

GHANA GRID COMPANY LIMITED

APPLICATION FOR CONNECTION TO THE NATIONAL INTERCONNECTED TRANSMISSION SYSTEM (NITS) FOR WHOLESALE SUPPLIERS

This Application is from:



FOR OFFICIAL USE ONLY

- EC Permit
- EPA Permit
- Application Fee
- Company Data
- Generation Data
- Transformer Data
- Grid Feasibility Study
- Land Documentation
- PPA
- Signatories
- Personal Data

The Connection Applicant has duly submitted all required information/data.

Application Form completely filled.

Endorsed by:

Name: _____

Department/Section: _____

Position: _____

Signature: _____

Date: _____



APPLICATION FOR CONNECTION TO THE NATIONAL INTERCONNECTED TRANSMISSION SYSTEM (NITS)

FOR WHOLESALE SUPPLIERS

Provide one copy of this completed Application form for each Point of Interconnection (POI) to the National Interconnection Transmission System (NITS).

- The undersigned Connection Application Customer submits this Application to connect its Generating Facility to the NITS. This Connection Application is for (select one):
 - A proposed new Generating Facility.
 - A modification to a proposed new Generating Facility.
 - An increase in the generating capacity of an existing Generating Facility.

2. Submission Address

Submit a completed application form by email to marketoperations@gridcogh.com and mail to the following address:

The Chief Executive
 Ghana Grid Company Limited
 P.O. Box CS 7979
 Tema, Ghana
Attn: Director, System Operations
 Generator Connection Application Form

3. Application Submitter

This Connection Application is submitted by:

Name of the Connection Applicant:	_____
Name of the Application Submitter:	_____
Designation/Title:	_____
Cell Phone Number::	_____
Other Phone Number::	_____
Email	_____
Signature/Date	_____

4. Documentation

Do you possess the following documentation/licenses?

Licence from Energy Commission

Yes No

Fuel Supply Arrangement

Yes No

Grid Interconnection Feasibility Studies

Yes No

Environmental Protection Agency Licence

Yes No

Power Purchase Agreement(s)

Yes No

Land Documentation

Yes No

Evidence of Payment of Application Fee

Yes No

Please attach a copy each of these documents to the completed Application Form

5. Land Documentation

a. Land Documents/Land Title Certificate

Yes No

b. Land Indenture

Yes No

c. Site Plan

Yes No

6. Name, address, telephone number, e-mail address of the Connection Applicant

a. Organization Name and Address

Organisation/Company Name: _____

Mailing Address: _____

Location: _____

City/Country _____

Note: Where a specific contact is not identified, all communications will be directed to the Main Executive Contact.

b. Primary Contact (Main Executive Contact)

Name	_____
Designation/Title	_____
Cell Phone Number::	_____
Other Phone Number::	_____
Email	_____
Signature/Date	_____

c. Technical Contact

Name	_____
Designation/Title	_____
Cell Phone Number::	_____
Other Phone Number::	_____
Email	_____
Signature/Date	_____

d. Financial/Commercial Contact

Name	_____
Designation/Title	_____
Cell Phone Number::	_____
Other Phone Number::	_____
Email	_____
Signature/Date	_____

e. Legal Contact

Name	_____
Designation/Title	_____
Cell Phone Number::	_____
Other Phone Number::	_____
Email	_____
Signature/Date	_____

7. The Connection Applicant shall provide the following information:

- a. Address or location, including the region and district, of the proposed new Generating Facility site or, in the case of an existing Generating Facility, the name and specific location;

Project Name: _____

Project Location: _____

Region/District: _____

GPS/Geographical Coordinates: _____

- b. Maximum net megawatt electrical output (as defined under 2(c) of Schedule A to this application) at the proposed project site or the amount of net megawatt increase in the generating capacity of an existing Generating Facility;

Maximum net megawatt electrical output (MW): _____

OR

Net Megawatt increase (MW): _____

c. Type of project (i.e., Photovoltaic, wind, gas turbine, hydro, etc.) and general description of the equipment configuration (if more than one type is chosen include nameplate MW for each);

<u>Technology</u>	<u>Nameplate</u>
<input type="checkbox"/> Cogeneration	<input type="checkbox"/> (MW)
<input type="checkbox"/> Reciprocating Engine	<input type="checkbox"/> (MW)
<input type="checkbox"/> Biomass	<input type="checkbox"/> (MW)
<input type="checkbox"/> Steam Turbine	<input type="checkbox"/> (MW)
<input type="checkbox"/> Gas Turbine	<input type="checkbox"/> (MW)
<input type="checkbox"/> Wind	<input type="checkbox"/> (MW)
<input type="checkbox"/> Hydro	<input type="checkbox"/> (MW)
<input type="checkbox"/> Photovoltaic	<input type="checkbox"/> (MW)
<input type="checkbox"/> Combined Cycle	<input type="checkbox"/> (MW)
<input type="checkbox"/> Fuel Type	<input type="checkbox"/>
<input type="checkbox"/> Other (please describe)	<input type="checkbox"/>

