GENERATOR/TRANSMISSION INTERCONNECTION REQUEST APPLICATION

1.0 Interconnection Customer Information

1.1) Legal Name of the Interconnection Customer (or, if an individual, individual's name)

Name:

_____

Contact Person:

_____

Mailing Address:

_____

City: _____ State: _____ Zip: _____

1.2) Telephone: _____

1.3) E-Mail Address: _____

1.4) Facility/Transmission Location:
Address: GPS Coordinates (Lat/Long):

_____

1.5) Requested commercial in-service date for the new or materially modified Generation/Transmission interconnection: _____

2.0 GENERATION INTERCONNECTION INFORMATION

2.1) Requested date for initial testing of the new or materially modified Generating Facility output: _____

2.2) Will the proposed new or materially modified Generating Facility be used to supply power to others? Yes ____ No ____

2.3) If Yes, who will be the off-taker of the output? _____

2.4) Entity that will provide Balancing Services for the new or materially modified Generating Facility[1]: _____

2.5) If applicable, Seminole Member cooperative's electric system to which the proposed Generating Facility will interconnect:_____

2.6) Requested Point of Interconnection ("POI") and voltage level for the new or materially modified Generating Facility:

_____
_____
_____

2.7) Is the new or materially modified Generating Facility a certified QF[2]? Yes ____ No ____

3.0 GENERATING FACILITY INFORMATION

Data applies only to the new or materially modified Generating Facility, not the Interconnection Facilities.

3.1) Energy Source: ___ Solar ___ Wind ___ Hydro ___ Diesel ___ Natural Gas ___ Fuel Oil
___ Battery Storage ___ Other (state type) _____

3.2) Prime Mover:___Fuel Cell ___Recip Engine ___Gas/Steam Turb ___Battery
___Microturbine ___PV ___Other

3.3) Type of Generator: ____Synchronous ____Induction ____ Inverter

3.4) Generator/Inverter/Battery Manufacturer:_____

3.5) Model Name & Number (include with application all OEM technical details):

_____

[1] In accordance with NERC FAC-001-3, R4.3, Seminole and the Interconnection Customer to discuss and confirm whom will provide balancing services to ensure that the new or materially modified generation Facility is within Seminole's or a neighboring entities Balancing Authority Area's metered boundaries.
[2] Qualifying Facility ("QF") as defined by the Public Utility Regulatory Policies Act of 1978 ("PURPA"). Refer to the Federal Energy Regulatory Commission ("FERC") website for additional details.

4.0 SYNCHRONOUS GENERATORS

4.1) Generator Output:
Generator Max Gross Nameplate Rating: _____MW (summer at 95° @ ____ Power Factor)
Generator Min Gross Nameplate Rating: _____MW (summer at 95° @ ____ Power Factor)
Generator Max Gross Nameplate Rating: _____MW (winter at 59° @ ____ Power Factor)
Generator Min Gross Nameplate Rating: _____MW (winter at 59° @ ____ Power Factor)

4.2) Interconnection Customer or Customer-Site Load (inclusive of balance of plant/aux load):
Summer (based on Generator Max output) - Real _____MW Reactive _____MVAR
Winter (based on Generator Max output) - Real _____MW Reactive _____MVAR

4.3) List components of the Generating Facility equipment package that are currently certified:

Equipment Type	Certifying Entity
1. _____	_____
2. _____	_____
3. _____	_____
4. _____	_____
5. _____	_____

4.4) Is the prime mover compatible with the certified protective relay package?
____Yes ____No

4.5) Max design fault contribution current: _____ Instantaneous ___ or RMS? ____

4.6) Harmonics Characteristics: _____

4.7) Start-up Requirements: _____

GENERATING FACILITY CHARACTERISTIC DATA (FOR SYNCHRONOUS MACHINES)

4.5) RPM Frequency: _____ Number of Poles: _____

4.6) MVA Base: _____
4.7) Field Volts: _____
4.8) Field Amperes: _____
4.9) Neutral Grounding Resistor (If Applicable): _____

Synchronous Generators

4.10) *Direct Axis Reactances (P.U):*
Synchronous Reactance, X_d: _____ P.U.
Transient Reactance (saturated), X'_{dv}: _____P.U.
Transient Reactance (unsaturated), X'_{di}: _____P.U.
Subtransient Reactance (saturated), X''_{dv}: _____P.U.
Subtransient Reactance (unsaturated), X''_{di}: _____P.U.
Negative Sequence Reactance, X_2: _____ P.U.
Zero Sequence Reactance, X_0: _____ P.U.
Armature Leakage, X_L: _____ P.U.

