Xcel Energy

Distributed Generation Interconnection Manual

Interconnection Process for Distributed Generation Systems

Interconnection Agreement
For the Interconnection of
Extended Parallel Distributed Generation Systems

Application to Interconnect Form

Engineering Data Submittal Form

Interconnection Requirements for Extended Paralleled Distribution Generation Systems

Version Date
September 14, 2007

Interconnection Process
for Distributed Generation Systems

Introduction

This document has been prepared to explain the process established to interconnect a Generation System with the Xcel Energy (Company) electric distribution system. This document covers the interconnection process for all types of Generation Systems that are rated 10 MWs or less of total generation Nameplate Capacity; are planned for interconnection with the Company's distribution system; are not intended for wholesale transactions; and are not anticipated to affect the transmission system. This document does not discuss the interconnection Technical Requirements, which are covered in the **"**Interconnection Requirements for Extended Paralleled Distribution Generation Systems**"** document. This interconnection requirements document also provides definitions and explanations of the terms utilized within this document. To interconnect a Generation System with the Company, several steps must be followed. This document outlines those steps and the Parties' responsibilities. At any point in the process, if there are questions, please contact the Generation Interconnection Coordinator at the Company. Since this document has been developed to provide an interconnection process that covers a very diverse range of Generation Systems, the process may appear to be very involved and cumbersome. For many Generation Systems, the process is streamlined and provides an easy path for interconnection.

The promulgation of interconnection standards for Generation Systems must be done in the context of a reasonable interpretation of the boundary between state and federal jurisdiction. The Federal Energy Regulatory Commission (FERC) has asserted authority in the area, at least as far as interconnection at the transmission level is concerned. This, however, leaves open the question of jurisdiction over interconnection at the distribution level. The Midwest Independent System Operator's (MISO) FERC Electric Tariff, (first revised volume 1, August 23,2001) Attachment R (Generator Interconnection Procedures and Agreement) states in Section 2.1:

> "Any existing or new generator connecting at transmission voltages, sub-transmission voltages, or distribution voltages, planning to engage in the sale for resale of wholesale energy, capacity, or ancillary services requiring transmission service under the Midwest ISO OATT must apply to the Midwest ISO for interconnection service".

Further in Section 2.4 it states:

> "A Generator not intending to engage in the sale of wholesale energy, capacity, or ancillary services under the Midwest ISO OATT, that proposes to interconnect a new generating facility to the distribution system of a Transmission Owner or local distribution utility interconnected with the Transmission System shall apply to the Transmission Owner or local distribution utility for interconnection".

It goes on further to state:

> "Where facilities under the control of the Midwest ISO are affected by such interconnection, such interconnections may be subject to the planning and operating protocols of the Midwest ISO…."

Through discussions with MISO personnel and as a practical matter, if the Generation System Nameplate Capacity is not greater in size than the minimum expected load on the distribution substation that is feeding the proposed Generation System, and the Generation System's energy is not being sold on the wholesale market, then that installation may be considered as not "affecting" the transmission system and the interconnection may be considered to be governed by this process. If the Generation System will be selling energy on the wholesale market or the Generation System's total Nameplate Capacity is greater than the expected distribution substation's minimum load, then the Applicant shall contact MISO (Midwest Independent System Operator) and follow their procedures.

FERC has issued a rule for interconnecting generation facilities to distribution systems as part of their Small Generator Interconnection Procedures (SGIP). This rule covers facilities from 0 to 20 MW. If a distribution connected facility requires MISO involvement as discussed above, it probably will fall under FERC jurisdiction and will need to be interconnected under the FERC SGIP rules.

General Information

A) Definitions

1) "Applicant" is defined as the person or entity who is requesting the interconnection of the Generation System with the Company and is responsible for ensuring that the Generation System is designed, operated, and maintained in compliance with the Technical Requirements.

2) "Area EPS" is the area electric power system that is also referred to as the Company electric distribution system in this document.

3) "Company" is defined as an electric power system (EPS) that serves a Local EPS. Note: Typically, the Company has primary access to public rights-of-way, priority crossing of property boundaries, etc.

4) "Company Operator" is the entity or group who operates the Company's electric distribution system.

5) "Dedicated Facilities" is the equipment that is installed due to the interconnection of the Generation System and not required to serve other Company customers.

6) "Distribution System" is the Company facilities that are not part of the Company Transmission System or any Generation System.

7) "Extended Parallel" means the Generation System is designed to remain connected with the Company for an extended period.

8) "Generation" is defined as any device producing electrical energy; i.e., rotating generators driven by wind, steam turbines, internal combustion engines, hydraulic turbines, solar, fuel cells, etc.; or any other electric producing device, including energy storage technologies.

9) "Generation Interconnection Coordinator" is the person or persons designated by the Company Operator to provide a single point of coordination with the Applicant for the generation interconnection process. For most installations, this is the Area Engineer assigned to the area of the proposed interconnection.

10) "Generation System" is the interconnected generator(s), controls, relays, switches, breakers, transformers, inverters and associated wiring and cables, up to the Point of Common Coupling.

11) "Interconnection Customer" is the party or parties who will own/operate the Generation System and are responsible for meeting the requirements of the agreements and Technical Requirements. This could be the Generation System applicant, installer, owner, designer, or operator.

12) "Local EPS" is an electric power system (EPS) contained entirely within a single premises or group of premises.

13) "Nameplate Capacity" is the total nameplate capacity rating of all the Generation included in the Generation System. For this definition, the "standby" and/or maximum rated kW capacity on the nameplate shall be used.

14) "Open Transfer" is a method of transferring the local loads from the Company to the generator such that the generator and the Company are never connected together.

15) "Point of Common Coupling" is the point where the Local EPS or Generation Facility is connected to the Company's distribution system.

16) "Quick Closed" is a method of generation transfer that parallels for less than 100 msec with the Company and has utility grade timers that limit the parallel duration to less then 100 msec with the Company.

17) "Quick Open" is a method of generation transfer that does not parallel with the Company and has a brief open interval, typically about 100 msec.

18) Soft Loading Transfer is a method of generation load transfer that parallels for typically less than 2 minutes to gradually transfer load between the generator and the Company.

19) "State" is the state wherein the interconnected generator is located.

20) "Technical Requirements" "is the Company "Interconnection Requirements for Extended Paralleled Distribution Generation Systems".

21) "Transmission System" means those facilities as defined by using the guidelines established by FERC.

B) Dispute Resolution

The following is the dispute resolution process to be followed for problems that occur with the implementation of this process.

Each Party agrees to attempt to resolve all disputes arising hereunder promptly, equitably, and in a good faith manner. In the event a dispute arises under this process, and if it cannot be resolved by the Parties within thirty (30) days after written notice of the dispute to the other Party, the Parties shall submit the dispute to mediation by a mutually acceptable mediator, in a mutually convenient location in the same state as the Generation Facility location. The Parties agree to participate in good faith in the mediation for a period of 90 days. If the parties are not successful in resolving their disputes through mediation, then the Parties may refer the dispute for resolution to the Public Utilities Commission of the state in which the Generation Facility is located, which shall maintain continuing jurisdiction over this process. The rules of that state's PUC shall govern the dispute resolution.

C) Company Generation Interconnection Coordinator

Each Company Operator shall designate a Generation Interconnection Coordinator(s) and this person or persons shall provide a single point of contact for an Applicant's questions on this Generation Interconnection process. The Company Operator may have several Generation Interconnection Coordinators assigned, due to the geographical size of the electrical service territory or the amount of interconnection applications. This Generation Interconnection Coordinator will typically not be able to directly answer or resolve all of the issues involved in the review and implementation of the interconnection process and standards, but shall be available to provide coordination assistance with the Applicant. The Applicant is encouraged to discuss with or attend a pre-scoping meeting with the Coordinator to discuss potential difficulties, alternatives, and system compatibility issues before filing an application to interconnect.

D) Engineering Studies

During the process of design of a Generation System interconnection between a Generation System and the Company, there are several studies that many need to be undertaken. On the Local EPS (Customers side of the interconnection), the addition of a Generation System may increase the fault current levels, even if the generation is never interconnected with the Company's system. The Interconnection Customer may need to conduct a fault current analysis of the Local EPS in conjunction with adding the Generation System. The addition of the Generation System may also affect the Company and special engineering studies may need to be undertaken looking at the Company with the Generation System included. Appendix D lists some of the issues that may need to receive further analysis for the Generation System interconnection.

While it is not a straightforward process to identify which engineering studies are required, we can use screening criteria to identify which Generation Systems may require further analysis. The following are the basic screening criteria to be used for this interconnection process:

1) Generation System total Nameplate Capacity does not exceed 5% of the radial circuit expected peak load. The peak load is the total expected load on the radial circuit when the other generators on that same radial circuit are not in operation.

2) The aggregate generation's total Nameplate Capacity, including all existing and proposed generation, does not exceed 25% of the radial circuit peak load and that total is less than the radial circuit's minimum load.

3) Generation System does not exceed 15% of the Annual Peak Load for the Line Section with which it will interconnect. A Line Section is defined as that section of the distribution system between two sectionalizing devices in the Company's distribution system.

4) Generation System does not contribute more than 10% to the distribution circuit's maximum fault current at the point of interconnection with the Company's primary distribution voltage.

5) The proposed Generation System total Nameplate Capacity, in aggregate with other generation on the distribution circuit, will not cause any distribution protective devices and equipment to exceed 85 percent of the short circuit interrupting capability.

6) If the proposed Generation System is to be interconnected on a single-phase shared secondary, the aggregate generation Nameplate Capacity on the shared secondary, including the proposed generation, does not exceed 20 kW.

7) Generation System will not be interconnected with a “networked” system.

E) Scoping Meeting

During Step 2 of this process, the Applicant or the Company Operator has the option to request a scoping meeting. The purpose of the scoping meeting shall be to discuss the Applicant’s interconnection request and review the application filed. This scoping meeting is to be held so that each Party can gain a better understanding of the issues involved with the requested interconnection. The Company and Applicant shall bring to the meeting personnel, including system engineers, and other resources as may be reasonably required, to accomplish the purpose of the meeting. The Applicant shall not expect the Company to complete the preliminary review of the proposed Generation System at the scoping meeting. If a scoping meeting is requested, the Company shall schedule the scoping meeting within the 15 business day review period allowed for in Step 2. The Company shall then have an additional 5 days, after the completion of the scoping meeting to complete the formal response required in Step 2. The Application fee shall cover the Company’s costs for this scoping meeting. There shall be no additional charges imposed by the Company for this initial scoping meeting.

F) Insurance

1) At a minimum, in connection with the Interconnection Customer’s performance of its duties and obligations under the Interconnection Agreement, the Interconnection Customer shall maintain, during the term of the Agreement, general liability insurance, from a qualified insurance agency with a B+ or better rating by “Best” and with a combined single limit of not less than:

   a) Two million dollars ($2,000,000) for each occurrence if the Gross Nameplate Rating of the Generation System is greater then 250 kW.

   b) One million dollars ($1,000,000) for each occurrence if the Gross Nameplate Rating of the Generation System is between 20 kW and 250 kW.

   c) Three hundred thousand ($300,000) for each occurrence if the Gross Nameplate Rating of the Generation System is less than 20 kW.

   d) Such general liability insurance shall include coverage against claims for damages resulting from (i) bodily injury, including wrongful death; and (ii) property damage arising out of the Interconnection Customer’s ownership and/or operation of the Generation System under this agreement.

2) The general liability insurance required shall, by endorsement to the policy or policies, (a) include the Company Operator as an additional insured; (b) contain a severability of interest clause or cross-liability clause; (c) provide that the Company Operator shall not by reason of its inclusion as an additional insured incur liability to the insurance carrier for the payment of premium for such insurance; and (d) provide for thirty (30) calendar days’ written notice to the Company Operator prior to cancellation, termination, alteration, or material change of such insurance.

3) If the Generation System is connected to an account receiving residential service from the Company Operator and it total generating capacity is 20 kW or smaller, then the endorsements required in Section F.2 shall not apply.

4) The Interconnection Customer shall furnish the required insurance certificates and endorsements to the Company Operator prior to the initial operation of the Generation System. Thereafter, the Company Operator shall have the right to periodically inspect or obtain a copy of the original policy or policies of insurance

5) Evidence of the insurance required in Section F.1 shall state that coverage provided is primary and is not excess to or contributing with any insurance or self-insurance maintained by the Company Operator.

6) If the Interconnection Customer is self-insured with an established record of self-insurance, the Interconnection Customer may comply with the following in lieu of Section F.1 - F.5:

7) Interconnection Customer shall provide to the Company Operator, at least thirty (30) days prior to the date of initial operation, evidence of an acceptable plan to self-insure to a level of coverage equivalent to that required under Section F.1 - F.5.

8) If Interconnection Customer ceases to self-insure to the level required hereunder, or if the Interconnection Customer is unable to provide continuing evidence of it's ability to self-insure, the Interconnection Customer agrees to immediately obtain the coverage required under Section F.1 - F.5.

Failure of the Interconnection Customer or Company Operator to enforce the minimum levels of insurance does not relieve the Interconnection Customer from maintaining such levels of insurance or relieve the Interconnection Customer of any liability.

G) Pre-Certification

The most important part of the process for interconnecting generation with Local and Company's systems is safety. One of the key components of ensuring the safety of the public and employees is to ensure that the design and implementation of the elements connected to the electrical power system operate as required. To meet this goal, all of the electrical wiring in a business or residence, is required to be listed by a recognized testing and certification laboratory for its intended purpose. Typically, we see this as "UL" listed. Since Generation Systems have tended to be uniquely designed for each installation, they have been designed and approved by Professional Engineers. This process has been set up to be able to deal with these uniquely designed systems. As the number of Generation Systems installed increase, vendors are working towards creating equipment packages that can be type-tested in the factory and then will only require limited field-testing. This will allow us to move towards "plug and play" installations. For this reason, this interconnection process recognizes the efficiently of "pre-certification" of Generation System equipment packages that will help streamline the design and installation process.

