than 50 MW without prior intimation to the SLDC, except during emergencies or to prevent an imminent danger to any costly equipment. Similarly no Distribution Licensee shall cause a sudden decrease/increase in its load due to imposition/lifting of power cuts etc. without prior intimation and consent of the SLDC, particularly when the frequency is less than 49.5 Hz or above 50.5 Hz.
- 6.46 All generating units shall have Automatic Voltage Regulators in operation, with appropriate settings. If for any reason, it has to be operated without the same, the SLDC shall be intimated immediately, with reasons and duration of such operation and its concurrence obtained. The metering and protection systems shall be provided according to the Metering and Protection Standard Annexure F (page 127).
- 6.47 Users shall comply with the following applicable standards issued separately:
- (a) Power System Management and Operation Standards
 - (b) Supply Code
 - (c) Distribution Code
 - (d) Power System Safety Standards
- 6.48 Users shall make all possible efforts to ensure that the grid frequency always remains within the 49.5 - 50.2 Hz band (as per the prevailing IEGC and amendment thereof), the

frequency range, within which the steam turbines conforming to the IEC specifications can safely operate.

- 6.49 No important element of the state grid shall be deliberately opened or removed from service at any time, except when specifically instructed by SLDC or with specific and prior clearance of SLDC. The list of such important grid elements on which the above stipulations apply shall be prepared by the SLDC, in consultation with the concerned users, CTU and STUs, and be available at the websites of SLDCs.
- 6.50 In case of opening/removal of any important element of the grid under an emergency situation, the same shall be communicated to SLDC at the earliest possible time after the event. SLDC shall inform the opening/removal of the important elements of the state grid to RLDC.
- 6.51 Any prolonged outage of power system elements of any user/STU, which is causing or likely to cause danger to the state grid or sub-optimal operation of the state grid shall regularly be monitored by SLDC. SLDC shall report such outages to SOCC, who shall finalise the action plan and give instructions to restore such elements in a specified time period.
- 6.52 All thermal generating units of 200 MW and above and all hydro units of 10 MW and above, operating at or up to 100% of their Maximum Continuous Rating (MCR) shall normally be capable of (and shall not in any way be prevented from) instantaneously picking up to 105% and 110% of their MCR, respectively, when frequency falls suddenly. After an increase in generation as above, a generating unit may ramp back to the original level at a rate of about one percent (1%) per minute, in case continued operation at the increased level is not sustainable. Any generating unit not complying with the above requirements shall be kept in operation (synchronized with the state grid) only after obtaining the permission of SLDC.
- 6.53 All Distribution Licensees / STUs shall provide automatic under-frequency and df/dt relays for load shedding in their respective systems, to arrest frequency decline that could result in a collapse/disintegration of the grid, as per the plan separately finalized by the concerned RPC and shall ensure its effective application to prevent cascade tripping of generating units in case of any contingency. All Distribution Licensees STUs and SLDCs shall ensure that the above under-frequency and df/dt load shedding/islanding schemes are always functional.

The provisions regarding under-frequency and df/dt relays of relevant CEA regulations shall be complied with. SLDC shall furnish monthly report of UFR and df/dt relay operation in their respective system to the respective RPC.

The RPC Secretariat shall carry out periodic inspection of the under-frequency relays and maintain proper records of the inspection.

The RPC shall decide and intimate the action required by distribution licensee and STUs to get required load relief from under-frequency and df/dt relays. All distribution licensee and STUs shall abide by these decisions.

- 6.54 All users, STU/SLDC, CTU/RLDC shall also facilitate identification, installation and commissioning of System Protection Schemes (SPS) (including inter-tripping and run-back) in the power system to operate the transmission system closer to their limits and to protect against situations such as voltage collapse and cascade tripping, tripping of important corridors/flow-gates etc. Such schemes would be finalized by the concerned RPC forum, and shall always be kept in service. If any SPS is to be taken out of service, permission of RLDC shall be obtained indicating reason and duration of anticipated outage from service.
- 6.55 Procedures shall be developed by SLDC in consultation with the WRLDC to recover from partial/total collapse of the grid in accordance with CEA (Grid Standards) Regulations, 2010 and amended from time to time, in accordance with the requirements stipulated under paragraph 'Contingency Planning of the Grid Code.' These procedures shall be followed by all the users, STU to ensure consistent, reliable and quick restoration.
- 6.56 Each user, STU and CTU shall provide and maintain adequate and reliable communication facility internally and with other users/STUs /RLDC/SLDC to ensure exchange of data/information necessary to maintain reliability and security of the grid. Wherever possible, redundancy and alternate path shall be maintained for communication along important routes; e.g. SLDC to RLDC.
- 6.57 All the users, STU shall send information/data including disturbance recorder/sequential event recorder output to SLDC within three days for the purpose of analysis of any grid disturbance/event. No user or STU shall block any data/information required by the SLDC for maintaining reliability and security of the grid and for analysis of an event.
- 6.58 All users, SLDC and STU shall take all possible measures to ensure that the grid voltage always remains within the operating range specified in the prevailing IEGC.

Voltage – (kV rms)		
Nominal	Maximum	Minimum
765	800	728
400	420	380
220	245	198
132	145	122
66	72	60
33	36	30

6.59 All users and STU shall provide adequate voltage control measures through voltage relay as finalized by RPC, to prevent voltage collapse and shall ensure its effective application to prevent voltage collapse/ cascade tripping

6.60 SLDC shall make all efforts to evacuate the available solar and wind power and treat as a must-run station.

However, the system operator may instruct the solar /wind generator to back down generation on consideration of grid security or safety of any equipment or personnel is endangered and solar/ wind generator shall comply with the same.

(I) SLDC/RLDC may direct a wind farm to curtail its VAr drawal/injection in case the security of grid or safety of any equipment or personnel is endangered.

(II) During the wind generator start-up, the wind generator shall ensure that the reactive power drawal (in-rush currents in case of induction generators) shall not affect the grid performance. For these, Data Acquisition System facility shall be provided for transfer of information to concerned SLDC and RLDC.

System Operation, Metering and Protection Code

Introduction

This section specifies the procedure to be adopted for system operation, the minimum requirement of protection levels and metering specifications for the various components of the system.

Objective

The main objective of this section is to formulate the detailed methodology to be followed by STU/ Transmission Licensee for healthy operation of the system to meet the specified standards of electrical power under normal operating conditions as follows:

- (a) Laying down procedures for the function of SLDC,
- (b) Defining the responsibilities of the Transmission Licensee and other users,
- (c) Specifying the minimum standards of protection to be employed in the generating stations, substations and Transmission and Distribution Systems by the concerned agencies.

General

6.61 It is essential that all the users of the Transmission System shall fully cooperate with STU/ Transmission Licensee to maintain the system integrity and healthy operations. The entire grid is one unit, right from the point of generation to the ultimate consumers and the various agencies involved in the management of the power system shall provide a

healthy coordination with the SLDC who will be the central agency for operation of the state grid. The success or failure of the power system entirely depends on the full cooperation of all the participants in this endeavour.

System Operation and Despatch:

- 6.62 The estimation of daily load demand on a day-ahead basis shall be carried out, in general, and furnished to the SLDC by the Distribution Licensees, keeping in view the following aspects:
- (a) Outage Planning/scheduled rostering,
 - (b) Historical data of load for the same month/day/time,
 - (c) Previous day's demand,
 - (d) Present weather conditions and meteorological reports,
 - (e) Requirement of meeting important loads on festivals etc.
 - (f) Force Majeure conditions such as cyclones, earthquake, riots etc.,
 - (g) Vacations, Sundays and other holidays,
 - (h) Number and frequency of breakdowns and their recovery period.
- 6.63 The state grid normally operates in synchronism with the western grid and the WRLDC has the overall responsibility of enforcing the grid discipline and managing the frequency in the region. The SLDC shall follow the instructions of WRLDC in this regard for backing down/shutting down generation, regulating the load flow etc. to meet the objective. The SLDC shall accordingly instruct the generating companies to regulate their generation and hold reserves, if any, of Active and Reactive Power within their respective declared parameters to ensure that the grid frequency remains in the frequency band of 49.5 to 50.2 Hz. (frequency band as per prevailing IEGC).
- 6.64 The SLDC shall also regulate the load as may be necessary to meet this objective. The transmission system voltage levels can be affected by regional operation. STU shall optimise voltage management by adjusting the transformer taps to the extent available and switching the capacitors/reactors and take such other operational steps indicated in the Transmission Management and Operating Standard. The SLDC shall also instruct the generating companies to regulate the MVar generation within their declared parameters. The SLDC shall also instruct the Distribution Licensees to regulate their demand if necessary. The Distribution Licensees shall also participate in the voltage management by regulating their drawal and by installing compensatory equipment, as may be required. If acceptable voltage levels are still not reached by these measures, the Transmission Licensee shall take necessary steps to augment the voltage level such as strengthening of the Transmission System and/or installation of requisite shunt capacitors adding compensatory equipment, building new lines etc. to meet the voltage criteria.
- 6.65 A regular procedure shall be evolved by SLDC with all the generating companies for a pattern of generation reduction at different generating stations when the system load comes down after the peak load period. Schedule and despatch procedure shall be suitably modified from time to time, keeping in view of the tariff agreements for

achieving optimum cost of power as soon as such arrangements are reached with the generating companies.

- 6.66 The Distribution Licensee shall maintain a power factor of not less than 0.90 lag as required in the distribution code and furnish all the data required by the SLDC to ascertain the Reactive Power flow to their distribution system. The SLDC may also instruct the Distribution Licensees to maintain appropriate power factor and take all measures minimise Reactive Power drawal.
- 6.67 WAMS for SLDC: WAMS is needed to keep up pace with the current technology as per need of time. It is essential for SLDC to establish full-fledged WAMS in line with SCADA, reliable multithread communication and IT infrastructure.

The outline of WAMS shall be:

- (a) Phasor Measurement Unit (PMU) at critical locations and to ensure complete grid observability,
- (b) Broadband communication between PMU at S/s and Phasor Data Concentrator (PDC) at SLDC,
- (c) PMU data collection, analysis and observation utility,
- (d) Advance application package like oscillation stability, transient stability, voltage stability and dynamic State Estimator to observe dynamic behaviour of the system.

Metering and Protection:

- 6.68 The metering and protection to be provided at the generating stations, sub-stations and the distribution systems shall meet the specific requirements of the Metering and Protection Standard under Annexure F (page 127). This standard also forms an integral part of this code. All users shall cooperate with the STU to ensure correct and appropriate settings of protection to achieve an effective, discriminatory removal of faulty equipment within the target clearance time specified in this standard. Protective Relay settings shall not be altered, or protection bypassed and/or disconnected, without consultation and agreement of all the affected users. In case where protection is bypassed and/or disconnected by agreement, then the cause must be rectified and protection shall be restored to normal condition, as quickly as possible. If agreement has not been reached, the electrical equipment shall be removed from service forthwith in case it is affecting the security of the system.
- 6.69 *Fire Protection:*
All adequate precaution shall be taken and protection shall be provided against fire hazards to all apparatus in the system conforming to the relevant Indian Standard Specifications and/or provisions of CEA (Measures Relating to Safety and Electric Supply) Regulations, 2010.

Monitoring of Generation and Drawal

Introduction

This section covers the procedure to be followed by the SLDC for monitoring the generating output, Active and Reactive reserve capacity required for evaluation of the performance of the generating station. The monitoring of scheduled drawal is important to ensure that STU/ Transmission Licensee contribute towards improving the regional performance and observes grid discipline.

Objective

The objective of this section is to define the responsibilities of all users in monitoring the performance of their generating units, and the Distribution Licensee's compliance with the scheduled drawal.

Monitoring Procedure

- 6.70 For the effective operation of the Transmission System, it is important that the declared availability of the generating company is realistic. SLDC shall continuously monitor the generating unit outputs and bus voltages. More stringent monitoring shall be performed at any time when there are reasons to believe that the generating company's declared availability may not match with the actual availability, or declared output does not match with the actual output.
- 6.71 STU/ Transmission Licensee shall inform the generating company, in writing, if continual monitoring demonstrates an apparent persistent or material mismatch between the despatch instructions and the Generating Unit output or breach of the connection conditions. Further, more stringent monitoring shall be carried out by the SLDC, if agreement is not reached between the concerned parties on the performance of the generating unit. The results of stringent monitoring shall be reported by the SLDC to the generating company. Continual discrepancies shall be reported to GERC for resolution.
- 6.72 The generating companies shall provide real time automatic data transfer facility to the sub-SLDC and should be compatible with the existing SCADA of sub-LDC. However, the generating companies shall provide to the SLDC, quarter hourly generation summation outputs wherever no automatic transmitting metering or SCADA equipment exists. All the CPPs (capacity above 5 MW) shall provide to the SLDC quarter hourly export/import MW and MVar. The generating company shall provide other logged readings, which the SLDC may reasonably require, for monitoring purposes wherever SCADA data is not available.

Monitoring of Drawal by the Grid

- 6.73 The SLDC shall continuously monitor actual MW drawal (import/export) against the scheduled drawal from the generating companies, by the use of SCADA equipment wherever available, or otherwise using available metering. The SLDC shall request the WRLDC and adjacent states, as appropriate, to provide any additional data required to enable this monitoring to be carried out.
- 6.74 The SLDC shall also monitor the actual MVar import/export. This will be used to assist in the voltage management in the Transmission System.

Generating Unit Trippings

- 6.75 The generating companies shall promptly inform the tripping of a generating unit and restrictions to generate full load, with reasons, to the SLDC in accordance with the guidelines given in the operational event/accident reporting section. The approximate and expected time of resynchronisation with grid shall be informed to the SLDC. The SLDC shall keep a written log of all such trippings, including the reasons for the purpose of demonstrating the effect on system performance and identifying the need for remedial measures. The generating companies shall submit a detailed report of their unit trippings to the SLDC every month. While restoring the tripped units, SLDC shall be informed.

Data Requirements

- 6.76 The generating companies and the CPPs shall submit the following data on monthly basis to the SLDC in the first week of every succeeding month:
- (a) Generating Companies:
 - (i) Quarter-hourly generation and summation on real time basis,
 - (ii) Logged readings of generating units as required,
 - (iii) Detailed report of the generator unit trippings.
 - (b) CPPs (above 5 MW): Quarter hourly export/import MW on real time basis.

Contingency Planning

Introduction

This section formulates the recovery procedure to be followed by all users in the event of failure of the Gujarat power grid, or the Western Grid resulting in total or partial collapse of the system causing blackouts.

Objective

The objective of this section is to define the responsibilities of all the users for achieving the fastest possible recovery of the grid in the event of a failure in the Transmission System, or any sudden loss of generation or a blackout caused due to the failure of the Western Grid.

The procedure to be adopted for a fast recovery shall take into account the following:

- (a) The essential loads to be restored immediately,
- (b) The capabilities of the generating stations,
- (c) The possible transfer of power from the neighbouring systems through Inter State Transmission Lines,
- (d) The extent of immediate availability of power from the Central Sector Generating Stations.

The main objective is to achieve the following:

- (a) Restoration of the total system and associated demand in the shortest possible time
- (b) Resynchronisation of parts of the system which have ceased to be in synchronism,
- (c) To ensure that the communication arrangements for use in circumstances of serious disruption to the system, are available to enable senior management representatives of the SLDC, the Transmission Licensee and the users who are authorised to take decisions on behalf of the Transmission Licensee or the user,
- (d) To ensure that the Transmission System can operate in the event the SLDC is incapacitated for any reason.

Strategy

- 6.77 The situation prevailing prior to the occurrence of the contingency; e.g. availability of specific generating stations, transmission lines, and load demands will largely determine the restoration procedure to be adopted in the event of a total blackout. The SLDC shall coordinate with WRLDC and other SLDCs in determining the extent of problems. The SLDC shall inform all users of the situation and advise them to follow the strategy as outlined in this section for restoration. The personnel authorised by the users shall be readily available at the users' end for communication and acceptance of all operational communications throughout the period of contingency. The use of communication channels shall be restricted to the for operational communications only, till normalcy is restored.

Total Regional Blackout

- 6.78 In case of total regional blackout, the recovery shall be as per the Black Start procedure prepared by WRLDC in consultation with all the constituents of western region. As these procedures are updated periodically, the last updated procedures shall be followed during the total regional blackout.

Total and Partial State Transmission System Blackout

- 6.79 In case of total and partial State Transmission System blackout, the recovery shall be as per the Black Start/Restoration procedure prepared by SLDC in consultation with all users. As these procedures are updated periodically, the last updated procedures shall be followed during the total and partial state transmission system blackout. The instruction issued by SLDC in restoration of system from total or partial blackout shall be followed by all users, even though the same is not specifically mentioned in Black Start procedure/ restoration document.

Responsibilities

- 6.80 The SLDC shall maintain a record of the generating station's Black Start capabilities and associated Generating Station's Black Start operation plans.
- 6.81 STU shall prepare, distribute, and maintain up-to-date Black Start procedures covering the restoration of the Transmission System, following total or partial blackouts. The users shall agree to these Black Start procedures and promptly inform the SLDC in advance whenever they have difficulty in following the same.
- 6.82 The SLDC shall be responsible for directing the overall Transmission System restoration process by coordination with all the users and in close coordination with the WRLDC.
- 6.83 The Distribution Licensees shall be responsible for sectionalising the distribution system into discrete, unconnected blocks of load. They shall advise the SLDC as to the quantum of load likely to be picked up by the generator being synchronised.
- 6.84 The Generating Companies shall be responsible for commencing their planned Black Start procedure on the instruction of the SLDC and steadily increasing their generation, according to the demand intimated by the SLDC.