4.11) *Quadrature Axis Reactances (P.U.):*
Synchronous, X_q: _____P.U.
Transient, X'_q: _____P.U.
Subtransient (saturated), X''_{qv}: _____P.U.
Positive Sequence Reactace, X1: _____ P.U.
Negative Sequence Reactance, X2: _____ P.U.
Zero Sequence Reactance, X0: _____ P.U.

4.12) *Time Constants (seconds):*
Direct Axis:
Transient, T'_{do} : _____ sec.
Transient, T'_d : _____ sec.
Subtransient, T''_{do} : _____ sec.
Subtransient, T''_d : _____ sec.

4.13) *Time Constants (seconds):*
Quadrature Axis:
Transient, T'_{qo} : _____ sec.
Transient, T'_q : _____ sec.
Subtransient, T''_{qo} : _____ sec.
Subtransient, T''_q : _____ sec.

4.14) *Resistance (P.U.):*
Positive Sequence, R1: _____P.U.
Negative Sequence, R2: _____P.U.
Zero Sequence, R0: _____P.U.

4.15) Intertia Constant (H): _____

4.16) *Saturation:*
S (1.0): _____
S (1.2): _____

Please include saturation curves, capability curves ("D-curves"), and generator characteristics information from the OEM to validate the information supplied above.

Induction Generators:

4.17) Motoring Power (MW): _____
4.18) I_2^2t or K (Heating Time Constant): _____
4.19) Rotor Resistance, R_r: _____
4.20) Stator Resistance, R_s: _____
4.21) Stator Reactance, X_s: _____
4.22) Rotor Reactance, X_r: _____
4.23) Magnetizing Reactance, X_m: _____
4.24) Short Circuit Reactance, X''_d: _____
4.25) Exciting Current: _____
4.26) Temperature Rise: _____
4.27) Frame Size: _____
4.28) Design Letter: _____
4.29) Reactive Power Required In Vars (No Load): _____
4.30) Reactive Power Required In Vars (Full Load): _____
4.31) Inertia Constant (H): _____

Note: Please contact Seminole prior to submitting this Interconnection Request Application to determine if the specified information above is required.

Generator, Excitation System/Power System Stabilizer and Governor System Data for Synchronous Generators Only

Provide appropriate IEEE model block diagrams and completed models in Siemens PSS/E format of all applicable generator, inverter, battery, excitation system/power system stabilizer (PSS) and governor system. A PSS may be required to be tuned and commissioned via the results of applicable studies. A copy of the manufacturer's block diagram(s) may not be substituted.

5.0 A-SYNCHRONOUS GENERATORS (PV, BATTERY)

Inverter(s):

5.1) Total Number of Inverter Modules in Solar farm to be interconnected pursuant to this Interconnection Request: _____ ___Single phase (string) ___Three phase (central)

5.2) Nameplate Rating (each Inverter): _____ kVA at _____ °C and at _____ AC rated voltage

5.2) Inverter AC Terminal voltage operating range: _____

5.3) Output of each PV Panel: _____ Watts

5.4) Are the PV Panels fixed tilt or tracking? If tracking, single or dual axis?
_____

5.6) Is the Inverter(s) UL 1741 and IEEE 1547 compliant?_____

5.7) Will the inverters/batteries be controlled by a central Power Plant Controller (PPC)?
____Yes ____No

If Yes, provide manufacturer documentation and settings for the PPC.

