Florida Municipal Power Agency and Its All Requirements Project Participants FACILITY INTERCONNECTION REQUIREMENTS

Table of Contents

List of Tables

1 Definitions

Affected Systems	Portions of the Bulk Electric System or sub-transmission systems owned by others that are affected by the proposed Interconnection
Applicant(s)	Parties (or their agents) that are either considering connecting to, or modifying facilities that are already connected to, the portion of the Bulk Electric System owned by the Florida Municipal Power Agency ("FMPA") or its All Requirements Project Participants
Bulk Electric System	As defined by the North American Electric Reliability Corp. (NERC). Refer to the NERC Glossary of Terms. Except as modified by Inclusions I1 – I4 and Exclusions E1 – E4, this term refers to "all Transmission Elements operated at 100 kV or higher and Real Power and Reactive Power resources connected at 100 kV or higher. This does not include facilities used in the local distribution of electric energy."
Interconnection	The Applicants proposed interconnection with the Owners System
Facility	The facility, equipment, etc., which the Applicant wishes to connect to the System
FIR	Facility Interconnection Requirements
FRCC	The Florida Reliability Coordinating Council
IEEE / ANSI	Institute of Electrical and Electronic Engineers / American National Standards Institute
NERC	The North American Electric Reliability Corp.
Owners	The Florida Municipal Power Agency ("FMPA") and its All Requirements Project Participants
Systems	The existing portion of the Bulk Electric System owned by the Owners, and any sub-transmission systems (e.g., 69 kV system) owned by the Owners

2 Introduction and Scope

This document, referred to as the Facility Interconnection Requirements (or "FIR"), serves as a reference to Applicants that are either considering connecting to, or modifying facilities that are already connected to, the portion of the Bulk Electric System owned by the Florida Municipal Power Agency ("FMPA") or its All Requirements Project Participants (singularly and collectively referred to as "Owners").

This FIR covers interconnection of Generation, Transmission, and End User Facilities(subject to local law limitations) and is offered in response to the North American Electric Reliability Corporation ("NERC") Standard FAC-001-3 that requires Transmission Owners and Generator Owners to make Facility interconnection requirements available upon request. A copy of this reliability standard is available on the internet at http://www.nerc.com/Pages/default.aspx.

NERC Standard FAC-001-3 states that its purpose is "To avoid adverse impacts on the reliability of the Bulk Electric System, Transmission Owners and applicable Generator Owners must document and make Facility interconnection requirements available so that entities seeking to interconnect will have the necessary information". It requires that each Transmission Owner and applicable Generator Owner document, maintain, and make FIRs available on request to ensure compliance with NERC Reliability Standards, applicable Regional Entity, and individual Transmission Owner, planning and operating criteria.

All new interconnections or modifications to existing Facilities within the portion of the Bulk Electric System owned by the Owners, including those to be constructed by its owner, must be in compliance with this FIR and all applicable construction standards of the Owners. Such connections must also comply with all applicable NERC standards and applicable industry standards and codes (e.g., OSHA, National Electric Safety Code, IEEE / ANSI Standards, etc.).

The Owners reserve the right to modify and amend this FIR at any time.

Table 1

FAC-001-3 Requirements

Req #	Requirement Description	FIR Section #	Page #
3.1	Procedures for coordinated studies of new or materially modified existing Interconnections and their impacts on Affected System(s).	4.1, 4.2	5
3.2	Procedures for notifying those responsible for the reliability of Affected System(s) or new or materially modified existing interconnections.	4.2	8
3.3	Procedures for confirming with those responsible for the reliability of affected systems of new or materially modified transmission Facilities are within a Balancing Authority Area's metered boundaries	4.2, Step 5	11

3 General Connection Requirements

The facility interconnection requirements described in this document are high level overviews of functional requirements for connecting new generation, transmission, and end user facilities or materially modifying existing generation, transmission or end user facilities connected to the Owners' Systems. Should such requirements conflict with any specific requirements of an individual owner, or to the extent that different specific requirements are developed during a joint interconnection study, the individual owner's requirements or jointly developed requirements, as well as applicable codes and standards, shall apply.

3.1 Codes, Standards, Contracts, and Regulations

All such facilities shall comply with all applicable codes, standards, government (Federal, State and Local) regulations, contracts, and operating agreements.

4 Interconnection Procedures, Studies and Agreement

It is the policy of the Owner(s) to permit any qualified Applicant to connect generation, transmission or end-use facilities ("Facilities") to its System and operate in parallel with its System (the "Connection") provided that there will be no adverse impacts on:

- The Owner's existing Systems (both Bulk Electric System portions and any sub-transmission systems);
- Neighboring utility systems (affected systems);
- Planned generator, transmission, or end-use facilities with an earlier application date than that of the Applicant
- The general public
- The tax-exempt status of any bond(s) issued to finance the Owner's facilities used in providing the facility connection service.

Although the Owners do not have tariffs filed with the Federal Energy Regulatory Commission, the Owners are active participants in the FRCC regional transmission planning and operations committees and processes, and consequently follow interconnection study procedures similar to those of the other regional utilities with filed tariffs. The process for gaining interconnection to the Owners' System is as follows:

1. Owners receive official request for interconnection from Applicant.
2. Owners and Applicant discuss and agree on the scope of any studies to be performed, which may include joint studies
3. Feasibility Study (If determined through agreement with the Applicant)
4. System Impact Study
5. Facilities Study
6. Interconnection and Operations Agreement

These steps are laid out in more detail in the following sections.