Special Considerations

- 6.85 During the process of restoration of the Transmission System, or Regional System blackout conditions, the normal standards of voltage and frequency need not be applied, and left to the discretion of the SLDC as appropriate depending on the prevailing situation.
- 6.86 The Distribution Licensees shall separately identify non-essential components of essential loads, which may be kept off during system contingencies. They shall also draw up an appropriate schedule with corresponding load blocks in each case. The non-essential loads can be put on only when the system normalcy is restored, and as advised by the SLDC.
- 6.87 All users shall pay special attention in carrying out the procedures to prevent secondary collapse of the system due to haste or inappropriate loading.

- 6.88 Despite the urgency of the situation, careful, prompt and complete logging of all operations and operational messages shall be ensured by all users to facilitate subsequent investigation into the incident and the efficiency of the restoration process. Such investigation shall be conducted promptly after the incident, and placed before the Grid Code Review Panel for appraisal in its next immediate meeting.

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7. Safety

Cross Boundary Safety

Introduction

This section specifies the requirements for safe working practices for maintenance of equipment associated with cross boundary operations and lays down the procedure to be followed when the work is carried out on electrical equipment connected to another User's System.

Objective

The objective of this section is to achieve an agreement on the principles of safety prescribed in the prescribed in the Central Electricity Authority (Measures Relating to Safety and Electric Supply) Regulations, 2010, when working across a control boundary between the STU/ Transmission Licensee and the Users.

Control Persons and their Responsibility

- 7.1 STU/ Transmission Licensee and all the Users shall nominate suitably authorised persons to be responsible for the co-ordination of safety across their boundary. These persons shall be referred to as Control Persons.

Procedure

- 7.2 STU/ Transmission Licensee shall issue a list of Control Persons with their names, designations, addresses and telephone numbers, to all the users having direct control boundary with it. This list shall be updated promptly whenever there is any change of name, designation or telephone number of any Control Person named in the list.
- 7.3 All users having a direct control boundary with STU/ Transmission Licensee shall issue a similar list of their Control Persons to STU/ Transmission Licensee. This list shall be updated promptly whenever there is any change of name, designation or telephone number of any Control Person named in the list.
- 7.4 Whenever any work across a cross boundary is to be carried out by the user or STU/ Transmission Licensee, the Control Person of the user or STU/ Transmission Licensee as the case may be, who has to carry out the work, shall directly contact his counterpart. Code words shall be agreed to, at the time of work, to ensure correct identification of both the parties. Contact between Control Persons shall normally be made by direct telephone.

- 7.5 If the work extends beyond one shift, the Control Person shall hand over charge to the relief Control Person and fully brief him on the nature of work and the code words in the operation.
- 7.6 The Control Persons shall cooperate to establish and maintain the precautions necessary to be taken for carrying out the required work in a safe manner. Both the established isolation and the established earth shall be kept in the locked positions wherever such facilities exist, and these shall be clearly identified and entered into the log sheet.
- 7.7 The Control Person in charge of the work shall satisfy himself that all the safety precautions to be taken are established before commencing the work. He should issue the safety documentation to the working party to allow the work to commence.
- 7.8 After completion of the work, the Control Person in charge of the work being carried out, should satisfy himself that the safety precautions taken are no longer required, and shall make a direct contact with his counterpart Control Person and request removal of the safety precautions. The equipment shall be declared as suitable for return to service only after confirmation of removal of all the safety precautions, by direct communication, using the code word contact between the two Control Persons, and the return of agreed safety documentation from the working party.
- 7.9 STU shall develop an agreed written procedure for Cross Boundary Safety and continuously update the same.
- 7.10 Any dispute concerning Cross Boundary Safety shall be resolved at the level of STU, if STU is not a party. In case where STU is a party, the dispute shall be referred to the GERC for resolution.

Special Considerations

- 7.11 All users shall comply with the agreed safety rules drawn up in accordance with Central Electricity Authority (Measures Relating to Safety and Electric Supply) Regulations, 2010.
- 7.12 All the equipment on Cross Boundary Circuits, which may be used for the purpose of safety coordination and establishment of isolation and earthing, shall be permanently and clearly marked with an identification number or name being unique to the particular substation. The equipment shall be regularly inspected and maintained in accordance with the manufacturer's specifications.
- 7.13 Each Control Person shall maintain a legibly written safety log, in chronological order, of all operations and messages relating to the safety coordination sent and received by him. All these safety logs shall be retained for a period of not less than ten years.

- 7.14 Each of the Distribution Licensees connected to the Transmission System shall maintain an updated map of his system pertaining to the area fed by each substation, and exhibit the same in the concerned area offices of the Distribution Licensee.

Safety and Line Clear Permits

Introduction

This section sets out the procedure for the record of the Line Clear Permit and sets guidelines for ensuring safety from electrical hazards to consumers, general public and working personnel.

Objective

The main objective of this section is to ensure safety to the working personnel of STU/ Transmission Licensee and users and maintenance of proper records for the issue of Line Clear Permits for allowing working personnel to carry out the works.

Safety Standards

- 7.15 The Safety Standard issued separately formulates the precautions to be taken for ensuring safety to the general public, consumers of electricity and the workmen. This forms an integral part of the Grid Code and STU/ Transmission Licensee and all the users shall comply with this standard.
- 7.16 STU/ Transmission Licensee shall prepare his own safety manual for the Transmission Lines, substations based on this standard. For the guidance of the shift operators, Operation and Maintenance Manuals for each substation shall be prepared by the Licensee. These manuals shall contain all the maintenance and operation schedules, based on the recommendations of the manufacturers of the various equipments installed in the substation. These manuals shall be periodically reviewed based on the experience gained and replacement of equipment. A maintenance register for the equipment including the station batteries shall be maintained at the respective substations. These shall be updated as and when the maintenance work is carried out and shall be periodically reviewed by the appropriate higher authority in whose control the substation falls. Similar registers shall be maintained for the Transmission Lines.
- 7.17 The Operation Manual shall clearly contain the details of isolation and earthing to be provided for allowing work on the equipments. The Single Line Diagram of the substation indicating the positions of various isolating devices shall be prominently displayed in the station. Charts showing the clearances from live parts (section clearance) for working on the isolated equipments where workmen are allowed to work shall be displayed prominently at each substation.

- 7.18 The danger boards as stipulated in the Central Electricity Authority (Measures Relating to Safety and Electric Supply) Regulations, 2010 and in relevant Indian Standards shall be displayed at the places approachable by the general public.
- 7.19 Regular maintenance shall be carried out on all the Transmission Lines in accordance with IS:5613 and records of all these shall be maintained. Wherever possible, hot line checking and replacement of failed insulators shall be made before and after the monsoon.
- 7.20 All the equipments in the receiving stations and substations shall be maintained in good condition as per the manufacturers' manuals and relevant Indian and/or International standards wherever available. The relays and circuit breakers shall be checked for their proper operations whenever these are taken out for maintenance purposes. The station batteries shall be maintained in good working condition by carrying out routine checks and maintenance works. The DC system provided in all these stations shall be properly maintained with no appreciable leakage current. An online monitoring system for monitoring of leakage and detection of ground faults shall be provided.

Line Clear Permit (LCP)

- 7.21 The format under Annexure G, H and I shall be used. The form under Annexure G (page 133) and designated as requisition for Line Clear Permit shall be used by the requesting safety coordinator, who is an authorised person. The form under Annexure H (page 133) and designated as check list for Line Clear Permit and Line Clear Permit shall be used at the time of issue of Line Clear Permit. The form under Annexure I (page 133) and designated as Line Clear Return shall be used for the return of the Line Clear Permit after the work for which the Line Clear Permit was taken, is completed.

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8. Communication and Data Acquisition

Introduction

This section specifies the minimum requirements of communication and data acquisition to be provided by each user at Connection Points/ Interface Points and Cross Boundary Circuits.

Objective

The objective of this section is to define the minimum acceptable communication and data acquisition requirements to enable STU/ Transmission Licensee to manage the Transmission System in a safe and economic manner, consistent with the requirements of his licence.

Supervisory Control and Data Acquisition (SCADA)

- 8.1. STU/Transmission Licensee shall install and make operative an operational metering data collection system under SCADA for storage, display and processing of operational metering data. All the users shall make available, outputs of their respective operational meters to the SCADA interface equipment.
- 8.2. The data collection, storage and display centre shall be the State Load Despatch Centre (SLDC).

Communication

- 8.3. Independent dedicated communication links for voice communication, written communication and data acquisition shall be installed and maintained by STU/ Transmission Licensee between all the generating stations, receiving stations, substations and SLDC / sub-SLDC. In addition, similar links between adjacent transmission system substations shall also be established. Other means of reliable communication systems shall also be established to ensure safe and secure grid operations.
- 8.4. Communication shall be available by direct dialling of discrete numbers and also through hotline by just lifting the telephone handset. Hotline links shall also be established by STU between all major generating stations, important substations and SLDC.

Data Acquisition

- 8.5. The following real time data are required by SLDC for effective control of the power system:
 - (a) MW and MVAR generated or absorbed in each generating station,
 - (b) MVAR imported or exported from the external connections,
 - (c) Voltages in all the system busbars,
 - (d) Frequency in the system,

(e) MW & MVar flow in each Transmission Line.

- 8.6 The generating companies shall provide the necessary transducers for the transmission of the above data from their generating stations to SLDC/WRLDC.
- 8.7 STU/ Transmission Licensee shall similarly provide the necessary transducers for the transmission of the above data from their receiving stations and substations to SLDC/WRLDC.
- 8.8 STU shall establish a suitable data transfer link between SLDC and WRLDC for exchange of operational data transmission.
- 8.9 Mutually agreed procedures shall be drawn up between the STU/ Transmission Licensee and other users outlining inter responsibility, accountability and recording of day-to-day communications and data transmission on operational matters.
- 8.10 All the additional data such as breaker/switch position shall be transmitted on an “if change” basis. Geographical Positioning Systems (GPS) may be used for time stamping of the trip information at the respective stations.
- 8.11 At all the 400 kV lines and important 220 kV lines, disturbance recorders shall be installed and recorder data shall be made available at SLDC for post event analysis of the disturbances.

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9. Operational Event and Incident/Accident Reporting

Introduction

This section covers the details of requirement for the exchange of information relating to operations and/or events on the total system, including the Western Grid, which have or may have an operational effect on:

- (a) The Gujarat power grid in case of an operation and/or event occurring on a user system,
- (b) A user system in the case of an operation and/or event occurring in the Transmission System.

The procedure for issue of warnings in the event of a risk of serious and widespread disturbance on the whole or part of the Gujarat state power grid is set out in this section.

Objective

The objective of this section is to define the incident to be reported, the reporting route to be followed and the information to be exchanged between users to ensure a consistent approach to the reporting of incidents and accidents on the Transmission System. These bits of information are required to identify the potential impact of an operation and/or event and assess the possible risk arising from it, so that appropriate action is taken by the concerned to maintain the integrity of the Transmission System. The action to be taken arising from the exchange of this information depends on the circumstances and details for each case and does not fall within the purview of this section.

Reportable Incidents

- 9.1. All events in the Transmission System having an operational effect on the user's system shall be notified by STU/ Transmission Licensee to SLDC and the users, whose systems are affected.
- 9.2. All events on the user's system having an operational effect on the Transmission System shall be notified by the user to STU/ Transmission Licensee and SLDC who in turn shall notify the other users on whose system the event may have an operational effect.
- 9.3. Typical examples of reportable incidents that could affect the Transmission System are as follows:
 - (a) Exceptionally high/low voltage or frequency,
 - (b) Serious equipment problem; i.e. major circuit breaker, transformer, busbar fault,
 - (c) Major problem in the generating unit,
 - (d) Tripping of ICT, Transmission Line or Capacitor Bank,
 - (e) Major fire incident, cyclones, storms, earthquakes etc.
 - (f) Major protection failure,

- (g) Overloading of equipment or transmission line which may result in hazard to the personnel,
- (h) Activation of any alarm or indication of abnormal operating condition,
- (i) Adverse climatic conditions being experienced or forecast,
- (j) Breakdown, or faults, or temporary changes in the capabilities of plant and/or apparatus,
- (k) Impending risks of protection operation,
- (l) Loss of load,
- (m) Accidents,
- (n) Excessive drawal deviations,
- (o) Minor equipment alarms.

The last two reportable incidents are typical examples of events of less consequence, but still affect the Transmission System and can be reasonably classified as minor. They require corrective action, but do not require immediate reporting to management but they should be reported at later stage within reasonable time.

- 9.4 The examples indicated in the above clause 9.3 are only illustrative and in no way, limit the general requirements to be reported.

Reporting Procedure

- 9.5 All reportable incidents occurring in lines and equipment of 66 kV and above at the grid substations shall promptly be reported orally by the user whose equipment has experienced the incident to all other significantly affected users and SLDC. The reporting user should submit a written confirmation to SLDC within one hour of such an oral report. If the incident is major in nature, the written report may be submitted within two hours, duly followed by a comprehensive report within 48 hours of the submission of the initial written report. In other cases, the reporting user shall submit a report within five working days to SLDC.
- 9.6 The SLDC shall call for a report from any user on any reportable incident affecting other users, in case such a user whose equipment might have been a source of the reportable incident does not report the same. However this shall not relieve any user from the obligation to report events in accordance with the Intimation of Accidents (Form and Time of Service of Notice) Rules, 2005 notified by the Central Government. The format for such a report shall be as per the approval of the Grid Code Review Panel and typically contain the following:
- (a) Location of the incident,
 - (b) Date and time of the incident,
 - (c) Plant or equipment involved,
 - (d) Supplies interrupted and the duration wherever applicable,
 - (e) Amount of generation lost, wherever applicable,
 - (f) System parameters before and after the incident, (voltage, frequency, flows, generation etc.)

- (g) Network configuration before the incident,
 - (h) Relay indications and performance of protection,
 - (i) Brief description of the incident,
 - (j) Estimated time of return to service,
 - (k) Any other relevant information,
 - (l) Recommendations for future improvement,
 - (m) Name and designation of reporting officer.
- 9.7 The report shall contain sufficient detail to describe the event to enable the recipient to assess the implications and risks arising out of the same. The cause need not be included in the report, but the recipient may ask for clarifications wherever necessary and it is obligatory that the reporting user shall put his best efforts and provide all the necessary and reasonable information.
- 9.8 In case of a request by either party the oral report shall be written down by the sender and dictated by way of a telephone message or sent by fax/e-mail to the recipient. In case of an emergency, the report can be given orally, followed by written confirmation.
- 9.9 The maximum time limit allowed for an oral report of the event is fifteen minutes from the time of the occurrence of the event.
- 9.10 SLDC will be responsible for reporting the event in line with the procedure set in IEGC.

Significant Events

- 9.11 A significant event includes events having an operational effect; e.g.
- (a) Tripping of plant and/or apparatus manually or automatically,
 - (b) Voltage outside statutory limits,
 - (c) System frequency outside statutory limits,
 - (d) System instability,
 - (e) System overloads.
- 9.12 Wherever a user reports an event, which the SLDC or STU/ Transmission Licensee considers to have had a significant effect on the Transmission System, the STU/ Transmission Licensee may require the user to report that event in writing within one day.
- 9.13 Wherever STU/ Transmission Licensee notifies SLDC and a user of any event which the user or SLDC considers to have had a significant effect on the user's system, the user may require the Transmission Licensee to report that event in writing within one day.

Warnings

- 9.14 An oral warning shall be issued by SLDC and confirmed in writing as well, to the STU/ Transmission Licensee and the users, who may be affected when SLDC knows that there is a risk of widespread and serious disturbance to the whole, or part of the total system.
- 9.15 Provided that sufficient time is available, the warning shall contain such information as the SLDC considers reasonable, to explain the nature, extent of the anticipated disturbance, to the user and STU/ Transmission Licensee, provided that such information is available to SLDC.
- 9.16 Each user and STU/ Transmission Licensee, on receipt of such a warning, shall take necessary steps to warn its operational staff and maintain its plant and apparatus in the condition in which it is best able to withstand the anticipated disturbance for the duration of the warning.
- 9.17 Scheduling and despatch may be affected during the period covered by such a warning.

Loss of communication with SLDC

- 9.18 In the event of loss of communication with SLDC, the provision made as above shall not apply; instead, the following provision shall apply:
- 9.19 Each generating station shall continue to operate in accordance with the last despatch instruction issued by SLDC, but shall use all reasonable endeavours to maintain the system frequency at the target of 50 Hz, plus or minus 0.5 Hz by monitoring frequency, until such time the new despatch instructions are received from SLDC.

Major Failure

- 9.20 Whenever a major failure takes place, STU/ Transmission Licensee and other users shall cooperate, inquire and establish the cause of the failure and produce appropriate recommendations. The STU shall submit the inquiry report to the Grid Code Review Panel and submit the report with the recommendations of the panel to GERC within two months of the incident.

Accident Reporting

- 9.21 If any accident occurs in connection with the generation, transmission, distribution supply or use of electricity or in connection with any part of electric lines or electrical plant of any person and the accident results or is likely to have resulted in loss of human or animal life or any injury to a human being or animal, the same shall be dealt with, in accordance with procedures laid down in the Power System Safety Standard.

Performance/ Operational Reporting

- 9.22 Every Discom / Licensee has to submit a quarterly performance report covering Demand Management (DM), Reactive Power Management and system operation, pocket-wise load forecasting details quarterly to GERC/ STU.
- 9.23 Similarly every generator also have to submit performance report in terms of PLF, other Key Performance Indicators, including range of maximum and minimum VAR injection and VAR absorption within capability curve, every half-yearly, to GERC and the STUs.
- 9.24 The STU has to submit operational / performance and planning of network development every six month to GERC, DISCOMs.
- 9.25 Similarly, SLDC has to submit operation/ performance report on grid stability and security, every half-yearly to GERC, STU, DISCOMs and licensee.

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10. Data Registration

Introduction

This section specifies a list of all the data required by STU, which is to be provided by the users, and the data required by the users to be provided by STU at the required time specified in the various sections of the Grid Code. The corresponding sections of the Grid Code contain the obligation to submit the data and define the times at which the data is to be supplied by the users.