Battery Storage:

5.8) Total Number of Battery Modules to be interconnected pursuant to this Interconnection Request: _____ ___Single phase ___Three phase

5.9) Will the Battery Modules be interconnected on the AC side or the DC side of the Inverter?
____AC Coupled ____DC Coupled

5.10) Output of each battery: _____ Watt/Hour

Inverter and/or Battery Facility:

5.11) Max Gross (AC) Nameplate Rating (at the Point of Interconnection – POI) of the new or materially modified Generating Facility (PV and/or Battery):
_____MW_{AC} (summer at 95° @ ____ Power Factor)

5.12) Max Gross (AC) Nameplate Rating (at the Point of Interconnection – POI) of the new or materially modified Generating Facility (PV and/or Battery):
_____MW_{AC} (winter at 59° @ ____ Power Factor)

5.13) Interconnection Customer or Customer-Site Load (inclusive of balance of plant/aux load):

Summer (based on Generator Max output) - Real _____MW Reactive _____MVAR
Winter (based on Generator Max output) - Real _____MW Reactive _____MVAR

5.14) Will there be reactive compensation at the POI? If yes, please provide the following:
5.3.4.1 Size:_____ kVar
5.3.4.2 Switched or fixed:_____
5.3.4.3 Number of Steps: _____
5.3.4.4 Location of the bank(s)_____

5.15) Short Circuit Current Contribution of the Generating Facility:
Maximum three-phase fault current contribution at the inverter AC terminals in per unit (pu) of rated Current: _____ per unit

5.16) Provide a one-line diagram of the PV collector system with the equivalent impdeance of the complete collector system up to the low-side of the step-up transformer/GSU.

5.17) List of adjustable set points for the protective equipment or software in the inverter and/or battery: _____

5.18) Can the inverter firmware/settings comply with the requirement to disable momentary cessation?
____Yes ____No

5.19) List components of the new or materially modified Generating Facility equipment package that are currently certified:

Equipment Type	Certifying Entity
1. _____	_____
2. _____	_____
3. _____	_____
4. _____	_____
5. _____	_____

5.20) Is the inverter compatible with a certified protective relay package?
____Yes ____No

Inverter Step-Up (Pad Mounted) Transformers

5.21) Size: _____kVA
5.22) Transformer Positive Impedance: _____ % on _____kVA Base _____ X/R Ratio
5.23) Transformer Zero Impedance: _____ % on _____kVA Base _____ X/R Ratio
5.24) Is the transformer: ____single phase _____three phase?

5.26) If Three Phase:
Transformer Primary: _____ Volts _____ Delta _____Wye _____ Wye Grounded
Transformer Secondary: _____ Volts _____ Delta _____Wye _____ Wye Grounded
Transformer Tertiary: _____ Volts _____ Delta _____Wye _____ Wye Grounded

Equivalent Collector System

5.27) Rating: _____MVA
5.28) Positive Sequence Impedance: R+jX, B _____ (pu)
5.29) Negative Sequence Impedance: R+jX, B _____ (pu)
5.30) Zero Sequence Impedance: R+jX, B _____ (pu)

Inverter, Battery (AC or DC Coupled), Power Plant Controller (PPC)

Provide inverter active and reactive power curves (P-Q diagrams), appropriate IEEE model block diagrams and completed models in Siemens PSS/E format of all applicable inverters, batteries (AC or DC Coupled), and Power Plant Controller (PPC). A copy of the manufacturer's block diagram(s) may not be substituted. Please provide literature of the inverter(s) and/or battery modules and the technical details associated with the applicable reactive compensation along with this application request.

6.0 INTERCONNECTION FACILITIES INFORMATION (SYNCHRONOUS AND A-SYNCHRNOUS)

6.1) Will a transformer be used between the new or materially modified Generating Facility and the Point of Interconnection (POI)?
___Yes ___No

6.2) Will the transformer be provided by the Interconnection Customer? ____Yes ____No

Transformer Data (for Interconnection Customer-Owned Transformer):

6.3) Size: _____kVA
6.4) Transformer Positive Impedance: _____% on _____kVA Base _____ X/R Ratio
6.5) Transformer Zero Impedance: _____% on _____kVA Base _____ X/R Ratio
6.5) Is the transformer: ____single phase _____three phase?