Attach general description of the equipment configuration (e.g. number, size, type, etc.)

d. Provide the following dates by day, month, and year for Generation Facility (dates must be sequential);

Proposed In-Service Date (first date transmission is needed to the facility) _____

Proposed Trial Operation Date: _____

Proposed Commercial Operation Date: _____

Proposed Term of Service (years): _____

e. Approximate location of the proposed Point of Connection (i.e., specify transmission facility connection point name, voltage level, and the location of connection);

Point of Connection: _____

Voltage Level: _____

Location: _____

f. Connection Facility data

The Connection Applicant shall provide to GRIDCo two (2) copies of the technical data required in Schedule B to this Connection Application.

The Connection Applicant hereby confirms its understanding and acceptance of the terms and conditions herein and by signing and submitting this application agrees to comply with the guidelines issued by GRIDCo for connection to the NITS. The Connection Applicant further certifies that all data/information provided in this application, schedules and attachments are true and accurate.

Signatory: _____

Name: _____

Designation: _____

Place: _____

Date: _____

Schedule A

1 Guidelines for Open Access to NITS to the Grid Participant

1. An application for connection to the NITS shall be made to GRIDCo in accordance with the requirements in this application form.
2. All information provided in this Application shall be treated as Confidential.
3. The application shall be addressed to:

The Chief Executive Officer
Ghana Grid Company Limited
P.O Box CS 7979
Tema
Attn: Director, System Operations
Generator Connection Application Form

Tel: +233 303 302369
Fax: +233 303 303322
E-mail: marketoperations@gridcogh.com

4. An total of Ninety Thousand United States Dollars (US\$90,000) Application Fee excluding bank charges, through a Bank draft payable to Ghana Grid Company Ltd is required for this Generator Connection Process as follows:
 - a. Payment of a non-refundable fee of US\$60,000 excluding bank charges, through a Bank draft payable to Ghana Grid Company Ltd at the submission of a duly completed Generator Connection Application Form.
 - b. A non-refundable fee of US\$30,000 to be settled before signing of Connection Agreement.

Bank Details

Bank:	Societe Generale Ghana
Swift Code:	SSEBGHAC
IBAN No.:	GH2880000990107
USD Account No.:	60000332352-7
Account Name:	GHANA GRID COMPANY LIMITED
Account branch:	Ring Road Central, Head Office

- c. The Application fee consist of
 - i. A non-refundable Processing Fee of Ten Thousand United States Dollars **(US\$10,000.00)**

II. A non-refundable Fee of Fifty thousand United States Dollars (US\$ 50,000) for Grid Studies

a. A Non-refundable Pre-Connection Agreement Fee of Thirty Thousand United States Dollars (US\$30,000).

b. Notwithstanding Schedule A, section 4 a-c above, based on prudent utility practices, any additional cost that may be incurred by GRIDCo in undertaking the Grid Studies relevant to this Application shall be borne by the Applicant.

5. **The application form should be duly filled out. An incomplete application shall NOT be processed [Refer to Schedule C (2)].**

SCHEDULE B

GENERATING FACILITY DATA

In accordance with Article 8.08 (e) of the National Electricity Grid Code, 2009 provide one set of original prints (no larger than 11" x 17" or A3 size) and electronic soft copy on cd/flash drive or by e-mail of the following:

1. Site Information

- A. Site drawing to scale, showing generator location and Point of Connection with NITS.
- B. Single-line diagram showing applicable equipment such as generating units, step-up transformers, auxiliary transformers, switches/disconnects of the proposed connection, including the required protection devices and circuit breakers. For wind and photovoltaic generator plants, the one line diagram should include the distribution lines connecting the various groups of generating units, the generator capacitor banks, the step up transformers, the distribution lines, and the substation transformers and capacitor banks at the Point of Connection with the NITS.

2. Generating Facility Information

- A. Total Generating Facility rated output (MW): _____
- B. Generating Facility auxiliary Load (MW): _____
- C. Project net capacity at the project site (Item 2A-2B) (MW): _____
- D. Standby Load when Generating Facility is off-line (MW): _____
- E. Maximum Injection at the Point of Connection (MW): _____
(Note: The customer shall ensure that this maximum MW value being requested at the POC is not exceeded at any given time of the generator's operation).
- F. Number of Generating Units: _____
(Please repeat the following items for each generator type)
- G. Individual generator rated output (MW for each unit): _____
- H. Manufacturer: _____
- I. Year Manufactured _____
- J. Nominal Terminal Voltage (kV): _____
- K. Rated Power Factor (%): _____
- L. Type (Induction, Synchronous, D.C. with Inverter): _____
- M. Phase (three phase or single phase): _____
- N. Connection (Delta, Grounded WYE, Ungrounded WYE, impedance grounded): _____
- O. Generator Voltage Regulation Range (+/- %): _____
- P. Generator Power Factor Regulation Range: _____
- Q. For combined cycle plants, specify the plant net output capacity (MW) for an outage of the steam turbine or an outage of a single combustion turbine _____