An equipment package shall be considered certified for interconnected operation if it has been submitted by a manufacture to and tested and listed by a nationally recognized testing and certification laboratory (NRTL) for continuous utility interactive operation in compliance with the applicable codes and standards. Presently generation paralleling equipment that is listed by a nationally recognized testing laboratory as having met the applicable type-testing requirements of IEEE 1547.1, including UL 1741, shall be acceptable for interconnection. An "equipment package" shall include all interface components including switchgear, inverters, or other interface devices and may include an integrated generator or electric source. If the equipment package has been type-tested and listed as an integrated package which includes a generator or other electric source, it shall not require further design review, testing or additional equipment to meet the certification requirements for interconnection. If the equipment package includes only the interface components (switchgear, inverters, or other interface devices), then the Interconnection Customer shall show that the generator or other electric source being utilized with the equipment package is compatible with the equipment package and consistent with the testing and listing specified for the package. Provided the generator or electric source combined with the equipment package is consistent with the testing and listing performed by the nationally recognized testing and certification laboratory, no further design review, testing or additional equipment shall be required to meet the certification requirements of this interconnection procedure. A certified equipment package does not include equipment provided by the Company.

The use of Pre-Certified equipment does not automatically qualify the Interconnection Customer to be interconnected to the Company. An application will still need to be submitted and an interconnection review may still need to be performed, to determine the compatibility of the Generation System with the Company. Typically, small Generation facilities utilizing pre-certified equipment would not be required to provide additional protective equipment. For larger installations, some additional equipment is often required. These aspects are discussed further in the interconnection requirements document.

H) Confidential Information

Except as otherwise agreed, each Party shall hold in confidence and shall not disclose confidential information to any person (except employees, officers, representatives, and agents who agree to be bound by this section). Confidential information shall be clearly marked as such on each page or otherwise affirmatively identified. If a court, government agency, or entity with the right, power, and authority to do so, requests or requires either Party, by subpoena, oral disposition, interrogatories, requests for production of documents, administrative order, or otherwise, to disclose Confidential Information, that Party shall provide the other Party with prompt notice of such request(s) or requirements(s) so that the other Party may seek an appropriate protective order or waive compliance with the terms of this Agreement. In the absence of a protective order or waiver, the Party shall disclose such confidential information which, in the opinion of its counsel, the party is legally compelled to disclose. Each Party will use reasonable efforts to obtain reliable assurance that confidential treatment will be accorded any confidential information so furnished.

I) Non-Warranty

Neither by inspection, if any, or non-rejection, nor in any other way, does the Company Operator give any warranty, expressed or implied, as to the adequacy, safety, or other characteristics of any structures, equipment, wires, appliances or devices owned, installed or maintained by the Applicant or leased by the Applicant from third parties, including without limitation the Generation System and any structures, equipment, wires, appliances or devices pertinent thereto.

J) Required Documents

The chart below lists the documents required for each type and size of Generation System proposed for interconnection. Find your type of Generation System interconnection, across the top, then follow the chart straight down, to determine what documents are required as part of the interconnection process.

<table>
<tr><th colspan="5">GENERATION INTERCONNECTION DOCUMENT SUMMARY</th></tr>
<tr><th rowspan="2">Open Transfer</th><th rowspan="2">Quick Closed & Quick Open Transfer</th><th rowspan="2">Soft Loading Transfer</th><th colspan="2">Extended Parallel Operation</th></tr>
<tr><th>QF facility <=20 kW</th><th>Without Sales</th><th>With Sales</th></tr>
<tr><td colspan="5">Interconnection Process (This document)</td></tr>
<tr><td></td><td colspan="4">Interconnection Requirements for Extended Paralleled Distribution Generation Systems</td></tr>
<tr><td></td><td colspan="4">Generation Interconnection Application (Appendix B)</td></tr>
<tr><td></td><td></td><td colspan="3">Engineering Data Submittal (Appendix C)</td></tr>
<tr><td></td><td></td><td></td><td colspan="2">Interconnection Agreement (Appendix E)</td></tr>
<tr><td></td><td></td><td></td><td></td><td>MISO / FERC</td></tr>
<tr><td></td><td></td><td></td><td></td><td>PPA</td></tr>
</table>

Interconnection Process = “Interconnection Process for Distributed Generation Systems.” (This document)

Generation Interconnection Application = The application form in Appendix B of this document.

Engineering Data Submittal = The Engineering Data Form/Agreement, which is attached as Appendix C of this document.

Interconnection Agreement = “Interconnection Agreement for the Interconnection of Extended Parallel Distributed Generation Systems with the Company”, which is attached as Appendix E to this document.

MISO = Midwest Independent System Operator, www.midwestiso.org

FERC = Federal Energy Regulatory Commission, www.ferc.gov

PPA = Power Purchase Agreement.

Process for Interconnection

Step 1 Application (By Applicant)

Once a decision has been made by the Applicant that they would like to interconnect a Generation System with the Company, the Applicant shall supply the Company with the following information:

1) Completed Generation Interconnection Application (Appendix B), including;
   a) One-line diagram showing:
      i) Protective relaying.
      ii) Point of Common Coupling.
   b) Site plan of the proposed installation.
   c) Proposed schedule of the installation.
2) Payment of the application fee, according to the following sliding scale:

Generation Interconnection Application Fees

Interconnection Type	≤ 20 kW	>20 kW & ≤250 kW	>250 kW & ≤500 kW	> 500 kW & ≤1000 kW	>1000 kW
Open Transfer	$0	$0	$0	$100	$100
Quick Closed & Quick Open	$0	$100	$100	$250	$500
Soft Loading	$100	$250	$500	$500	$1000
Extended Parallel (Pre-Certified System)	$0	$250	$1000	$1000	$1500
Other Extended Parallel Systems	$100	$500	$1500	$1500	$1500

This application fee is to contribute to the Company Operator's labor costs for administration, review of the design concept, and preliminary engineering screening for the proposed Generation System interconnection.

For the Application Fees chart above:
The size (kW) of the Generation System is the total maximum Nameplate Capacity of the Generation System.

Step 2 Preliminary Review (By the Company)

Within 15 business days of receipt of all the information listed in Step 1, the Company's Generation Interconnection Coordinator shall respond to the Applicant with the information listed below. (If the information required in Step 1 is not complete, the Applicant will be notified, within 10 business days of what is missing and no further review will be completed until the missing information is submitted. The 15-day clock will restart with the new submittal)

As part of Step 2, the proposed Generation System will be screened to see if additional Engineering Studies are required. The base screening criteria is listed in the general information section of this document.

1) A single point of contact with the Company Operator for this project. (Generation Interconnection Coordinator)

2) Approval or rejection of the generation interconnection request.
   a) Rejection – The Company shall supply the technical reasons, with supporting information, for rejection of the interconnection Application.
   b) Approval - An approved Application is valid for 6 months from the date of the approval. The Company Generation Interconnection Coordinator may extend this time if requested by the Applicant.

3) If additional specialized engineering studies are required for the proposed interconnection, the following information will be provided to the Applicant. Typical Engineering Studies are outlined in Appendix D. The costs to the Applicant, for these studies will not exceed the values shown in the following table for pre-certified equipment.

Generation System Size	Engineering Study Maximum Costs
<20 kW	$0
20 kW – 100 kW	$500
100 kW – 250 kW	$1000
>250 kW or not pre-certified equipment	Actual costs

a) General scope of the engineering studies required.
b) Estimated cost of the engineering studies.
c) Estimated duration of the engineering studies.
d) Additional information required allowing the completion of the engineering studies.
e) Study authorization agreement.

4) Comments on the schedule provided.

5) If the rules of MISO (Midwest Independent System Operator) require that this interconnection request be processed through the MISO process, the Generation Interconnection Coordinator will notify the Applicant that the generation system is not eligible for review through the State process.

Step 3 Go-No Go Decision for Engineering Studies (By Applicant)

In this step, the Applicant will decide whether or not to proceed with the required engineering studies for the proposed generation interconnection. If no specialized engineering studies are required by the Company Operator, the Company Operator and the Applicant will automatically skip this step.

If the Applicant decides NOT to proceed with the engineering studies, the Applicant shall notify the Company Generation Interconnection Coordinator so other generation interconnection requests in the queue are not adversely impacted. Should the Applicant decide to proceed, the Applicant shall provide the following to the Company Generation Interconnection Coordinator:

1) Payment required by the Company Operator for the specialized engineering studies.

2) Additional information requested by the Company Operator to allow completion of the engineering studies.

Step 4 Engineering Studies (By Company)

In this step, the Company Operator will be completing the specialized engineering studies for the proposed generation interconnection as outlined in Step 2. These studies should be completed in the time frame provided in Step 2, by the Company. It is expected that the Company Operator shall make all reasonable efforts to complete the Engineering Studies within the time frames shown below. If additional time is required to complete the engineering studies, the Generation Interconnection Coordinator shall notify the Applicant and provide the reasons for the time extension. Upon receipt of written notice to proceed, payment of applicable fee, and receipt of all engineering study information requested by the Company Operator in Step 2, the Company Operator shall initiate the engineering studies.

Generation System Size	Engineering Study Completion
<=20 kW	20 working days
>20 kW – 250 kW	30 working days
>250 kW – 1 MW	40 working days
> 1 MW	90 working days

Once it is known by the Company Operator that the actual costs for the engineering studies will exceed the estimated amount by more the 25%, then the Applicant shall be notified. The Company Operator shall then provide the reason(s) for

the studies needing to exceed the original estimated amount and provide an updated estimate of the total cost for the engineering studies. The Applicant shall be given the option of either withdrawing the application, or paying the additional estimated amount to continue with the engineering studies.

Step 5 Study Results and Construction Estimates (By the Company)

Upon completion of the specialized engineering studies, or if none were necessary, the following information will be provided to the Applicant.

1) Results of the engineering studies, if needed.

2) Monitoring & control requirements for the proposed generation.

3) Special protection requirements for the Generation System interconnection.

4) Comments on the schedule proposed by the Applicant.

5) Interconnection Agreement (if applicable).

6) Cost estimate and payment schedule for required Company work, including, but not limited to;
   a) Labor costs related to the final design review.
   b) Labor & expense costs for attending meetings.
   c) Required Dedicated Facilities and other Company modification(s).
   d) Final acceptance testing costs.

Step 6 Final Go-No Go Decision (By Applicant)

In this step, the Applicant shall again have the opportunity to indicate whether they want to proceed with the proposed generation interconnection. If the decision is NOT to proceed, the Applicant will notify the Company Generation Interconnection Coordinator so that other generation interconnections in the queue are not adversely impacted. Should the Applicant decide to proceed, a more detailed design, if not already completed by the Company, must be done, and the following information is to be supplied to the Company Generation Interconnection Coordinator:

1) Applicable up-front payment required by the Company, per Payment Schedule provided in Step 5 (if applicable).

2) Signed Interconnection Agreement (if applicable).

3) Final proposed schedule incorporating the Company comments. The schedule of the project should include such milestones as foundations poured, equipment delivery dates, all conduit installed, cutover (energizing of the new switchgear/transfer switch), Company work, relays set and tested, preliminary vendor testing, final Company acceptance testing, and any other major milestones.

4) Detailed one-line diagram of the Generation System, including the generator, transfer switch/switchgear, service entrance, lockable and visible disconnect, metering, protection and metering CT's / VT's, protective relaying, and generator control system.

5) Detailed information on the proposed equipment including wiring diagrams, models, and types.

6) Proposed relay settings for all interconnection required relays.

7) Detailed site plan of the Generation System.

8) Drawing(s) showing the monitoring system (as required per table 5A and section 5 of the "Interconnection Requirements for Extended Paralleled Distribution Generation Systems"; including a drawing that shows the interface terminal block with the Company monitoring system.

9) Proposed testing schedule and initial procedure, including;
   a) Time of day (after-hours testing required?).
   b) Days required.

c) Testing steps proposed.

Step 7 Final Design Review (By the Company)

Within 15 business days of receipt of the information required in Step 6, the Company Generation Interconnection Coordinator will provide the Applicant with an estimated time table for final review. If the information required in Step 6 is not complete, the Applicant will be notified, within 10 business days of what information is missing. No further review may be completed until the missing information is submitted. The 15-business day clock will restart with the new submittal. This final design review shall not take longer then 15 additional business days to complete, for a total of 30 business days.

During this step, the Company shall complete the review of the final Generation System design. If the final design has significant changes from the Generation System proposed on the original Application, which invalidate the engineering studies or the preliminary engineering screening, the Generation System Interconnection Application request may be rejected by the Company Operator and the Applicant may be requested to reapply with the revised design.

Upon completion of this step, the Generation Interconnection Coordinator shall supply the following information to the Applicant.

1) Requested modifications or corrections of the detailed drawings provided by the Applicant.

2) Approval of and agreement with the Project Schedule. (This may need to be interactively discussed between the Parties during this Step)

3) Initial testing procedure review comments. (Additional work on the testing process will occur during Step 8, once the actual equipment is identified)

Step 8 Order Equipment and Construction (By Both Parties)

The following activities shall be completed during this step. For larger installations, this step will involve much interaction between the Parties. It is typical for approval drawings to be supplied by the Applicant to the Company for review and comments. It is also typical for the Company to require review and approval of the drawings that cover the interconnection equipment and interconnection protection system. If the Company also requires remote control and/or monitoring, those drawings are also exchanged for review and comment.

By the Applicant's personnel:

1) Ordering of Generation System equipment.
2) Installing Generation System.
3) Submit approval drawings for interconnection equipment and protection systems, as required by the Company Operator.
4) Provide final relay settings to the Company Operator.
5) Submit Completed and signed Engineering Data Submittal form.
6) Submit proof of insurance as required by the Company tariff(s) or interconnection agreements.
7) Submit required electrical inspection forms to the Company Operator.
8) Inspecting and functional testing Generation System components.
9) Work with the Company personnel and equipment vendor(s) to finalize the installation testing procedure.