Objective

The objective of this section is to list all the data and the corresponding sections of the Grid Code to be provided by the users to STU and vice versa.

Responsibility

- 10.1. All the users are responsible for submitting the up-to-date data in accordance with the provisions of the Grid Code. All the users shall provide STU with the names, addresses and telephone numbers of the persons responsible for sending the data. STU shall inform all the users the names, addresses and telephone numbers of the persons responsible for receiving the data.
- 10.2 STU shall provide up-to-date data to users as provided in the relevant sections of the Grid Code.
- 10.3 Responsibility for the correctness of these data rests with the concerned users providing the data.

List of Data to be Registered

- 10.4 The following data are required to be furnished by the generating companies to STU:
 - (a) Planning Data Requirements: Generation - As per Annexure B (page 101)
 - (b) Operation Planning data pertaining to the generating stations - As per Annexure E (page 123)
 - (c) System Data pertaining to the generating stations - As per Transmission Section 3 of GERC (Power System Management Standards) Regulations, 2005.
- 10.5 The following data are required to be furnished by the distribution companies to STU:
 - (a) Planning Data Requirements: Distribution - As per Annexure B (page 101)

(b) Operation Planning Data pertaining to Distribution - As per Annexe E (page 123)

10.6 STU is required to furnish the data to the user as per Annexure C (page 111).

Methods of Submission of Data

- 10.7 The data schedules are structured to serve as standard formats for data submission and these formats shall be used for written data submission. Wherever standard data formats are not given, these should be developed by SLDC in consultation with the users.
- 10.8 All the data to be submitted to STU or to such other department including any other Transmission Licensee as STU may, from time to time, notify users. The name of the person who submits each schedule of data shall be indicated.
- 10.9 Wherever a computer data link exists between the user and SLDC/Transmission Licensee, data may be submitted through this link. The data shall be in the same format as specified for paper transmission except for electronic encoding, for which, some other format may be more appropriate. The user shall specify the method to be used in consultation with STU/SLDC/Transmission Licensee and resolve issues such as protocols, transmission speeds etc. at the time of transmission.

Changes in User's Data

- 10.10 Whenever the user becomes aware of the change to any items of the data registered under license, the user must promptly notify the STU of the changes. The STU, on receipt of the changes, shall promptly correct the database accordingly. This shall also apply to any data compiled by STU regarding its own system.

Data not supplied

- 10.11 All the users are obliged to supply the data referred to in the individual sections of the Grid Code and listed in clause 10.4, 10.5 and 10.6. In case any data is missing and not supplied by the user, STU may act reasonably. If and when necessary, he may estimate such data, depending upon the urgency of the situation. Similarly in case any data is missing and not supplied by STU, the concerned user may, act reasonably. If and when necessary, he may estimate such data depending upon the urgency of the situation. Such estimates, in each case, shall be based upon the corresponding data for similar plant or apparatus, or upon such other information, the user or STU, as the case may be, deems appropriate.

Special Considerations

- 10.12 STU or any user may at any time make a reasonable request for extra data as necessary.

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11. Schedule and Despatch Code

Introduction

This Part sets out the following:

- a) Demarcation of responsibilities between various intra-state entities and SLDC in scheduling and despatch,
- b) The procedure for scheduling and despatch,
- c) The Reactive power and voltage control mechanism.

Objective

This code deals with the procedures to be adopted for scheduling of the net injection / drawals of concerned regional entities on a day-ahead basis with the modality of the flow of information between the SLDC, ALDC and intra-state entities. The procedure for submission of capability declaration by each generating station and submission of requisition / drawal schedule by other state entities is intended to enable SLDCs to prepare the despatch schedule for each ISGS/SGS and drawal schedule for each intra-state entity. It also provides methodology of issuing real time despatch/drawal instructions and rescheduling, if required, to intra-state entities along with the commercial arrangement for the deviations from schedules, as well as, mechanism for reactive power pricing. This code also provides the methodology for rescheduling of wind and solar energy on three (3) hourly basis and the methodology of compensating the wind and solar energy-rich state for dealing with variable generation through a renewable regulatory charge. For this, appropriate meters and a Data Acquisition System facility shall be provided for accounting of UI charges and transfer of information to the concerned SLDC and RLDC. The provisions contained in this part are without prejudice to the powers conferred on SLDC under sections 32 and 33 of the Electricity Act, 2003.

Scope

- 11.1 This code will be applicable to SLDCs, sub-SLDC, STU, Distribution Licensees, other intra-state entities; including generators/captive generating plants/independent power producers, wind and solar generating stations and other concerned persons in the state grid.

The scheduling and despatch procedure for the generating stations of hydro generating station of GSECL (UHPS, KHPS) shall be as per the procedure formulated by the SLDC and approved by the Commission.

Demarcation of Responsibilities:

- 11.2 The State Load Despatch Centre is responsible for coordinating the scheduling of a generating station, within the control area which is not scheduled by the RLDC in terms of CERC regulation, as notified from time to time. The SLDC shall also be responsible

for such generating stations for (1) real-time monitoring of the station's operation, (2) checking that there is no gaming (gaming is an intentional mis-declaration of a parameter related to commercial mechanism in vogue, in order to make an undue commercial gain) in its availability declaration, (3) revision of availability declaration and injection schedule, (4) switching instructions, (5) metering and energy accounting, (6) issuance of UI accounts within the control area, (7) collections/disbursement of UI payments, (8) outage planning etc.

- 11.3 The state grid shall be treated and operated as a loose power pool (with decentralized scheduling and despatch), in which the Discom shall have full operational autonomy and Area Load Despatch Centre (ALDC) shall have the total responsibility for (i) regulating demand of their customers (ii) scheduling their drawl from the generating station and Inter State Generating Station (ISGS); (iii) arranging any bilateral transaction; (iv) regulating their net drawl from the state grid as per following the guidelines.
- 11.4 The system of each Discom shall be treated as a notional control area. The algebraic summation of scheduled drawal from ISGS/SGS and from contracts through a long-term access, medium -term and short –term open access arrangements shall provide the drawal schedule of each Discom, and this shall be determined in advance on a day-ahead basis. The Discom(s) would generally be expected to regulate their generation and/or consumers' load so as to maintain their actual drawal from the state grid close to the above schedule. The Discom(s) may, at their discretion, deviate from the drawl schedule as long as such deviations do not cause system parameters to deteriorate beyond permissible limit and / or do not lead to unacceptable line loading.
- 11.5 The above flexibility has been provided in view of the fact that all Discoms do not have all requisite facilities for minute-to-minute online monitoring of actual net drawl from the state grid, as also the fact that the only manner in which a Discom can regulate its net drawl from the state grid is through curtailment of consumer load, which should be avoided. Deviations from the net drawal schedule are however to be appropriately priced through the unscheduled interchange (UI) mechanism.
- 11.6 Each Distribution Licensee, through their ALDC, shall always endeavour to restrict the net drawl of their own Distribution Licensee from the grid to within the drawl schedules, whenever the system frequency is below 49.7 Hz. The concerned distribution licensee, user, shall ensure that their automatic demand management scheme acts to ensure that there is no over-drawal when frequency is 49.5 Hz or below. If the automatic demand management scheme has not yet been commissioned, then action has to be taken as per manual demand management scheme to ensure zero over-drawal when frequency is 49.5 Hz or below.
- 11.7 The Distribution Licensees shall regularly carry out the necessary exercises regarding short-term demand estimation for their respective area, to enable them to plan in advance as to how they would meet their consumers' load without over-drawing from the grid.

- 11.8 The SGS/IPP/CGP, other generating stations and sellers shall be responsible for power generation/power injection generally according to the daily schedules advised to them by the SLDC on the basis of the contracts/ requisitions received from the SLDCs/buyers/power exchanges.
- 11.9 The generating station would normally be expected to generate power according to the daily schedules advised to them. The generating stations may deviate from the given schedules within the limits specified in the CERC UI regulations of CERC, as amended from time to time, depending on the plant and system conditions. In particular, they may be allowed to generate beyond the given schedule under deficit conditions, as long as such deviations do not cause system parameters to deteriorate beyond permissible limits and/or do not lead to unacceptable line loading. Deviations, if any, from the ex-power plant generation schedules shall be appropriately priced in accordance with UI Regulations. In addition, deviations from schedules causing congestion, shall also be priced in accordance with the Congestion Charge Regulations of CERC.
- 11.10 Provided that when the frequency is higher than 50.2 Hz, the actual net injection shall not exceed the scheduled for that time block. Also, while the frequency is above 50.2 Hz, the SGS/ISGS may (at their discretion) back down without waiting for advice from SLDC to restrict the frequency rise. When the frequency falls below 49.7 Hz, the generation at all SGS/ISGS (except those on peaking duty) shall be maximized, at least up to the level to which can be sustained, without waiting for advice from SLDC subject to the condition that such increase does not lead to unacceptable line loading or system parameters to deteriorate beyond permissible limit.
- 11.11 However, notwithstanding the above, SLDC may direct the generating station/other intra-state entities to increase/decrease their drawal/generation in case of contingencies; e.g. overloading of lines/transformers, abnormal voltages, threat to system security. Such directions shall immediately be acted upon. In case the situation does not call for very urgent action and SLDC has some time for analysis, it shall be checked whether the situation has arisen due to deviations from schedules, pursuant to short-term open access. These shall be terminated first, before any action, which would affect the scheduled supplies to the long term and medium term customers is initiated in accordance with Gujarat Electricity Regulatory Commission (Terms and Conditions of Intra-state Open Access Regulation 2011 (Notification No.3/2011)) and amendment time to time.
- 11.12 For all outages of generation and transmission system, which may have an effect on the state grid, all state entities shall cooperate with each other and coordinate their actions through the State Operational Coordination Committee (SOCC) for outages foreseen sufficiently in advance and through SLDC (in all other cases), as per procedures finalized separately by SOCC. In particular, outages requiring restriction of generating station generation and/or restriction of ISGS/SGS share, which a beneficiary can receive and curtailment of other long-term transactions shall be planned carefully to achieve the best optimization.

- 11.13 The generating station shall make an advance declaration of ex-power plant MW and MWh capabilities foreseen for the next day; i.e. from 00.00 hrs to 2400 hrs. During fuel shortage condition, in case of thermal stations, they may specify minimum MW, maximum MW, MWh capability and declaration of fuel shortage. The generating stations shall also declare the possible ramping up / ramping down in a block. In case of a gas turbine generating station or combined cycle generating station, the generating station shall declare the capacity for units and modules on APM gas, RLNG and liquid fuel separately, and these shall be scheduled separately.
- 11.14 While making or revising its declaration of capability, except in case of run-off-river (with up to three hour pondage) hydro stations, the SGS/ISGS shall ensure that the declared capability during peak hours is not less than that during other hours. However, exception to this rule shall be allowed in case of tripping/re-synchronization of units as a result of forced outage of units.
- 11.15 It shall be incumbent upon the generating station to declare the plant capabilities faithfully; i.e., according to their best assessment. In case, it is suspected that they have deliberately over/under declared the plant capability contemplating to deviate from the schedules given on the basis of their capability declarations (and thus make money either as undue capacity charge or as the charge for deviations from schedule), the SLDC may ask the generating station to explain the situation with necessary back-up data.
- 11.16 The quantum of penalty for the first mis-declaration for any duration/block in a day shall be the charges corresponding to two days' fixed charges. For the second mis-declaration, the penalty shall be equivalent to fixed charges for four days and for subsequent mis-declarations, the penalty shall be multiplied in geometrical progression over a period of a month.
- 11.17 STU shall install special energy meters on all inter connections between the state entities and other identified points for recording of actual net MWh interchanges and MVARh draws. The installation, operation and maintenance of special energy meters shall be in accordance with Central Electricity Authority (Installation and Operation of Meters) Regulations, 2006. All concerned Transmission Licences (in whose premises the special energy meters are installed) shall take weekly meter readings and transmit them to SLDC by Tuesday noon. Regulatory requirement of Special Energy Meters is shown in Annexure J (page 139).
- 11.18 SLDC shall be responsible for 15 minute block-wise computation of actual net injection / drawal of concerned intra-state entities, based on the above meter readings and preparation of State Energy Accounts. All computations carried out by SLDC shall be open to all intra-state entities for checking/verifications for a period of 15 days. In case any mistake/omission is detected, the SLDC shall forthwith make a complete check and rectify the same.
- 11.19 SLDC shall periodically review the actual deviation from despatch and net drawal schedule being issued, to check whether any of the constituents are indulging in unfair

gaming or collusion. In case any such practice is detected, the matter should be reported to the Commission for further investigation/action.

- 11.20 The operating log books of the generating station shall be available for review by the SLDC. These books shall keep record of machine operation and maintenance.

Scheduling and Despatch Procedure

- 11.21 Scheduling and despatch procedure for long-term, medium-term and short-term open access (to be read with provisions of CERC Open Access Regulations 2008 and Intra-state OA regulation-2011 as amended from time to time). The scheduling procedure for medium-term open access transactions shall be similar to the scheduling procedure for long-term access transactions and is as given below, except where it is specifically mentioned for collective transactions.
- 11.22 All intra-state generating stations and (SGS) shall be duly listed on the SLDC web-sites. The station capacities and allocated/contracted shares of different beneficiaries shall also be listed out.
- 11.23 Each Discom shall be entitled to a MW despatch up to (declared ex-power plant MW capacity for the day) X (Discoms share in the station's capacity) for all such stations. In case of hydroelectric stations, there would also be a limit on daily MWh despatch equal to (MWh generation capacity for the day) X (Discoms share in the station's capacity)
- 11.24 By 8 AM every day, the generating station shall advise the SLDC of the station-wise ex-power plant MW and MWh capabilities foreseen for the next day; i.e. from 00.00 hrs to 2400 hrs, the following day.
- 11.25 The above information of the foreseen capabilities of the generating station and ISGS/SGS and the corresponding MW and MWh entitlements of each Discom, shall be compiled by the SLDC every day for the next day, and advised to all beneficiaries, by 11 AM. The SLDC shall review it vis-à-vis their foreseen load pattern and their own generating capability including bilateral exchanges, if any, and advise the RLDC by 2 PM for their drawal schedule for each of the ISGS/SGS in which they have shares, long-term and medium-term bilateral interchanges, approved short-term bilateral interchanges.
- 11.26 Scheduling of collective transaction:
- a. NLDC shall indicate to the Power Exchange(s), the list of interfaces/control areas/regional transmission systems on which unconstrained flows are required to be advised by the Power Exchange(s) to NLDC. The Power Exchange(s) shall furnish the interchange on various interfaces/control areas/regional transmission systems as intimated by NLDC. The Power Exchange(s) shall also furnish the information of total drawal and injection in each of the regions. Based on the information furnished by the Power Exchange(s), NLDC shall check for congestion. In case of congestion, NLDC shall inform the exchanges about the period of congestion and the available

limit for scheduling of collective transaction on respective interface/control area/transmission systems during the period of congestion for scheduling of collective transaction through the respective Power Exchange. The limit for scheduling of collective transaction for the respective Power Exchange shall be worked out in accordance with CERC directives. Based on the application for scheduling of collective transaction submitted by the Power Exchange(s), NLDC shall send the details (Scheduling Request of Collective Transaction) to different RLDCs for final checking and incorporating them in their schedules. After getting confirmation from RLDCs, NLDC shall convey the acceptance of scheduling of collective transaction to the Power Exchange(s). RLDCs shall schedule the collective transaction at the respective periphery of the regional entities.

- b. The individual transactions for state utilities/intra-state entities shall be scheduled by the respective SLDCs. The Power Exchange(s) shall send the detailed break-up of each point of injection and each point of drawal within the state to respective SLDCs after receipt of acceptance from NLDC. The Power Exchange(s) shall ensure necessary coordination with SLDCs for scheduling of the transactions.
- c. The timeline for the above activities will be as per the detailed procedure for scheduling of the collective transaction issued in accordance with CERC (Open-access in inter-state transmission) Regulations, 2008 and as amended from time to time.

11.27 By 7 PM each day, the SLDC shall convey:

- (i) the ex-power plant despatch schedule to each of the generating stations, in MW for different time blocks, for the next day. The summation of the ex-power plant drawal schedules advised by all beneficiaries shall constitute the ex-power plant station-wise despatch schedule.
- (ii) the net drawal schedule to each intra-state entity, in MW, for a different time block, for the next day. The summation of the station-wise ex-power plant drawl schedule for all generating station and ISGS/SGS and drawl schedules consequent to bilateral inter changes, after deducting the transmission losses(estimated) shall constitute the entity-wise drawl schedule.

11.28 While finalizing the above daily despatch schedule for the generating station, SLDC shall ensure that the same are operationally reasonable, particularly in terms of ramping-up/ramping-down rates and the ratio between minimum and maximum generation levels. A ramping rate of up to 20% of the capacity on bars per hour should generally be acceptable for the generating station except for the hydroelectric generating station, which may be able to ramp up/ramp down at a faster rate.

11.29 The ALDCs/generating station shall inform any modifications/changes to be made in drawal schedule/foreseen capabilities, if any, to SLDC by 10 PM, or preferably earlier.