3. Synchronous Generator – General Information:

(Please repeat the following for each generator model)

- A. Rated Generator speed (rpm): _____
- B. Rated MVA: _____

- C. Rated Generator Power Factor: _____
- D. Generator Efficiency at Rated Load (%): _____
- E. Moment of Inertia (including prime mover): _____ kg-m²
- F. Inertia Time Constant (on machine base) H: _____ sec or MJ/MVA
- G. SCR (Short-Circuit Ratio - the ratio of the field current required for rated open-circuit voltage to the field current required for rated short-circuit current):

- H. Please attach generator reactive capability curves.
- I. Rated Hydrogen Cooling Pressure in psig (Steam Units only): _____
- J. Please attach a plot of generator terminal voltage versus field current that shows the air gap line, the open-circuit saturation curve, and the saturation curve at full load and rated power factor.

4. Excitation System Information

(Please repeat the following for each generator model)

- A. Indicate the Manufacturer _____ and Type _____ of excitation system used for the generator. For exciter type, please choose from 1 to 9 below or describe the specific excitation system.
 - (1) Rotating DC commutator exciter with continuously acting regulator. The regulator power source is independent of the generator terminal voltage and current.
 - (2) Rotating DC commutator exciter with continuously acting regulator. The regulator power source is bus fed from the generator terminal voltage.
 - (3) Rotating DC commutator exciter with non-continuously acting regulator (i.e., regulator adjustments are made in discrete increments).
 - (4) Rotating AC Alternator Exciter with non-controlled (diode) rectifiers. The regulator power source is independent of the generator terminal voltage and current (not bus-fed).
 - (5) Rotating AC Alternator Exciter with controlled (thyristor) rectifiers. The regulator power source is fed from the exciter output voltage.
 - (6) Rotating AC Alternator Exciter with controlled (thyristor) rectifiers.
 - (7) Static Exciter with controlled (thyristor) rectifiers. The regulator power source is bus-fed from the generator terminal voltage.
 - (8) Static Exciter with controlled (thyristor) rectifiers. The regulator power source is bus-fed from a combination of generator terminal voltage and current (compound-source controlled rectifiers system).
 - (9) Other (specify): _____
- B. Attach a copy of the block diagram of the excitation system from its instruction manual. The diagram should show the input, output, and all feedback loops of the excitation system.
- C. Excitation system response ratio: _____
- D. Full load rated exciter output voltage: _____
- E. Maximum exciter output voltage (ceiling voltage): _____
- F. Other comments regarding the excitation system?

5. Power System Stabilizer Information

(Please repeat the following for each generator model. All new generators are required to install power system stabilizers (PSS). Exemption can be obtained from GRIDCo for units that do not have suitable excitation systems.)

- A. Manufacturer: _____
- B. Is the PSS digital or analog? _____
- C. Note the input signal source for the PSS?
_____ Bus frequency _____ Shaft speed _____ Bus Voltage
_____ Other (specify source)
- D. Please attach a copy of a block diagram of the PSS from the PSS Instruction Manual and the correspondence between dial settings and the time constants or PSS gain.
- E. Other comments regarding the PSS?

6. Turbine-Governor Information

(Please repeat the following for each generator model)

Please complete Part A for steam, gas or combined-cycle turbines, Part B for hydro turbines, and Part C for both.

- A. Steam, gas or combined-cycle turbines:
 - (1) List type of unit (Steam, Gas, or Combined-cycle): _____
 - (2) If steam or combined-cycle, does the turbine system have a reheat process (i.e., both high and low pressure turbines)? _____
 - (3) If steam with reheat process, or if combined-cycle, indicate in the space provided, the percent of full load power produced by each turbine:
Low pressure turbine or gas turbine: _____%
High pressure turbine or steam turbine: _____%
- B. Hydro turbines:
 - (1) Turbine efficiency at rated load: _____%
 - (2) Length of penstock: _____m
 - (3) Average cross-sectional area of the penstock: _____m²
 - (4) Typical maximum head (vertical distance from the bottom of the penstock, at the gate, to the water level): _____m
 - (5) Is the water supply run-of-the-river or reservoir: _____
 - (6) Water flow rate at the typical maximum head: _____m³/sec
 - (7) Average energy rate: _____kW-hrs/acre-m
 - (8) Estimated yearly energy production: _____kW-hrs
- C. Complete this section for each machine, independent of the turbine type.
 - (1) Turbine manufacturer: _____

- (2) Maximum turbine power output: _____ MW
- (3) Minimum turbine power output (while on line): _____ MW
- (4) Governor information:
 - (a) Droop setting (speed regulation): _____
 - (b) Is the governor mechanical-hydraulic or electro-hydraulic (Electro-hydraulic governors have an electronic speed sensor and transducer)? _____
 - (c) Other comments regarding the turbine governor system?