By the Company personnel:

1) Ordering any necessary Company equipment.
2) Installing and testing any required equipment.
   a) Monitoring facilities.
   b) Dedicated Equipment.
3) Assisting Applicant's personnel with interconnection installation coordination issues.
4) Providing review and input for testing procedures.

Step 9 Final Tests (By Company / Applicant)

Due to equipment lead times and construction, a significant amount of time may take place between the execution of Step 8 and Step 9. During this time, the final test steps are developed and the construction of the facilities is completed. For installations 20 kW and under using pre-certified interconnection equipment, this step is typically highly abbreviated.

Final acceptance testing will commence when all equipment has been installed, all contractor preliminary testing has been accomplished, and all Company preliminary testing of the monitoring and dedicated equipment is completed. One to three weeks prior to the start of the acceptance testing of the generation interconnection, the Applicant shall provide a report stating:

- Generation System meets all interconnection requirements;
- contractor preliminary testing has been completed;
- protective systems are functionally tested and ready;
- and provides a proposed date that the Generation System will be is ready to be energized and acceptance tested.

For non-type certified systems a Professional Electrical Engineer registered in the State is required to provide this formal report.

For smaller systems, scheduling of this testing may be more flexible as less testing time is required than for larger systems.

In many cases, this testing is done after hours to ensure no typical business-hour load is disturbed. If acceptance testing occurs after hours, the Company Operator's labor will be billed at overtime wages. During this testing, the Company Operator will typically require three different tests. These tests can differ depending on which type of communication/monitoring system(s) the Company Operator decides to install at the site.

For problems created by the Company or any Company equipment problems that arise during testing, the Company will fix the problem as soon as reasonably possible. If problems arise during testing which are caused by the Applicant or Applicant's vendor or any vendor supplied or installed equipment, the Company will leave the project until the problem is resolved. Having the testing resume will then be subject to Company personnel's time and availability.

Step 10 (By Company)

After all of the Company Operator's required acceptance testing has been accomplished and all requirements are met, the Company Operator shall provide written approval for normal operation of the Generation System interconnection within 3 business days of the successful completion of the acceptance tests.

Step 11 (By Applicant)

Within two (2) months of interconnection, the Applicant shall provide the Company with updated drawings and prints showing the Generation System as approved for normal operation by the Company Operator. The drawings shall include all changes that were made during the construction and the testing process.

Attachments:

Attached are several documents that may be required for the interconnection process. They are as follows:

Appendix A: Flow chart showing summary of the interconnection process.

Appendix B: Generation Interconnection Application Form.

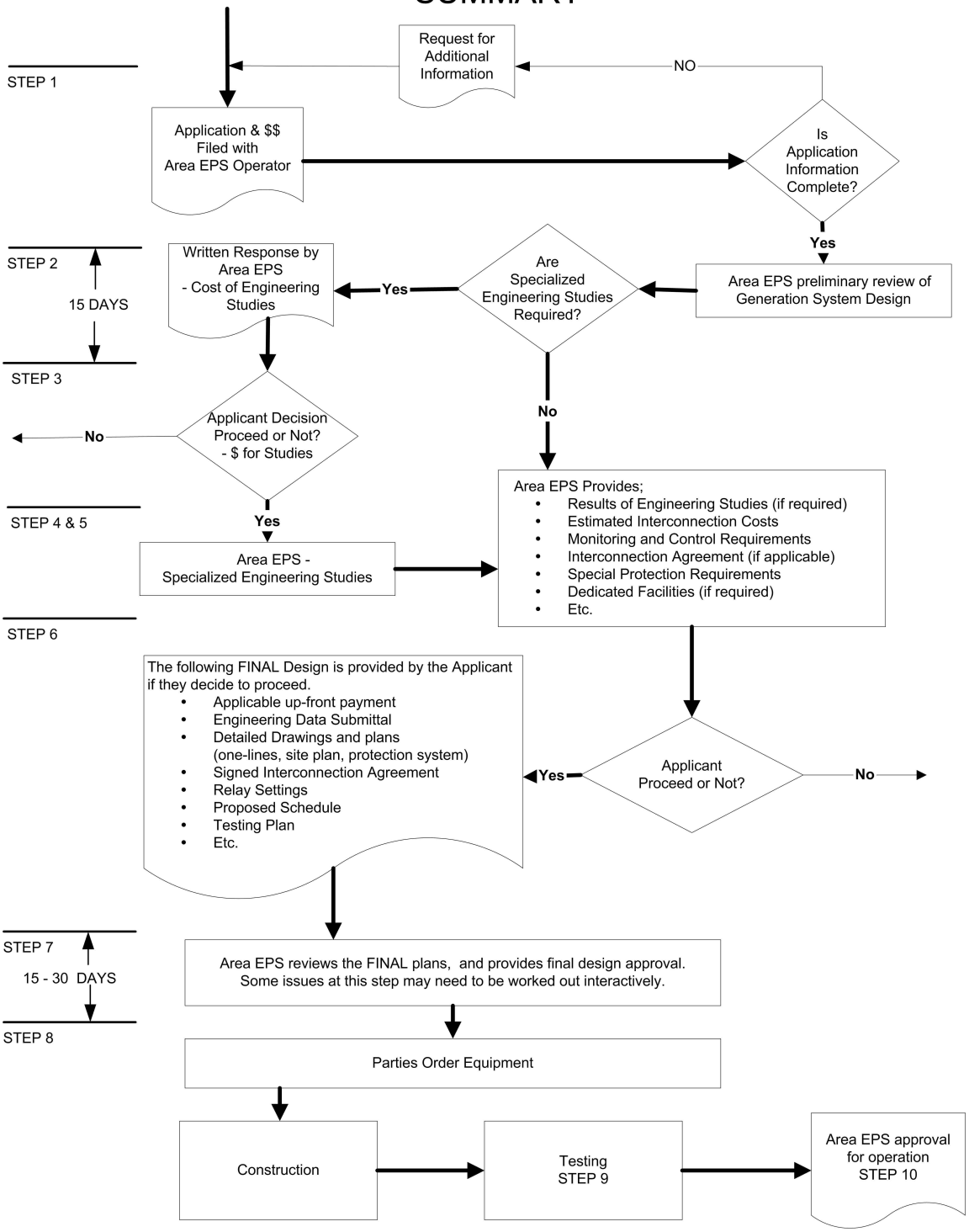
Appendix C: Engineering Data Submittal Form.

Appendix D: Engineering Studies: Brief description of the types of possible Engineering Studies that may be required for the review of the Generation System interconnection.

Appendix E: Interconnection Agreement for the Interconnection of Extended Paralleled Distributed Generation Systems with the Company.

.APPENDIX A

DISTRIBUTED GENERATION INTERCONNECTION PROCESS SUMMARY



APPENDIX B

Application to Interconnect Form

WHO SHOULD FILE THIS APPLICATION: Anyone expressing interest to install generation that will interconnect with the Company. This application should be completed and returned to the Company Generation Interconnection Coordinator in order to begin processing the request.
INFORMATION: This application is used by the Company Operator to perform a preliminary interconnection review. The Applicant shall complete as much of the form as possible. The fields in BOLD are required to be completed to the best of the Applicant's ability. The Applicant will be contacted if additional information is required. The response may take up to 15 business days after receipt of all the required information.
COST: A payment to cover the application fee shall be included with this application. The application fee amount is outlined in the "Interconnection Process for Distributed Generation Systems".

OWNER/APPLICANT		
Company / Applicant's Name:		
Representative:	**Phone Number:**	**FAX Number:**
Title:		
Mailing Address:		
Email Address:		
LOCATION OF GENERATION SYSTEM INTERCONNECTION		
Street Address, legal description or GPS coordinates:		
PROJECT DESIGN / ENGINEERING (if applicable)		
Company:		
Representative:	Phone:	FAX Number:
Mailing Address:		
Email Address:		
ELECTRICAL CONTRACTOR (if applicable)		
Company:		
Representative:	Phone:	FAX Number:
Mailing Address:		
Email Address:		
GENERATOR		
Manufacturer:		Model:
Type (Synchronous Induction, Inverter, etc):		**Phases: 1 or 3**
Rated Output (Prime kW):	**(Standby kW):**	**Frequency:**
Rated Power Factor (%):	**Rated Voltage (Volts):**	Rated Current (Amperes):
Energy Source (gas, steam, hydro, wind, etc.)		
TYPE OF INTERCONNECTED OPERATION		
Interconnection / Transfer method: **? Open ? Quick Open ? Closed ? Soft Loading ? Inverter**		
Proposed use of generation: (Check all that may apply) **? Peak Reduction ? Standby ? Energy Sales** **? Cover Load**	**Duration Parallel:** **? None ? Limited ? Continuous**	
Pre-Certified System: Yes / No (Circle one)	**Exporting Energy Yes / No (Circle one)**	

ESTIMATED LOAD INFORMATION

The following information will be used to help properly design the interconnection. This Information is not intended as a commitment or contract for billing purposes.

Minimum anticipated load (generation not operating):	**kW:**	**kVA:**
Maximum anticipated load (generation not operating):	**kW:**	**kVA:**

ESTIMATED START/COMPLETION DATES

Construction start date:	**Completion (operational) date:**

DESCRIPTION OF PROPOSED INSTALLATION AND OPERATION

Attach a single line diagram showing the switchgear, transformers, and generation facilities. Give a general description of the manner of operation of the generation (cogeneration, closed-transition peak shaving, open-transition peak shaving, emergency power, etc.). Also, does the Applicant intend to sell power and energy or ancillary services and/or wheel power over Company facilities? If there is intent to sell power and energy, also define the target market?

SIGN-OFF AREA:

With this Application, we are requesting the Company Operator to review the proposed Generation System Interconnection. We request that the Company identifies the additional equipment and costs involved with the interconnection of this system and to provide a budgetary estimate of those costs. We understand that the estimated costs supplied by the Company Operator will be estimated using the information provided. We also agree that we will supply, as requested, additional information to allow the Company Operator to better review this proposed Generation System interconnection. We have read the "Interconnection Requirements for Extended Paralleled Distribution Generation Systems" and will design the Generation System and interconnection to meet those requirements.

Applicant Name (print):

Applicant Signature: **Date:**

SEND THIS COMPLETED & SIGNED APPLICATION AND ATTACHMENTS TO THE COMPANY GENERATION INTERCONNECTION COORDINATOR

APPENDIX C

Engineering Data Submittal Form

WHO SHOULD FILE THIS SUBMITTAL: Anyone in the final stages of interconnecting a Generation System with the Company. This submittal shall be completed and provided to the Company Generation Interconnection Coordinator during the design of the Generation System as established in the "Interconnection Process for Distributed Generation Systems".

INFORMATION: This submittal is used to document the interconnected Generation System. The Applicant shall complete as much of the form as applicable. The Applicant will be contacted if additional information is required.

OWNER / APPLICANT		
Company / Applicant:		
Representative:	Phone Number:	FAX Number:
Title:		
Mailing Address:		
Email Address:		

PROPOSED LOCATION OF GENERATION SYSTEM INTERCONNECTION
Street Address, Legal Description or GPS coordinates:

PROJECT DESIGN / ENGINEERING (if applicable)		
Company:		
Representative:	Phone:	FAX Number:
Mailing Address:		
Email Address:		

ELECTRICAL CONTRACTOR (if applicable)		
Company:		
Representative:	Phone:	FAX Number:
Mailing Address:		
Email Address:		

TYPE OF INTERCONNECTED OPERATION	
Interconnection / Transfer method: ? Open ? Quick Open ? Closed ? Soft Loading ? Inverter	
Proposed use of generation: (Check all that may apply) ? Peak Reduction ? Standby ? Energy Sales ? Cover Load	Duration Parallel: ? None ? Limited ? Continuous
Pre-Certified System: Yes / No (Circle one)	Exporting Energy Yes / No (Circle one)

GENERATION SYSTEM OPERATION / MAINTENANCE CONTACT INFORMATION		
Maintenance Provider:	Phone #:	Pager #:
Operator Name:	Phone #:	Pager #:
Person to Contact before remote starting of units		
Contact Name:	Phone #:	Pager #:
	24 hr Phone #:	

GENERATION SYSTEM OPERATING INFORMATION	
Fuel Capacity (gals):	Full Fuel Run-time (hrs):
Engine Cool Down Duration (Minutes):	Start time Delay on Load Shed signal:
Start Time Delay on Outage (Seconds):	

ESTIMATED LOAD		
The following information will be used to help properly design the interconnection. This Information is not intended as a commitment or contract for billing purposes.		
Minimum anticipated load (generation not operating):	kW:	kVA:
Maximum anticipated load (generation not operating):	kW:	kVA:

REQUESTED CONSTRUCTION START/COMPLETION DATES	
Design Completion:	
Construction Start Date:	
Footings in place:	
Primary Wiring Completion:	
Control Wiring Completion:	
Start Acceptance Testing:	
Generation operational (In-service):	

(Complete all applicable items, copy these pages as required for additional generators)

SYNCHRONOUS GENERATOR (if applicable)

Unit Number:	Total number of units with listed specifications on site:		
Manufacturer:	Type:	Phases: 1 or 3	
Serial Number (each)	Date of manufacture:	Speed (RPM):	Freq. (Hz);
Rated Output (each unit) kW Standby:	kW Prime:	kVA:	
Rated Power Factor (%):	Rated Voltage (Volts):	Rated Current (Amperes):	
Field Voltage (Volts):	Field Current (Amperes):	Motoring Power (kW):	

Synchronous Reactance (X_d):	% on	kVA base
Transient Reactance (X'_d):	% on	kVA base
Subtransient Reactance (X''_d):	% on	kVA base
Negative Sequence Reactance (X_s):	% on	kVA base
Zero Sequence Reactance (X_o):	% on	kVA base

Neutral Grounding Resistor (if applicable):

I^2t or K (heating time constant):

Exciter data:

Governor data:

Additional Information:

INDUCTION GENERATOR (if applicable)

Rotor Resistance (R_r):	Ohms	Stator Resistance (R_s):	Ohms
Rotor Reactance (X_r):	Ohms	Stator Reactance (X_s):	Ohms
Magnetizing Reactance (X_m):	Ohms	Short Circuit Reactance (X_d''):	Ohms
Design Letter:		Frame Size:	
Exciting Current:		Temp Rise (deg C°):	

Rated Output (kW):

Reactive Power Required: kVArs (no Load) kVArs (full load)

If this is a wound-rotor machine, describe any external equipment to be connected (resistor, rheostat, power converter, etc.) to rotor circuit, and circuit configuration. Describe ability, if any, to adjust generator reactive output to provide power system voltage regulation.