- 11.30 Since variation of generation in run-of-river power stations shall lead to spillage, these shall be treated as must-run stations. All renewable energy power plants, except for biomass power plants and non-fossil fuel-based cogeneration plants, whose tariff is determined by CERC, shall be treated as must-run power plants and shall not be subjected to Merit Order Despatch principles.
- 11.31 While finalizing the drawal and despatch schedules as above, the SLDC shall also check that the resulting power flows do not give rise to any transmission constraints. In case any impermissible constraints are foreseen, the SLDC shall moderate the schedules to the required extent, under intimation to the concerned regional entities. Any changes in the scheduled quantum of power which are too fast or involve unacceptably large steps may be converted into suitable ramps by the SLDC.
- 11.32 In case of forced outage of unit, the SLDC shall revise the schedule on the basis of revised declared capacity. The revised declared capacity and the revised schedule shall become effective from the 4th time block, counting the time block in which the revision is advised by the generating station to be the first one.
- 11.33 In the event of a bottleneck in evacuation of power due to any constraint, outage, failure or limitation in the transmission system, associated switchyard and substations owned by the State Transmission Utility or any other transmission licensee involved in intra-state transmission (as certified by the SLDC) necessitating reduction in generation, the SLDC shall revise the schedules which shall become effective from the 4th time block, counting the time block in which the bottleneck in evacuation of power has taken place to be the first one. Also, during the 1st, 2nd and 3rd time blocks of such an event, the scheduled generation of the generating station shall be deemed to have been revised to be equal to actual generation, and the scheduled drawals of the beneficiaries shall be deemed to have been revised accordingly.
- 11.34 In case of any grid disturbance, scheduled generation of all the generating stations and scheduled drawal of all the beneficiaries shall be deemed to have been revised to be equal to their actual generation/drawal for all the time blocks affected by the grid disturbance. Certification of grid disturbance and its duration shall be done by the SLDC.
- 11.35 Revision of declared capability by the generating station having two part tariff with capacity charge and energy charge (except hydro stations) and requisition by beneficiary(ies) for the remaining period of the day shall also be permitted with advance notice, but only in case of a contingency. Revised schedules/declared capability in such cases shall become effective from the 6th time block, counting the time block in which the request for revision has been received in the SLDC to be the first one.
- 11.36 In case of forced outage of a unit for a short-term bilateral transaction (within intra-state), where a generator of capacity of 100 MW and above is the seller, the generator

shall immediately intimate the same along with the requisition for revision of schedule and estimated time of restoration of the unit, to SLDC as the case may be. The consent of the buyer shall not be a pre-requisite for such revision of schedule. The schedule of the generator and the buyer shall be revised, accordingly. The revised schedules shall become effective from the 4th time block, counting the time block in which the forced outage is declared to be the first one. The SLDC shall inform the revised schedule to the seller and buyer. The original schedule shall become effective from the estimated time of restoration of the unit. However, the transmission charges as per the original schedule shall continue to be paid for two days.

- 11.37 If at any point of time, the SLDC observes that there is need for revision of the schedules in the interest of better system operation, it may do so on its own, and in such cases, the revised schedules shall become effective from the 4th time block, counting the time block in which the revised schedule is issued by the SLDC to be the first one.
- 11.38 To discourage frivolous revisions, an SLDC may, at its sole discretion, refuse to accept schedule/capability changes of less than two (2) percent of previous schedule/capability. The schedule of thermal generating stations indicating fuel shortage (including revision in gas supply) while intimating the declared capacity to the SLDC shall not be revised except in case of forced outage of generating unit. Provided that in case of a gas-based generating station, for optimum utilization of gas, this shall be permitted; i.e. in case of tripping of a unit, this gas may be diverted to another unit, using the same gas.
- 11.39 Special dispensation for scheduling of wind and solar generation
- (i) Scheduling of wind power generation plant would have to be done for the purpose of UI where the sum of generation capacity of such plants connected at the connection point to the transmission or distribution system is 10 MW and above and where PPA has not been signed before 3rd May, 2010. For capacity and voltage level below this, as well as for old wind farms (a wind farm is a collection of wind turbine generators that are connected to a common connection point), it could be mutually decided between the wind generator and the transmission and distribution utility, as the case may be, if there is no existing contractual agreement to the contrary. The schedule by wind power generating station(s) may be revised by giving advance notice to SLDC. Such revisions by wind power generation station(s) shall be effective from the 6th Time Block, the first being the Time Block in which notice was given. There may be a maximum of eight revisions for each three-hour time slot, starting from 00:00 hours during the day.
 - (ii) The schedule of solar generation shall be given by the generator, based on availability of the generator, weather forecasting, solar insolation, season and normal solar generation curve and shall be vetted by the SLDC in which the generator is located and incorporated in the inter-state schedule. If SLDC is of the opinion that the schedule is not realistic, it may ask the solar generator to modify the schedule.

- (iii) The SLDC shall maintain the record of the schedule from renewable power generating stations, based on the type of renewable energy sources; i.e. wind or solar from the point of view of grid security. While scheduling generating stations in a region, the system operator shall aim at utilizing available wind and solar energy fully.
- 11.40 Generation schedules and drawal schedules issued/revised by the State Load Despatch Centre shall become effective from designated time block irrespective of communication success.
- 11.41 For any revision of scheduled generation, including post facto deemed revision; there shall be a corresponding revision of scheduled drawls of the beneficiaries.
- 11.42 A procedure for recording the communication regarding changes to schedules duly taking into account the time factor shall be evolved by the State Transmission Utility.
- 11.43 When for the reason of transmission constraints, such as congestion, or in the interest of grid security, it becomes necessary to curtail power flow on a transmission corridor; the transactions already scheduled may be curtailed by the State Load Despatch Centre.
- 11.44 The short-term customer shall be curtailed first, followed by medium- term customers, who shall be followed by the long-term customers and amongst customers of a particular category, curtailment shall be on prorata basis.
- 11.45 After the operating day is over at 2400 hours, the schedule finally implemented during the day (taking into account all before-the-fact changes in despatch schedule of generating stations and drawal schedule of the Discoms) shall be issued by SLDC. These schedules shall be the datum for commercial accounting. The average ex-bus capability for each generating station shall also be worked out, based on all before-the-fact advice to SLDC.
- 11.46 If RLDCs curtail a transaction at the periphery of the regional entities, SLDC shall further incorporate the inter-se curtailment of intra-state entities to implement the curtailment.
- 11.47 SLDC shall properly document all the above information; i.e. station-wise foreseen ex-power plant capabilities advised by the generating stations, the drawal schedules advised by intra-state entities, all schedules issued by the SLDC, and all revisions/updating of the above.
- 11.48 The procedure for scheduling and the final schedules issued by SLDC shall be open to all intra-state entities and other intra-state open access customers entities for any checking/verification, for a period of five days. In case any mistake/omission is detected, the SLDC shall forthwith make a complete check and rectify the same.

- 11.49 While availability declaration by generating station shall have a resolution of one (1) MW and one (1) MWh, all entitlements, requisitions and schedules shall be rounded off to the nearest two decimals at each control area boundary for each of the transaction, to have a resolution of 0.01 MW and 0.01 MWh.

Reactive Power and Voltage Control

- 11.50 Reactive power compensation should ideally be provided locally, by generating Reactive Power as close to the Reactive Power consumption as possible. The beneficiaries are therefore expected to provide local VAr compensation/generation, such that they do not draw VARs from the state grid, particularly under low-voltage conditions. However, considering the present limitations, this is not being insisted upon. Instead, to discourage VAr drawals by beneficiaries, VAr exchanges with Intra-State Transmission System shall be priced as follows:
- (a) The beneficiary pays for VAr drawal when voltage at the metering point is below 97%,
 - (b) The beneficiary gets paid for VAr return when voltage is below 97%,
 - (c) The beneficiary gets paid for VAr drawal when voltage is above 103%,
 - (d) The beneficiary pays for VAr return when voltage is above 103%.
- 11.51 The charge/payment for VARs shall be at a nominal paise/kVARh rate as may be specified by the Central Electricity Regulatory Commission (CERC) from time to time, and will be between the beneficiary and the State Pool Account for VAr interchanges.
- 11.52 Notwithstanding the above, SLDC may direct a beneficiary to curtail its VAr drawal/injection in case the security of grid or safety of any equipment is endangered.
- 11.53 In general, the beneficiaries shall endeavour to minimize the VAr drawal at an interchange point when the voltage at that point is below 95% of the rated voltage and shall not return VAr when the voltage is above 105%. Transformer taps at the respective drawal points may be changed to control the VAr interchange as per the beneficiary's request to SLDC, but only at reasonable intervals. A beneficiary may also request the SLDC for increase/decrease of VAr generation at a generating station for addressing a voltage problem.
- 11.54 Switching in/out of all bus and line reactors throughout the state grid shall be carried out as per instructions of SLDC. Tap changing on all transformers in STU system shall also be done as per SLDCs instructions only.
- 11.55 The generating station shall change generator-transformer taps and generate/absorb Reactive Power as per instructions of SLDC, within capability limits of the respective generating units; that is without sacrificing the active generation required at that time. No payments shall be made to the generating companies for such VAr

generation/absorption at the generating stations, the full annual fixed cost of which is being borne by the beneficiaries through capacity charge.

11.56 VAR exchange directly between two beneficiaries on the interconnecting lines owned by them (singly or jointly) generally addresses or causes a local voltage problem, and generally do not have an impact on the voltage profile of the state grid. Accordingly, the management/control and commercial handling of the VAR exchanges on such lines shall be as per following provisions, on case-by-case basis:

- (i) The two concerned beneficiaries may mutually agree not to have any charge/payment for VAR exchanges between them on an interconnecting line,
- (ii) The two concerned beneficiaries may mutually agree to adopt a payment rate/scheme for VAR exchanges between them identical to or at variance from that specified by GERC for VAR exchanges with the state transmission system. If the agreed scheme requires any additional metering, the same shall be arranged by the concerned beneficiaries,
- (iii) The computation and payments for such VAR exchanges shall be effected as mutually agreed between the two beneficiaries.

In case of a disagreement between the concerned beneficiaries (e.g. one party wanting to have the charge/payment for VAR exchanges, and the other party refusing to have the scheme), the scheme as specified in Annexure K (page 143) shall be applied.

Complementary Commercial Mechanisms

11.57 The beneficiaries shall pay to the respective generating stations, capacity charges corresponding to plant availability and energy charges for the scheduled despatch, as per the relevant notifications and orders of GERC. The bills for these charges shall be issued by the respective generating station to each beneficiary on a monthly basis.

11.58 The sum of the above two charges from all beneficiaries shall fully reimburse the generating station for generation according to the given despatch schedule. In case of deviation from the despatch schedule, the concerned generating station shall be additionally paid for excess generation through the UI mechanism approved by CERC. In case of actual generation being below the given despatch schedule, the concerned station shall pay back through the UI mechanism for the shortfall in generation.

11.59 The summation of station-wise ex-power plant despatch schedules from each generating station and any bilaterally agreed interchanges of each beneficiary shall be adjusted for transmission losses, and the net drawal schedule so calculated shall be compared with the actual net drawal of the beneficiary. In case of excess drawal, the beneficiary shall be required to pay through the UI mechanism for the excess energy.

In case of under-drawal, the beneficiary shall be paid back through the UI mechanism, for the energy not drawn.

- 11.60 When requested by a constituent, SLDC shall assist the constituent in locating a buyer/seller and arranging a scheduled interchange within the region or across the regional boundary. The SLDC shall act only as a facilitator (not a trader / broker), and shall assume no liabilities under the agreement between the two parties, except:
- (i) ascertaining that no component of the power system of any other constituent shall be over-stressed by such interchange/trade,
 - (ii) incorporating the agreed interchange/trade in the net interchange schedules for the concerned constituents.
- 11.61 Monthly energy accounts and weekly statement of UI charges shall be prepared by the SLDC. The weekly statement of UI charges shall be issued to all constituents by Thursday for the seven-day period ending on the penultimate Sunday at midnight. Payment of UI charges shall have a high priority and the concerned constituents shall pay the indicated amounts within 10 (ten) days of the statement issue into a state UI pool account operated by the SLDC. The agencies that have to receive the money on account of UI charges would then be paid out from the state UI pool account, within three (3) working days.
- 11.62 The SLDC shall also issue the weekly statement for VAr charges, to all constituents who have a net drawal / injection of Reactive Energy under low/high voltage conditions. These payment shall also have a high priority and the concerned constituents shall pay the indicated amounts into the state reactive account operated by the SLDC within 10 (ten) days of statement issue. The constituents who have to receive the money because of VAr charges would then be paid out from the state reactive account, within three (3) working days.
- 11.63 If payments against the above UI and VAr charges are delayed by more than two days; i.e. beyond twelve (12) days from statement issue, the defaulting constituent shall have to pay simple interest @ 0.04% for each day of delay. The interest so collected shall be paid to the constituents who had to receive the amount, payment of which got delayed. Persistent payment defaults, if any, shall be reported by the SLDC to the Commission, for initiating remedial action.
- 11.64 The money remaining in the state reactive account after pay-out of all VAr charges upto 31st March of every year shall be utilized for training of the SLDC operators, and other similar purposes which would help in improving/streamlining the operation of the respective regional grids, as decided by the SPC from time to time.
- 11.65 In case the voltage profile of the grid improves to an extent that the total payout from the VAr charges account for a week exceeds the total amount being paid-in for that week, and if the reactive account has no balance to meet the deficit, the pay-outs shall

be proportionately reduced according to the total money available in the above account.

- 11.66 The SLDC shall prepare the complete statement of the state UI account and the state Reactive Energy account, on a quarterly basis and circulate the same to all the pool members for verification.
- 11.67 All 15-minute energy figures (net scheduled, actually metered and UI) shall be rounded off to the nearest 0.01 MWh.
- 11.68 Complementary Commercial Mechanism for wind and solar generators shall be according to the Indian Electricity Grid Code (IEGC), 2010 and as amended from time to time.

Dr. Ketan Shukla
SECRETARY

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Transmission System Planning and Security Standard Clause (4.14)

1. Introduction

The Transmission System Planning and Security Standard formulates the guidelines for planning and expansion of the Transmission System in the state of Gujarat. The scope of this standard covers:

- (a) System studies
- (b) Assessment of system data
- (c) Assessment of generation availability
- (d) Planning criteria
- (e) Security conditions required for maintaining specified degree of reliability
- (f) Criteria for substation planning
- (g) Estimation of Reactive Power compensation required

2. Transmission Planning

- I. The long and short-term perspective planning involves an integrated approach for evacuating power from different generating stations, irrespective of their ownership, and delivering it to the beneficiaries over an optimally designed Transmission System with reliability, security and economy. The power system in Gujarat has to be planned in such a manner that the power received from all the generating stations, the share of power from the western grid and central sector generating stations can be transmitted without constraints to different beneficiaries, as per their allocated shares, maintaining a reasonably good voltage profile, stability conditions and redundancy criteria.
- II. The transmission planning should be developed to achieve a strong coordinated power system for the western region and ultimately a national grid, where substantial inter-regional transfers can be achieved with optimised utilisation of available generation. The transmission planning shall also provide a high standard of supply to beneficiaries with acceptable degree of reliability and at reasonable cost. The criterion should be that even under the conditions of the specified outages considered in the security standards, the power flow should not be affected. The transmission planning should keep in view the long-term future load growth also and the transmission lines and substations shall be so planned that the same can be upgraded when necessary in future, with minimum interruptions and modifications.
- III. For the purpose of reducing inventory, procurement time and installation time, the licensee shall adopt standardised designs as far as possible for transmission line towers, structures for substations, substation lighting, control room lighting and ventilation, substation earthing, standardised specification for line materials, transformers, substation equipment, cables, busbar accessories, insulators, hardware, lightning arrestors etc.
- IV. The possibility of providing adequate transmission connections within the Gujarat state grid, as well as between inter-state grids has to be considered wherever economically

feasible, considering all economic energy/capacity interchanges subject to trade-off between new generation and cost of transmission. The modern Flexible AC Transmission System (FACTS) based on thyristor-based controls, HVDC, fast controllable phase shifters etc. have also to be considered wherever economically feasible and/or constraints of corridor exist for construction of new transmission lines.

3. System Studies

- I. The loads to be supplied from various substations at steady state within the limits of declared voltage and acceptable frequency of 50 Hz and the future load development have to be assessed after making a detailed study of the present conditions and a load survey. A reasonable estimate of transmission losses shall also be included to arrive at peak generation capacity. The system is to be further evolved based on the following power system studies:
 - (a) Load flow
 - (b) Optimal power flow for various conditions
 - (c) Short circuit
 - (d) System stability-steady state
 - (e) System stability-transient
 - (f) Studies to determine switching/temporary over voltages
 - (g) Other studies as required
- II These studies require suitable computer programmes. Mathematical models of generation, transmission and load shall be prepared separately for each year of a plan period assessing probable year of commissioning of particular lines, substations, additional transformers in existing substations etc. based on the system network for the year in question with all the generation and load buses properly located. Interconnections with the western grid through neighbouring states at 400kV and 220kV levels shall have to be incorporated. Appropriate equivalent circuit models shall be used to take into account the fault level at the Connection Points/ Interface Points. The interconnection buses shall be modelled by representing significant and necessary portions of the neighbouring networks to represent realistically the MW and MVA imports/exports. Studies shall be carried out both, for peak load and minimum load conditions.

4. System Data

To arrive at a reasonably accurate load forecast and for conducting studies, compilation and updating of system data is absolutely necessary. The planning study should begin with the proper representation of the existing system to establish the base case and to validate the model. The results obtained for the existing system should be verified with the meter readings, logged data at the substations and the State Load Despatch Centre to closely match the same. The system parameters have to be updated incorporating the correct data whenever addition or modifications have been carried out on the system, either by survey of the correct line lengths and conductor configurations or preferably by direct measurement of the line impedance values whenever and wherever possible. All the system data shall be the same for both, the planning standards and operation

standards. The loads shall be modelled at 220 kV, 132 kV and 66 kV buses. The annual minimum load shall be taken as a percentage of annual peak demand as prevailing in the base year.

5. **Generation**

For peak load conditions, different generation mixes of various generating stations, resulting in an optimal average cost shall be determined by conducting the required number of load flow studies, or using well developed computer programme packages to determine the same. For the minimum load conditions, the generator which must run, shall be used in conjunction with the most economical generation. The generation despatch for the purpose of sensitivity analysis, corresponding to a complete closure of a major generating station, shall be worked out by increasing the generation at other stations to the extent possible, keeping in view the maximum likely availability at those stations, cost of power etc. Transmission constraints will have to be addressed properly. The Transmission System being planned shall consider the adequacy of the network required to transmit power even under various outage conditions specified in the security standards. Studies shall be repeated for normal and contingency conditions as required in the security standards.