4.1 Process for Requesting Interconnection

Step 1: Request for Interconnection

All Applicants desiring to interconnect new facilities or materially modify an existing interconnection shall submit a Request for Interconnection (Request). An Applicant shall submit a separate Request for each proposed new or modified interconnection

and may submit multiple Requests for a single Facility if multiple configurations/options are desired to be considered. The Request must contain the following information dependent upon the type of Facility(ies) the Applicant wishes to interconnect.

Table 2
Application Information Requirements

	Generation	Transmission	End-Use
Size	Maximum Gross and Net MW and MVAR Output	Project rating and voltage	Maximum MW and MVAR demand, projected load profile
Location of the proposed facility and Interconnection	Location of plant and proposed interconnection point	Proposed interconnection points (both ends), proposed line route	Location of End-Use Facilities and proposed interconnection point
Modeling Information for use in power flow, stability and short circuit models, including but not limited to	Ratings, impedances, time constants, gains, inertia constants; governor system, excitation system and power system stabilizer modeling information	Ratings, series impedance, shunt susceptance, conductor or transmission line type for each new or materially modified component.	Ratings, impedances
Construction Details	Projected in-service date, projected back-feed date, projected station service need date	Projected in-service date, projected construction schedule, construction type	Projected in-service date
Status of Site Acquisition	Status of site acquisition	Projected routing, status of ROW acquisition	Status of site acquisition
Permitting Status	Status of air permit, any other permits required	Status of siting approval, environmental permits, etc.	Status of any permits, including environmental
Balancing Authority Area	Identification of the Balancing Authority Area for any new or materially modified Facilities	Identification of the Balancing Authority Area for any new or materially modified Facilities	Identification of the Balancing Authority Area for any new or materially modified Facilities

Step 2: Interconnection Study Scope Meeting

The date and time at which the Owners determine that the Application is complete will be the official request date of the Application. The Owners will schedule a meeting with the Applicant to discuss the scope of study work to be performed as well as any Facility interconnections that may also be evaluated and have earlier official request dates. If necessary the Owners will utilize a queue. At this meeting the Owners and Applicant will determine whether a Feasibility Study will be conducted as an initial step, or a full System Impact Study will be conducted without the Feasibility Study step. The Owners and Applicant will also discuss the study costs and schedule.

The Owners shall receive, process, and analyze all Requests for Interconnection on an equal basis, including Requests made by the Owners. Applications will be processed in the order in which there deemed complete (official request date).

4.1.1.1 Withdrawing Requests

The Applicant may withdraw its Request at any time by written notice of such withdrawal to the Owners.

Withdrawal shall result in the loss of the Applicant's priority order, if multiple Requests are being evaluated. An Applicant that withdraws its Request shall pay the Owners all costs that the Owners incurred with respect to that Request. Owners will stop all work associated with the Request once notice is received. The Applicant must pay all monies due to the Owners before it is allowed to obtain any work products that may be available (such as preliminary study results).

4.1.1.2 Modifications to Request for Interconnection

Changes can be made to the Request for Interconnection at any time before the start of the System Impact Study (including following the Feasibility Study, if one is performed) as long as the changes are not material. Allowable changes include:

- Minor reconfiguration of the interconnection. Changes in interconnection location, including connection to a different voltage level at the same substation would require a new Request.
- Reduction in the proposed amount of power transferred to/from the Owners System (e.g., generation capacity or peak load forecast) by up to 50%. Increases in proposed power transferred of any amount or reductions of more than 50% of the original Request would require a new Request.
- Other changes deemed immaterial to the Request at the sole discretion of the Owners.

The following changes may be allowed following commencement if the System Impact Study:

- Changes in equipment which do not significantly impact equipment modeling characteristics. The significance of such changes shall be determined at the Owners' sole discretion.

- Changes in substation layouts/arrangements that do not significantly impact the results of various studies performed. The significance of such changes shall be determined at the Owners' sole discretion.
- Minor changes in the projected schedule for construction of the Facilities.
- Any other changes deemed minor at the sole discretion of the Owner.

Other changes not expressly discussed above require submission of a Request.

The Applicant must meet certain milestones to maintain the priority of its Request (provided others are also received):

- Signing any study agreement within 30 days and providing the appropriate fee / deposit
- Proof of site control before execution of the Interconnection and Operations and Maintenance Agreements.
- The Facility must be commercially in-service and operational no more than 3 years after the projected in service date forecasted at the completion of the Facilities Study.

If the Applicant fails to adhere to all the provisions of this FIR, the Owners shall deem the Request to be withdrawn and shall provide written notice to the Applicant of the deemed withdrawal and explanation of the reasons for such deemed withdrawal. Withdrawal shall result in the loss of the Applicant's priority position.

4.2 Procedures for Coordinated Joint Studies and Notification of New or Modified Facilities to Others

Once all required information has been provided, the Owners will initiate planning and engineering studies to assure that all NERC, FRCC and Owners' requirements are met. If the proposed interconnection causes a violation of planning criteria on the Systems, then the studies will also determine what additions and/or improvements to the Systems will be required to accommodate the interconnection.

In the event that studies show that third party portions of the Bulk Electric System or sub-transmission systems owned by third parties are affected by the interconnection ("Affected Systems"), the Owner will contact the owners of those Affected Systems and the FRCC and continue studies in coordination with all owners of Affected Systems.