7. Induction Generator Data:

- A. Rated Generator Power Factor at rated load: _____
- B. Moment of Inertia (including prime mover): _____
- C. Do you wish reclose blocking? Yes ____, No ____

Note: Sufficient capacitance may be on the line now, or in the future, and the generator may self-excite unexpectedly.

7a. Wind Generators

Please provide the following data:

Average Site Elevation: _____ Single Phase _____ Three Phase _____
 Number of WTGs: _____
 Nameplate rating (each WTG): _____ MW
 WTG Manufacturer and Model: _____
 WTG Type: _____

For Type 1 or Type 2 WTGs:

Uncompensated power factor at full load: _____
 Power factor correction capacitors at full load: _____ MVar
 Number of shunt stages and size _____
 Please attach capability curve describing reactive power or power factor range from 0 to full output, including the effect of shunt compensation.

For Type 3 and Type 4 WTGs:

Maximum under-excited power factor at full load: _____
 Maximum over-excited power factor at full load: _____
 Control mode: _____ (voltage control, fixed power factor)
 Please attach capability curve describing reactive power or power factor range from 0 to full output.

Wind Farm Reactive Power Compensation. Provide the following information for wind farm level reactive compensation, if applicable:

Individual shunt capacitor and size of each: _____ X _____ MVA
 Dynamic reactive control device, (SVC, STATCOM): _____
 Control range _____ MVar (lead and lag)
 Control mode (line drop, voltage droop, voltage control): _____
 Regulation point _____

Describe the overall reactive power control strategy:

Field Volts: _____
Field Amperes: _____
Motoring Power (MW): _____
Neutral Grounding Resistor (If Applicable): _____
I22t or K (Heating Time Constant): _____
Rotor Resistance: _____
Stator Resistance: _____
Stator Reactance: _____
Rotor Reactance: _____
Magnetizing Reactance: _____
Short Circuit Reactance: _____
Exciting Current: _____
Temperature Rise: _____
Frame Size: _____
Reactive Power Required In VAR (No Load): _____
Reactive Power Required In VAR (Full Load): _____
Total Rotating Inertia, H: _____ Per Unit on 100 MVA Base

Note: A completed data sheet must be supplied with this Connection Application. If additional relevant data are available, the Applicant shall provide it to GRIDCo at the Scoping Meeting.

8. Generator Short Circuit Data

For each generator model, provide the following reactances expressed in p.u. on the generator base:

- X"1 – positive sequence subtransient reactance: _____ p.u.**
- X2 – negative sequence reactance: _____ p.u.**
- X0 – zero sequence reactance: _____

Generator Grounding (select 1 for each model):

- A. _____ Solidly grounded
- B. _____ Grounded through an impedance
(Impedance value in p.u on generator base. R: _____ p.u.
X: _____ p.u.)
- C. _____ Ungrounded

9. Step-Up Transformer Data

For each step-up transformer, fill out the data form provided in Table 1.

10. Generator Connection Applicant's Facilities Line Data

Note: There is no need to provide data for new lines that are to be planned by GRIDCo

For transmission lines proposed by the generator developer (Generator Connection Applicant), please provide the following information:

Nominal Voltage: _____ kV
Line Length: _____ Km
Line termination Points: _____
Conductor Type: _____ Size: _____
If bundled. Number per phase: _____, Bundle spacing: _____ cm.
Phase Configuration. Vertical: _____, Horizontal: _____
Phase Spacing: A-B: _____ m., B-C: _____ m., C-A: _____ m.
Distance of lowest conductor to Ground at full load and 40 C: _____ m
Ground Wire Type: _____ Size: _____ Distance to Ground: _____ m
Attach Tower Configuration Diagram
Highest Temperature line ratings in amperes (normal and emergency) _____
Positive Sequence Resistance (R): _____ p.u. ** (for entire line length)
Positive Sequence Reactance: (X): _____ p.u.** (for entire line length)
Zero Sequence Resistance (R0): _____ p.u. ** (for entire line length)
Zero Sequence Reactance: (X0): _____ p.u** (for entire line length)
Line Charging (B/2): _____ p.u**
** On 100-MVA and nominal line voltage (kV) Base

10a. For Wind/Photovoltaic plants, provide collector System Equivalence Impedance Data

Provide values for each equivalence collector circuit at all voltage levels.