6. **Planning Criteria**

- I. The Central Electricity Authority (CEA) manual on Transmission Planning Criteria shall be adopted with modification as stated below, particularly with reference to steady state voltage limits and security standards for withstanding outages.
- II. The transmission shall be planned in such a way to maintain steady state voltage within limits as stated below:

Nominal system	Maximum	Minimum
Voltage kV-rms.	kV- rms	kV- rms
66	72	60
132	145	122
220	245	198
400	420	380
765	800	728
± 500kV HVDC		

III. *Line Loading Limits*

The permissible line loading limits shall conform to CEA's manual on Transmission Planning Criteria. The overloading and under-loading of lines shall be decided accordingly.

IV Options for Strengthening of Transmission Network:

- (a) Addition of new transmission lines to avoid overloading of existing system (wherever three or more circuits of the same voltage class are envisaged between two substations, the next higher transmission voltage may be considered);
- (b) Upgradation of the existing transmission lines such as raising height of conductor supports and / or switch over to insulated cross-arms to facilitate change over to higher voltage, if the tower design so permits;
- (c) Reconductoring of the existing transmission line with higher size of conductors or with AAAC (All Aluminium Alloy Conductor);
- (d) The choice shall be based on cost, reliability, right of way requirements, energy losses, down time etc.

V. All single circuit lines shall be planned with double circuit towers, wherever technically feasible, to enable future expansion without right-of-way problems.

7. Security Standards

I. Steady State Stability

The system shall be planned to withstand satisfactorily without any load shedding or altering the generation at generating stations, for at least any one of the following outage conditions:

- (a) Outage of any tower in a D/C transmission line
- (b) Two circuits of 66 kV or 132 kV or 220 kV lines
- (c) One circuit of 400 kV line
- (d) One interconnecting transformer
- (e) One largest capacity generator
- (f) One inter-connecting line with neighbouring grid

The above contingencies shall be considered assuming a pre-contingency system depletion (planned outage) of another 220 kV double circuit line or 400 kV single circuit line in another corridor and not emanating from the same substation. All the generating stations shall operate within the limits as per their reactive capability curves and the network voltage profile shall also be maintained within the specified voltage limits.

II. Transient Stability

The system shall be designed to maintain synchronism and system integrity under the following disturbances:

- (a) Outage of the largest size generator in the western grid or connection with neighbouring grids

- (b)
 - (i) A single line to ground fault on a 400 kV line, single pole opening of the faulted phase (5 cycles) with unsuccessful reclosure (dead time 1 sec) followed by 3 pole opening (5 cycles) of the faulted line.
 - (ii) 400 kV D/C line:
 - i. When both the circuits are in operation, the system shall be capable of withstanding a permanent fault on one of the circuits followed by a three-pole opening (100-m sec.) of the faulted circuit.
 - ii. When one of the circuits is under maintenance / outage the system shall be capable of withstanding a transient fault on the circuit in service.
- (c) A permanent 3-phase fault with duration of 8-cycles on 220 kV or 132 kV or 66 kV line, assuming three-pole opening.
- (d) No stability studies for faults are required for radial lines.

8. Substation Planning Criteria

For meeting a particular quantum of load, the number of required substations depends upon the choice of voltage levels, the MVA capacity and the number of feeders permissible etc. The number of EHT transformers, Interconnecting Transformers shall also be considered in planning to take care of contingencies of planned/forced outages. The rupturing capacity of the circuit breakers shall have 20 percent margin to take care of increase in short circuit levels as the system grows. The following criteria can be adopted:

- (a) The transformation capacity of any single sub-station for meeting loads at different voltage levels shall not normally exceed the values indicated in table below [CEA notification of technical standards for construction of electrical plants and electric lines, Part-A,41(3)];

765kV	4500 MVA
400kV	1500 MVA
220kV	500 MVA
110/132kV	150 MVA
66kV	75 MVA

- (b) Size and number of Interconnecting Transformers (ICTs) shall be planned in such a way that the outage of any single unit would not overload the remaining ICTs or the underlying system.
- (c) Size and number of HT / EHT transformers shall be planned in such a way that in the event of outage of any single unit, the remaining HT / EHT transformers would still supply 80% of the load. This has to be achieved in such a way that with the connection of the adjacent substations, the load exceeding the capacity of the available transformers may be transferred on to them.

- (d) The rated rupturing capacity of the circuit breaker to be installed at any new substation or switchyard shall be at least 25% higher than the calculated maximum fault level at the bus to take care of the increase in short circuit levels as the system grows. The rated breaking current capability of switchgear and breakers to be installed at different voltage levels, based on available capacities of the breakers, shall be considered as shown in table below [CEA notification of technical standards for construction of electrical plants and electric lines, Part-A, 41(1)];

66 kV	31.50 KA (for 1 sec.)
110/132 kV	31.50 KA (for 1 sec.)
220 kV	40 KA (for 1 sec.)
400 kV	40 KA or 50KA (for 1 sec.)
765 kV	40 KA or 50KA (for 1 sec.)

9. Reactive Compensation

I. Shunt Capacitors

Shunt capacitor shall be installed at 22 kV and 11 kV preferably at load centres. In case it is not possible at the load centre, then reactive compensation shall be provided in 66/132 kV systems, with a view to meet the reactive power requirement of load close to the load points.

II. Shunt Reactors

Switchable shunt reactors shall be provided at 400 kV sub-stations for controlling voltages within the limits specified. The step changes shall not cause a voltage variation exceeding 5%. Suitable line reactors (switchable/fixed) shall be provided to enable charging of 400 kV lines without exceeding voltage limits specified. The line reactors shall be installed for long line at high voltage level for curtailing switching over voltage and limiting the fault currents.

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Planning Data Requirement from the Generating and Distribution Company (Clause 4.24, Clause 10.4, 10.5)
Part- I - Generation

(To be furnished by the generating company to STU)

1 Standard Planning Data (Generation)
1.1 Thermal

(I). General:

1. Site	Furnish location map (schematic) showing roads, railway lines, transmission lines, rivers, and reservoirs, if any.
2. Approximate period of construction	
3. Annual generation in million kWh	

(II) Connection:

1. Connection Point / Interface Point	Furnish single line diagram of the proposed connection with the Transmission System with clear indication of possibility for right-of-way for unobstructed outlet
2. Step up voltage for connection kV	

(III) Station Capacity:

1. Total generating station capacity (MW)	
2. No. of units and unit size MW	State whether development will be carried out in phases and if so, furnish details

(IV) Generating Unit Data:

1. Generator	
(a) Make and Type	
(b) Rating (MVA)	
(c) Terminal Voltage (kV)	
(d) Rated Power Factor	
(e) Reactive Power capability (MVar) in the range 0.95 leading and 0.85 lagging	
(f) Short Circuit Ratio	
(g) Direct axis transient reactance (% on MVA rating)	
(h) Direct axis sub-transient reactance (% on MVA rating)	
(i) Auxiliary Power Requirement	

2. Generator Transformer	
(a) Type	
(b) Rated Capacity (MVA)	
(c)Voltage Ratio (HV/LV)	
(d) Tap change range (+% to - %)	
(e) Percentage Impedance (Positive Sequence at Full load).	

1.2 Hydro Electric

- (i) General:
(as applicable to thermal generating stations mentioned above)
- (ii) Connection:
(as applicable to thermal generating stations mentioned above)
- (iii) Station Capacity
(as applicable to thermal generating stations mentioned above)
- (iv) Generation Unit Data:
(as applicable to thermal generating stations mentioned above)

2 Detailed Planning Data (Generation)

2.1 Thermal Generating Stations

I. General:

1. Name of generating station
2. No. and capacity of generating units (MW)
3. Single line diagram of generating station and switchyard
4. Relaying and metering diagram
5. Neutral grounding of generating units
6. Excitation control
7. Earthing arrangements with earth resistance values
8. Communication- details of PLCC and other communication equipment installed

II. Protection and Metering:

- 1 Full description including settings for all relays and protection systems installed on the generating unit, generating unit transformer, auxiliary transformer and electrical motor of major equipment; viz. boiler feed pump, ID fans, condensate extraction pump etc.
- 2 Full description including settings for all relays installed on all outgoing feeders from generating station switchyard, tie circuit breakers, incoming circuit breakers.
- 3 Full description of inter-tripping of circuit breakers at Connection Point(s) / Interface Point(s) with the Transmission System
- 4 Most probable fault clearance time for electrical faults on the user's system
- 5 Full description of operational and commercial metering schemes
- 6 Breaker operating time counting from initiation of protective relay to the opening of breaker

III. Switchyard:

1. In relation to Interconnecting Transformers between EHV / HV Transmission System and the Generator Transformer Voltage System:
 - (a) Rated MVA
 - (b) Voltage Ratio
 - (c) Vector Group
 - (d) Positive sequence reactance (maximum, minimum, normal Tap (% on MVA)
 - (e) Positive sequence resistance (maximum, minimum, normal Tap (% on MVA)
 - (f) Zero sequence reactance (% on MVA)
 - (g) Tap changer range (+ % to - %) and steps
 - (h) Type of tap changer (OFF/ON)
 - (i) Details of reactors, and other circuits connected to tertiary winding of ICT
 - (j) Method of grounding
- 2 In relation to switchgear including circuit breakers, isolators on all circuits connected to the points of connection:
 - (a) Rated voltage (kV)
 - (b) Type of breaker (MOCB/ABCB/SF6 ---)
 - (c) Rated short circuit breaking current (kA) 3 Phase
 - (d) Rated short circuit breaking current (kA) 1 Phase
 - (e) Rated short circuit making current (kA) 3 Phase
 - (f) Rated short circuit making current (kA) 1 Phase
 - (g) Provisions of auto reclosing with details.
 - (h) Details of instrument transformers
- 3 Lightning arresters, technical data
4. Communication- Details of PLCC and other communication equipment installed at Connection Point(s)/ Interface Point(s).
5. Basic insulation level (kV)
 - (a) Busbar
 - (b) Switchgear
 - (c) Transformer bushings
 - (d) Transformer windings

IV Generating Units:

A. Parameters of Generating Units:

1. Rated terminal voltage (kV)
2. Rated MVA
3. Rated MW

4. Inertia constant H (MW Sec./MVA) of generator
5. Short circuit ratio
6. Direct axis synchronous reactance (% on MVA) (Both unsaturated and saturated)
7. Direct axis transient reactance (% on MVA) (Both unsaturated and saturated)
8. Direct axis sub-transient reactance (% on MVA) (Both unsaturated and saturated)
9. Quadrature axis synchronous reactance (% on MVA) (Both unsaturated and saturated)
10. Quadrature axis transient reactance (% on MVA) (Both unsaturated and saturated)
11. Quadrature axis sub-transient reactance (% on MVA) (Both unsaturated and saturated)
12. Direct axis transient open circuit time constant (Sec) T'_{do}
13. Direct axis sub-transient open circuit time constant (Sec) T_{do}
14. Quadrature axis transient open circuit time constant (Sec) T'_{qo}
15. Quadrature axis sub-transient open circuit time constant (Sec) T_{qo}
16. Stator resistance (Ohm)
17. Stator leakage reactance (Ohm) T_a
18. Stator time constant (Sec)
19. Rated field current (A)
20. Open circuit saturation characteristic for various terminal voltages giving the exciting current to achieve the same.
21. Generator Capability Curve
22. Rated stator current (A)
23. Phase connection
24. Number of terminals brought out
25. Rated speed (rpm)
26. Rated Frequency (Hz.)
27. Efficiency at MCR condition (percent)
28. Negative sequence current capability (I_2T)
29. Capacitance of generator stator winding to ground (microF/ph)
30. DC resistance of rotor at 200 C (in ohm)
31. Zero sequence reactance X_0 (Percentage)
32. Negative sequence reactance X_2 (Percentage)
33. Negative sequence reactance R_2 (Percentage)
34. Sub-Transient S-C time constant (in second)
 - a. Direct axis T_d
 - b. Quadrature axis T_q
35. Transient S-C time constant (in second)
 - a. Direct axis T'_d
 - b. Quadrature axis T'_q
36. Machine saturation at 1.0 pu voltage in pu
37. Machine saturation at 1.2 pu voltage in pu
38. Percentage regulation
39. Short circuit characteristics curves

B. Parameters of Excitation Control System:

1. Type of Excitation
2. Maximum Field voltage

3. Minimum Field voltage
4. Rated Field voltage
5. Gain factor
6. Feedback strength
7. Time constant for control amplifier
8. Time constant for Exciter
9. Time constant for Feedback
10. Output voltage of control amplifier
11. Maximum output voltage of control amplifier
12. Minimum output voltage of control amplifier
13. Details of excitation loop in block diagrams showing transfer functions of individual elements using IEEE symbols along with set values.
14. Dynamic characteristics of over - excitation limiter
15. Dynamic characteristics of under -excitation limiter
16. Exciter IEEE model / type no.
17. Exciter response time

C. Parameters of Governor/ Turbine:

1. Governor average gain (MW/Hz)
2. Speeder motor setting range
3. Time constant of steam or fuel governor valve
4. Governor valve opening limits
5. Governor valve rate limits
6. Time constant of turbine (HP, IP, LP)
7. Governor block diagram showing transfer functions of individual elements using IEEE symbols along with set values.
8. Type of governor, whether IEEE standard governor used
9. Regulation and droop
10. Fraction of total power generated HP, IP, LP turbine
11. Maximum velocity limit HP, IP, LP turbine
12. Minimum velocity limit HP, IP, LP turbine

D. Operational Parameters:

1. Min. notice required for synchronising a generating unit from de-synchronisation
2. Min. time between synchronising different generating units in a generating station
3. The minimum block load requirements on synchronising
4. Time required for synchronising a generating unit for the following conditions:
 - a. Hot
 - b. Warm
 - c. Cold
5. Maximum Generating Unit loading rate for the following conditions:
 - a. Hot
 - b. Warm
 - c. Cold

6. Minimum load without oil support (MW)

V. Plant Performance:

Daily Demand Profile (Last Year)	Half-hourly integrated demand throughout the day
Units Generated (Million kWH)	
Units consumed in Auxiliaries (Million kWH)	
Units supplied from system to Auxiliary Load	
Seasonal Generation	

2.2 Hydroelectric Stations:

I. General:

1. Name of generating station:
2. No. and capacity of units (MW)
3. Expected level of generation (MU)
4. Period of generation (in months) per year
5. Whether the plant is based on water released from dam/canal for irrigation purposes
6. Rating of all major equipments.
 - a. Turbine
 - b. Generators
 - c. Generator Transformers
 - d. Auxiliary Transformers
7. Single line diagram of generating station and switchyard
8. Relaying and metering diagram
9. Neutral grounding of generator
10. Excitation control
11. Earthing arrangements with earth resistance values
12. Communication- Details of PLCC and other communication equipment installed

II. Protection:

(As applicable to thermal generating stations mentioned above)

III. Switchyard:

(As applicable to thermal generating stations mentioned above)

IV Generating Units:

A. Parameters of generating units:

(As applicable to thermal generating station mentioned above)

B. Parameters of Excitation Control System:

(As applicable to thermal generating stations mentioned above)

C. Parameters of governor/ turbine:

(As applicable to thermal generating stations mentioned above)

D. Operational Parameters:

- (a) Minimum notice required for synchronising a generating unit from de-synchronisation
- (b) Minimum time between synchronising different generating units in a generating station
- (c) Minimum block load requirements on synchronising

3 Planning Data Generation

(For submission on request by STU)

3.1 For Thermal Generating Stations, if desired by STU:

Connection:

- 1. Report of studies of parallel operation with Transmission System:
 - a. Load flow studies
 - b. Stability studies
 - c. Short Circuit studies
- 2. Proposed connection with Transmission system:
 - a. Voltage
 - b. No. of circuits
 - c. Connection Point(s) / Interface Point(s)

3.2 For Hydroelectric Generating Stations, if desired by STU:

(As applicable to thermal generating stations mentioned above)

Part - II - Distribution

(To be furnished by the distribution company to STU)

1 Standard Planning Data Distribution

I. General:

1. Single Line Diagram	Licensee-wise up to 66kV substations.
2. Consumer Data	Furnish category wise number of consumers, their connected loads to the best judgement of the Distribution Licensee
3. Reference to area offices presently in charge of the distribution	

II. Connection:

1. Connection Points/ Interface Points:	Furnish single line diagram showing Connection Points/ Interface Points.
2. Voltage of supply at Connection Points/ Interface Points:	
3. Names of Grid Substation feeding the	

Connection Points/ Interface Points:	
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III. Lines and Substations:

1. Line Data:	Furnish length of line and voltages (EHV level)
2. Substation Data:	Furnish transformer details of 220/ 11kV, 132/11 kV, 66/22 kV, 66/ 11 kV substations, capacitor installations

IV. Loads:

1. Loads drawn at Connection Points/ Interface Points:	If the Distribution Licensee receive power at a number of connection points in a compact area, which are interconnected in a ring, then such a Distribution Licensee shall forward the overall load drawn for overall Area of Supply, as well as at each connection point with the variation or tolerance as mutually discussed and agreed upon with the STU.
2. Details of loads fed at EHV if any:	Give name of consumer, voltage of supply, contract demand and name of grid substation from which line is drawn, length of EHT line from grid substation to the consumer's premises.

V. Demand Data (For All Loads 5 MW and Above):

1. Type of Load & Rating in HP or kW:	State whether furnace loads, rolling mills, traction loads, other industrial loads, pumping loads etc.
2. Rated voltage:	
3. Electrical loading of equipment:	State number and size of motors, rating of arc furnaces/ induction furnace, types of drive and control arrangements.
4. Sensitivity of load to voltage and frequency of supply:	
5. Maximum harmonic content of load:	
6. Average and maximum phase unbalance of load:	
7. Nearest substation from which load is to be fed:	
8. Location map to scale:	Map shall show the location of load with reference to lines and sub-stations in the vicinity.