The Owners participate in the FRCC and follow the *FRCC Reliability Evaluation Process for Generator and Transmission Service Requests*. If the interconnection meets certain criteria established by this process and/or by the Owners, the Owners will contact the FRCC to commence a joint study. At that time, the evaluation of the Request will follow the FRCC process outlined in the document referenced above. If the interconnection does not meet the requirements for a coordinated joint study under

the FRCC process, the Owners may still contact Owners of Affected Systems and give them the opportunity to review the study results.

The following types of analyses will generally be performed. All analyses will be conducted with and without the proposed interconnection and associated Facilities and will test all reasonable contingencies deemed necessary to model the overall systems' response.

- Power flow (steady state) contingency analysis
- Short circuit analysis
- Dynamic stability analysis
- Protection System Coordination analysis

In general, for all Requests, there will be three studies performed:

1. Interconnection Request Feasibility Study (unless Owners and Applicant agree to forego this study)
2. Interconnection Request System Impact Study
3. Interconnection Request Facilities Study

The Applicant can choose to forgo the Feasibility Study and proceed directly to the System Impact Study. Coordination with owners of Affected Systems can occur during any and/or all of these three studies. The three studies are described in more detail in the following sections.

The Owners will coordinate the completion of any studies required to determine the impact of the Request on Affected Systems with affected third parties and, if possible, include those results (if available) in the Owners' applicable study.

The Applicant will cooperate with the Owners in all matters related to the conduct of studies.

Step 3: Interconnection Feasibility Study

Within 10 days of the acknowledgement of a valid Request, the Owners shall provide the Applicant an Interconnection Feasibility Study Agreement that specifies the study to be performed, the responsibilities of the parties, a schedule for study completion and a good faith estimate of the cost for completing the study. The estimate for performing the study may be based on the type of interconnection and proposed power flow exchanged with the Owner's Systems. Study fees will be paid as a deposit equal to the good faith estimate before any study work is performed. The final fee will be reconciled at the completion of the study.

An Interconnection Feasibility Study is an assessment of the proposed project based on previous studies, general knowledge of system performance and power flow analyses of the transmission system. The purpose of this study is to provide a quick initial assessment of potential impacts of the interconnection and whether modifications to the transmission system may be required. The documentation of this study may be informal or formal.

Following completion of the Feasibility Study, the Owners will meet with the Applicant to review the study results, discuss any recommended or required transmission system modifications, and determine whether the Applicant wishes to proceed with further studies of the proposed Interconnection. The Owners will request written agreement from the Applicant to proceed to the System Impact Study.

Step 4: Interconnection System Impact Study

Within 10 days of receiving acceptance of the Feasibility Study results and agreement from the Applicant to proceed with further studies, the Owners shall provide the Applicant an Interconnection System Impact Study Agreement that specifies the study to be performed, the responsibilities of the parties, a schedule for study completion, and a good faith estimate of the cost for completing the study. The estimate for performing the study may be based on the type of interconnection and proposed power flow exchanged with the Owners' Systems. Study fees will be paid as a deposit equal to the good faith estimate before any study work is performed. The final fee will be reconciled at the completion of the study.

The System Impact Study is a detailed study that provides a more thorough assessment of the potential impact of the proposed interconnection on the Bulk Electric System and sub-transmission systems. The study identifies transmission system modifications that might be required to accommodate the interconnection and keep the Systems and any Affected Systems compliant with industry standards and Owner performance criteria and operating reliably. This study typically includes power flow (steady state contingency analysis), short circuit, and dynamic stability analyses, and other types of analyses as required.

Following completion of the Interconnection System Impact Study, the Owners will meet with the Applicant to review the study results, discuss any recommended or required transmission system modifications, and determine whether the Applicant wishes to proceed with further studies of the proposed Interconnection. The Owners will request written agreement from the Applicant to proceed to the Facilities Study.

Step 5: Interconnection Facilities Study

Within 10 days of receiving acceptance of the System Impact Study results and agreement from the Applicant to proceed with further studies, the Owners shall provide the Applicant an Interconnection Facilities Study Agreement that specifies the study to be performed, the responsibilities of the parties, a schedule for study completion, and a good faith estimate of the cost for completing the study. The estimate for performing the study may be based on the type of interconnection and proposed power flow exchanged with the Owners' Systems. Study fees will be paid as a deposit equal to the good faith estimate before any study work is performed. The final fee will be reconciled at the completion of the study.

The Facilities Study develops the conceptual engineering plans for the interconnection (interconnection facilities) and any system upgrades necessary based on the results of the System Impact Study, and provides budgetary level cost estimates for the

necessary projects. The developed conceptual engineering plans will include delineation of metered boundaries for appropriate Balancing Authority(ies). Additionally, the Owners will prepare a high level assessment of potential construction schedules to determine whether proposed in-service dates can be achieved. During the Interconnection Facilities Study, additional analyses may occur, such as power quality and protective device coordination. Depending on the number of Affected Systems involved, there may not be a single document labeled "Facilities Study", but instead the collection of designs, estimates and supplemental studies may be considered the Facilities Study.

Following completion of the Interconnection Facilities Study, the Owners will meet with the Applicant to review the study results, discuss the budgetary cost estimates and schedule(s) and determine whether the Applicant wishes to proceed with the Interconnection. The Owners will request written agreement from the Applicant to draft an Interconnection and Operations Agreement.