Additional Information:

PRIME MOVER (Complete all applicable items)

Unit Number:	Type:		
Manufacturer:			
Serial Number:		Date of Manufacture:	
H.P. Rated:	H.P. Max:	Inertia Constant:	lb.-ft.^{2}

Energy Source (hydro, steam, wind, wind etc.):

INTERCONNECTION (STEP-UP) TRANSFORMER (If applicable)			
Manufacturer:		kVA:	
Date of Manufacture:		Serial Number:	
High Voltage:	kV	Connection: delta wye	Neutral solidly grounded?
Low Voltage:	kV	Connection: delta wye	Neutral solidly grounded?
Transformer Impedance (Z):		% on	kVA base
Transformer Resistance (R):		% on	kVA base
Transformer Reactance (X):		% on	kVA base
Neutral Grounding Resistor (if applicable)			

TRANSFER SWITCH (If applicable)	
Model Number:	Type:
Manufacturer:	Rating(amps):

INVERTER (If applicable)		
Manufacturer:	Model:	
Rated Power Factor (%):	Rated Voltage (Volts):	Rated Current (Amperes):
Inverter Type (ferroresonant, step, pulse-width modulation, etc.):		
Type of Commutation: forced line	Minimum Short Circuit Ratio required:	
Minimum voltage for successful commutation:		
Current Harmonic Distortion	Maximum Individual Harmonic (%): Maximum Total Harmonic Distortion (%):	
Voltage Harmonic Distortion	Maximum Individual Harmonic (%): Maximum Total Harmonic Distortion (%):	
Describe capability, if any, to adjust reactive output to provide voltage regulation:		
NOTE: Attach all available calculations, test reports, and oscillographic prints showing inverter output voltage and current waveforms.		

POWER CIRCUIT BREAKER (if applicable)					
Manufacturer:			Model:		
Rated Voltage (kilovolts):			Rated Ampacity (Amperes):		
Interrupting Rating (Amperes):			BIL Rating:		
Interrupting Medium (vacuum, oil, gas, etc.)			Insulating Medium (vacuum, oil, gas, etc.)		
Control Voltage (Closing):	(Volts)	AC	DC		
Control Voltage (Tripping):	(Volts)	AC	DC	Battery	Charged Capacitor
Close Energy (circle one):	Spring	Motor	Hydraulic	Pneumatic	Other
Trip Energy (circle one):	Spring	Motor	Hydraulic	Pneumatic	Other
Bushing Current Transformers (Max. ratio):			Relay Accuracy Class:		
CT'S Multi Ratio? (circle one); No / Yes:	(Available taps):				

MISCELLANEOUS (Use this area and any additional sheets for applicable notes and comments)

SIGN OFF AREA

This Engineering Data Submittal documents the equipment and design of the Generation System. We agree to supply the Company Operator with an updated Engineering Data Submittal any time significant changes are made in the equipment used or the design of the proposed Generation System. The Applicant agrees to design, operate, and maintain the Generation System within the requirements set forth by the "Interconnection Requirements for Extended Paralleled Distribution Generation Systems".

Applicant Name (print):

Applicant Signature: **Date:**

SEND THIS COMPLETED & SIGNED ENGINEERING DATA SUBMITTAL AND ANY ATTACHMENTS TO THE COMPANY GENERATION INTERCONNECTION COORDINATOR

APPENDIX D

Engineering Studies

For the engineering studies, there are two main parts of the study: 1. Does the distributed generator cause a problem? and 2. What would it cost to make a change to handle the problem? The first question is relatively straightforward to determine as the Company Engineer reviews the proposed installation. The second question typically has multiple alternatives and can turn into an iterative process. This iterative process can become quite large for more complex generation installations. For the Engineer, there is no "cook book" solution that can be applied.

For some of the large generation installations and/or the more complex interconnections, the Company Operator may suggest dividing the engineering studies into the two parts: 1. identify the scope of the problems, and 2. attempt to identify solutions to resolve the problems. By splitting the engineering studies into two steps, it will allow the Applicant to see the problems identified and to provide the Applicant the ability to remove the request for interconnection if the problems are too large and expensive to resolve. This would then save the additional costs to the Applicant for the more expensive engineering studies to identity ways to resolve the problem(s).

This appendix provides an overview of some of the main issues that are looked at during the engineering study process. Every interconnection has its unique issues, such as relative strength of the distribution system, ratio of the generation size to the existing area loads, etc. Thus, many of the generation interconnections will require further review of one or several of the issues listed.

- Short circuit analysis – the system is studied to make sure that the addition of the generation will not over stress any of the Company equipment and that equipment will still be able to clear during a fault. It is expected that the Applicant will complete their own short circuit analysis on their equipment to ensure that the addition of the generation system does not overstress the Applicant's electrical equipment.

- Power Flow and Voltage Drop
    - Reviews potential islanding of the generation.
    - Will Company Equipment be overloaded?
        - Under normal operation?
        - Under contingent operation?
        - With backfeeds?

- Flicker Analysis –
    - Will the operation of the generation cause voltage swings?
        - When it loads up?
        - When it off-loads?
    - How will the generation interact with Company voltage regulation?
    - Will Company capacitor switching affect the generation while on-line?

- Protection Coordination
    - Reclosing issues – this is where the reclosing for the distribution system and transmission system are looked at to see if the Generation System protection can be set up to ensure that it will clear from the distribution system before the feeder is reenergized.
        - Is voltage supervision of reclosing needed?
    - Is transfer-trip required?
    - Do we need to modify the existing protection systems? Existing settings?
    - At which points do we need "out of sync" protection?
    - Is the proposed interconnection protection system sufficient to sense a problem on the Company's system?
    - Are there protection problems created by the step-up transformer?

- Grounding Reviews
    - Does the proposed grounding system for the Generation System meet the requirements of the NESC? "National Electrical Safety Code" published by the Institute of Electrical and Electronics Engineers (IEEE)

- System Operation Impact.
    - Are special operating procedures needed with the addition of the generation?
    - Reclosing and out of sync operation of facilities?
    - What limitations need to be placed on the operation of the generation?
    - Operational var requirements?

APPENDIX E

Interconnection Agreement for the Interconnection of Extended Parallel Distributed Generation Systems

This Generating System Interconnection Agreement is entered into by and between the Area Electrical Power System Operator (Company Operator) "_____" and the Interconnection Customer "_____". The Interconnection Customer and the Company are sometimes also referred to in this Agreement jointly as "Parties" or individually as "Party".

In consideration of the mutual promises and obligations stated in this Agreement and its attachments, the Parties agree as follows:

I. SCOPE AND PURPOSE

A) Establishment of Point of Common Coupling: This Agreement is intended to provide for the Interconnection Customer to interconnect and operate a Generation System, with a total Nameplate Capacity of 10 MWs or less, in parallel with the Company at the location identified in Exhibit C and shown in the Exhibit A one-line diagram.

B) This Agreement governs the facilities required to and contains the terms and condition under which the Interconnection Customer may interconnect the Generation System to the Company. This Agreement does not authorize the Interconnection Customer to export power or constitute an agreement to purchased or wheel the Interconnection Customer's power. Other services that the Interconnection Customer may require from the Company, or others, may be covered under separate agreements.

C) To facilitate the operation of the Generation System, this agreement also allows for the occasional and inadvertent export of energy to the Company. The amount, metering, billing, and accounting of such inadvertent energy exporting shall be governed by Exhibit D (Operating Agreement). This Agreement does not constitute an agreement by the Company Operator to purchase or pay for any energy, inadvertently or intentionally exported, unless expressly noted in Exhibit D or under a separately executed power purchase agreement (PPA).

D) This agreement does not constitute a request for, nor the provision of, any transmission delivery service or any local distribution delivery service.

E) The Technical Requirements for interconnection are covered in a separate Technical Requirements document known as the "Interconnection Requirements for Extended Paralleled Distribution Generation Systems", a copy of which as been made available to the Interconnection Customer and incorporated and made part of this Agreement by this reference.

II. DEFINITIONS

A) "Area EPS" - the area electric power system that is also referred to as the Company electric distribution system in this document.

B) "Company" - an electric power system (EPS) that serves the Local EPS. Note: Typically, the Company has primary access to public rights-of-way, priority crossing of property boundaries, etc.

C) "Company Operator" - the entity that operates the Company's electric distribution system.

D) "Commission" – The public utilities commission of the State wherein the Generation Facility is located.

E) "Dedicated Facilities" - the equipment that is installed due to the interconnection of the Generation System and not required to serve other Company customers.

F) "EPS" - (Electric Power System) facilities that deliver electric power to a load. Note: This may include generation units.

G) "Extended Parallel" - means the Generation System is designed to remain connected with the Company for an extended period of time.

H) "Generation" - any device producing electrical energy; i.e., rotating generators driven by wind, steam turbines, internal combustion engines, hydraulic turbines, solar, fuel cells, etc.; or any other electric producing device, including energy storage technologies.

I) "Generation Interconnection Coordinator" - the person or persons designated by the Company Operator to provide a single point of coordination with the Applicant for the generation interconnection process.

J) "Generation System" - the interconnected generator(s), controls, relays, switches, breakers, transformers, inverters and associated wiring and cables up to the Point of Common Coupling.

K) "Interconnection Customer" - the party or parties who will own/operate the Generation System and are responsible for meeting the requirements of the agreements and Technical Requirements. This could be the Generation System applicant, installer, owner, designer, or operator.

L) "Local EPS" - an electric power system (EPS) contained entirely within a single premises or group of premises.

M) "Nameplate Capacity" - the total nameplate capacity rating of all the Generation included in the Generation System. For this definition, the "standby" and/or maximum rated kW capacity on the nameplate shall be used.

N) "Open Transfer" - a method of transferring the local loads from the Company to the generator such that the generator and the Company are never connected together.

O) "Point of Common Coupling" - the point where the Local EPS is connected to the Company's distribution system.

P) "Point of Delivery" - the point where the energy changes possession from one party to the other. Typically this will be where the metering is installed but it is not required that the Point of Delivery is the same as where the energy is metered.

Q) "Quick Closed" - a method of generation transfer that parallels for less than 100 msec with the Company and has utility grade timers that limit the parallel duration to less than 100 msec with the Company.

R) "Quick Open" - a method of generation transfer that does not parallel with the Company and has a brief open interval, typically about 100 msec.

S) "Soft Loading Transfer": - a method of generation load transfer that parallels for typically less than 2 minutes to gradually transfer load between the generator and the Company.

T) "State" - the state wherein the interconnected generator is located.

U) "Technical Requirements" - "Requirements for Interconnection of Distributed Generation".

III. DESCRIPTION OF INTERCONNECTION CUSTOMER'S GENERATION SYSTEM

A) A description of the Generation System, including a single-line diagram showing the general arrangement of how the Interconnection Customer's Generation System is interconnected with the Company's distribution system, is attached to and made part of this Agreement as Exhibit A. The single-line diagram shows the following:

1) Point of Delivery (if applicable)

2) Point of Common Coupling

3) Location of Meter(s)

4) Ownership of the equipment.

5) Generation System total Nameplate Capacity _____ kW

6) Scheduled operational (on-line) date for the Generation System.

IV. RESPONSIBILITIES OF THE PARTIES

A) The Parties shall perform all obligations of this Agreement in accordance with all applicable laws and regulations, operating requirements, and good utility practices.

B) Interconnection Customer shall construct, operate, and maintain the Generation System in accordance with the applicable manufacture's recommend maintenance schedule, the Technical Requirements, and in accordance with this Agreement.

C) The Company Operator shall carry out the construction of the Dedicated Facilities in a good and workmanlike manner and in accordance with standard design and engineering practices.

V. CONSTRUCTION

The Parties agree to cause their facilities or systems to be constructed in accordance with the laws of the State and to meet or exceed applicable codes and standards provided by the NESC (National Electrical Safety Code), ANSI (American National Standards Institute), IEEE (Institute of Electrical and Electronic Engineers), NEC (National Electrical Code), UL (Underwriter's Laboratory), Technical Requirements, local building codes, and other applicable ordinances in effect at the time of the installation of the Generation System.

A) Charges and Payments

The Interconnection Customer is responsible for the actual costs to interconnect the Generation System with the Company, including, but not limited to, any Dedicated Facilities attributable to the addition of the Generation System, Company labor for installation coordination, installation testing, and engineering review of the Generation System and interconnection design. Estimates of these costs are outlined in Exhibit B. While estimates, for budgeting purposes, have been provided in Exhibit B, the actual costs are still the responsibility of the Interconnection Customer even if they exceed the estimated amount(s). All costs, for which the Interconnection Customer is responsible must be reasonable under the circumstances of the design and construction.