VI. Load Forecast Data:

1. Peak load for Connection Point/ Interface Point as well as peak load and energy forecast for Area of Supply for each of the succeeding five years.
2. Details of methodology and assumptions on which forecasts are based.
3. Details of load 5 MW and above.

- a. Name of prospective consumer.
- b. Phasing of load.

2 Detailed Planning Data (Distribution)

I. General:

1. Schematic single line diagram of Distribution System (showing distribution lines from Connection Points/ Interface Points with Transmission System 220kV/ 11kV, 132/11 kV, 66/22 kV & 66/ 11 kV substations, consumer bus if fed directly from Transmission System)
2. Numbering and nomenclature of lines and substations (identified with feeding grid substations of the Transmission System and concerned 220kV/11kV, 132/ 11kV, 66/22 kV & 66/11 kV substation).

II Connection:

1. Connection Points/ Interface Points (furnish details of existing arrangement of connection)
2. Details of metering of Connection Points/ Interface Points.

3 Detailed Planning Data (Distribution)

(For submission on request by STU)

I. Connection:

1. Connection Points/ Interface Points as applied for
 - a.New
 - b.Upgrading existing connection
2. Changes in metering at Connection Points/ Interface Points

II. Loads:

1. Details of major loads of 1 MW and above to be contracted for next three years.

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Planning Data Requirement by User from STU/ Transmission Licensee (Clause 4.25, Clause 10.6)

(To be furnished to the user on request by STU/ Transmission Licensee)

1 Standard Planning Data (Transmission)

1.Name of the line: (indicating generating stations and substations to be connected)	
2. Voltage of line (kV):	
3. No. of circuits:	
4. Route length (CKM):	
5. Conductor sizes:	
6. Line parameters (PU on 100 MVA base or ohmic values):	Resistance/KM Inductive Reactance /KM Suceptance/KM
7. Approximate power flow MW & MVar:	
8. Line Route (Topographic Sheets)	
9. Purpose of connection:	Reference to scheme, wheeling to other states etc.
10. Approximate period of construction:	

2 Detailed System Data (Transmission)

I. General:

1. Single line diagram of the Transmission System up to 66 kV bus at grid sub-station:
2. Name of substation
3. Generating station connected
4. Number and length of circuits
5. Interconnecting transformers
6. Substation bus layouts
7. Power transformers
8. Reactive compensation equipment
9. The details of capacitors installed
 - a. Additional capacitors to be commissioned along with additional loads
 - b. Lightning arresters
10. Bus and/or line reactors

II. Substation Layout Diagrams Showing:

1. Bus bar layouts
2. Electrical circuitry, lines, cables, transformers, switchgear etc
3. Phasing arrangements
4. Earthing arrangements
5. Switching facilities and interlocking arrangements

6. Operating voltages
7. Numbering and nomenclature
 - a. Transformers
 - b. Circuits
 - c. Circuit breakers
 - d. Isolating switches

III.Line Parameters: (For All Circuits)

1. Designation of line
2. Length of line (KM)
3. No. of circuits, size and type of conductor, thermal rating
4. Per circuit values
 - a. Operating voltage (kV)
 - b. Positive phase sequence reactance - ohms/KM
 - c. Positive phase sequence resistance - ohms/KM
 - d. Positive phase sequence suceptance - mhos/KM
 - e. Zero Phase Sequence Reactance - Ohms/Km
 - f. Zero phase sequence resistance - ohms/KM
 - g. Zero Phase sequence suceptance - mhos/KM

IV. Transformer Parameters: (For All Transformers Substation-wise)

1. Rated MVA
2. Voltage ratio
3. Vector group
4. Positive sequence reactance on rated MVA base (Max., min. & normal)
5. Positive sequence resistance on rated MVA base (max., min. & Normal)
6. Zero sequence reactance on rated MVA base
7. Tap change range (+% to -%) and steps
8. Details of tap changer (OFF/ON)
9. Neutral grounding transformer/resistor values
10. % Impedance (Max/Min/Normal Tap)

V. Equipment Details: (For All Substations):

1. Circuit breakers
2. Isolating switches
3. Current transformers
4. Potential transformers
5. Lightning arresters
6. Earthing switches

VI Relaying and Metering:

1. Relay protection installed for all transformers and feeders along with their settings and level of coordination with other users.
2. Metering Details

VII System Studies:

- Load flow studies (peak and lean load for maximum hydro and maximum thermal generation)
- Transient stability studies for 3 phase fault in critical lines, and single pole reclosing for 400 kV lines
- Dynamic stability studies
- Short circuit studies (3 phase and single phase to earth)
- Transmission and distribution losses in the system.

VIII Demand Data: (For All Sub-Stations)

1. Demand Profile (peak and off peak load)
 - (a) Forecast for next five years

IX Reactive Compensation Equipment:

1. Type of equipment (fixed or variable)
2. Capacities and/or inductive rating (voltage and MVar) or its operating range.
3. Details of control
4. Connection Point/ Interface Point to the system.

3 Detailed Planning Data (Transmission)

- I. Connection:
 1. Single Line Diagram showing position of connection
 2. Substation layout diagram
 3. New
 4. Addition and alteration
 5. Revised system studies with changed parameters
 6. Connection Point/ Interface Point
 - a. Voltage
 - b. Length of circuit
 - c. Circuit parameters
 - d. PLCC facilities
 - e. Relaying with inter tripping arrangements to inter trip system breaker at Connection Point/ Interface Point to isolate on fault
 - f. Metering at Connection Point/ Interface Point.
 - g. Other communication facility

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Standards and Conditions for Connectivity to the Grid (Objective: Connection Code)

Schedule –I

Standards for Connectivity to the Grid

General

1. Standards and Codes of Practice

- (1) The user shall follow the industry best practices and applicable industry standards in respect of the equipment installation and its operation and maintenance.
- (2) The equipment including overhead lines and cables shall comply with the relevant Indian Standards, British Standard (BS) or International Electro Technical Commission (IEC) Standard, or American National Standards Institute (ANSI) or any other equivalent international standard:
- (3) The effects of wind, storms, floods, lightening, elevation, temperature extremes, icing, contamination, pollution and earthquakes must be considered in the design and operations of the connected facilities.
- (4) Installation, operation and maintenance of the equipment by user shall conform to the relevant standards specified by the authority under Section 177, and section 73 of the Act, as and when they come into force.

2. Safety

The user shall comply with the CEA (Measures Relating to Safety and Electric Supply) Regulations, 2010.

3. Substation Grounding

Each transmission substation must have a ground mat solidly connected to all metallic structures and other non-energized metallic equipment. The mat shall limit the ground potential gradients to such voltage and current levels that will not endanger the safety of people or damage equipment which are in, or immediately adjacent to, the station under normal and fault conditions. The ground mat size and type shall be based on local soil conditions and available electrical fault current magnitudes. Areas where ground mat voltage rises would not be within acceptable and safe limits (for example due to high soil resistivity or limited sub-station space), grounding rods and ground wells may be used to reduce the ground grid resistance to acceptable levels. Substation grounding shall be done in accordance with the norms of the Institute of Electrical and Electronics Engineers (IEEE).80.

4. Metering

Meters shall be provided as specified in the Central Electricity Authority (Installation and Operation of Meters) Regulations, 2006 as amended time to time.

5. Basic Insulation Level and Insulation Coordination

- (1) Basic Insulation Level (BIL) of various items of equipment and ratings of surge arresters for generating stations, lines and substations shall be decided on the following order of priority, namely:
 - (a) ensuring safety to public and operating personnel;
 - (b) avoiding permanent damage to plant;
 - (c) preventing failure of costly equipment;
 - (d) minimizing circuit interruptions;
 - (e) minimizing interruptions of power supply to consumers;
- (2) Insulation coordination of equipment and lines on both sides of a connection point belonging to the user and the grid shall be accomplished and the coordination shall be done by the GETCO (State Transmission Utility).

6. Protection system and Coordination

- (1) Protection system shall be designed to reliably detect faults on various abnormal conditions and provide means and location to isolate the equipment or system automatically. The protection system must be able to detect a power system faults within the protection zone. The protection system should also detect abnormal operating conditions such as equipment failures or open phase conditions.
- (2) Every element of the power system shall be protected by a standard protection system having the required reliability, selectivity, speed, discrimination and sensitivity. Where failure of protective relay in the user's system has substantial impact on the grid, it shall connect an additional protection as back-up protection, besides the main protection.
- (3) Notwithstanding the protection systems provided in the grid, the user shall provide requisite protections for safeguarding his system from the faults originating in the grid.
- (4) Busbar protection and breaker fail protection or Local Breaker Back-up protection shall be provided wherever stipulated in the regulations.
- (5) Special protection scheme such as under frequency relay for load shedding. Voltage instability, angular instability, generation backing down or islanding schemes may also be required to be provided to avert system disturbances.
- (6) Protection coordination issues shall be finalized by the regional power committee.
- (7) User shall develop protection manuals conforming to various standards for the reference and use of its personnel.

7. Disturbance Recording and Event Logging Facilities

User and substation connected to the grid at a substation shall provide disturbance recording and event logging facilities. All such equipment shall be provided with time synchronization facility for global common time reference.

8. Schematic Diagrams

User shall prepare single line schematic diagrams in respect of its system facility and make the same available to the GETCO (State Transmission Utility), through which his system is connected and the State Load Despatch Centre.

9. Inspection, Test, Calibration and Maintenance prior to connection

Before connecting, the user shall complete all inspections and tests finalized in consultation with the GETCO (State Transmission Utility) to which his equipment is connected. The user shall make available all drawings, specifications and test records of the project GETCO (State Transmission Utility) or generating station, as the case may be.

Schedule –II

Grid Connectivity Standards (applicable to generating units only)

The units of a user proposed to be connected to the grid shall comply with the following requirements besides the general connectivity conditions given in the regulations and general requirements given in Schedule-I:

New Generating Units

- (1) The excitation system for every generating unit:
 - (a) shall have state of the art excitation system;
 - (b) shall have Automatic Voltage Regulator (AVR). Generators of 100MW rating and above shall have Automatic Voltage Regulator with digital control and two separate channels having independent inputs and automatic changeover;
 - (c) The Automatic Voltage Regulator of generator of 100 MW and above shall include power system stabilizer (PSS).
- (2) The short-circuit ratio (SCR) for generators shall be as per IEC-34.
- (3) The generator transformer windings shall have delta connection on low voltage side and star connection on high voltage side. Star point of high voltage side shall be effectively (solidly) earthed, so as to achieve the earth fault factor of 1.4 or less.
- (4) All generating machines irrespective of capacity shall have electronically controlled governing system with state speed/load characteristics to regulate frequency. The governors of thermal generating units shall have a droop of 3 to 6%.
- (5) The project of the user shall not cause voltage and current harmonics on the grid which exceed the limits specified in Institute of Electrical and Electronics Engineers (IEEE) standard 519.
- (6) Generating units located near load centre, shall be capable of operating at rated output for power factor varying between 0.85 lagging (over-excited) to 0.95 leading (under-excited) and generating units located far from load centres shall be capable of operating at rated output for power factor varying between 0.9 lagging (over-excited) to 0.95 leading (under-excited). The above performance shall also be achieved with voltage variation of +5% of nominal

frequency variation of +3% and -5% and combined voltage and frequency variation of + 5%. However, for gas turbines, the above performance shall be achieved for voltage variation of + 5%.

- (7) The coal and lignite based thermal generating units shall be capable of generating up to 105% of Maximum Continuous Rating (subject to maximum load capability under valve wide open condition) for short duration to provide the frequency response.
- (8) Every generating unit shall have standard protections to protect the units not only from faults within the units and within the station, but also from faults in transmission lines. For generating units having rated capacity greater than 100 MW, two independent sets of protections acting on two independent sets of trip coils fed from independent Direct Current (DC) supplies shall be provided. The protections shall include but not be limited to the Local Breaker Back-up (LBB) protection.
- (9) Bus bar protection shall be provided at the switchyard of all generating station.
- (10) The station auxiliary power requirement, including voltage and reactive requirements, shall not impose operating restrictions on the grid beyond those specified in the Grid Code or state Grid Code as the case may be.

All the terms and conditions mentioned in the notification issued by Central Electricity Authority No.12/X/STD/ (CONN)/GM/CEA/dt.21st Feb-2007 and as amended, from time to time, shall be binding to and will fulfil all the criteria mentioned in the notification of CEA.

MINISTRY OF POWER
(CENTRAL ELECTRICITY AUTHORITY)
NOTIFICATION

New Delhi, the 21st February, 2007

No. 12/X/STD (CONN)/GM/CEA.—Whereas the draft of the Central Electricity Authority (Technical Standards for Connectivity to the Grid) Regulations, 2006 were published as required by Sub-section (2) of Section 177 of the Electricity Act, 2003 (36 of 2003) read with rule 3 of the Electricity (Procedure for previous Publication) Rules, 2005;

Now, therefore, in exercise of powers conferred by Section 7 and clause (b) of Section 73 read with Sub-section (2) of Section 177 of Electricity Act, 2003, the Central Electricity Authority hereby makes the following Regulations for regulating the technical standards for connectivity to the grid, namely :—

1. Short title and commencement

- (1) These Regulations may be called the Central Electricity Authority (Technical Standards for Connectivity to the Grid) Regulations, 2007.
- (2) These Regulations shall come into force on the date of their publication in the Official Gazette.

2. Definitions

In these regulations, unless the context otherwise requires,—

- (1) "Act" means The Electricity Act, 2003 (No. 36 of 2003);
- (2) "Appropriate Load Despatch Centre" means the National Load Despatch Centre (NLDC), Regional Load Despatch Centre (RLDC) or State Load Despatch Centre (SLDC) or Area Load Despatch Centre as the case may be;
- (3) "Area Load Despatch Centre" means the centre as established by the state for load despatch and control in a particular area of the state;
- (4) "Appropriate Transmission Utility" means the Central Transmission Utility or State Transmission Utility as the case may be;
- (5) "Automatic Generation Control" (AGC) means capability to regulate the power output of selectable units in response to total power plant output, tie-line power flow, and power system frequency;
- (6) "Automatic Voltage Regulator" (AVR) means a continuously acting automatic excitation control system to regulate a generating unit terminal voltage;
- (7) "British Standards" (BS) means those standards and specifications approved by the British Standards Institution;
- (8) "Bulk consumer" means a consumer who avails supply at voltage of 33 kV or above;
- (9) "Earth Fault Factor" at a location in a three-phase system means the ratio of 'the highest root mean square (r.m.s.) phase-to-earth power frequency voltage on a sound phase during a fault to earth (affecting one or more phases)' to 'the r.m.s. phase-to-earth power frequency voltage which would be obtained at the selected location without the fault';
- (10) "Earthing" means connection between conducting parts and general mass of earth by an earthing device;
- (11) "Energy Management System" (EMS) means a complete system comprising software for facilitating operation of a power system, maintaining safety, reliability and economy;
- (12) "Event Logging Facilities" means a device provided to record the chronological sequence of operations of the relays and other equipment;
- (13) "Frequency" means the number of alternating cycles per second [expressed in Hertz (Hz)];
- (14) "Generating Unit" means an electrical Generator coupled to a prime mover within a Power Station together with all Plant and Apparatus at that Power Station (up to the Connection Point) which relates exclusively to the operation of that generator;
- (15) "IEC Standard" means a standard approved by the International Electrotechnical Commission;
- (16) "Indian Standards" (IS) means standards specified by Bureau of Indian Standards;
- (17) "Interconnection point" means a sub-station or switchyard at which point the interconnection is established between the requester and the grid;
- (18) "Isolator" means a device for achieving isolation of one part of an electrical system from the rest of the system;
- (19) "Maximum Continuous Rating" (MCR) of a generating unit means the maximum continuous output in MW at the generator terminals guaranteed by the manufacturer at rated parameters;

- (20) "New Unit" means a generating unit for which the requester is seeking connection to the grid;
- (21) "Power Factor" means the cosine of the electrical angle between the voltage and current complexors in an AC electrical circuit;
- (22) "Power System Stabilizer" (PSS) means controlling equipment which receives input signals of speed, frequency and power to control the excitation via the voltage regulator for damping power oscillations of a synchronous machine;
- (23) "Protection System" means the equipment by which abnormal conditions in the grid are detected and fault clearance, actuating signals or indications are initiated without the intervention by the operator;
- (24) "Reactive Power" means in relation to an AC electrical system, the product of root mean square (r.m.s.) voltage, root mean square (r.m.s.) current and the sine of the electrical phase angle between the voltage complexor and current complexor, measured in volt-amperes reactive (VAR);
- (25) "Requester" means a person such as a Generating Company including captive generating plant or Transmission Licensee (excluding Central Transmission Utility and State Transmission Utility) or Distribution Licensee or Bulk Consumer, who is seeking connection of his new or expanded electrical plant to the Grid at voltage level 33 kV and above;
- (26) "SCADA" means Supervisory Control and Data Acquisition System that acquires data from remote locations over communication links and processes it at centralised control location for monitoring, supervision, control as well as decision support;
- (27) "Site Common Drawing" means a drawing prepared for a connection site, which depicts layout of connection site, electrical layout, common protection and control drawings and common services;
- (28) "Site Responsibility Schedule" (SRS) means a Schedule for demarcating the ownership, responsibility for control, operation and maintenance of the equipment at the interconnection point;
- (29) "System Protection Scheme" means a scheme designed to detect abnormal system conditions and take predetermined, corrective action to preserve system integrity and provide acceptable system performance;
- (30) "Thermal Generating Unit" means a generating unit using fossil fuels such as coal, lignite, gaseous and liquid fuel;
- (31) "Total Harmonic Distortion" (THD) means a measure of distortion of the voltage or current wave form (which shall ideally be sinusoidal) and is the square root of the sum of squares of all voltage or current harmonics expressed as a percentage of the magnitude of the fundamental;
- (32) "Transmission System" means a network of transmission lines and sub-stations;
- (33) "Under Frequency Relay" means a relay which operates when the system frequency falls below a pre-set value;
- (34) "User" means a person such as a Generating Company including captive generating plant or Transmission Licensee (other than the Central Transmission Utility and State Transmission Utility) or Distribution Licensee or Bulk Consumer, whose electrical plant is connected to the grid at voltage level 33 kV and above; and
- (35) "Voltage Unbalance" means the deviation between highest and lowest line voltage divided by Average Line Voltage of the three phases.