Step 6: Interconnection and Operations Agreement

At the completion of the Facilities Study, an Interconnection and Operations Agreement will be negotiated between the Applicant and the Owners. Engineering design of the Interconnection Facilities or System Upgrade facilities will not begin until there is agreement among the parties and there is an executed Interconnection and Operations Agreement. If Affected Systems were identified, these may require execution of a separate agreement between the Applicant and the third party owner of the Affected System(s), and the Owners may elect to delay commencement of engineering design and/or construction or procurement of Interconnection Facilities or System Upgrade Facilities until the associated third party agreement has been executed. The Applicant will not be allowed to connect its Facility until Interconnection Facilities and System Upgrades are completed, except as agreed separately for delivery of back-feed and/or test power. The Interconnection and Operations Agreement will address:

- Responsibilities, including cost responsibilities for design, construction, commissioning, operations, etc. of facilities required for interconnection
- Allocation of ownership of facilities and responsibilities for ongoing operations and maintenance
- Milestones established to for construction of required facilities (Interconnection and System Upgrade Facilities)
- Responsibilities and liabilities associated with NERC Reliability Standards.
- Technical requirements, as appropriate, that are included in this FIR

5 Technical Requirements

5.1.1 General

Some Owners will have technical requirements specific to an interconnection with that Owner. All interconnections must meet both the individual Owner's requirements and the Owners' requirements detailed in this document. If the individual Owner's requirements conflict with the collective Owners' requirements, the individual requirements will rule to the extent it is more stringent than the collective.

5.1.2 Voltage Level, MW & MVAR Capacity or Demand at Point of Interconnection

Generation, Transmission and End Use

The Owners will provide Applicants and adjacent utilities with their Facility Ratings for Facilities adjacent to the point of interconnection. The Owners do not allow facility loading above continuous thermal ratings during normal conditions, and require that facility loading be within applicable short/long term emergency ratings following contingencies, in compliance with applicable NERC reliability standards. For voltage criteria, nominal voltages for the Owners are 230 kV, 138 kV and 69 kV and typical allowable limits are shown in Table 5-1 below. Where the Owners Systems are surrounded by third party transmission networks, the Owners coordinate their allowable voltages with those of the neighboring system. All transmission voltage equipment in the Facility and the interconnection shall be designed for continuous operation at +/- 10% voltage range of nominal.

Table 5-1 – Voltage Level/Operating Criteria

	Normal/Post-Contingency	
Nominal Voltage (kV)	Vmin (p.u.)	Vmax (p.u.)
69, 138	0.95 / 0.95	1.05 / 1.07
230	0.95 / 0.95	1.05 / 1.07

Generators

Generator Step-Up transformers (GSUs) must be supplied with taps capable of changing the turns ratio of the transformer by at least +/- 5% with a maximum tap step size of 2.5%. The nominal rated winding voltage of the GSU shall be selected so that it does not limit the operating voltage range of the transmission system at the point of interconnection.

All generators must contribute reactive power and regulate voltage on the Bulk Electric System in order to maintain the Bulk Electric System's reliability in accordance with NERC Standard VAR-002 or its successor and FRCC supplements. All generators must be capable of continuous operation at voltages of +/- 5% of nominal at the generator terminal. The generator shall be capable of continuous operation at 0.9 power factor lagging (supplying MVARs into the System) and 0.95 power factor leading (absorbing MVARs from the System) net, as measured at the Connection.

The net MW and MVA capacity of the generator will be determined as a result of the System Impact and Facilities Studies and specified in the Interconnection and Operations Agreement. The generator will not be allowed to exceed the specified capacity except: 1) during emergency conditions as determined by the Owners; and 2) if the Applicant makes a second Application for Interconnection for an incremental increase in capacity of the plant. The Applicant may be required to test MW and MVAR capabilities in accordance with NERC Standards MOD-024 and MOD-025 and their successors and supplements as applicable.

Transmission

All Transmission Facilities must be constructed with a capacity that allows performance to meet the requirements of NERC's TPL standards and their successors and supplements for at least a 10 year planning horizon. Based on the results of the studies required above, a new facility may be significantly larger than is contemplated initially.

End Use

The MW and MVA capacity of the End Use Facility will be determined as a result of the System Impact and Facilities Studies and specified in the Interconnection and Operations Agreement. The Applicant will not be allowed to exceed the specified capacity unless the Applicant makes a second Application for Inteconnection for an incremental increase in capacity of the Facility.

5.1.3 Breaker Duty and Temporary Overvoltage (TOV) Protection

Generators, Transmission and End Use

The System Impact Study and the Facilities Study will determine the minimum requirements for breaker interrupting capability. All equipment required for the Interconnection and Facilities shall be sized at a commercial rating that exceeds the maximum available fault current by at least 20%.

AC high voltage circuit breakers are specified by operating voltage, continuous current, interrupting current, and operating time in accordance with ANSI/IEEE Standards C37 series for breakers rated on a "Symmetrical Current Basis." When calculating breaker duty, asymmetrical fault current and other factors will be taken into account in accordance with ANSI / IEEE C37 standards.

All equipment must be designed to withstand temporary overvoltages caused by ground faults. The level of overvoltage and the duration will be determined as part of the Facilities Study and specified in the Interconnection and Operations Agreement.

The Applicant shall design the protection systems of the Facility and its ownership share of the Interconnection to remove ground faults from the System promptly such that no equipment that makes up the System exceeds its TOV withstand capability.