1) Dedicated Facilities

a) During the term of this Agreement, the Company Operator shall design, construct, and install the Dedicated Facilities outlined in Exhibit B. The Interconnection Customer shall be responsible for paying the actual costs of the Dedicated Facilities attributable to the addition of the Generation System.

b) Once installed, the Dedicated Facilities shall be owned and operated by the Company and all costs associated with the operating and maintenance of the Dedicated Facilities, after the Generation System is operational, shall be the responsibility of the Company Operator unless otherwise agreed.

c) By executing this Agreement, the Interconnection Customer grants permission for the Company Operator to begin construction and to procure the necessary facilities and equipment to complete the installation of the Dedicated Facilities as outlined in Exhibit B. If for any reason, the Generation System project is canceled or modified, so that any or all of the Dedicated Facilities are not required, the Interconnection Customer shall be responsible for all costs incurred by the Company, including, but not limited to, the additional costs to remove and/or complete the installation of the Dedicated Facilities. The Interconnection Customer may, for any reason, cancel the Generation System project so that any or all of the Dedicated Facilities are not required to be installed. The Interconnection Customer shall provide written notice to the Company Operator of cancellation. Upon receipt of a cancellation notice, the Company Operator shall take reasonable steps to minimize additional costs to the Interconnection Customer, where reasonably possible.

2) Payments

a) The Interconnection Customer shall provide reasonable adequate assurances of credit including a letter of credit or personal guaranty of payment and performance from a creditworthy entity acceptable under the Company Operator's credit policy and procedures for the unpaid balance of the estimated amount shown in Exhibit B.

b) The payment for the costs outlined in Exhibit B, shall be as follows;

i. 1/3 of estimated costs, outlined in Exhibit B, shall be due upon execution of this agreement.

ii. 1/3 of estimated costs, outlined in Exhibit B, shall be due before initial energization of the Generation System with the Company.

iii. Remainder of actual costs incurred by the Company shall be due within 30 days from the date the bill is mailed by the Company after project completion.

VI. DOCUMENTS INCLUDED WITH THIS AGREEMENT.

A) This agreement includes the following exhibits, which are specifically incorporated herein and made part of this Agreement by this reference*: (if any of these Exhibits are deemed not applicable for this Generation System installation, they may be omitted from the final Agreement by the Company Operator.)*

1) Exhibit A – Description of Generation System and single-line diagram. This diagram shows all major equipment, including visual isolation equipment, Point of Common Coupling, Point of Delivery for Generation Systems that intentionally export, ownership of equipment, and the location of metering.

2) Exhibit B – Estimated installation and testing costs payable by the Interconnection Customer. Included in this listing shall be the description and estimated costs for the required Dedicated Facilities being installed by the Company Operator for the interconnection of the Generation System and a description and estimate for the final acceptance testing work to be done by the Company Operator.

3) Exhibit C – Engineering Data Submittal – A standard form that provides the engineering and operating information about the Generation System.

4) Exhibit D – Operating Agreement – This provides specific operating information and requirements for this Generation System interconnection. This Exhibit has a separate signature section and may be modified, in writing, from time to time with the agreement of both parties.

5) Exhibit E – Maintenance Agreement – This provides specific maintenance requirements for this Generation System interconnection. This Exhibit has a separate signature section and may be modified, in writing, from time to time with the agreement of both parties.

VII. TERMS AND TERMINATION

A) This Agreement shall become effective as of the date when both the Interconnection Customer and the Company Operator have both signed this Agreement. The Agreement shall continue in full force and effect until the earliest date that one of the following events occurs:

1) The Parties agree in writing to terminate the Agreement; or

2) The Interconnection Customer may terminate this agreement at any time, by written notice to the Company Operator, prior to the completion of the final acceptance testing of the Generation System by the Company Operator. Once the Generation System is operational, then VII.A.3 applies. Upon receipt of a cancellation notice, the Company Operator shall take reasonable steps to minimize additional costs to the Interconnection Customer, where reasonably possible; or

3) Once the Generation System is operational, the Interconnection Customer may terminate this agreement after 30 days written notice to the Company Operator, unless otherwise agreed to within the Exhibit D, Operating Agreement; or

4) The Company Operator may terminate this agreement after 30 days written notice to the Interconnection Customer if:

a) The Interconnection Customer fails to interconnect and operate the Generation System per the terms of this Agreement; or

b) The Interconnection Customer fails to take all corrective actions specified in the Company's written notice that the Generation System is out of compliance with the terms of this Agreement, within the time frame set forth in such notice; or

c) If the Interconnection Customer fails to complete the Company Operator's final acceptance testing of the generation system within 24 months of the date proposed under section III.A.5.

B) Upon termination of this Agreement, the Generation System shall be disconnected from the Company. The termination of this Agreement shall not relieve either Party of its liabilities and obligations, owed or continuing, at the time of the termination.

VIII. OPERATIONAL ISSUES

Each Party will, at its own cost and expense, operate, maintain, repair, and inspect and shall be fully responsible for the facilities that it now or hereafter may own, unless otherwise specified.

A) Technical Standards: The Generation System shall be installed and operated by the Interconnection Customer consistent with the requirements of this Agreement; the Technical Requirements; the applicable requirements located in the National Electrical Code (NEC); the applicable standards published by the American National Standards Institute (ANSI) and the Institute of Electrical and Electronic Engineers (IEEE); and local building and other applicable ordinances in effect at the time of the installation of the Generation System.

B) Right of Access: At all times, the Company Operator's personnel shall have access to the disconnect switch of the Generation System for any reasonable purpose in connection with the performance of the obligations imposed on it by this Agreement to meet its obligation to operate the Company safely and to provide service to its customers. If necessary for the purposes of this Agreement, the Interconnection Customer shall allow the Company Operator access to the Company's equipment and facilities located on the premises.

C) Electric Service Supplied: The Company will supply the electrical requirements of the Local EPS that are not supplied by the Generation System. Such electric service shall be supplied to the Interconnection Customer's Local EPS under the rate schedules applicable to the Customer's class of service as revised from time to time by the Company.

D) Operation and Maintenance: The Generation System shall be operated and maintained by the Interconnection Customer in accordance with the Technical Standards and any additional requirements of Exhibit D and Exhibit E, attached to this document, as amended in writing from time to time.

E) Cooperation and Coordination: Both the Company Operator and the Interconnection Customer shall communicate and coordinate their operations so that the normal operation of the Company does not unduly effect or interfere with the normal operation of the Generation System and the Generation System does not unduly effect or interfere with the normal operation of the Company. Under abnormal operations of either the Generation System or the Company system, the responsible Party shall provide reasonably timely communication to the other Party to allow mitigation of any potentially negative effects of the abnormal operation of their system.

F) Disconnection of Unit: The Company Operator may disconnect the Generation System, as necessary, for termination of this Agreement; non-compliance with this Agreement; system emergency, imminent danger to the public or Company personnel; or routine maintenance, repairs and modifications to the Company. When reasonably possible, the Company Operator shall provide prior notice to the Interconnection Customer explaining the reason for the disconnection. If prior notice is not reasonably possible, the Company Operator shall, after the fact, provide information to the Interconnection Customer as to why the disconnection was required. It is agreed

that the Company Operator shall have no liability for any loss of sales or other damages, including all consequential damages for the loss of business opportunity, profits, or other losses, regardless of whether such damages were foreseeable, for the disconnection of the Generation System per this Agreement. The Company Operator shall expend reasonable effort to reconnect the Generation System in a timely manner and to work towards mitigating damages and losses to the Interconnection Customer where reasonably possible.

G) Modifications to the Generation System – When reasonably possible, the Interconnection Customer shall notify the Company Operator, in writing, of plans for any modifications to the Generation System interconnection equipment, including all information needed by the Company Operator as part of the review described in this paragraph, at least twenty (20) business days prior to undertaking such modification(s). Modifications to any of the interconnection equipment, including all interconnection required protective systems, the generation control systems, the transfer switches/breakers, interconnection protection VT's & CT's, and Generation System capacity, shall be included in the notification to the Company Operator. When reasonably possible, the Interconnection Customer agrees not to commence installation of any modifications to the Generating System until the Company Operator has approved the modification, in writing, which approval shall not be unreasonably withheld. The Company Operator shall have a minimum of five (5) business days to review and respond to the planned modification. The Company Operator shall not take longer than a maximum of ten (10) business days to review and respond to the modification after the receipt of the information required to review the modifications. When it is not reasonably possible for the Interconnection Customer to provide prior written notice, the Interconnection Customer shall provide written notice to the Company Operator as soon as reasonably possible after the completion of the modification(s).

H) Permits and Approvals: The Interconnection Customer shall obtain all environmental and other permits lawfully required by governmental authorities before the construction of the Generation System. The Interconnection Customer shall also maintain these applicable permits and compliance with these permits during the term of this Agreement.

IX. LIMITATION OF LIABILITY

A) Each Party shall at all times indemnify, defend, and save the other Party harmless from any and all damages, losses, claims, including claims and actions relating to injury or death of any person or damage to property, costs and expenses, reasonable attorneys' fees and court costs, arising out of or resulting from the Party's performance of its obligations under this agreement, except to the extent that such damages, losses, or claims were caused by the negligence or intentional acts of the other Party.

B) Each Party's liability to the other Party for failure to perform its obligations under this Agreement shall be limited to the amount of direct damage actually incurred. In no event shall either Party be liable to the other Party for any punitive, incidental, indirect, special, or consequential damages of any kind whatsoever, including for loss of business opportunity or profits, regardless of whether such damages were foreseen.

C) Notwithstanding any other provision in this Agreement, with respect to Company Operator's provision of electric service to any customer, including the Interconnection Customer, the Company Operator's liability to such customer shall be limited as set forth in the Company Operator's tariffs and terms and conditions for electric service, and shall not be affected by the terms of this Agreement.

X. DISPUTE RESOLUTION

A) Each Party agrees to attempt to resolve all disputes arising hereunder promptly, equitably, and in a good faith manner.

B) In the event a dispute arises under this Agreement, and if it cannot be resolved by the Parties within thirty (30) days after written notice of the dispute to the other Party, the Parties agree to submit the dispute to mediation by a mutually acceptable mediator, in a mutually convenient location in the State. The Parties agree to participate in good faith in the mediation for a period of 90 days. If the parties are not successful in resolving their disputes through mediation, then the Parties may refer the dispute for resolution to the Commission, which shall maintain continuing jurisdiction over this Agreement.

XI. INSURANCE

A) At a minimum, in connection with the Interconnection Customer's performance of its duties and obligations under this Agreement, the Interconnection Customer shall maintain during the term of the Agreement, general liability insurance from a qualified insurance agency with a B+ or better rating by "Best" and with a combined single limit of not less than:

1) Two million dollars ($2,000,000) for each occurrence if the Gross Nameplate Rating of the Generation System is greater then 250 kW.

2) One million dollars ($1,000,000) for each occurrence if the Gross Nameplate Rating of the Generation System is between 20 kW and 250 kW.

3) Three hundred thousand ($300,000) for each occurrence if the Gross Nameplate Rating of the Generation System is less than 20 kW.

4) Such general liability insurance shall include coverage against claims for damages resulting from (i) bodily injury, including wrongful death; and (ii) property damage arising out of the Interconnection Customer's ownership and/or operating of the Generation System under this agreement.

B) The general liability insurance required shall, by endorsement to the policy or policies, (a) include the Company Operator as an additional insured; (b) contain a severability of interest clause or cross-liability clause; (c) provide that the Company Operator shall not by reason of its inclusion as an additional insured incur liability to the insurance carrier for the payment of premium for such insurance; and (d) provide for thirty (30) calendar days' written notice to the Company Operator prior to cancellation, termination, alteration, or material change of such insurance.

C) If the Generation System is connected to an account receiving residential service from the Company Operator and its total generating capacity is 20 kW or smaller, then the endorsements required in Section XI.B shall not apply.

D) The Interconnection Customer shall furnish the required insurance certificates and endorsements to the Company Operator before the initial operation of the Generation System. Thereafter, the Company Operator shall have the right to periodically inspect or obtain a copy of the original policy or policies of insurance.

E) Evidence of the insurance required in Section XI.A. shall state that coverage provided is primary and is not excess to or contributing with any insurance or self-insurance maintained by the Company Operator.

F) If the Interconnection Customer is self-insured with an established record of self-insurance, the Interconnection Customer may comply with the following in lieu of Section XI.A – E:

1) Interconnection Customer shall provide to the Company Operator, at least thirty (30) days prior to the date of initial operation, evidence of an acceptable plan to self-insure to a level of coverage equivalent to that required under section XI.A - E.

2) If Interconnection Customer ceases to self-insure to the level required hereunder, or if the Interconnection Customer is unable to provide continuing evidence of it's ability to self-insure, the Interconnection Customer agrees to immediately obtain the coverage required under Section XI.A - E.

G) Failure of the Interconnection Customer or Company Operator to enforce the minimum levels of insurance does not relieve the Interconnection Customer from maintaining such levels of insurance or relieve the Interconnection Customer of any liability.

H) All insurance certificates, statements of self-insurance, endorsements, cancellations, terminations, alterations, and material changes of such insurance shall be issued and submitted to the following:

Company_____

Attention_____

Address_____

_____

XII. MISCELLANEOUS

A) FORCE MAJEURE

1) An event of Force Majeure means any act of God, act of the public enemy, war, insurrection, riot, fire, storm or flood, explosion, breakage or accident to machinery or equipment, any curtailment, order, regulation or restriction imposed by governmental, military or lawfully established civilian authorities, or any other cause beyond a Party's control. An event of Force Majeure does not include an act of negligence or intentional wrongdoing.

2) Neither Party will be considered in default of any obligation hereunder if such Party is prevented from fulfilling the obligation due to an event of Force Majeure. However, a Party whose performance under this Agreement is hindered by an event of Force Majeure shall make all reasonable efforts to perform its obligations hereunder.

B) NOTICES

1) Any written notice, demand, or request required or authorized in connection with this Agreement ("Notice") shall be deemed properly given if delivered in person or sent by first class mail, postage prepaid, to the person specified below:

a) If to Company Operator

Company_____

Attention_____

Address_____

_____

b) If to Interconnection Customer

Customer_____

Address_____

_____

2) A Party may change its address for notices at any time by providing the other Party written notice of the change, in accordance with this Section.