Nominal Voltage: _____
Summer line ratings in amperes (normal and emergency) _____
Positive Sequence Resistance (R1): _____ p.u. ** (for entire line length of each collector circuit)
Positive Sequence Reactance: (X1): _____ p.u** (for entire line length of each collector circuit)
Zero Sequence Resistance (R0): _____ p.u. ** (for entire line length of each collector circuit)
Zero Sequence Reactance: (X0): _____ p.u** (for entire line length of each collector circuit)
Line Charging (B/2): _____ p.u** (for entire line length of each collector circuit)
** On 100-MVA and nominal line voltage (kV) Base

11. Inverter-Based Machines

Number of inverters to be connected pursuant to this Generator Connection Application: _____

Inverter manufacturer, model name, number, MW rating and version:

List of adjustable set points for the protective equipment or software:

Max design fault contribution current:

Harmonics Characteristics:

Start-up requirements:

Note: A completed data sheet must be supplied with this Connection Application. If additional relevant data are available, the Applicant shall provide it to GRIDCo at the Scoping Meeting.

12. Load Flow and Dynamic Models:

Provide load flow model for the generating plant and its Connection Facilities in Siemens PSS/E or DIgSILENT Powerfactory or any other format as requested by GRIDCo, including new buses, generators, transformers and Connection Facilities. An equivalent model is required for the plant with generation collector systems. This data should reflect the technical data provided in this Schedule B.

For each generator, governor, exciter and power system stabilizer, select the appropriate dynamic model in PSS/E or DIgSILENT Powerfactory or any other format as requested by GRIDCo and provide the required input data. For inverter based generating facilities, select the appropriate generator, plant control and plant protection models Siemens PSS/E or DIgSILENT Powerfactory or any other format as requested by GRIDCo and provide the required input data. Provide a complete dynamic file that contains the information specified in this section. One copy of this data should be provided on DVD, CD, or USB flash drive media.

Accurate models are important to obtain accurate study results. Generic Library Models are not accepted for GIS and FAS. Costs associated with any changes in facility requirements that are due to differences between model data provided by the generation developer and the actual generator test data, shall be the responsibility of the generation developer (Connection Applicant).

TABLE 1

TRANSFORMER DATA
 (Provide for each level of transformation)

UNIT _____

NUMBER OF TRANSFORMERS _____ PHASE _____

RATING	H Winding	X Winding	Y Winding
Rated MVA	_____	_____	_____
Connection (Delta, Wye, Gnd.)	_____	_____	_____
Cooling Type (OA,OA/FA, etc) :	_____	_____	_____
Temperature Rise Rating	_____	_____	_____
Rated Voltage	_____	_____	_____
BIL	_____	_____	_____
Available Taps (% of rating)	_____	_____	_____
Load Tap Changer? (Y or N)	_____	_____	_____
Tap Settings	_____	_____	_____
IMPEDANCE	H-X	H-Y	X-Y
Percent	_____	_____	_____
MVA Base	_____	_____	_____
Tested Taps	_____	_____	_____
WINDING RESISTANCE	H	X	Y
Ohms	_____	_____	_____

CURRENT TRANSFORMER RATIOS

H _____ X _____ Y _____ N _____

Percent exciting current at 100 % Voltage; _____ 110% Voltage _____

Supply copy of nameplate and manufacture's test report when available

Schedule C

Terms and Conditions

1. The Applicant shall abide by the Electricity Transmission (Technical, Operational and Standards of Performance) Rules, 2008 (LI 1934), the Electricity Regulations, 2008 (LI 1937), and the National Electricity Grid Code, 2009.
2. A complete application shall include:
 - a. The duly filled Generator Connection Application Form (GCAF)
 - b. All Documentation in Sections 4 and 5 of this GCAF
 - c. All Applicable Data Required under Schedule B of this GCAF
 - d. Payment of Application Fees in accordance with Schedule A, Section 4 of this GCAF
3. GRIDCo shall perform Grid Studies as defined in Schedule C, Section 18, to evaluate the impact of the proposed development on the NITS.
4. The parties shall execute a Generator connection MOU after completion and acceptance of GIFAS (Schedule C, Section 18) Results.
5. Failure to satisfy any financial obligation relating to this Application including within 60 Days after the due date shall be grounds for withdrawal of this Application.
6. The parties shall negotiate and execute a Generator Connection Agreement after payment of the Pre-Connection Agreement Fee.
7. The Generator Connection Agreement will require a Power Purchase Agreement (PPA) between the Applicant and its offtaker.
8. Generator Connection Agreement shall however only come into force on the Commercial Operation Date.
9. The Applicant shall make an advanced payment towards the cost of any system upgrades identified in the GIFAS, including Delivery Network Upgrades (DNU) and Reliability Network Upgrades (RNU) as indicated in Schedule C, Section 18 of this GCAF. The cost of the DNU is refundable after three (3) years of commercial operation of the Generation Facility at a rate proportionate to energy generated by the Applicant into the NITS.
10. GRIDCo shall commence work on the DNU after payment of approximate cost (as indicated under section 19(f)) for DNU and RNU (if Applicants requires GRIDCo to undertake construction of RNU). The Applicant may request GRIDCo to develop and construct the Generating Facility's RNU for which GRIDCo shall indicate their consent and their terms and conditions within twenty (20) business days from receipt of request.