5.1.4 System Protection and Coordination

Generation, Transmission and End Use

Utility grade, transmission level protective relays and fault clearing systems are to be provided. All protective relays should meet or exceed ANSI/IEEE Standard C37.90. All major pieces of equipment shall be protected in their own protection zone with redundant and independent protection systems.

Adjoining power systems may share a common zone of protection between two parties (e.g., a jointly owned transmission line). Compatible relaying equipment must be used on each side of the point of ownership within a given zone of protection. The design must provide coordination for speed and sensitivity in order to maintain power system security and reliability.

All Bulk Electric System equipment is to have primary protective relaying that operates with no intentional time delay for 100% of the specified zone of coverage. On transmission lines, this is accomplished through the use of a communication channel. A second high-speed protection system may be required depending on critical clearing times.

Backup protective systems should provide additional coverage for breaker and relay failure outside the primary zone. Specific breaker failure protection schemes and relay failure backup schemes must always be applied at the Bulk Electric System level. Time and sensitivity coordination must be maintained to prevent misoperations.

At least one DC supply consisting of a stationary battery and battery charger(s) is to be provided at locations where protective equipment is applied. The battery is to be sized with enough capacity to operate all tripping devices after eight hours without a charger. An undervoltage alarm must be provided for remote monitoring by the Applicant who shall take immediate action to restore power to the protective equipment. Redundant battery systems and redundant breaker trip coils may be required depending on critical clearing times and the importance of the Facility and Interconnection to the Bulk Electric System.

Mechanical and electrical logic and interlocking mechanisms are required between interconnected facilities to ensure safe and reliable operation. These include, but are not limited to, breaker and switch auxiliary contacts, undervoltage and synch-check relays, and physical locking devices.

A transfer trip is required for many installations. It is used for backup protection and islanding schemes. For new installations, fiber optics is the preferred means of communication. Power line carrier schemes may also be used.

Applicants connecting to the System shall investigate and keep a log of all protective relay actions and misoperations as required by the FRCC in compliance with NERC Standard PRC-004 and its successors and supplements, as applicable.

As part of the Facilities Study, the Applicant is to provide evidence that its protection systems will comply with applicable portions of NERC Reliability Standards PRC-023 and PRC-025, as applicable.

The Owners shall review and approve any protection system design of the Facility and the Connection.

The Owner, Applicant and neighboring utilities shall work together to perform protection system coordination studies and set protection system relays accordingly in accordance with NERC Standard PRC-001, PRC-027, and their successors and supplements.

Generation Protection

Protection requirements for generators shall include at minimum:

- Overvoltage
- Undervoltage
- Overload (e.g. stator backup overcurrent or equivalent for non-synchronous resources)
- Phase and ground fault protection
- Open circuit detection
- Overfrequency
- Underfrequency
- Loss of source (e.g. transfer trip)
- Isolated operating conditions
- Prevention of dead-line reclosing

Additional protection schemes may be required at the discretion of the Owners (e.g., Loss of Excitation, Out-Of-Step).

Facility protection devices shall include a circuit breaker to be located at the high side of each generator step up transformer prior to the point of interconnection. The Applicant shall be solely responsible to disconnect the Facility from the System if System conditions are such that continued connection would damage the Facility.

Transmission and End-Use Protection

Facility protection devices shall include a circuit breaker to be located on the Facility side of the Connection. The Facility operator shall be solely responsible to disconnect the Facility from the System if System conditions are such that continued connection would damage the Facility.

Acceptable transmission line relaying:

- Line Current Differential Relaying using high speed communication between ends of the line for primary relaying
- Phase and Ground Impedance relaying (mho and/or quad characteristics) applied with communications assisted schemes such as directional comparison blocking, permissive overreaching transfer trip, and directional comparison unblocking are all possible schemes but will be best selected based on existing adjacent protection. Any communications requirements for backup and stuck breaker protection will be determined during the Facilities study based on critical clearing times and other considerations.
- Ground directional overcurrent relaying may be acceptable in certain locations, depending upon the specific adjacent protection.

Typical transformer and bus protection schemes:

- Differential schemes
- Backup phase and ground overcurrent. Directional supervision may be required based on system conditions observed in the studies.

Other relaying schemes may be required at the sole discretion of the Owners (e.g., underfrequency load shedding schemes (UFLS) for End Use Connection). Reclosing of overhead transmission lines may be allowed as determined solely by the Owners.

5.1.5 Metering and Telecommunications

Generation, Transmission and End-Use

The Owners shall install required metering equipment at the point of Connection prior to any operation of the Facility and shall own, operate, test and maintain all such equipment. Each installation needs to be evaluated separately for metering requirements because of the many possible contractual agreements and interconnection configurations. In general, however, the following quantities are to be provided for each supply point. MW-hours received, MW-hours delivered, KQ-hours received, KQ-hours delivered, MVAR-hours received, MVAR-hours delivered, Three Phase Voltage, Three Phase Current, +/- MW, and +/- MVAR. These quantities may need to be provided to various parties through various information/communication systems. Specific designs will be developed to meet those requirements. All metering devices are to be pre-approved by the Owners prior to installation.

Revenue meters are to have an accuracy class of 0.3% or better. Transducers are to be accurate to +/- 0.2% of full scale. Three element meters are to be used on all effectively grounded power systems. Both primary and backup revenue meters are to be provided. Backup current transformers (CTs) and potential transformers (PT's) are not required.