The words and expressions used and not defined in these regulations but defined in the Act shall have the meaning assigned to them in the Act.

Applicability of the Regulations

These regulations shall be applicable to all the users, requesters, Central Transmission Utility and State Transmission Utility.

Objectives

- (1) The aim of these regulations is to ensure the safe operation, integrity and reliability of the grid.
- (2) The new connection shall not cause any adverse effect on the grid. The grid shall continue to perform with specified reliability, security and quality as per the Central Electricity Authority (Grid Standards for Operation and Maintenance of Transmission Lines) Regulations, as and when they come into force. However, these regulations are not to be relied upon to protect the plant and equipment of the requester or user.
- (3) A requester is required to be aware, in advance, of the standards and conditions his system has to meet for being integrated into the grid.

Standards

The equipment shall meet the requirements in accordance with the provisions of Technical Standards for connection to the Grid as given in the Schedule of these regulations and Central Electricity Authority (Grid Standards for Operation and Maintenance of Transmission Lines) Regulations as and when they come into force, and Grid Code and the Grid Code(s) as specified by the appropriate Commission.

6. General Connectivity Conditions

- (1) The requester shall be responsible for the planning, design, construction, reliability, protection and safe operation of its own equipment subject to the regulations for construction operation and maintenance and connectivity and other statutory provisions.
- (2) The requester and user shall furnish data as required by the Appropriate Transmission Utility or by the licensee or generating station with whose system the inter-connection is proposed, for permitting inter-connection with the grid.
- (3) The requester and user shall provide necessary facilities for voice and data communication and transfer of on-line operational data, such as voltage, frequency, line flows, and status of breaker and isolator position and other parameters as prescribed by the Appropriate Load Despatch Centre.
- (4) The requester and user shall cooperate with the Regional Power Committee, and Appropriate Load Despatch Centres in respect of the matters listed below, but not limited to :—
 - (a) protection coordination and settings of its protective relays accordingly;
 - (b) agree to maintain meters and communication system in its jurisdiction in good condition;
 - (c) participate in contingency operations such as load shedding, increasing or reducing generation, is landing, black start, providing start-up power and restoration as per the procedure decided by the Appropriate Load Despatch Centre;
 - (d) furnish data as required by Appropriate Transmission Utility or Transmission Licensee, Appropriate Load Despatch Centre, Appropriate Regional Power Committee, and any committee constituted by the Authority of appropriate Government for system studies or for facilitating analysis of tripping or disturbance in power system;
 - (e) carryout modifications in his equipment with respect to short circuit level, protection coordination and other technical reasons considered necessary due to operational requirements;
 - (f) abide by the coordinated outage plan of the state and region in respect of generating units and transmission lines as approved by the Regional Power Committee; and
 - (g) cooperate with the Regional Power Committee for tuning of Power System Stabilizer provided in the excitation system of the generating unit.
- (5) The requester and user shall make arrangements for integration of the controls and tele-metering features of his system into the Automatic Generation Control, Automatic Load Shedding, Special Protection System, Energy Management Systems and Supervisory Control and Data Acquisition System of the respective state or region.
- (6) For inter-connection studies the requester shall make a request for connection in the planning stage to the Appropriate Transmission Utility. In case a requester is seeking inter-connection to a distribution system, such a request will be made to the distribution licensee. The Appropriate Transmission Utility or distribution licensee shall carry out the inter-connection study to determine the point of inter-connection, required inter-connection facilities and modifications required on the existing grids, if any, to accommodate the inter-connection. The study may also address the transmission system capability, transient stability, voltage stability, losses, voltage regulation, harmonics, voltage flicker, electromagnetic transients, machine dynamics, ferro resonance, metering requirements, protective relaying, sub-station grounding and fault duties, as the case may be.
- (7)(1) Every connection of a requester's system to the grid shall be covered by a connection agreement between the requester and
 - (a) Appropriate Transmission Utility in case of connection to Inter-state transmission system or intra state transmission system as the case may be;
 - (b) Distribution licensee in case of inter-connection to distribution licensee's system; and
 - (c) Transmission licensee and Appropriate Transmission Utility, in case of inter-connection to a transmission licensee (tri-partite agreement).
- (2) The connection agreement shall contain general and specific technical conditions, applicable to that connection.

7. Site Responsibility Schedule

- (1) A Site Responsibility Schedule (SRS) for every connection point shall be prepared by the owner of the sub-station where connection is taking place.
- (2) Following information shall be included in the Site Responsibility Schedule, namely,—
 - (a) Schedule of electrical apparatus services and supplies;

- (b) Schedule of telecommunications and measurement apparatus; and
- (c) Safety rules applicable to each plant and apparatus.
- (3) Following information shall also be furnished in the Site Responsibility Schedule for each item of equipment installed at the connection site, namely :—
 - (a) the ownership of equipment;
 - (b) the responsibility for control of equipment;
 - (c) the responsibility for maintenance of equipment;
 - (d) the responsibility for operation of equipment;
 - (e) the manager of the site;
 - (f) the responsibility for all matters relating to safety of persons at site; and
 - (g) the responsibility for all matters relating to safety of equipment at site.

8. Access at Connection Site

The requester or user, as the case may be, owning the electrical plant shall provide reasonable access and other required facilities to the licensee or Appropriate Transmission Utility or Appropriate Load Despatch Centre, whose equipment is installed or proposed to be installed at the Connection Site for installation, operation and maintenance, etc. of the equipment.

9. Site Common Drawings

Site Common Drawings shall be prepared for each connection point by the owner of the Sub-station where connection is taking place.

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Operation Planning Data (Clause 6.13, Clause 10.4, Clause 10.5)
A Outage Planning Data:**I Demand Estimates:**

Estimated aggregate annual sales of energy in million units and peak and lean demand in MW and MVar in the Area of Supply for the next financial year from 1st April to 31st of March shall be submitted before October 15.

Estimated aggregate monthly sales of energy in million units and peak and lean demand in MW and MVar in the Area of Supply for the next month shall be submitted before the 15th of the current month.

Hourly demand estimates for the day ahead shall be submitted by the Distribution Licensee to SLDC at 0900 hours every day.

II. Estimates of load shedding:

Details of discrete load blocks that can be shed to comply with instructions issued by the SLDC when required, from each Connection Point / Interface Point soon after the connection is made.

III. Year-ahead outage programme:

(For the period 1st April to 31st March)

(a) Generating companies' outage programme:

Information shall be furnished by 15th October each year:

- (i) Identification of generating unit
- (ii) MW which will not be available as a result of outage.
- (iii) Preferred start-dates and start-time or range of start-dates and start-times and period of outage.
- (iv) If outages are required to meet statutory requirements, then the latest date by which outage must be taken.

(b) WRLDC's year-ahead outage programme:

(Affecting Transmission System)

Information shall be furnished as draft annual outage plan by 31st December and **as** final annual outage plan by 31st January.

- (i) MW which will not be available as a result of outage from imports through external connections, including ISGS/SGS.
- (ii) Start-date, start-time and period of outage

(c) CPP's year-ahead outage programme:

Information to be furnished by 15th October of each year -

- (i) MW which will not be available as a result of outage

- (ii) Start-date and start-time and period of outage
- (d) Distribution Licensee's 'year ahead' outage programme:
Information shall be furnished by 15th October each year (not pertaining to internal distribution network maintenance, which is not substantially affecting the loading on the Transmission Licensee's lines):
- (i) Load in MW not to be availed from each Connection Point / Interface Point as well as Area of Supply in case of radial feeder and if the distribution system is connected in ring, the Distribution Licensee shall furnish the load in MW not to be availed for his Area of Supply.
 - (ii) Period of suspension of drawal with start-date and start-time.
- (e) Advance intimation required for outage for construction of new EHV lines and maintenance due to any unforeseen trouble, but which can be planned and not of extreme nature; shall be given by the Transmission Licensee / Distribution Licensee to SLDC as under.

Line Voltage	Advance notice in days
66kV	7
132kV	7
220kV	10
400kV	15
HVDC (± 500 kV)	15

B Generation Scheduling Data:

Schedule and despatch shall be submitted by:

- (a) Status of generating unit AVR in service (Yes/No) of all generating units at 0900 hrs every day
- (b) Status of generating unit speed controls system governor in service (Yes/No) of all generating units at 0900 hrs every day
- (c) Backing down capability with/without oil support (MW) of all thermal generating units at 0900 hrs every day
- (d) Hydro reservoir level & restrictions for all generating units at 0900 hrs every day

C. Capability Data:

- Generators shall submit to SLDC up-to-date capability curves for all generating units on receipt of request from SLDC
- CPPs shall submit to SLDC net return capability that shall be available for export/import from Transmission System on receipt of request from SLDC

D. Response to Frequency Change:

- Primary response in MW at different levels of loads ranging from minimum generation to registered capacity for frequency changes resulting in fully opening of governor valve
- Secondary response in MW to frequency changes

E. Monitoring of Generation:

- Logged readings of generators to SLDC whenever required
- Detailed report of generating unit tripping on monthly basis

F. Essential and Non-essential Load Data:

- (a) Schedule of essential and non-essential loads on each discrete load block for purposes of load shedding shall be furnished as soon as possible after connection.

G. Protection Data:

- Generators/CPPs shall submit details of protection requirement and schemes installed by them as per detailed planning data.
- The Transmission Licensee shall submit details of protection equipment and schemes installed by them.
- Detailed system data required for relaying and metering of transmission lines and substations in relation to connection with any user, as per detailed planning data.

H. Metering Data:

- Generators/CPPs shall submit details of metering equipment and schemes installed by them
- Detailed planning data
- STU/ Transmission Licensee shall submit details of metering equipment and schemes installed by them

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Metering and Protection Standards (Clause No. 6.46, 6.68)

I. Introduction

This standard provides guidelines for the following:

- (a) Minimum requirement of metering for commercial and operational purposes to be provided by the user at Connection Points/ Interface Points including generating stations, switching stations, substations and also cross boundary circuits.
- (b) Minimum requirement of protection to be provided to safeguard the system from faults which may occur.

II. Metering Requirements:

Generating Station Operational Metering:

- 1. The generating companies shall install operational metering to the licensees' specifications, so as to provide operational information for both, real time and recording purposes to SLDC in relation to each generating unit, at each generating station, in respect of the following:
 - (a) Bus voltage
 - (b) Frequency
 - (c) MW
 - (d) MVA_r
 - (e) Any other data agreed to between the licensee and the generating company
- 2. All the instrument transformers used in conjunction with the operational metering shall be of accuracy class 0.2, except where already existing CT/PT; which are of 0.5 class, which may continue to be used. These shall be of suitable rating to meet the burden of lead wires and meters and shall conform to the relevant IEC or IS specifications.
- 3. All the meters shall be calibrated to achieve the overall accuracy of Operational Metering in accordance with the limits agreed to between the Transmission Licensee/Distribution Licensee and the generating company. Records of calibration shall be maintained for reference and shall be made available to the licensee, upon request. Joint site testing shall be carried out at least once in six months.

III. Transmission System Operational Metering

The Transmission Licensee shall install operational metering for both, real time and recording purposes at each substation as follows:

- (a) For station busbars:
 - (i) bus voltage
 - (ii) frequency
- (b) For outgoing/incoming lines, power transformers, auxiliary transformers and compensating devices:

- (i) MW
- (ii) MVar
- (iii) Power Factor
- (iv) Current

IV. Supervisory Control and Data Acquisition (SCADA)

1. The Transmission Licensee shall install and make operative an Operational Metering Data Collection System under SCADA for storage, display and processing of operational metering data. All users shall make available outputs of their respective operational meters to the SCADA interface equipment.
2. The data collection, storage and display centre shall be the State Load Despatch Centre (SLDC).

V. Tariff Metering

1. The Generating Companies, CPP, Transmission Licensees, Distribution Licensees and EHV consumers who intend to use open access provisions would need to install the meters suitable for Availability Based Tariff (ABT) at inter-utility exchange points, which would record the parameters as mentioned under clause 5.8.
2. The auxiliary transformers in the generating stations shall be provided with the following meters:
 - (a) MW
 - (b) Current
 - (c) Voltage
 - (d) Active
 - (e) Energy
3. Each metering point associated with determination of energy exported or imported, between the generating companies, Transmission Licensees and Distribution Licensees shall be provided with both, main and check meters on separate core of CT/EMPT/CVT. The minimum standard of accuracy for these meters shall be accuracy class 0.2s. If the present metering system needs upgradation to class 0.2s, it shall be completed within six months from the effective date of this code.
4. All the instrument transformers used in conjunction with commercial (tariff) metering shall also be of accuracy class 0.2s, except where already existing CT/EMPT/CVT/ which are of 0.5 class, shall be upgraded to class 0.2s within two years from the effective date of this code. These shall conform to the relevant IEC or IS specifications. The rating shall take into account the burdens imposed by lead wires and metering.
5. Accuracy class: All interface meters and meters for energy accounting and audit shall be of 0.2S class of accuracy. Consumer meters shall have the following characteristics:
 - (a) For the consumers connected at above 33 kV voltage level should be of 0.2S class of accuracy,

- (b) Consumers connected at above 650 volts and up to 33 kV shall be of 0.5S or better accuracy class,
 - (c) Consumers connected at 650 volts or below shall be of accuracy class 1 or better,
 - (d) The accuracy class of current transformers (CTs) and voltage transformers (VTs) shall not be inferior to that of associated meters. However, till the VTs of 0.2S class of accuracy is available, 0.2 accuracy class may be installed. The existing CTs and VTs not complying with these regulations shall be replaced by new CTs and VTs, if found defective, non-functional or as per the directions of the Commission.
6. Data shall be collected from both, the main and check metering schemes.
 7. Voltage failure relays shall be provided to initiate alarm on loss of one or more phases of the voltage supply to the meter.
 8. All the meters shall be tested and calibrated at least once a year, using standard meters for this purpose. The standard meters shall be calibrated and sealed at a government-authorized meter testing house/laboratory once a year. Records of testing and calibration of substandard meters shall be maintained by the Transmission Licensee according to the guidelines provided in the relevant IEC/IS specifications. Records of these calibrations and tests shall be maintained for reference.
 9. In case of Inter State Transmission Lines / Intra-State Transmission lines, meters suitable for Availability Based Tariff shall be provided having the following parameters:
 - (a) Net Active Energy import/ export for each 15 minute time block of the day
 - (b) Net Reactive Energy import/ export for the day above 103% of voltage
 - (c) Net Reactive Energy export/ import when voltage is below 97%
 - (d) Cumulative active energy export/ import.
 - (e) Average frequency for each 15 minute time block of the day
 - (f) Provision of storage of data in non-volatile memory for at least 10 days
 10. The Generating Companies, Transmission Licensees and Distribution Licensees shall formulate a procedure, covering the summation, collection and processing of tariff meter readings at various connection sites in their areas. Whenever necessary, these procedures can be revised.
 11. The ownership, responsibility of maintenance and testing of these meters shall be as mutually agreed, between the users and the licensees.

VI. Protection Requirements

General Principles

1. No item of electrical equipment shall be allowed to remain connected to the system, unless it is covered by the appropriate protection aimed at reliability, selectivity, speed

and sensitivity. The guidelines mentioned in the manual on protection of generators, generator transformers, and 220 kV and 400 kV networks vide publication no 274 of C.B.I.P shall be kept in view. All the generating companies and Distribution Licensees shall cooperate with the Transmission Licensee(s) to ensure correct and appropriate settings of protection to achieve effective, discriminatory isolation of faulty line/equipment within the target clearance times specified elsewhere in this standard.

2. Protection settings shall not be altered, or protection bypassed and/or disconnected without consultation and agreement of all affected users. In case the protection has been bypassed and/or disconnected by agreement due to any cause, the same should be rectified and protection restored to normal conditions, as quickly as possible. If agreement has not been reached, the electrical equipment shall be isolated forthwith.

VII. Protection Coordination

1. The settings of protective relays starting from the generating unit up to the remote end of 66 kV / 33 kV and 11 kV lines shall be such that only the faulty section is isolated under all circumstances. The Transmission Licensee shall notify the initial settings and any subsequent changes to the users from time to time. Routine checks on the performance of the protective relays shall be conducted and any malfunction shall be noted and corrected as soon as possible. The Transmission Licensee shall conduct the required studies for deciding the relay settings, with the data collected from the users. Representatives of the generating companies, Transmission Licensees and Distribution Licensees shall meet periodically to discuss such malfunctions, changes in the system configuration, if any, and possible revised settings of relays.
2. The Transmission Licensee shall be responsible for arranging periodical meetings between the generating companies and Distribution Licensees to discuss coordination of protection. The Transmission Licensee shall investigate any malfunction of protection or other unsatisfactory protection issues. The concerned licensees shall take prompt action to correct any protection malfunction or issue as discussed and agreed to in these periodical meetings.