6.6) If Three Phase:
Transformer Primary: _____ Volts _____ Delta _____Wye _____ Wye Grounded
Transformer Secondary: _____ Volts _____ Delta _____Wye _____ Wye Grounded
Transformer Tertiary: _____ Volts _____ Delta _____Wye _____ Wye Grounded

Transformer Fuse Data (If Applicable, for Interconnection Customer-Owned Fuse):

(Attach copy of fuse manufacturer's Minimum Melt and Total Clearing Time-Current Curves)

6.7) Manufacturer: _____ Type: _____ Size: _____
Speed: _____

Interconnecting Circuit Breaker:

6.8) Manufacturer: _____ Type: _____
6.9) Load Rating (Amps): _____ Interrupting Rating (Amps): _____
6.10) Trip Speed (Cycles): _____

Interconnection Protective Relays:

6.11) List of Functions and Adjustable Set-points for the protective equipment or software:

Setpoint Function	Minimum	Maximum
1. _____	_____	_____
2. _____	_____	_____
3. _____	_____	_____
4. _____	_____	_____
5. _____	_____	_____
6. _____	_____	_____

6.12) If Discrete Components:

(Enclose Copy of any Proposed Time-Overcurrent Coordination Curves)

Manufacturer: _____ Type: _____ Style/Catalog No.: _____ Proposed Setting: _____

Manufacturer: _____ Type: _____ Style/Catalog No.: _____ Proposed Setting: _____

Manufacturer: _____ Type: _____ Style/Catalog No.: _____ Proposed Setting: _____

Current Transformer Data:

6.13) Enclose Copy of Manufacturer's Excitation and Ratio Correction Curves

Manufacturer: _____
Type: _____ Accuracy Class: ____ Proposed Ratio Connection: ____

Manufacturer: _____
Type: _____ Accuracy Class: ____ Proposed Ratio Connection: ____

6.14) Potential Transformer Data (If Applicable):

Manufacturer: _____
Type: _____ Accuracy Class: ____ Proposed Ratio Connection: ____

Manufacturer: _____
Type: _____ Accuracy Class: ____ Proposed Ratio Connection: ____

7.0 TRANSMISSION INTERCONNECTION INFORMATION

7.1) New or materially modified transmission interconnection voltage: _____ kV
7.2) New or materially modified transmission interconnection milleage: _____ miles

7.3) New or materially modified Transmission Line Route:

_____
_____
_____

7.4) Seminole transmission line/substation Interconnection point (from and to):

_____

New or materially modified Transmission line characteristics:

7.5) Positive Sequence Impedance: R+jX, B _____ (pu)
7.6) Negative Sequence Impedance: R+jX, B _____ (pu)
7.7) Zero Sequence Impedance: R+jX, B _____ (pu)
7.8) Mutual Impedance (if applicable): _____ (pu)

Transmission Line Rating (expressed in MVA on 100 MVA Base) for summer and winter:

7.9) Summer (normal – Rate A): _____MVA _____Time Value
7.10) Winter (normal – Rate A): _____MVA _____Time Value
7.11) Summer (long-term emergency – Rate B): _____MVA _____Time Value
7.12) Winter (long-term emergency – Rate B): _____MVA _____Time Value
7.13) Summer (short-term emergency – Rate C): _____MVA _____Time Value
7.14) Winter (short-term emergency – Rate C): _____MVA _____Time Value

7.15) Balancing Authority Area in which the new or materially modified Transmission Inteconnection will reside[3]: _____

7.16) Will the new or materially modified Transmission Interconnection be used to serve new or existing load:_____

7.17) Electronic copies of this Interconnection Application and supporting documentation shall be submitted to the email address below, the application fee a shall all be submitted to the mailing address indicated below:

Transmission Services Department
Seminole Electric Cooperative, Inc.
16313 N Dale Mabry Hwy.
Tampa, FL 33618
TransmissionServices@seminole-electric.com

If a wire transfer is preferred, send an email to the above email address to request the current wire transfer instructions.