11. The Applicant shall submit Land Documentation to GRIDCo and may proceed with construction in coordination with GRIDCo. The Applicant shall submit a valid Land Title Certificate to GRIDCo as soon as possible and in any event not later than the Commercial Operation Date.
12. The Applicant may indicate whether it wishes GRIDCo to undertake any additional technical studies and shall bear the cost of such studies.
13. The cost of any revisions and addendums to the final reports resulting from Applicant modifications shall be paid by the Applicant. Other revisions and addendums due to changes in NITS conditions shall be the responsibility of GRIDCo.
14. The Applicant shall execute the GCA and ensure that all required licenses and certificates issued by the Energy Commission (EC), regulatory agencies and GRIDCo are obtained prior to the proposed Project In-service Date.
15. The Applicant shall comply with rules governing the testing of equipment as an integral part of a Compliance Study (Schedule C, Section 18) as well as actual user defined model validation as a requirement to obtaining a construction permit from the Energy Commission (EC) in accordance with Article 8.47 – 8.52 and 8.53 – 8.54 of the National Electricity Grid Code.
 - For an Intermittent RE plant a Compliance Study should include but not limited to Inverter and Panel test in accordance with IEC standards and system simulations using actual user defined models to determine the compliance of the project to grid requirements. The GCA should also provide warranty certificates of the durability of panels.
 - For a conventional plant a Compliance Study should be carried out with actual generator, exciter, governor and power system stabilizer data and models supplied to GRIDCo.
16. Testing should be performed in the presence of GRIDCo representatives at a certified testing facility acceptable to GRIDCo.
17. Sixty (60) calendar days prior to the Generating Facility synchronizing to the NITS, GRIDCo will conduct Commercial Operation Date Assessment (CODA).

18. Definitions and Explanations

a) Comparability

GRIDCo shall receive, process, and analyze Generator Connection Applications in a timely manner. GRIDCo will use same reasonable efforts in processing and analyzing Connection Applications from all Connection Applicants.

b) No Applicability to Transmission Service.

Nothing in this GCAF for connection to the NITS shall constitute a request for transmission service or confer upon a Generator Connection Applicant any right to receive transmission service.

c) The Product.

Connection Service allows the Generator Connection Applicant to connect the Generating Facility to the NITS and be eligible to deliver the Generating Facility's output using the available capacity of the NITS. Connection Service does not in and of itself convey any right to deliver electricity to any specific customer or point of delivery or rights to any specific MW of available capacity on the NITS.

d) Grid Studies.

For this Generator Connection Application, the Grid Studies shall include, Grid Impact and Facilities Assessment Study (GIFAS), Compliance Study ("CS") and Commercial Operation Date Assessment ("CODA").

e) Grid Impact and Facilities Assessment Study

This study requires actual equipment data to be submitted by the Applicant, however, if actual data is not available GRIDCo will use generic generation data submitted by the Applicant. The report of this study will be in two parts, consisting a Grid Impact Study (GIS) Report and Facility Assessment Study Report.

a. Grid Impact Study (GIS) For Conventional Power Plants

The objectives of this Study are to:

- i. Determine the technical feasibility of interconnecting the proposed Power Plant to the National Interconnected Transmission System (NITS) at the selected Point of Connection (POC).
- ii. Determine all the infrastructural facilities that would be required to connect the proposed Power Plant to the NITS.
- iii. Identify any network reinforcements and/or expansions that would be required in the NITS to make the integration of the Power Plant feasible at the identified POC.
- iv. Determine switchgear rating for the Power Plant at the POC and assess whether ratings of any switchgear at the adjoining substations would be violated.

In line with the above objectives, the following analyses would be conducted.