VIII. Fault Clearance Time

1. From stability considerations, the maximum Fault Clearance Time for faults on any user's system directly connected to the Transmission System, or any faults on the Transmission System itself, shall be as follows:

Voltage Class	Target Clearance Time
400kV	100 milliseconds
220kV	120 milliseconds
132kV	160 milliseconds
66kV	300 milliseconds

2. Less Fault Clearance Time than the above is preferable.

3. Lower Fault Clearance Times for faults on a user's system may be agreed to, but only if, in the opinion of the Transmission Licensee, system conditions allow the same. At the generating stations, line faults should be cleared at the generating station end, within the critical time, to keep the generators in synchronism.

IX. Generator Requirements

All generating units and all associated electrical equipment of the generating company connected to the Transmission System shall be protected by adequate protection, as per CBIP manual vide publication 274, so that the Transmission System does not suffer due to any disturbances originating at the generating unit.

X. Transmission Line Requirements

Every EHT line taking off from a generating station or a substation or a switching station shall necessarily have distance protection along with other protection as follows:

- (a) **400 kV lines:** - These lines shall have two main distance protections; viz. Main I and Main II with permissive inter trip for remote earth fault. Three zone static/numerical non-switched distance protection with permissive inter trip for accelerated tripping at remote end in case of zone 2 fault as Main I protection shall be provided. Main II protection shall be similar fast protection using direction comparison or phase comparison carrier relay scheme. In addition to the above, single pole tripping and single shot single pole auto reclosing after an adjustable dead time shall be provided. In addition to the above, back-up protection with OCR and EFR shall be provided.
- (b) **220 kV lines:** - Three zone static/numerical non-switched distance protection, with permissible inter-trip for end zone fault as main protection in case of zone 2 fault shall be provided. The back-up shall be three-phase directional over current relay and earth fault relay protection. Three pole tripping and Single Shot Three Pole Auto-reclosing with adjustable dead time shall be provided for the stability of the power system. However, for short 220 kV lines directional comparison or phase comparison carrier protection as Main II can be provided. In addition to the above back-up protection with directional OCR (Over Current Relay) and directional EFR (Earth Fault Relay) shall be provided.
- (c) **132 kV lines:** - Three zone static/numerical switched protection with permissible inter trip for accelerated tripping at the remote end in case of zone 2 protection shall be provided as main protection. The back-up will be directional three-phase over current and earth fault protection.
- (d) **Busbar Protection:** - Adequate busbar protection for the station busbar sections in all 400 kV and 220 kV class substations shall be provided.
- (e) **Local Breaker Backup Protection (LBB):** - In the event of any circuit breaker failing to trip on receipt of trip command from protective relays, all circuit breakers connected to the bus section to which the faulty circuit breaker is connected are required to be tripped

with minimum possible delay through LBB protection. This protection also provides coverage for faults between the circuit breaker and the current transformer, which are not covered by other protections. All 220 kV and 400 kV circuits shall have Local Breaker Back-up Protection.

- (f) **400 kV class Power Transformers:** - These shall be provided with differential protection, restricted earth fault protection, Bucholtz protection, and winding temperature protection along with back-up directional HV & LV IDMT over current protection.
- (g) **220 kV, 132 kV and 66 kV class power transformers:** These shall have differential protection, restricted earth fault protection, Bucholtz protection, and winding/oil temperature protection. They shall also have directional over current as back-up protection with an instantaneous element. In addition to the above, Over Fluxing Relays, pressure relief valves/diaphragms shall be provided for all the power transformers. Appropriate fire protection for all the power transformers as per CBIP specifications and tariff advisory committee recommendations shall be provided. Over Fluxing Relays shall be provided on transformers having rating more than 100 MVA.
- (h) **Distribution System:** For smaller transformers of HV class on the distribution system, differential protection shall be provided for 8 MVA capacity and above, along with back-up time lag over current and earth fault protection with directional feature for parallel operation. Transformers of 1.6 MVA capacity and above, but less than 8 MVA shall be protected by time lag over current, earth fault and instantaneous restricted earth fault relays. In addition, all transformers of 1.6 MVA and above shall be provided with gas operated relays, winding and oil temperature protection.
- (i) **Distribution Lines:** All the 33 kV, 22 kV and 11 kV lines at Connection Points/ Interface Points shall be provided with a minimum of over current and earth fault relays as follows:
- (j) **Plain Radial Feeders:** Directional over current and earth fault relays with suitable settings to obtain discrimination between adjacent relay settings.
- (k) **Parallel/Ring Feeders:** Directional time lag over current and earth fault relay.
- (l) **Inadvertent Flow:** - When two systems are operating in parallel with floating tie-line, it may not be possible to have tie-line absolutely floating because of dynamics of network parameters and there will be a flow of energy from one system to another system. Such inadvertent flow shall be accounted for the purpose of commercial billing.

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Requisition for Line Clear Permit (Clause No. 7.21)

Date

Time

I Mr/Ms. ----- request Line Clear Permit on the following HT/EHT line/equipment

HV/EHV Apparatus/Line Identification:**Details of works to be carried out:****Estimated time required for completion:**

Name and Signature

(Requesting Safety Coordinator)

(In-charge of crew)

Designation.....

Date.....

.....

.....

(For use in substation from where Line Clear Permit will be issued)

(a) Line Clear Permit issued : Yes/No

(b) Number and date of issue (Code No.):

(c) Time of issue:

(d) Date & time of return:

(e) Remarks: see check list LCP - H

Receipt of LCP

I have received confirmation from(name of issuing safety coordinator) at(location) that the safety precautions have been established and the instructions will not be issued at his location for their removal until his LCP-H is cancelled.

Name and Signature.....

(Requesting safety coordinator)

In charge of the crew at(time) on(date)

(To be printed on the reverse of LCP-H: Checklist of Line Clear Permit)

Conditions:

(a) This permit is valid only for working in the feeder/equipment mentioned herein and not in any other feeder/equipment.

(b) Only authorised persons are allowed to work on feeders/equipments for which the permit has been issued.

- (c) Works as per requisition only should be carried out.
- (d) Before touching any part of the feeder/equipment, the same should be earthed at two points on either side through standard discharge rods connected with good earth. Temporary earthing may only be removed after completion of all works and after all the men have come down from the feeder/equipment.
- (e) Work should be so planned that the Line Clear is returned before or at the time indicated. If unavoidable delay is anticipated, advance information should be given to the location from where the Line Clear is issued.
- (f) Before return of the Line Clear, it should be ensured that all the men, materials, tools/tackles etc. on line have returned and reported that all temporary returned and reported and all temporary earths removed. There should also be a check on the material, tools and plant issued for the work to ensure that nothing is left behind on the line or equipment.
- (g) Only authorised persons should return Line Clear.
- (h) In case the Line Clear cannot be returned in person, the same may be returned to the Line Clear Issuing Authority over telephone by naming the code words assigned and the telephone number which is used for naming the code words assigned. In case two or more different code words are issued to the two or more persons in whose favour the permit is given, those persons must jointly return the Line Clear by naming their own code words. The Line Clear Return will not be deemed to be accepted unless returned by all these persons.
- (i) The Line Clear issuing authority should go over the checklist of Line Clear Return before accepting it.
- (j) If Line Clear is returned over telephone, the Line Clear return form duly filled and signed should be sent to the Line Clear issuing authority by post immediately for record.
- (k) Control person should keep all the required data of LCP issued & LCR received. He should monitor and keep specific note in log sheet when more than one LCP are issued on same line/ equip/bay along with code words.

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Check list for Line Clear Permit and Line Clear Permit (Clause No.7.21)

LCP-H Number.....

Dated..... Time.....

Check List of the Line Clear Permit:

- (a) Name of location for which line clear is issued
- (b) Reference and authority requisitioning Line Clear: (Indicate original LCP-G number including suffix and prefix)
- (c) Identity of HV Apparatus
- (d) Sources from which the line/equipment is charged
- (e) Number/name of circuit breaker/isolating switch open at each of above sources
- (f) Whether confirmed that the line is disconnected at both ends
- (g) Whether line is earthed at both ends
- (h) Whether circuit breaker truck removed in case of indoor switchgear controlling the feeder/equipment for which line clear is given
- (i) Whether fuses of control supply voltage of the circuit breaker/isolating switches controlling the feeder/equipment for which line clear is given are removed and kept in safe custody
- (j) Time of issue of Line Clear Permit and LCP-G No.
- (k) Name of requesting safety coordinator on whom LCP-G is issued
- (l) Approximate time for returning LCP-G as ascertained from the requesting coordinator

Name and Signature.....

(Issuing Safety Coordinator)

Designation.....

Line Clear Permit

LCP - G No.....

I, Mr/Ms.----- (Issuing Safety Coordinator) do hereby issue permission to Mr/Ms.-----
 --- (Requesting Safety Coordinator) for carrying out works as per requisition
 No.....date.....time

The EHV/ HV Line/equipment herein described is declared safe. The permission is subject to the
 conditions given in LCP-F.

Name and Signature.....

(Person issuing Line Clear Permit)

Designation.....

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Line Clear Return (Clause No. 7.21)

LCP - I Number.....

Date Time.....

LCP-H No..... Dated.....

I, Mr/Ms. ----- hereby return the LCP No. -----at ----- (time) for the following HT/EHT Line/Apparatus. I declare that all the crew who were sent on work have been withdrawn, temporary earth(s) removed, all repair tools and materials checked and the feeders/equipments mentioned below are safe to be energised.

- (a) HV/EHV Apparatus/Line Identification:
- (b) Safety precaution no longer required:
- (c) Isolation [state locations and each point of isolation indicating means by which isolation was achieved]
- (d) Earthing [state location at which earthing was established and identify each point of earthing]
- (e) Details of work done

Check list to be ticked off:

- (a) Whether all men withdrawn: *Yes/No*
- (b) Whether all temporary earth removed: *Yes/No*
- (c) Whether materials, tools and plant used in the work have been checked: *Yes/No*
- (d) Code Number (If used when Line Clear is returned over phone) -----

Name and Signature.....

(Requesting Safety Coordinator)

Designation.....

In-charge of Crew -----

(Designation)

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Regulatory Requirements of Special Energy Meters (Clause No 11.17)

1. Special energy meters of a uniform technical specification shall be provided on the electrical periphery of each state constituent, to determine its actual net interchange with the state grid. Each interconnection shall have one (1) main meter. In addition, stand-by/check meters shall be provided such that correct computation of net interchange of a constituent is possible even when a main meter, a CT or a VT has a problem.
2. The Interface meters suitable for ABT shall be static type, composite meters, as self-contained devices for measurement of Active and Reactive energy and certain other parameters as described in the following paragraphs. The meters shall be suitable for being connected directly to voltage transformers (VTs) having a rated secondary line-to-line voltage of 110 V, and to current transformers (CTs) having a rated secondary current of 1A (Model-A: 3 element 4 wire or Model C: 2 element, 3 wire) or 5A (model-B: 3 element, 4 wire or Model D: 2 element 3 wire). The reference frequency shall be 50Hz.
3. The meters shall have a non-volatile memory, in which the following shall be automatically stored:
 - (i) Average frequency for each successive 15-minute block, as a two digit code (00 to 99 for frequency from 49.0 to 51.0Hz)
 - (ii) Net Wh transmittal during each successive 15-minute block, up to second decimal, with plus/minus sign
 - (iii) Cumulative Wh transmittal at each midnight, in six digits including one decimal
 - (iv) Cumulative VARh transmittal for voltage high condition, at each midnight, in six digits including one decimal
 - (v) Cumulative VARh transmittal for voltage low condition, at each midnight, in six digits including one decimal
 - (vi) Date and time blocks of failure of VT supply on any phase, as a star (*) mark
4. The meters shall store all the above listed data in their memories for a period of at least ten days. The data older than ten days shall get erased automatically. Each meter shall have an optical port on its front for tapping all data stored in its memory, by using a hand-held data collection device. The meter shall be suitable for transmitting the data to remote a location, using appropriate communication medium.
5. The active energy (Wh) measurement shall be carried out on a 3-phase, 4-wire principle, with an accuracy as per class 0.2 S of IEC-687/IEC-62053-22. In models A and C, the energy shall be computed directly in CT and VT secondary quantities, and indicated in watt-hours. In models B and D, the energy display and recording shall be one fifth of the Wh computed in CT and VT secondary quantities.
6. The Var and reactive energy measurement shall also be on a 3-phase, 4-wire principle, with an accuracy as per class 2 of IEC-62053-23 or better. In models A or C, the Var and VARh computation shall be directly in CT and VT secondary quantities. In models B or D, the

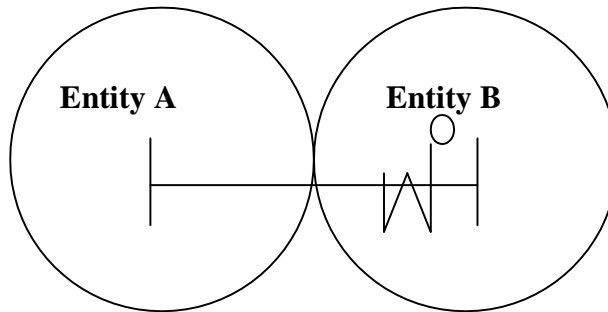
above quantities shall be displayed and recorded as one-fifth of those computed in CT and VT secondary quantities. There shall be two reactive energy registers, one for the period when average RMS voltage is above 103% and the other for the period the voltage is below 97%.

7. The 15-minute Wh shall have a +ve sign when there is a net Wh export from substation busbars, and a –ve sign when there is a net Wh import. The integrating (cumulative) registers for Wh and Varh shall move forward when there is Wh/Varh export from substation busbars, and backward when there is an import.
8. The meters shall also display (on demand), by turn, the following parameters:
 - (i) Unique identification number of the meter
 - (ii) Date
 - (iii) Time
 - (iv) Cumulative Wh register reading
 - (v) Average frequency of the previous 15-minute block
 - (vi) Net Wh transmittal in the previous 15-minute block, with +/-sign
 - (vii) Average percentage voltage
 - (viii) Reactive power with +/- sign
 - (ix) Voltage-high VARh register reading
 - (x) Voltage-low VARh register reading
9. The three line-to-neutral voltages shall be continuously monitored, and in case any of these falls below 70%, the condition shall be suitably indicated and recorded. The meters shall operate with the power drawn from the VT secondary circuits, without the need for any auxiliary power supply. Each meter shall have a built-in calendar and clock, having an accuracy of 30 seconds per month or better.
10. The meters shall be totally sealed and tamper-proof, with no possibility of any adjustment at site, except for a restricted clock correction. The harmonics shall preferably be filtered out while measuring Wh, VAr and VARh, and only fundamental frequency quantities shall be measured/computed.
11. The main meter and check meter shall be connected to the same core of CTs and VTs
12. All metering equipment shall be of proven quality, fully type-tested, individually tested and accepted by the State Transmission Utility (STU) before despatch from the manufacturer.
13. In-situ functional checking and rough testing of accuracy shall be carried out for all meters, once a year, by the STU, with portable test equipment complying with IEC-60736, for type and acceptance testing of energy meters of 1.0 class.
14. Full testing for accuracy for every meter shall be carried out by the STU at an accredited laboratory, once every five (5) years.

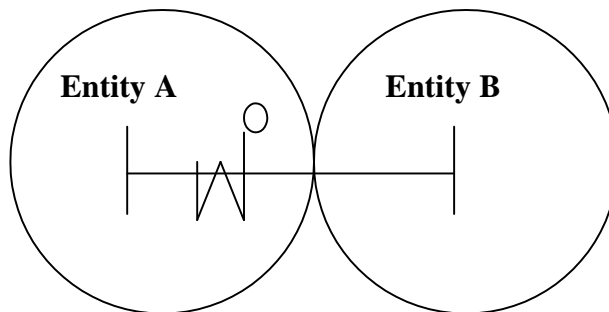
15. The current and voltage transformers to which the above special energy meters are connected shall have a measurement accuracy class of 0.5 or better. Main and stand-by/check meters shall be connected to different sets of CTs and VTs, wherever available.
16. Only functional requirements from regulatory perspective are given in this code. Detailed specifications for the meters, their accessories and testing, and procedures for collecting their weekly readings shall be finalized by the STU with the approval of the Commission.

Payment for Reactive Energy Exchanges on Lines Owned By Individual Entities (Clause No.11.56)

Case- 1: Interconnecting line owned by Entity – A
Metering Point: Substation of Entity – B



Case- 2: Interconnecting line owned by Entity – B
Metering Point: Substation of Entity – A

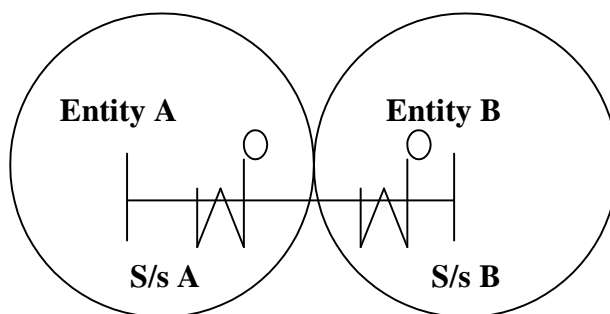


Entity B pays to Entity A for

- (i) Net VARh received from Entity A while voltage is below 97% (ii)
- Net VARh supplied to Entity A while voltage is above 103%

Note: Net VARh and net payment may be positive or negative

Case- 3: Interconnecting line jointly owned by Entity – A & B
 Metering Point: Substations of Entity - A & Entity - B



Net VARh exported from S/S-A, while voltage < 97% = X1
 Net VARh exported from S/S-A, while voltage > 103% = X2
 Net VARh imported at S/S-B, while voltage < 97% = X3
 Net VARh imported at S/S-B, while voltage > 103% = X4

- (i) State-B pays to State-A for X1 or X3, whichever is smaller in magnitude, and
- (ii) State-A pays to State-B for X2 or X4, whichever is smaller in magnitude.

Note:

1. Net VARh and net payment may be positive or negative.
2. In case X1 is positive and X3 is negative, or vice-versa, there would be no payment under (i) above.
3. In case X2 is positive and X4 is negative, or vice-versa, there would be no payment under (ii) above.

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