8.0 GENERAL INFORMATION

8.1) Evidence of Site Control. Is Evidence Documentation Enclosed? ___Yes ____No

[3] In accordance with NERC FAC-001-3, R3.3, Seminole and the Interconnection Customer to discuss and confirm the Balancing Authority Area where the new or materially modified Transmission Interconnection will reside to ensure that it will be located within a Balancing Authority Area's metered boundaries.

8.2) Enclose a KMZ (Keyhole Markup Language Zipped) file for generator/transmission interconnection, including an electronic copy of site electrical one-line diagram showing the configuration of all Generating Facility equipment. Is the KMZ and one-line diagram enclosed? ____Yes ____No

8.3) Proposed location of protective interface equipment on property (include address if different from the Interconnection Customer's address)

_____

8.5) Enclose copy of any documentation that describes and details the operation of the protection and control schemes. Is Documentation Enclosed? ___Yes ____No

8.6) Enclose copies of schematic drawings for all protection and control circuits, relay current circuits, relay potential circuits, and alarm/monitoring circuits (if applicable).
Are Schematic Drawings Enclosed? ___Yes ____No

8.7) Enclose application fee in the amount of $5,000 (non-refundable), made out to Seminole Electric Cooperative, Inc., toward Seminole's costs for processing this application. Is the fee enclosed? ___Yes ____No

8.8) For a QF facility, enclose proof of certification or proof of having filed with FERC for QF certification. Is documentation enclosed? ___Yes ____No

9.0 EMT MODEL REQUIREMENT

Model Accuracy Features
In order to be sufficiently and accuratly model PV interconnections, the following EMT model data shall be provided by the Interconnection Customer for all inverter based resources:

Item	Description	Check
1	Represent the full detailed inner control loop of the power electronics. The model cannot use the same approximations classically used in transient stability modeling, and should fully represent all fast inner controls, as implemented in the real equipment. It is preferred and recommended to create models which embed the actual hardware code into a PSCAD component whenever possible. If the model is assembled using standard blocks available in the PSCAD master library, approximations are usually introduced, and specific implementation details for important control blocks may be lost. In addition, there is a risk that errors will be introduced in the process of manually assembling the model. NOTE: For this type of manually assembled model, (not using a direct "real code" embedding process), validation is recommended.	

2	Incorporate a full IGBT representation (preferred) or may use a voltage source interface that mimics IGBT switching (i.e. a firing pulse based model). A three phase sinusoidal source representation is not acceptable. Models manually translated from MATLAB (i.e. block-by-block) or control block diagrams are often unacceptable because the method used to model the electrical network and interface to the controls may not be accurate, or portions of the controls (such as protection) are omitted. Note, however, that MATLAB may be used to generate C code which is used in the real control hardware, and if this approach is used by the developer, the same C code may be directly used to create an extremely accurate PSCAD model of the controls. The controller source code may be compiled into DLLs or binary if the source code is unavailable due to confidentiality restrictions.	
3	Represent plant level controllers as they are implemented in the real controls, such as automatic voltage regulation. Parameters typically requiring site-specific adjustment should be made user-accessible. For example, the plant level controller should provide access to regulation gains and droop settings.	
4	Represent all pertinent control features as they are implemented in the real controls (e.g. customized PLLs, ride-through controllers, etc.)	
5	Represent dynamic reactive devices including automatically controlled capacitor and reactor banks, if applicable.	
6	Have all pertinent protections modeled for both balanced and unbalanced fault conditions in detail. Typically, this includes various over-voltage and under-voltage protections (individual phase and RMS), frequency protections, DC bus voltage protections, and overcurrent protection. There may be others.	
7	Accurately reflect behavior throughout the valid (MW and MVAr) output range from minimum power through maximum power.	