- i. Perform series of Steady State Power Flow Simulations to determine all infrastructural facilities for integrating the proposed Power Plant into the NITS.
- ii. Carry out Short Circuit Calculations to determine the switchgear rating for the proposed Power Plant and to identify any switchgear capability limits violations as a result of the connection of the proposed Plant at the identified POC and recommend remedial measures, if any.
- iii. Carry out Steady State Analyses to identify any additional reactive power compensation requirements based on the Capability Curve of the individual Machines.
- iv. Carry out series of Steady State Power Flow Simulations with the objective of identifying any thermal overload (for transmission lines transformers) or voltage limits violations resulting from the integration of the proposed Plant to the NITS, and to determine potential network reinforcements and/or expansions that would be required to eliminate any such capacity bottlenecks with regards to the injection of the additional generation from the proposed Power Plant at the identified POC.
- v. Carry out Transient Stability Analysis to assess the impact of the proposed Units on the overall stability of the NITS. Relevant stability analyses to evaluate the sizes of individual Units on the stability of the National Interconnected Power System (NIPS) shall also be performed and appropriate recommendations made.

b. Grid Impact Study (GIS) For Renewable Energy Power Plants

This determines the effect of the RE power plant on the grid using actual user defined models acquired by the Applicant from an EPC contractor. This study will give detailed information on the inverter capabilities as follows;

- i. The steady state load flow and transmission requirements for the integration of the RE plant.
- ii. The maximal voltage change at the Point of Common Coupling (PCC)
- iii. The ability of the inverters to operate within the PQ capabilities as per the RE sub code or in the case of Wind Turbine Generators (WTG) of type 1, type 2 and type 3, the required compensation to be able to operate within limits.
- iv. Impact of the complete or partial loss of the RE plant on the system frequency, angle spread and voltage on the grid. (Complete or partial loss could be as a result of cloud cover for the case of PVs and lower wind speed for the case of WTGs).
- v. Sensitivity analysis is also performed on the grid to determine the impact on the grid following the loss of the biggest generating unit and

the loss of the biggest distribution transformer on the grid before and after integration of the RE power plants.

- vi. Sensitivity analysis is also performed on the grid by considering the effect of the presence of other RE power plants on the grid.
- vii. Active power and frequency control capability of the inverters.
- viii. Reactive power/Voltage control capabilities.
- ix. Voltage Ride Through capabilities (High Voltage Ride Through and Low Voltage Ride Through).
- x. Voltage Unbalance Studies
- xi. Frequency Response capability.
- xii. Active and reactive power behavior during voltage recovery

The GIS will identify Customer's direct Connection Facilities and required Reliability Network Upgrades/reinforcements (RNU) and Delivery Network Upgrades (DNU) necessary to connect the Generating Facility. The study will mitigate thermal overloads and voltage violations, address short circuit, stability, and reliability issues associated with the requested Connection Service.

The Facilities Assessment report of the GIFAS shall set forth the applicable cost estimates for RNUs, DNUs and Interconnection Facilities that shall, as applicable, establish the basis for the Connection Financial Security postings. These costs shall be based on the identified system concerns, Network Upgrades and reinforcements attributable to the Connection Application. Where a connection Study report identifies specific transmission facilities for Network Upgrade or Connection Facilities, the **cost estimates** will be set forth in present dollar costs as well as time-adjusted dollar costs, adjusted to the estimated year of expenditure for construction of the components being constructed.

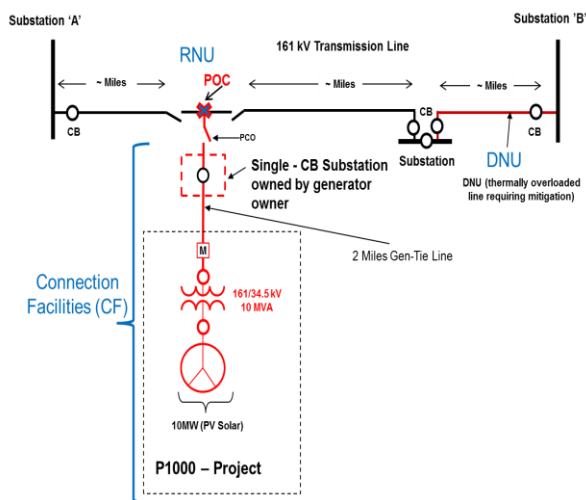


Fig. 1: Generator connection via HV transmission line tapping showing RNU and DNU

The results of the Grid Impact and the Facilities Assessment Studies (GIFAS) will be submitted to the applicant within sixty (60) business days after the submission of duly completed GCAF.

A Results Meeting to discuss the results of the GIFAS will be held with the Applicant not earlier than fifteen (15) business days after submission of GIS report by GRIDCo. Following the Results meeting, the Applicant shall indicate its acceptance or otherwise of the results of the GIFAS in writing to GRIDCo within fifteen (15) business days.

f) Validity of GIFAS

The GIFAS shall be valid for two (2) years from the date of acceptance of the results by the Applicant.

g) Compliance Study

This Compliance Study is required especially for Renewable Energy Power Plants. This is required because, at the time of completing this Application Form, Applicants may not have settled on the Technology and specific equipment to be used for GIFAS and therefore the GIFAS was based on generic plant data submitted by the Applicant, which does not present the true impact of their plant on the NITS.

