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**AGREEMENT**

This Agreement is made at Vadodara, this day ..... of month ..... of the year ..... for connectivity with 220/132/66 Kv ..... Substation of GETCO.

**BETWEEN**

**M/s.** ..... a Company Registered under the Companies Act 1956, having its Registered Office at ..... (hereinafter called the Company), which expression includes its permissible assigns and successors, a Party of the first part

**AND**

**"GUJARAT ENERGY TRANSMISSION CORPORATION LIMITED"**, a Government Company registered under the Companies Act 1956 and functioning as the "State Transmission Utility" under the Electricity Act 2003 having its Head Office at Sardar Patel Vidyut Bhavan, Race Course, Vadodara, 390007 (hereinafter referred to as

GETCO which expression shall include its permitted assigns and successors) a Party the Second Part."

**NOW THEREFORE IN CONSIDERATION OF THE PREMISES COVENANTS AND CONDITIONS THE PARTIES HEREINTO HEREBY AGREE AS UNDER:**

**SCHEDULE -I**  
**Standards for Connectivity to the Grid**  
**General**

**1. Standards and Codes of Practice**

- (1) M/s ..... 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 operation of the connected facilities.
- (4) Installation, operation and maintenance of the equipment by **M/s** ..... at **220/132/66 Kv** ..... substation of GETCO 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**

M/s ..... shall comply with the Indian Electricity Rules, 1956 till such time Central Electricity Authority (safety and Electric supply) Regulations.

**3. Sub-station Grounding**

Each transmission sub-station 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. In 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. Sub-station space), grounding rods and ground wells may be used to reduce the ground grid resistance to acceptable levels. Sub-station 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 at the interconnection point with STU i.e 220/132//66 Kv .....of GETCO as specified in the Central Electricity Authority (Installation and operation of Meters). Meters will be as per GTCO specification and metering scheme. The meters will be procured/replaced throughout the term of PPA at the cost of M/s.....

**5. Basic Insulation Level and Insulation Co-ordination**

- (1) Basic Insulation Level (BIL) of various items of equipment and ratings of surge arresters for generating stations, lines and sub-stations shall be decided on the following order of priority, namely:-
  - (a) ensure safety to public ;and operating personnel;

- (b) avoid permanent damage to plant;
  - (c) prevent failure of costly equipment;
  - (d) minimize circuit interruptions; and
  - (e) Minimize interruptions of power supply to consumers.
- (2) Insulation co-ordination of equipment and lines on both sides of a connection point belonging to the **M/s** ..... and the grid shall be accomplished and the co-ordination shall be done by the GETCO (State Transmission Utility).

**6. Protection system and Co-ordination**

- (1) Protection system shall be designed to reliably detect faults on various abnormal conditions and provide an State means and location to isolate the equipment or system automatically. The protection system must be able to detect 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 **M/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, **M/s** ..... and user shall provide requisite protections for safeguarding his system from the faults originating in the grid.
- (4) Bus bar 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 co-ordination issues shall be finalized by the regional power committee.
- (7) **M/s** ..... and user shall develop protection manuals conforming to various standards for the reference and use of its personnel.

**7. Disturbance Recording and Event Logging Facilities.**

**M/s** ..... and sub-station connected to the grid at **66/132 KV** ..... **S/S** 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**

**M/s** ..... shall prepare single line schematic diagrams in respect of its system facility and make the same available to the GETCO 220/132/ 66 Kv ..... substation (State Transmission Utility) through which his system is connected and the State Load Dispatch Centre.

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

Before connecting, the **M/s** ..... shall complete all inspections and tests finalized in consultation with the GETCO (State Transmission Utility) 132/66 Kv Jam-Khambhaliya substation to which his equipment's are connected. The **M/s** ..... 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

### Standards for Connectivity to the Grid

Grid connectivity Standards applicable to the Generating Units

The Wind/Solar/Thermal Power Project of ..... MW of M/s. .... proposed to be connected to the GETCO grid at 400/220/66 Kv.....S/S 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; and
  - (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 M/s ..... 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 centers 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  $\pm 5\%$  of nominal frequency variation of  $+3\%$  and  $-5\%$  and combined voltage and frequency variation of  $\pm 5\%$ . However, for gas turbines, the above performance shall be achieved for voltage variation of  $\pm 5\%$ .
- (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.21<sup>st</sup> Feb-2007 and as amended from time to time shall be binding to **M/s. ....** will fulfill all the criteria mentioned in the Notification of CEA.

On Behalf of  
Gujarat Energy Transmission  
Corporation Limited. Vadodara

On Behalf of  
M/s. ....  
Mumbai.

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Witness:

1. \_\_\_\_\_

2. \_\_\_\_\_

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1. \_\_\_\_\_

2. \_\_\_\_\_

**MINISTRY OF POWER**  
**(CENTRAL ELECTRICITY AUTHORITY)**  
**NOTIFICATION**

New Delhi, the 21<sup>st</sup> 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 power 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 Regulation may be called the Central Electricity Authority (Technical Standards for Connectivity to the Grid) Regulation, 2007.
- (2) These Regulation 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 dispatch 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 specification 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 ration of ‘the highest root mean square (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 operation 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 Standard” (IS) means standards specified by Bureau of Indian Standard;
- (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 oscillation 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 Supervisor Control and Data Acquisition System that acquires data from remote locations over communication links and process it at centralized 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 interconnection point;
- (29) "System Protection Scheme" means a scheme designed to detect abnormal system condition 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 from (which shall ideally be sinusoidal) and is the square root of the sum of square 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 33kV 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 expression used and not defined in these regulation but defined in the Act shall have the meaning assigned to them in the Act.

### **3. Applicability of the Regulations**

These regulations shall be applicable to all the user, requester, Central Transmission Utility and State Transmission Utility.

### **4. 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 Standard 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.

### **5. Standards**

The equipment shall meet the requirement in accordance with the provisions of Technical Standards for Connectivity 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 State 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 request 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 operation such as load shedding, increasing or reducing generation, is landing, back start, providing start-up power and restoration as per 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 or 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, transients 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 requestor'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 of 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 matter 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 Drawing shall be prepared for each connection point by the owner of the Sub-station where connection is taking place.