3) The Parties may also designate operating representatives to conduct the daily communications that may be necessary or convenient for the administration of this Agreement. Such designations, including names, addresses, and phone numbers may be communicated or revised by one Party's written notice to the other Party.

C) ASSIGNMENT

The Interconnection Customer shall not assign its rights nor delegate its duties under this Agreement without the Company Operator's written consent. Any assignment or delegation the Interconnection Customer makes without the Company Operator's written consent shall not be valid. The Company Operator shall not unreasonably withhold its consent to the Generating Entities assignment of this Agreement.

D) **NON-WAIVER**

None of the provisions of this Agreement shall be considered waived by a Party unless such waiver is given in writing. The failure of a Party to insist in any one or more instances upon strict performance of any of the provisions of this Agreement or to take advantage of any of its rights hereunder shall not be construed as a waiver of any such provisions or the relinquishment of any such rights for the future, but the same shall continue and remain in full force and effect.

E) **GOVERNING LAW AND INCLUSION OF COMPANY OPERATOR'S TARIFFS AND RULES.**

1) This Agreement shall be interpreted, governed, and construed under the laws of the State as if executed and to be performed wholly within the State without giving effect to choice of law provisions that might apply to the law of a different jurisdiction.

2) The interconnection and services provided under this Agreement shall at all times be subject to the terms and conditions set forth in the tariff schedules and rules applicable to the electric service provided by the Company Operator, which tariff schedules and rules are hereby incorporated into this Agreement by this reference.

3) Notwithstanding any other provisions of this Agreement, the Company Operator shall have the right to unilaterally file with the Commission, pursuant to the Commission's rules and regulations, an application for change in rates, charges, classification, service, tariff, or rule or any agreement relating thereto.

F) **AMENDMENT AND MODIFICATION**

This Agreement can only be amended or modified in writing and signed by both Parties.

G) **ENTIRE AGREEMENT**

This Agreement, including all attachments, exhibits, and appendices, constitutes the entire Agreement between the Parties with regard to the interconnection of the Generation System of the Parties at the Point(s) of Common Coupling expressly provided for in this Agreement and supersedes all prior agreements or understandings, whether verbal or written. It is expressly acknowledged that the Parties may have other agreements covering other services not expressly provided for herein, which agreements are unaffected by this Agreement. Each party also represents that in entering into this Agreement, it has not relied on the promise, inducement, representation, warranty, agreement, or other statement not set forth in this Agreement or in the incorporated attachments, exhibits, and appendices.

H) **CONFIDENTIAL INFORMATION**

Except as otherwise agreed or provided herein, each Party shall hold in confidence and shall not disclose confidential information to any person (except employees, officers, representatives, and agents who agree to be bound by this section). Confidential information shall be clearly marked as such on each page or otherwise affirmatively identified. If a court, government agency or entity with the right, power, and authority to do so requests or requires either Party by subpoena, oral disposition, interrogatories, requests for production of documents, administrative order, or otherwise, to disclose Confidential Information, that Party shall provide the other Party with prompt notice of such request(s) or requirements(s) so that the other Party may seek an appropriate protective order or waive compliance with the terms of this Agreement. In the absence of a protective order or waiver, the Party shall disclose such confidential information that, in the opinion of its counsel, the party is legally compelled to disclose. Each Party will use reasonable efforts to obtain reliable assurance that confidential treatment will be accorded any confidential information so furnished.

I) **NON-WARRANTY**

Neither by inspection, if any, or non-rejection, nor in any other way, does the Company Operator give any warranty, expressed or implied, as to the adequacy, safety, or other characteristics of any structures, equipment, wires, appliances, or devices owned, installed, or maintained by the Interconnection Customer or leased by the Interconnection Customer from third parties, including without limitation the Generation System and any structures, equipment, wires, appliances, or devices appurtenant thereto.

J) **NO PARTNERSHIP**

This Agreement shall not be interpreted or construed to create an association, joint venture, agency relationship, or partnership between the Parties or to impose any partnership obligation, or partnership liability upon either Party.

Neither Party shall have any right, power, or authority to enter into any agreement or undertaking for, or act on behalf of, or to act as or be an agent or representative of, or to otherwise bind, the other Party.

XIII. SIGNATURES

IN WITNESS WHEREOF, the Parties hereto have caused two originals of this Agreement to be executed by their duly authorized representatives. This Agreement is effective as of the last date set forth below.

Interconnection Customer

By: _____

Name: _____

Title: _____

Date: _____

Company Operator

By: _____

Name: _____

Title: _____

Date: _____

EXHIBIT A

GENERATION SYSTEM DESCRIPTION AND SINGLE-LINE DIAGRAM

EXHIBIT B

SUMMARY OF COMPANY COSTS AND DESCRIPTION OF DEDICATED FACILITIES BEING INSTALLED BY THE COMPANY OPERATOR FOR THE INTERCONNECTION OF THE GENERATION SYSTEM

This Exhibit shall provide the estimated total costs that will be the responsibility of the Interconnection Customer. It is assumed that the Initial application has been filed and the engineering studies have been paid for and completed. Therefore, those costs are not included on this listing.

What is listed below is a general outline of some of the major areas where costs could occur. Other costs than those listed below may be included by the Company if those costs are a direct result from the request to interconnect the Generation System. The following list is only a guideline and the Company Operator, for each installation, will be creating a unique Exhibit B that is tailored for that specific Generation System interconnection.

A) Dedicated Facilities (equipment, design, and installation labor)

B) Monitoring & Control System (equipment, design, and installation labor)

C) Design Coordination and Review

D) Construction Coordination Labor Costs

E) Testing (development of tests and physical testing)

F) Contingency

EXHIBIT C

ENGINEERING DATA SUBMITTAL

Attach a completed “Engineering Data Submittal” form from Appendix C of “Interconnection Process for Distributed Generation Systems”.

EXHIBIT D

OPERATING AGREEMENT

Each Generation System interconnection will be unique and will require a unique Operating Agreement. The following is a listing of some of the possible areas that will be covered in an operating agreement. The following has not been developed into a standard agreement due to the unique nature of each Generation System. It is envisioned that this Exhibit will be tailored by the Company Operator for each Generation System interconnection. It is also intended that this Operating Agreement Exhibit will be reviewed and updated periodically to allow the operation of the Generation System to change to meet the needs of both the Company Operator and the Interconnection Customer, if the change does not negatively affect the other Party. There may also be operating changes required by outside issues such has changes in FERC and MISO requirements and/or policies which will require this Operating Agreement to be modified.

The following items are provided to show the general types of items that may be included in this Operating Agreement. The items included in the Operating Agreement shall not be limited to the items shown on this list.

A) Applicable Company Tariffs – Discussion on which tariffs are being applied for this installation and possibly how they will be applied.

B) Var Requirements – How will the Generation System be required to operate to control the power factor of the energy flowing in either direction across the interconnection.

C) Inadvertent Energy – This Operating Agreement needs to provide the method(s) that will be used to monitor, meter, and account for the inadvertent energy used or supplied by the Generation System. Tariffs and operating rules that apply for this Generation System interconnection shall be discussed in this Operating Agreement.

D) Control Issues - Starting and stopping of the generation including the remote starting and stopping, if applicable.

E) Dispatch of Generation Resources - What are the dispatch requirements for the Generation System? Can it only run during Peak Hours? Are there a limited number of hours that it can run? Is it required to have met an availability percentage? This will greatly depend upon the PPA and other requirements. Is the Interconnection Customer required to coordinate outages of the Generation System with the Company?

F) Outages of Distribution System – How are emergency outages handled? How are other outages scheduled? If the Interconnection Customer requires the Company Operator to schedule the outages during after-hours, who pays for the Company Operator's overtime?

G) Notification / Contacts - Who should be notified? How should they be notified? When should they be notified? For what reasons should the notification take place?

   1) Starting of the Generation

   2) Dispatching of Generation

   3) Notification of failures (both Company and Generation System failures)

H) Documentation of Operational Settings – How much fuel will the generation System typically have on hand? How long can it run with this fuel capacity? How is the generation system set to operate for a power failure? These may be issues that should be documented in the Operating Agreement. The following are a couple of examples:

   1) "The Generation System will monitor the Company phase voltage and after 2 seconds of any phase voltage below 90% the generation will be started and the load transferred to the generator if the generation is not already running."

   2) "The Generation System will wait for 30 minutes after it senses the return of the Company frequency and voltage before it will automatically reconnect to the Company."

I) Cost of testing for future failures – If a component of the Generation System fails or needs to be replaced, which effects the interconnection with the Company, what is the process for retesting and for replacement? Who pays for the additional costs of the Company to work with the Interconnection Customer to resolve these problems and/or to complete retesting of the modified equipment?

J) Right of Access - At all times, the Company Operator shall have access to the disconnect switch of the Generation System for any reasonable purpose in connection with the performance of the obligations imposed on it by this Agreement to meet its obligation to operate the Company safely and to provide service to its customers. If necessary for the purposed of this Agreement, the Interconnection Customer shall allow the Company Operator access to the Company's equipment and facilities located on the premises.

Add Signature Section -The Operating Agreement should be set up so that it is individually signed and dated by both parties.

EXHIBIT E

MAINTENANCE AGREEMENT

Each Generation System interconnection will be unique and will require a unique Maintenance Agreement. It is envisioned that this Exhibit will be tailored for each Generation System interconnection. It is also intended that this Maintenance Agreement Exhibit will be reviewed and updated periodically to allow changes to the maintenance of the Generation System to meet the needs of both the Company Operator and the Interconnection Customer, if the change does not negatively affect the other Party. There may also be changes required by outside issues such has changes in FERC and MISO requirements and/or policies that will require this agreement to be modified.

A) Routine Maintenance Requirements

1) Who is providing maintenance – Contact information

2) Periods of maintenance

B) Modifications to the Generation System - The Interconnection Customer shall notify the Company Operator, in writing of plans for any modifications to the Generation System interconnection equipment at least twenty (20) business days before undertaking such modification. Modifications to any of the interconnection equipment including all required protective systems, the generation control systems, the transfer switches/breakers, VT's & CT's, generating capacity, and associated wiring shall be included in the written notification to the Company Operator. The Interconnection Customer agrees not to commence installation of any modifications to the Generating System until the Company Operator has approved the modification, in writing. The Company shall have a minimum of five (5) business days and a maximum of ten (10) business days to review and respond to the modification after the receipt of the information required to review the modifications.

Add signature Section

INTERCONNECTION REQUIREMENTS FOR EXTENDED PARALLELED DISTRIBUTION GENERATION SYSTEMS

TABLE OF CONTENTS

Foreword

Electric distribution system connected generation units span a wide range of sizes and electrical characteristics. Electrical distribution system design varies widely from that required to serve the rural customer to that needed to serve the large commercial customer. With so many variations possible, it becomes complex and difficult to create one interconnection standard that fits all generation interconnection situations.

In establishing a generation interconnection standard, there are three main issues that must be addressed: Safety, Economics, and Reliability.

The first and most important issue is safety; the safety of the general public and of the employees working on the electrical systems. This standard establishes the technical requirements that must be met to ensure the safety of the general public and the employees working with the Company. Typically, designing the interconnection system for the safety of the general public will also provide protection for the interconnected equipment.

The second issue is economics. The interconnection design must be affordable to build. The interconnection standard must be developed so that only those items that are necessary to meet safety and reliability are included in the requirements. This standard sets the benchmark for the minimum required equipment. If it is not needed, it will not be required.

The third issue is reliability. The generation system must be designed and interconnected such that the reliability and the service quality for all customers of the electrical power system are not compromised. This applies to all electrical systems not just the Company's.

Many generation interconnection standards exist or are in draft form. The IEEE, FERC, and many states have been working on generation interconnection standards. There are other standards, such as the National Electrical Code (NEC), that establish requirements for electrical installations. The NEC requirements are in addition to this standard. This standard is designed to document the requirements where the NEC has left the establishment of the standard to "the authority having jurisdiction" or to cover issues that are not covered in other national standards.

This standard covers installation, with an aggregated capacity of 10 MWs or less. Many of the requirements in this document do not apply to small, 20 kW or less generation installations.

1. Introduction

This standard has been developed to document the technical requirements for the interconnection between a Generation System and Company's electric distribution system. This standard covers 3-phase Generation Systems with an aggregate capacity of 10 MWs or less and single-phase Generation Systems with a aggregate capacity of 20 kW or less at the Point of Common Coupling. This standard covers Generation Systems that are interconnected with the Company's distribution facilities. This standard does not cover Generation Systems that are directly interconnected with the Company's Transmission System. Contact the Company for their Transmission System interconnection standards.

While this standard provides the technical requirements for interconnecting a Generation System with a typical radial distribution system, it is important to note that there are some unique areas of the Company's distribution system that have special interconnection needs. One example of a unique area would be one operated as a "networked" system. This standard does not cover the additional special requirements of those systems. The Interconnection Customer must contact the Company Operator to make sure that the Generation System is not proposed for a unique area system. If the planned interconnection is with a unique area, the Interconnection Customer must obtain the additional requirements for interconnecting.

The Company Operator has the right to limit the maximum size of any Generation System or number of Generation Systems that may want to interconnect if the Generation System would reduce the reliability to the other customers connected to the Company.

This standard only covers the technical requirements and does not cover the interconnection process from the planning of a project through approval and construction. Please read the companion document "Interconnection Process for Distributed Generation Systems" for the description of the procedure to follow and the forms to submit. It is important to also get copies of the Company's tariffs concerning generation interconnection which will include rates, costs, and standard conditions. The earlier the Interconnection Customer gets the Company Operator involved in the planning and design of the Generation System interconnection, the smoother the process will go.