The results of the Compliance Study will be submitted to the Applicant within 30 days after the submission of the necessary data requirement.

h) Commercial Operation Date Assessment

GRIDCo will conduct Commercial Operation Date Assessment (CODA) to account for later conditions since GRIDCo performed the GIS and Facilities Assessment Study in the prior Connection Application.

19. Grid Feasibility Studies

The feasibility study of the GCAF should contain the following:

- a) Line loadings of the transmission line(s) they intend to connect to
- b) The Short Circuit level at the GCA's Point of Connection
- c) If the connection requires a new line in order to connect to existing substation, the Generator Connection Applicant must provide the specifications of the conductor.

20. Obligation for Study Costs

GRIDCo shall charge and the Generator Connection Applicant(s) shall pay the actual costs of the Grid Studies. The cost of Grid Studies performed will be charged solely to the Generator Connection Applicant that submitted the Connection Application.

21. Proposed Commercial Operation Date.

Commencement of construction of the Generation Facility shall not exceed two (2) years after acceptance of results of Grid Studies. The proposed Commercial Operation Date of the new Generating Facility or increase in capacity of the existing Generating Facility shall not exceed five years from the date of acceptance of results of GIFAS Study.

Where the Connection Applicant demonstrates, and GRIDCo agrees, such agreement not to be unreasonably withheld, that engineering, permitting and construction of the new Generating Facility or increase in capacity of the existing Generating Facility will take longer than the five year period, this may be extended for an additional period as determined by GRIDCo. GRIDCo's agreement to an extension of the proposed Commercial Operation Date does not relieve the Connection Applicant from compliance with the requirements of any of the criteria set forth in this GCAF and applicable Codes.

The Applicant shall bear the cost of a new studies pertaining to the proposed extension period and comply with the recommendations of the new studies.

22. Withdrawal

The Generator Connection Applicant may withdraw its Connection Application at any time by written notice of such withdrawal to GRIDCo. In addition, after confirmation by GRIDCo of a complete Connection Application, if the Connection Applicant fails to adhere to all requirements of this GCAF and applicable Codes, GRIDCo shall deem the Generator Connection Application to be withdrawn and shall provide written notice to the Connection Applicant within ten (10) business days of the deemed withdrawal and an explanation of the reasons for such deemed withdrawal. Upon receipt of such written notice, the Generator Connection Applicant shall have ten (10) business days in which to respond with information or action that either cures the deficiency or supports its position that the deemed withdrawal was erroneous and notifies GRIDCo of its intent to pursue Dispute Resolution.

Withdrawal shall result in the termination of the Generator Connection Application and grid study process. If a Generator Connection Applicant disputes the withdrawal and has elected to pursue Dispute Resolution, the Connection Applicant's Connection Application will not be considered in any ongoing Connection Study during the Dispute Resolution process.

23. Results Meeting

Within twenty (20) business days of issuing the GIFAS report to the Connection Applicant, GRIDCo and the Connection Applicant shall hold a Results Meeting to discuss the results of the GIFAS, including assigned cost responsibility. GRIDCo shall prepare the minutes from the meetings, and provide the Connection Applicant and the other attendees an opportunity to confirm the accuracy thereof.

Generator Connection Applicant may provide written comments, if any, on the GIFAS report no later than three (3) business days before the Results Meeting is conducted to discuss the report. GRIDCo will address the written comments in the GIFAS Results Meeting. Should the Generator Connection Applicant provide comments at any later time (up to the time of the Results Meeting), then such comments shall be considered informal inquiries to which GRIDCo will provide informal, informational responses at the Results Meeting, to the extent possible.

The Generator Connection Applicant may submit, in writing, additional comments on the final GIFAS report up to five (5) business days following the Results Meeting. Based on any discussion at the Results Meeting and any comments received, GRIDCo in consultation with any applicable party(s) will determine whether it is necessary to follow the GIFAS report with a revised study report or an addendum. GRIDCo will issue any such revised report or addendum to the Connection Applicant no later than twenty (20) business days following the Results Meeting.

24. Commercial Operation Date.

At the Results Meeting, the Generator Connection Applicant shall provide a schedule outlining key milestones including expected procurement date of project equipment, power supply requirements for project construction, and expected project construction date. This will assist the parties in determining if Commercial Operation Dates are reasonable. If permitting and equipment procurement lead times may result in the need to alter the proposed Commercial Operation Date, the parties may agree to a new Commercial Operation Date. In addition, where a Generator Connection Applicant intends to establish Commercial Operation separately for different electric generating units or project phases at its Generating Facility, it may only do so in accordance with an implementation plan agreed to in advance by GRIDCo, which agreement shall not be unreasonably withheld.

Confirmation of Acceptance of Terms and Conditions

Signatory

Name _____

Designation _____

Place _____

Date _____