Instrument transformers are to have an accuracy class of 0.3% or better with 0.15% being preferred. Metering accuracy CTs and PTs are to be installed as close to the delivery point as practical. CT ratios are to be selected just above the expected full load. Using multi-ratio CT's are not advisable since accuracy is lost when using lower

taps. Metering CT's and PT's should not be used to feed non-metering equipment such as protective relays. Metering CT's are not to be connected in parallel. Auxiliary CT's are not to be used in metering circuits. When more than one point is to be monitored, individual metering is to be used. The impedance of the CT and PT cable leads is to be kept low and not impose burdens above that of the instrument transformer rating.

When the metering location is different from the delivery point, compensation for losses is required. Meter compensation settings shall be provided to the Owners for review and comment and shall be agreed upon in advance prior to commercial operation of the new or modified Interconnection.

Revenue meters are to remain sealed during operation and following maintenance or calibration testing. All parties are to be notified prior to removing seals. Calibration testing is to be performed annually and is to include all associated parties. Test equipment must be certified and traceable to the National Bureau of Standards.

The Owners will provide metered quantities in a mutually agreed upon form to the Applicant upon request.

The Applicant may, at its sole option and expense, install check meters on its premises and on its side of the Connection to verify the Owners' meters. Check meters shall not be used for the measurement of power flows unless specifically authorized by this FIR. The check meters shall be subject to inspection by the Owners at all reasonable times.

The Owners shall inspect and test all of its metering equipment upon installation and thereafter at intervals not to exceed two (2) years. At the request of the Applicant, the Owners will inspect and test its metering equipment at any time within the two (2) year period and/or on a more frequent standard interval. The Owners will strive to notify the Applicant a minimum of twenty four (24) hours prior to any inspection or test so that the Applicant may witness the work if deemed necessary. If, at any time, the Owners' metering equipment is found to be inaccurate or defective, it shall be adjusted, repaired or replaced as required.

If the metering equipment fails to register or reads more than 2% different from standard test meters, the Owners will adjust all readings taken since the last verified test by using the Applicant's check meter, if installed. If no check meter was installed, the Owner will estimate the adjustment using industry accepted engineering methods.

All metered data will be sent electronically to locations designated by the Owners and the Applicant. This data will be used as the official measurement of the amount of energy delivered to or withdrawn from the System by the Facility.

Prior to initial connection to the System, the Applicant shall establish the following minimum voice and data communications with the Owners.

Voice: The voice communications listed below shall be sufficiently redundant so that a failure of a single phone cable/switch/etc. will not render all inoperable. Communication systems shall be in accordance with NERC Standards COM-001, COM-002 and other standards, successors and supplements, as applicable.

- Voice phone system / design shall be provided to the Owners for review. Security and redundancy will be important factors in approval of any system.
- Facsimile communications to the Facility control room using a separate phone line.
- Dedicated phone connection between Facility control room and the Owners'(or Owner's agent's) dispatch center (at this time, the Florida Municipal Power Pool is the Owners' dispatcher and balancing authority).

Data: A remote terminal unit ("RTU") compatible with the Owners' Supervisory Control and Data Acquisition System ("SCADA") shall be installed and be fully operational prior to the initial connection of the Facility to the System. The RTU shall be connected to the Owners' SCADA by a dedicated method with equal or better redundancy than for voice circuits. The data required from the RTU will be negotiated and specified in the Connection and Operations Agreement.

Bi-directional real and reactive power flow information including magnitude and direction shall be communicated instantaneously and continuously to the Owners via the data circuits.

5.1.6 Grounding and Safety Issues

Generation, Transmission and End-Use

The Facility shall conform to all applicable government and industry standards including but not limited to the National Electrical Safety Code, OSHA, National Electrical Code, IEEE Guides and Standards, ANSI Standards, NERC Standards, and to the Owners safety and installation standards. Strict adherence to established switching, tagging and grounding procedures will be required at all times. The Interconnection and Operations Agreement will document expected safety, switching and operating practices including tagging, outage scheduling and coordination/communication.

5.1.7 Surge Protection, Insulation and Insulation Coordination

Generation, Transmission and End-Use

The Protection studies, conducted after the Interconnection and Operations Agreement is executed and design is underway, will determine the insulation levels and surge protection required for all connecting facilities including those on the Facility side of the Connection and at the Facility. Requirements will vary by Owner and by location. Additional insulation beyond normal industry requirements may be required due to the high keraunic levels of Florida and the potential for salt build-up on insulators. Depending on the location of the Facility and the Connection in proximity to the shoreline, it may be necessary to wash insulators periodically to eliminate salt accumulation on the insulators. The necessity and frequency of this maintenance

practice will be negotiated in the Interconnection and Operations Agreement, in addition to insulation and surge protection specifications.

5.1.8 Voltage, Reactive Power and Power Factor Control

Generation

All generators must contribute reactive power to the Bulk Electric System in order to maintain the Bulk Electric System's reliability. NERC Standards require that generator owners and operators and transmission operators work jointly to optimize the use of reactive power capability (Standards VAR-001 and VAR-002 or any standards that supersede or supplement these). Therefore, all generation owners and operators that desire to Interconnect to the System shall be required to operate its automatic voltage controls (such as Automatic Voltage Regulators for synchronous generators) in voltage control mode to maintain a proscribed voltage schedule. A study will be performed after the Interconnection and Operations Agreement is executed to determine a voltage schedule and GSU no-load tap settings for the Facility in accordance with NERC Standards VAR-001 and VAR-002 and their successors and supplements.