Model Usability Features

In order to allow study engineers to perform system studies and analyze simulation results, the model provided for each facility shall:

8	Have pertinent control or hardware options accessible to the user (e.g. adjustable protection thresholds or real power recovery ramp rates). Diagnostic flags (e.g. flags to show control mode changes or which protection has been activated) should be accessible to facilitate analysis and should clearly identify why a model trips during simulations.	
9	Be capable of running at timesteps anywhere in the range from 5 µs to 10 µs and accurate when running timesteps higher than10 µs Most of the time, requiring a smaller time step means that the control implementation has not used the interpolation features of PSCAD, or is using inappropriate interfacing	

	between the model and the larger network. Lack of interpolation support introduces inaccuracies into the model at higher time steps. The model should not be restricted to operating at a single step, but should be able to operate within a range (e.g., 10 -20 μs).	
10	Include documentation and a sample implementation test case. Access to technical support engineers is desirable.	
11	Be capable of initializing itself. Models shall initialize and ramp to full output without external input from simulation engineers. Additionally, the model should accept any slow control function from switched shunts and power plant controllers and accept initial condition variables if required.	
12	Accept external reference values. This includes real and reactive power reference values (for Q control modes), or voltage reference values (for V control modes). The model should accept these reference variables for initialization, and be capable of changing them mid-simulation (i.e., dynamic signal references)	
13	Allow protection models to be disabled. Many studies result in inadvertent tripping of converter equipment, and the ability to disable protection functions temporarily provides simulation engineers with valuable system diagnostic information.	
14	Allow the active power capacity of the model to be scaled. This is distinct from a dispatchable power order, and is used for modeling different plant capacities or breaking a lumped equivalent plant into smaller composite models.	

Model Efficiency Features

In order to improve study efficiency, model compatibility, and enable studies which include the model to be performed as efficiently as possible, the model provided for each facility shall:

15	Be compiled with Intel Fortran version 12 or higher. The model should not be dependent on a specific Fortran version to run.	
16	Use PSCAD version 4.5.3 or higher. The model should not be dependent on a specific PSCAD version to run.	
17	Initialize as quickly as possible (for example <5 seconds) to user supplied terminal conditions.	
18	Support multiple instances of its own definition in the same simulation case.	
19	Support the PSCAD “timed snapshot” feature.	
20	Support the PSCAD “multiple run” feature.	
21	Model should not use or rely upon global variables and should not utilize multiple layers including ‘disabled layers’ in the PSCAD environment.	
22	Allow replication in different PSCAD cases or libraries through the “copy” or “copy transfer” features.	

Applicant Signature

I hereby certify that, to the best of my knowledge, all the information provided in this Interconnection Request is true and correct.

By (signature): _____

Name (type or print): _____

Title: _____

Date: _____

**Please review the application and ensure that all required information under "General Information" is provided during the submission of the application to avoid a response of "incomplete application" once reviewed by Seminole Electric Cooperative, Inc. **

REV. #	DATE	DESCRIPTIONS	AUTHOR	APPROVED BY
0	12/4/15	Initial Creation	G. McKaig	R. DeMelo
1	3/9/2017	Revisions to include additional data requirements	G. McKaig	R. DeMelo
2	10/11/17	Fixed Typos	G. McKaig	R. DeMelo
3	12/14/2018	Updated to include FAC-001-3, R3.3 and 4.3, update inverter/battery requirements, include new Transmission Interconnection request section	C. Torres-Casiano	R. DeMelo
4	4/4/2019	Inserted section number identifiers and inserted new information requirements for inverters	C. Torres-Casiano	R. DeMelo
5	10/30/2020	Added section 9 for EMT model requirement for PV interconnections and updated Sections 7.17 and 8.7	C. Torres-Casiano	R. DeMelo

6	4/15/2021	Added X/R ratio information request, one-line diagram and equivalent collector system impedance information, Pad-mount transformer information, and updated General Information requirement section. Updated department responsibility.	G. Garcia	R. DeMelo
7	8/11/2025	Updated mailing address and payment options	K.Allemang	R.DeMelo