A) Definitions

The definitions defined in the "IEEE Standard for Interconnecting Distributed Resources with Electric Power Systems", IEEE 1547, apply to this document as well. The following definitions are in addition to the ones defined in IEEE 1547, or are repeated from the IEEE 1547 standard.

i) "Area EPS" – the area electric power system that is also referred to as the Company electric distribution system in this document.

ii) "Company" - an electric power system (EPS) that serves the Local EPS. Note: Typically, the Company has primary access to public rights-of-way, priority crossing of property boundaries, etc.

iii) "Generation" - any device producing electrical energy; i.e., rotating generators driven by wind, steam turbines, internal combustion engines, hydraulic turbines, solar, fuel cells, etc.; or any other electric producing device including energy storage technologies.

iv) "Generation System" - the interconnected Distributed Generation(s), controls, relays, switches, breakers, transformers, inverters, and associated wiring and cables up to the Point of Common Coupling.

v) "Interconnection Customer" - the party or parties who are responsible for meeting the requirements of this standard. This could be the Generation System applicant, installer, designer, owner, or operator.

vi) "Local EPS" - an electric power system (EPS) contained entirely within a single premises or group of premises.

vii) "Open Transfer" - a method of transferring the local loads from the Company to the generator such that the generator and the Company are never connected together.

viii) "Point of Common Coupling" - the point where the Local EPS is connected to the Company's system.

ix) "Quick Closed" - a method of generation transfer that parallels for less than 100 msec with the Company and has utility grade timers that limit the parallel duration to less then 100 msec with the Company.

x) "Quick Open" - a method of generation transfer that does not parallel with the Company and has a brief open interval, typically about 100 msec.

xi) "Soft Loading Transfer" - a method of generation load transfer that parallels for typically less than 2 minutes to gradually transfer load between the generator and the Company.

xii) "Transmission System" - those facilities as defined by using the guidelines established by FERC.

xiii) "Type-Certified" - Generation paralleling equipment that is listed by an OSHA listed national testing laboratory as having met the applicable type-testing requirements of IEEE 1547.1, such as UL 1741. This definition does not preclude other forms of type-certification if agreeable to the Company Operator. "Type-Certified" is the same as "pre-certified" and "certified" when used in this text.

B) Interconnection Requirements Goals

This standard defines the minimum technical requirements for the implementation of the electrical interconnection between the Generation System and the Company. It does not define the overall requirements for the Generation System. The requirements in this standard are intended to achieve the following:

i) Ensure the safety of utility personnel and contractors working on the electrical power system.

ii) Ensure the safety of utility customers and the general public.

iii) Protect and minimize the possible damage to the electrical power system and other customer's property.

iv) Ensure proper operation to minimize adverse operating conditions on the electrical power system.

C) Protection

The Generation System and Point of Common Coupling shall be designed with proper protective devices to promptly and automatically disconnect the Generation from the Company in the event of a fault or other system abnormality. The type of protection required will be determined by:

i) Size and type of the generating equipment.

ii) The method of connecting and disconnecting the Generation System from the electrical power system.

iii) The location of generating equipment on the Company's system.

D) Company Modifications

Depending upon the match between the Generation System, the Company, and how the Generation System is operated, certain modifications and/or additions may be required to the existing Company system with the addition of the Generation System. To the extent possible, this standard describes the modifications that could be necessary to the Company facilities for different types of Generation Systems. For some unique interconnections, additional and/or different protective devices, system modifications, and/or additions will be required by the Company Operator. In these cases, the Company Operator will provide the final determination of the required modifications and/or additions. If any special requirements are necessary, the Company Operator will identify them during the application review process.

E) Generation System Protection

The Interconnection Customer is solely responsible for providing protection for the Generation System. Protection systems required in this standard are structured to protect the Company's electrical power system and the public. The Generation System Protection is not provided for in this standard. Additional protection equipment may be required to ensure proper operation for the Generation System. This is especially true while operating disconnected from the Company. The Company does not assume responsibility for protection of the Generation System equipment or of any portion of the Local EPS.

F) Electrical Code Compliance

The Interconnection Customer shall be responsible for complying with all applicable local, independent, state, and federal codes such as building codes, National Electric Code (NEC), National Electrical Safety Code (NESC), and noise and emissions standards. The Company will require proof of complying with the National Electrical Code before the interconnection is made through installation approval by an electrical inspector.

The Interconnection Customer's Generation System and installation shall comply with latest revisions of the ANSI/IEEE standards applicable to the installation, especially IEEE 1547; "Standard for Interconnecting Distributed Resources with Electric Power Systems" and IEEE 1547.1 – 1547.6. See the reference section in this document for a partial list of the standards that apply to the generation installations covered by this standard.

2. References

The following standards shall be used in conjunction with this standard. When the stated version of the following standards is superseded by an approved revision, then that revision shall apply.

IEEE Std 100-2000, "IEEE Standard Dictionary of Electrical and Electronic Terms".

IEEE Std 519-1992, "IEEE Recommended Practices and Requirements for Harmonic Control in Electric Power Systems".

IEEE Std 519-1992, "IEEE Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems".

IEEE Std 1547-2003, "IEEE Standard for Interconnecting Distributed Resources with Electric Power Systems".

IEEE Std 1547.1-2005, "IEEE Standard Conformance Test Procedures for Equipment Interconnecting Distributed Resources with Electric Power Systems".

IEEE Std C37.90.1-1989 (1995), "IEEE Standard Surge Withstand Capability (SEC) Tests for Protective Relays and Relay Systems".

IEEE Std C37.90.2 (1995), "IEEE Standard Withstand Capability of Relay Systems to Radiated Electromagnetic Interference from Transceivers".

IEEE Std C62.41.2-2002, "IEEE Recommended Practice on Characterization of Surges in Low Voltage (1000V and Less) AC Power Circuits".

IEEE Std C62.42-1992 (2002), "IEEE Recommended Practice on Surge Testing for Equipment Connected to Low Voltage (1000V and less) AC Power Circuits".

ANSI C84.1-1995, "Electric Power Systems and Equipment – Voltage Ratings (60 Hertz)".

ANSI/IEEE 446-1995, "Recommended Practice for Emergency and Standby Power Systems for Industrial and Commercial Applications".

ANSI/IEEE Standard 142-1991, "IEEE Recommended Practice for Grounding of Industrial an Commercial Power Systems – Green Book",

UL Std. 1741 "Inverters, Converters, and Controllers for use in Independent Power Systems".

NEC – "National Electrical Code", National Fire Protection Association (NFPA), NFPA-70-2002.

NESC – "National Electrical Safety Code". ANSI C2-2002, Published by the Institute of Electrical and Electronics Engineers, Inc.

3. Types of Interconnections

A) The manner in which the Generation System is connected to and disconnected from the Company can vary. Most transfer systems normally operate using one of the following five methods of transferring the load from the Company to the Generation System.

B) If a transfer system is installed which has a user accessible selection of several transfer modes, the transfer mode that has the greatest protection requirements will establish the protection requirements for that transfer system.

i) Open Transition (Break-Before-Make) Transfer Switch – With this transfer switch, the load to be supplied from the Distributed Generation is first disconnected from the Company and then connected to the Generation. This transfer can be relatively quick, but voltage and frequency excursions are to be expected during transfer. Computer equipment and other sensitive equipment will shut down and reset. The transfer switch typically consists of a standard UL approved transfer switch with mechanical interlocks between the two source contactors that drop the Company source before the Distributed Generation is connected to supply the load.

(1) To qualify as an Open Transition switch and the limited protective requirements, mechanical interlocks are required between the two source contacts. This is required to ensure that one of the contacts is always open and the Generation System is never operated in parallel with the Company. If the mechanical interlock is not present, the protection requirements are as if the switch is a closed transition switch.

(2) As a practical point of application, this type of transfer switch is typically used for loads less then 500 kW. This is due to possible voltage flicker problems created on the Company when the load is removed from or returned to the Company source. Depending up the Company system's stiffness, this level may be larger or smaller than the 500 kW level.

(3) Figure 1 at the end of this document provides a typical one-line of this type of installation.

ii) Quick Open Transition (Break-Before-Make) Transfer Switch – The load to be supplied from the Distributed Generation is first disconnected from the Company and then connected to the Distributed Generation, similar to the open transition. However, this transition is typically much faster (under 500 ms) than the conventional open transition transfer operation. Voltage and frequency excursions will still occur, but some computer equipment and other sensitive equipment will typically not be affected with a properly designed system. The transfer switch consists of a standard UL approved transfer switch with mechanical interlocks between the two source contacts that drop the Company source before the Distributed Generation is connected to supply the load.

(1) Mechanical interlocks are required between the two source contacts to ensure that one of the contacts is always open. If the mechanical interlock is not present, the protection requirements are as if the switch is a closed transition switch

(2) As a practical point of application, this type of transfer switch is typically used for loads less then 500 kW. This is due to possible voltage flicker problems created on the Company, when the load is removed from or returned to the Company source. Depending up the Company system's stiffness, this level may be larger or smaller than the 500 kW level.

(3) Figure 2 at the end of this document provides a typical one-line of this type of installation and shows the required protective elements.

iii) Closed Transition (Make-Before-Break) Transfer Switch – The Distributed Generation is synchronized with the Company before the transfer occurs. The transfer switch then parallels with the Company for a short time (100 msec. or less) and then the Generation System and load is disconnect from the Company. This transfer is less disruptive than the Quick Open Transition because it allows the Distributed Generation a brief time to pick up the load before the support of the Company is lost. With this type of transfer, the load is always being supplied by the Company or the Distributed Generation.

(1) As a practical point of application, this type of transfer switch is typically used for loads less then 500 kW. This is due to possible voltage flicker problems created on the Company, when the load is removed from or returned to the Company source. Depending up the Company system's stiffness, this level may be larger or smaller than the 500 kW level.

(2) Figure 2 at the end of this document provides a typical one-line of this type of installation and shows the required protective elements. The closed transition switch must include a separate parallel time limit relay, which is not part of the generation control PLC and trips the generation from the system for a failure of the transfer switch and/or the transfer switch controls.

iv) Soft Loading Transfer Switch

(1) With Limited Parallel Operation – The Distributed Generation is paralleled with the Company for a limited amount of time (generally less then 1-2 minutes) to gradually transfer the load from the Company to the Generation System. This minimizes the voltage and frequency problems by softly loading and unloading the Generation System.

(a) The maximum parallel operation shall be controlled via a parallel timing limit relay (62PL). This parallel time limit relay shall be a separate relay and not part of the generation control PLC.

(b) Protective Relaying is required as described in Section 6.

(c) Figure 3 at the end of this document provides a typical one-line diagram of this type of installation and shows the required protective elements.

(2) With Extended Parallel Operation – The Generation System is paralleled with the Company in continuous operation. Special design, coordination, and agreements are required before any extended parallel operation will be permitted. The Company interconnection study will identify the issues involved.

(a) Any anticipated use in the extended parallel mode requires special agreements and special protection coordination.

(b) Protective Relaying is required as described in Section 6.

(c) Figure 4 at the end of this document provides a typical one-line diagram for this type of interconnection. It must be emphasized that these are a typical installations only and final installations may vary from the examples shown due to transformer connections, breaker configuration, etc.

v) Inverter Connection

This is a continuous parallel connection with the system. Small Generation Systems may utilize inverters to interface to the Company. Solar, wind, and fuel cells are some examples of Generation that typically use inverters to connect to the Company. Either these inverters shall contain all necessary protection to prevent unintentional islanding or the Interconnection Customer shall install conventional protection to affect the same protection. All required protective elements for a soft-loading transfer switch apply to an inverter connection. Figure 5 at the end of this document, shows a typical inverter interconnection.

(1) Inverter Certification – Before installation, the inverter shall be Type-Certified for interconnection to the electrical power system. The certification will confirm its anti-islanding protection and power quality related levels at the Point of Common Coupling. Also, utility compatibility, electric shock hazard, and fire safety are approved through UL listing of the model. Once this Type Certification is completed for that specific model, additional design review of the inverter should not be necessary by the Company Operator.

(2) For three-phase operation, the inverter control must also be able to detect and separate for the loss of one phase. Larger inverters will still require custom protection settings, which must be calculated and designed to be compatible with the specific Company system.

(3) A visible, lockable loadbreak disconnect switch is required for safety to isolate the Distributed Generation. The inverter shall not be used as a safety isolation device.

(4) When banks of inverter systems are installed at one location, a design review by the Company must be preformed to determine any additional protection systems, metering, or other needs. The issues will be identified by the Company during the interconnection study process

4. Interconnection Issues and Technical Requirements

A) General Requirements - The following requirements apply to all interconnected generating equipment. The Company shall be the source side and the customer's system shall be the load side in the following interconnection requirements.

i) Visible, Lockable Loadbreak Disconnect Switch - A disconnecting device shall be installed to electrically isolate the Company from the Generation System. The only exception for the installation of a visible, lockable loadbreak disconnect is if the generation is interconnected via a mechanically interlocked open transfer switch and installed per the NEC (702.6) "so as to prevent the inadvertent interconnection of normal and alternate sources of supply in any operation of the transfer equipment."

The visible, lockable loadbreak disconnect shall provide a visible air gap between Interconnection Customer's Generation and the Company in order to establish the safety isolation required for work on the Company system. This disconnecting device shall be readily accessible 24 hours per day by the Company field personnel and shall be capable of padlocking by the Company field personnel. The disconnecting device shall be lockable in the open position. In general, the device is not considered accessible if site personnel must be contacted or used to access and/or operate the device.

The visible, lockable loadbreak disconnect shall be a UL approved or National Electrical Manufacture's Association approved, manual safety disconnect switch of adequate ampere capacity. The visible disconnect shall not open the neutral when the switch is open. A draw-out type circuit breaker can be used as a visual open as long as it meets the Company field personnel accessibility requirement.