The Owners maintain similar voltages to that of nearby Transmission Operators. For instance, Owners located close to Florida Power and Light (FPL) (e.g., Beaches Energy Services, Fort Pierce, Vero Beach, Clewiston) try to maintain a similar voltage schedule to FPL's voltage schedule.

Transmission

The Connection System Impact Study will identify voltage issues and reactive power issues associated with new transmission connections. If the Facility, Interconnection and the System do not perform within criteria limits (e.g., no continuous voltage excursions beyond +/- 5%, no danger of voltage collapse, etc.), the Applicant will need to install reactive compensation (active and/or passive) to cause the Facility, Interconnection and System to perform within criteria limits, and the System to perform no worse than before the Facility's Interconnection.

End Use

The transmission of FMPA and its All Requirements Project Participants (ARPP) are in three Zones:

- Central Zone - Kissimmee
- East Zone - those cities within Florida Power and Light (FPL) service territory (e.g., Jacksonville Beach, Fort Pierce, Lake Worth, Key West and Clewiston)
- West Zone – those cities within Duke Energy Florida (DEF) service territory (e.g., Ocala)

For the East and West, FPL and DEF place power factor requirements on FMPA and its ARPP that FMPA and its ARPP will also require of end users in those same Zones. For the Central zone, FMPA and KUA will adopt FPL's requirements.

The Applicant should design and operate its load connections so that the load power factor measured at the delivery point or interconnection point is in accordance with the following:

- Central Zone: between 0.95 lagging and 0.99 leading as measured at the time of the yearly Central Zone summer peak load.
- East Zone: between 0.95 lagging and 0.99 leading as measured at the time of the yearly FPL System summer peak load (see FPL's Facility Interconnection Requirements document)
- West Zone: between 0.95 lagging and 0.99 leading as measured at the time of the yearly DEF System summer peak load and DEF System winter peak load (see Attachment V of DEF's OATT)

The End User loads or delivery points that are within close electrical/geographical proximity and/or are connected to a common transmission line may aggregate power factors (by summing delivery point kW and kVar values at their delivery points / interconnection points), such that the collective power factor for the aggregated delivery points at the time of the Zonal peak load is compared to the power factor requirement. To the extent that FMPA deems there are reactive issues at other times, these will be addressed on a case by case basis.

Each Zone occasionally experiences unusually high loads outside of the peak period (e.g. 7 a.m. peak loads associated with winter cold fronts). Load serving entities should cooperate to the extent feasible with requests from FMPA or its agent to help support system voltage.

For transmission level delivery points, the End User shall adhere to the power factor requirements set forth herein except for: (1) temporary outages of equipment; (2) with FMPA's written consent, which shall not be unreasonably withheld, consistent with Good Utility Practice; or (3) as may occur in the event of a higher than anticipated Zonal peak load, i.e., the Zonal peak load is higher than the forecasted Zonal peak load as reflected in the projections included in the previous year's Ten Year Site Plan. If the necessary reactive compensation and control to comply with the power factor requirements has not been provided, or FMPA deems that documentation demonstrating use of due diligence to resolve the matter is unsatisfactory, best efforts shall be used to install, or to contract with others to have installed, the necessary equipment to meet the power factor requirements set forth herein within the shortest practicable time.

5.1.9 Power Quality Impacts

Generation, Transmission and End Use

The Facility shall not degrade the quality of the System's voltage or current and shall operate within limits as established by the following standards and guidelines:

Table 3
Power Quality Requirements

Continuous Voltage Variations	ANSI C84.1
Harmonics	IEEE Standard 519
Voltage Flicker	IEC 61000-2-2, IEEE 1453
Voltage Balance, Negative Sequence Voltage and Current	ANSI / NEMA MG1, IEEE 112, ANSI C84.1
Switching Transients	Within the applicable limits of surge arrestors and insulation as determined through study

Additional analysis may be necessary (e.g., harmonics studies, transient studies) at the Facilities Study stage to determine whether Power Quality criteria are met. If not, additional equipment may need to be installed as part of the connection (e.g., harmonic filters, additional surge protection, higher insulation levels, etc.)

5.1.10 Equipment Ratings

Generation, Transmission and End Use

All new equipment associated with the Facility and the interconnection shall be rated a minimum of 20% above the maximum loading determined by the studies referenced above for a 10 year planning horizon (except the GSU for a generator, which needs to be sized to the capacity of the generator). The Applicant is responsible for developing ratings methodologies and ratings for equipment owned by the Applicant. The Owners are responsible for developing rating methodologies and ratings for equipment owned by the Owners (e.g., NERC Standard FAC-008-3).

5.1.11 Synchronizing of Facilities

Generation, Transmission and End Use

The Applicant shall be responsible for the proper synchronization of the Facility to the System. All synchronization of the Facility to the System shall be with the circuit breaker on the high side of the Facility or on the Applicant's side of the Interconnection. Under no circumstances shall the Owners' circuit breakers be used for this task.

All generation and networked transmission facilities will be required to have at least one functional synchronizing check relay (IEEE Device 25) that supervises the

connection and prevents asynchronous closing and/or closing under large voltage or angular differences. Additional synchronizing requirements will be negotiated in the Interconnection and Operations Agreement.

5.1.12 Maintenance Coordination

Generation and Transmission

The Applicant is solely responsible for all maintenance of equipment owned by the Applicant unless the Owners have reserved for themselves specific maintenance items as part of the Interconnection and Operations Agreement.

The removal of the Facility from service for routine maintenance shall be scheduled with the Owners a minimum of six (6) months prior to beginning, and the Owners shall have the right to modify said schedule if short term operations planning projects potential issues that may compromise the reliability of the Bulk Electric System. No removal for routine maintenance will be allowed if the Facility's capacity is required to meet projected demands during the projected outage period.

End Use

The Facility owner is solely responsible for all maintenance of the Facility and the Connection equipment owned by the Applicant unless the Owners have reserved for themselves specific maintenance items as part of the Connection and Operations Agreement

5.1.13 Operational Issues (abnormal frequency and voltages)

Generation, Transmission and End Use

The Interconnection and Operations Agreement will have within it provisions for the Owners or its agent to direct the operation of the Applicant's Facility in accordance with NERC Standards IRO-001 and TOP-001, and their successors and supplements.

NERC Standard PRC-002, and its successors and supplements, may require the Applicant to install Disturbance Monitoring Equipment. The Applicant will install such monitoring equipment if it is deemed necessary by the standards. Installation, maintenance, testing and operations of the Disturbance Monitoring Equipment will be addressed in the Interconnection and Operations Agreement, including provisions to install such equipment at a later date

Generation

Generation units larger than 50 MVA shall install and establish control parameters for a power system stabilizer (PSS), and the Facility will operate with the PSS in service if directed by the Owners based on the Studies above.

All new synchronous generators connected to the System with a nameplate rating greater than 20 MVA shall be equipped with a speed/load governing control that has a speed droop characteristic in the 3 to 6% range. The preferred droop characteristic setting is 5% as this is the typical setting for generators in peninsular Florida.

The generator and its protection systems shall be designed to meet the performance requirements of NERC Reliability Standard PRC-024 and its successor and supplements to ensure that the Facility can "ride through" frequency deviations of pre-determined magnitudes. The term "ride through" refers to the ability of the generator to remain connected to and synchronized with the Bulk Electric System during frequency excursions of pre-determined size and duration.

Generating facilities must be designed to remain on line and delivering energy (supplying current) for normal clearing system faults within the close proximity to the plant switchyard. Voltage may approach zero at the switchyard bus for six cycles for some types of faults. Control systems, contactors, motors and auxiliary loads that might otherwise cause a generator trip if lost must not drop out under these conditions. Critical contactors must be provided with ride-through capability where required.

Non-synchronous generation connected with inverters, such as solar and wind, shall not use momentary cessation for disturbances where voltage and frequency remain within the no-trip zone of the PRC-024 standard curves. The Applicant shall advise of the Owners of any use of momentary cessation outside the PRC-024 curve no-trip zone and its detailed settings, and shall provide suitable models for use in dynamic stability simulations.

Transmission

In the course of studies described above (e.g., System Impact Study), and in the course of annual planning studies, there may come a time when it is determined that the Applicant's Transmission Facility may require specialized protection systems, such as out-of-step relaying, to maintain the reliability of the Bulk Electric System. If such specialized protection is deemed to be necessary, then the Applicant will be required to install the relaying. Installation, maintenance, testing and operations of the specialized protection system equipment will be addressed in the Interconnection and Operations Agreement, including provisions to install such equipment at a later date.

End Use

Under-Frequency Load Shedding (UFLS) and/or Under-Voltage Load Shedding (UVLS) equipment may need to be installed at the Interconnection or at the Facility to meet the Owners' obligations for NERC Standards PRC-006 and associated FRCC program documents. Installation, maintenance, testing and operations of the UFLS or UVLS equipment will be addressed in the Interconnection and Operations Agreement, including provisions to install such equipment at a later date.

5.1.14 Inspection Requirements for Existing or New Facilities

Generation, Transmission and End Use

The Owners shall have the right to inspect any and all portions of new or upgraded Facility and Interconnection that in any way actually or potentially impact the System. Inspection rights will be negotiated as part of the Interconnection and Operations Agreement.

5.1.15 Communications and Procedures - Normal and Emergency Operating Conditions

Generation, Transmission and End Use

During normal and emergency operating conditions, the Florida Municipal Power Pool (FMPP) (who is the Owners' Balancing Authority), the Owners' operations group, the Transmission Operator and the Reliability Coordinator are responsible for maintaining a safe and reliable Bulk Electric System. Should the Facility or any portion therefore be located within the metered boundary of another Balancing Authority (other than FMPP), that BA must also coordinate with FMPP and is included in this section. All facilities connected to the System shall immediately follow directives issued by any of these and/or their designee in accordance with NERC Standards, particularly IRO-001 and TOP-001 and their successors and supplements.

Specific details regarding these functions will be included in the Interconnection and Operations Agreement.

6 Approval

Approved by:

Carl J. Turner
Engineering Services Manager

12-30-2018
Date

Version #	Date	Revision	Revision By	Authorized By	Signature
0	August 29, 2007	Version 0	Frank Gaffney	Rick Casey	
1	March 23, 2009	Reviewed document – no changes made	Frank Gaffney	Frank Gaffney	
2	April 21, 2009	Added Cover Page	Frank Gaffney	Frank Gaffney	
3	August 26, 2010	Errata Revision	Frank Gaffney	Frank Gaffney	
4	September 29, 2011	Revised Power Factor Requirements	Frank Gaffney	Frank Gaffney	
5	March 10, 2014	Minor revisions to track FAC 001-1 Changed “Progress” to “Duke”	Cara Gowan	Frank Gaffney	
6	December 29, 2018	Updated Document to align with FAC-001-3	Carl Turner	Carl Turner