The visible disconnect shall be labeled, as required by the Company Operator to inform the Company field personnel.

ii) Energization of Equipment by Generation System – The Generation System shall not energize a de-energized Company system. The Interconnection Customer shall install the necessary padlocking (lockable) devices on equipment to prevent the energization of a de-energized electrical power system. Lock out relays shall automatically block the closing of breakers or transfer switches on to a de-energized Company system.

iii) Power Factor - The power factor of the Generation System and connected load shall be as follows:

(1) Inverter Based interconnections – for 20 kW and less, shall operate at a power factor of no less then 90% at the inverter terminals. Facilities over 20 kW shall meet the extended parallel requirements.

(2) Limited Parallel Generation Systems, such as closed transfer or soft-loading transfer systems shall operate at a power factor of no less then 90% during the period when the Generation System is parallel with the Company as measured at the Point of Common Coupling.

(3) Extended Parallel Generation Systems shall be designed to be capable of operating between 90% lagging and 95% leading. These Generation Systems shall operate near unity power factor (+/-98%) or as mutually agreed between the Company Operator and the Interconnection Customer.

iv) Grounding Issues

(1) Grounding of sufficient size to handle the maximum available ground fault current shall be designed and installed to limit step and touch potentials to safe levels as set forth in "IEEE Guide for Safety in AC Substation Grounding", ANSI/IEEE Standard 80.

(2) It is the responsibility of the Interconnection Customer to provide the required grounding for the Generation System. A good standard for this is the IEEE Std. 142-1991 "Grounding of Industrial and Commercial Power Systems"

(3) All electrical equipment shall be grounded in accordance with local, state, and federal electrical and safety codes, and applicable standards

v) Sales to Company or other parties – Transportation of energy on the Transmission system is regulated by the area reliability council and FERC. Those contractual requirements are not included in this standard. The Company will provide these additional contractual requirements during the interconnection approval process.

B) For Inverter based, closed transfer and soft loading interconnections - The following additional requirements apply:

i) Fault and Line Clearing - The Generation System shall be removed from the Company system for any faults, or outages occurring on the electrical circuit serving the Generation System.

ii) Operating Limits - in order to minimize objectionable and adverse operating conditions on the electric service provided to other customers connected to the Company, the Generation System shall meet the Voltage, Frequency, Harmonic and Flicker operating criteria as defined in IEEE 1547 and IEEE 519 standards during periods when the Generation System is operated in parallel with the Company.

If the Generation System creates voltage changes greater than 4% on the Company system, it is the responsibility of the Interconnection Customer to correct these voltage sag/swell problems caused by the operation of the Generation System. If the operation of the interconnected Generation System causes flicker, which causes problems for others customer's interconnected to the Company, the Interconnection Customer is responsible for correcting the problem.

iii) Flicker - The operation of the Generation System is not allowed to produce excessive flicker to adjacent customers. See IEEE 1547 and IEEE 519 standards for a more complete discussion on this requirement.

The stiffer the Company system, the larger a block load change that it will be able to handle. For any of the transfer systems, the Company voltage shall not drop or rise greater than 4% when the load is added or removed from the Company. It is important to note, that if another interconnected customer complains about the voltage change caused by the Generation System, even if the voltage change is below the 4% level, it is the Interconnection Customer's responsibility to correct or pay for correcting the problem. Utility experience has shown that customers have seldom objected to instantaneous voltage changes of less then 2% on the Company system.

iv) Interference - The Interconnection Customer shall disconnect the Distributed Generation from the Company if the Distributed Generation causes radio, television, or electrical service interference to other customers, via the distribution system or interference with the operation of the Company's system. The Interconnection Customer

either shall effect repairs to the Generation System or reimburse the Company Operator for the cost of any required modifications address the interference.

v) Synchronization of Customer Generation-

(1) An automatic synchronizer with synch-check relaying is required for unattended automatic quick open transition, closed transition, or soft loading transfer systems.

(2) To prevent unnecessary voltage fluctuations on the Company system, it is required that the synchronizing equipment be capable of closing the Distributed Generation into the Company system within the limits defined in IEEE 1547. Actual settings shall be determined by the Registered Professional Engineer establishing the protective settings for the installation.

(3) Unintended Islanding – Under certain conditions with extended parallel operation, it would be possible for a part of the Company's system to be disconnected from the rest of the Company's system and have the Generation System continue to operate and provide power to a portion of the isolated circuit. This condition is called "islanding". It is not possible to successfully reconnect the energized isolated circuit to the rest of the Company's system since there are no synchronizing controls associated with all of the possible locations of disconnection. Therefore, it is a requirement that the Generation System be automatically disconnected from the Company's system immediately by protective relays for any condition that would cause the Company's system to be de-energized. The Generation System must either isolate with the customer's load or trip. The Generation System must also be blocked from closing back into the Company's system until the Company's system is reenergized and the voltage is within Range B of ANSI C84.1 Table 1 for a minimum of 1 minute. Depending upon the size of the Generation System, it may be necessary to install direct transfer trip equipment from the Company's source(s) to remotely trip the generation interconnection to prevent islanding for certain conditions

vi) Disconnection – the Company Operator may refuse to connect or may disconnect a Generation System from the Company under the following conditions:

(1) Lack of approved Standard Application Form and Standard Interconnection Agreement.

(2) Termination of interconnection by mutual agreement.

(3) Non-Compliance with the technical or contractual requirements.

(4) System Emergency or for imminent danger to the public or Company personnel (Safety).

(5) Routine maintenance, repairs, and modifications to the Company. The Company Operator shall coordinate planned outages with the Interconnection Customer to the extent practical.

5. Generation Metering, Monitoring, and Control

Metering, Monitoring and Control – Depending upon the method of interconnection and the size of the Generation System, there are different metering, monitoring, and control requirements. Table 5A summarizes the metering, monitoring, and control requirements.

Due to the variation in Generation Systems and Company operational needs, the requirements for metering, monitoring, and control listed in this document are the expected maximum requirements that the Company will apply to the Generation System. It is important to note that for some Generation System installations, the Company may waive some of the requirements of this section if they are not needed. An example of this is with rural or low capacity feeders that require more monitoring then larger capacity, typically urban feeders.

Another factor that will effect the metering, monitoring, and control requirements will be the tariff under which the Interconnection Customer is supplied by the Company. Table 5A has been written to cover most application but some Company tariffs may have greater or lesser metering, monitoring, and control requirements than shown in Table 5A.

TABLE 5A Metering, Monitoring, and Control Requirements			
Generation System Capacity at Point of Common Coupling	**Metering**	**Generation Remote Monitoring**	**Generation Remote Control**
< 20 kW with all sales to Company	Bi-Directional metering at the point of common coupling**	None Required	None Required
20 – 250 kW with limited parallel	Detented* Company Metering at the Point of Common Coupling	None Required	None Required
20 – 250 kW with extended parallel	Recording metering on the Generation System and a separate recording meter on the load	Interconnection Customer supplied direct dial phone line. Company to supply it's own monitoring equipment	None Required
250 – 1000 kW With limited parallel	Detented* Company Metering at the Point of Common Coupling	Interconnection Customer supplied direct dial phone line and monitoring points available. See B (i)	None Required
250 – 1000 kW With extended parallel operation	Recording metering on the Generation System and a separate recording meter on the load.	Required Company remote monitoring system See B (i)	None Required
>1000 kW With limited parallel Operation	Detented* Company Metering at the Point of Common Coupling	Required Company SCADA monitoring system. See B (i)	None required
>1000 kW With extended parallel operation	Recording metering on the Generation System and a separate recording meter on the load.	Required Company SCADA monitoring system See B (i)	Direct Control via SCADA by Company of interface breaker.

* "Detented" - A meter that is detented will record power flow in only one direction.

** Meter will be detented unless a specific Company tariff permits net metering and the Interconnection customer has arranged for this service.

A) Metering

i) As shown in Table 5A, the requirements for metering will depend up on the type of generation and the type of interconnection. For most installations, the requirement is a single point of metering at the Point of Common Coupling. The Company Operator will install a special meter that is capable of measuring and recording energy flow in both directions, for three-phase installations or two detented meters wired in series, for single-phase installations. A dedicated, direct dial phone line may be required to be supplied to the meter for the Company's use to read the metering. Some monitoring may be done through the meter and the dedicated, direct dial phone line. In many installations, the remote monitoring and the meter reading can be done using the same dial-up phone line. The actual metering configuration and meters installed will be in accordance with the application and the tariffs that apply to the facility.

ii) Depending upon which tariff under which the Generation System and/or customer's load is being supplied, additional metering requirements may result. Contact the Company for tariff requirements. In some cases, the direct dial-phone line requirement may be waived by the Company for smaller Generation Systems.

iii) All Company's revenue meters shall be supplied, owned, and maintained by the Company. All voltage transformers (VT) and current transformers (CT) used for revenue metering shall be approved and/or supplied by the Company. The Company's standard practices for instrument transformer location and wiring shall be followed for the revenue metering.

iv) An additional, separate meter may be required to record energy for renewable energy credit (REC) payments. This will be determined by the present tariffs on file and approved by the Commission.

B) Monitoring (SCADA) is required as shown in table 5A. The need for monitoring is based on the need of the system control center to have the information necessary for the reliable operation of the Company's system. This remote monitoring is especially important during periods of abnormal and emergency operation.

The difference in Table 5A between remote monitoring and SCADA is that SCADA typically is a system that is in continuous communication with a central computer and provides updated values and status to the Company Operator within several seconds of the changes in the field. Remote monitoring on the other hand will tend to provide updated values and status within minutes of the change in state of the field. Remote monitoring is typically less expensive to install and operate.

i) Where Remote Monitoring or SCADA is required, as shown in Table 5A, the following monitored and control points are required:

(1) Real and reactive power flow for each Generation System (kW and kVAr). Only required if separate metering of the Generation and the load is required, otherwise #4 monitored at the point of Common Coupling will meet the requirements.

(2) Phase voltage representative of the Company's service to the facility.

(3) Status (open/close) of Distributed Generation and interconnection breaker(s) or if a transfer switch is used, status of transfer switch(s).

(4) Customer load from Company service (kW and kVAr).

(5) Control of interconnection breaker - if required by the Company Operator.

When telemetry is required, the Interconnection Customer must provide the communications medium to the Company's Control Center. This could be radio, dedicated phone circuit, or other form of communication. If a telephone circuit is used, the Interconnection Customer must also provide the telephone circuit protection. The Interconnection Customer shall coordinate the RTU (remote terminal unit) addition with the Company. The Company may require a specific RTU and/or protocol to match their SCADA or remote monitoring system.

6. Protective Devices and Systems

A) Protective devices required to permit safe and proper operation of the Company while interconnected with customer's Generation System are shown in the figures at the end of this document. In general, an increased degree of protection is required for increased Distributed Generation size. This is due to the greater magnitude of short circuit currents and the potential impact to system stability from these installations. Medium and large installations require more sensitive and faster protection to minimize damage and ensure safety. The relaying requirements illustrated are typical requirements. Additional requirements may be needed to accommodate the Facility. Additional requirements are likely where the Facility size is large compared to the system capacity and short circuit strength.

If a transfer system is installed that has a user accessible selection of several transfer modes, the transfer mode that has the greatest protection requirements will establish the protection requirements for that transfer system.

The Interconnection Customer shall provide protective devices and systems to detect the Voltage, Frequency, Harmonic, and Flicker levels as defined in the IEEE 1547 standard during periods when the Generation System is operated in parallel with the Company. The Interconnection Customer shall be responsible for the purchase, installation, and maintenance of these devices. Discussion on the requirements for these protective devices and systems follows:

i) Relay settings

(1) If the Generation System is utilizing a Type-Certified system, such as a UL listed inverter a Professional Electrical Engineer is not required to review and approve the design of the interconnecting system. If the Generation System interconnecting device is not Type-Certified or if the Type-Certified Generation System interconnecting device has additional design modifications made, the Generation System control, the protective system, and the interconnecting device(s) shall be reviewed and approved by a Professional Electrical Engineer registered in the State.

(2) A copy of the proposed protective relay settings shall be supplied to the Company Operator for review and approval to ensure proper coordination between the generation system and the Company.

ii) Relays

(1) All equipment providing relaying functions shall meet or exceed ANSI/IEEE Standards for protective relays; i.e., C37.90, C37.90.1 and C37.90.2.

(2) Required relays that are not "draw-out" cased relays shall have test plugs or test switches installed to permit field testing and maintenance of the relay without unwiring or disassembling the equipment. Installations 20 kW and under utilizing Type-Certified interconnection equipment are exempt from this requirement. The Company may waive compliance with this requirement for larger installations utilizing Type-Certified equipment in some situations.

(3) Three phase interconnections shall utilize three-phase power relays that monitor all three phases of voltage and current, unless otherwise noted in the appendix one-lines.

(4) All relays shall be equipped with setting limit ranges at least as wide as specified in IEEE 1547 and meet other requirements as specified in the Company interconnect study. Setting limit ranges are not to be confused with the actual relay settings required for the proper operation of the installation. At a minimum, all protective systems shall meet the requirements established in IEEE 1547.

(a) Over-current relays (IEEE Device 50/51 or 50/51V) shall operate to trip the protecting breaker at a level to ensure protection of the equipment and at a speed to allow proper coordination with other protective devices. For example, the over-current relay monitoring the interconnection breaker shall operate fast enough for a fault on the customer's equipment, so that no protective devices will operate on the Company's system. 51V is a voltage restrained or controlled over-current relay and may be required to provide proper coordination with the Company.

(b) Over-voltage relays (IEEE Device 59) shall operate to trip the Distributed Generation per the requirements of IEEE 1547.

(c) Under-voltage relays (IEEE Device 27) shall operate to trip the Distributed Generation per the requirements of IEEE 1547

(d) Over-frequency relays (IEEE Device 81O) shall operate to trip the Distributed Generation off-line per the requirements of IEEE 1547.

(e) Under-frequency relay (IEEE Device 81U) shall operate to trip the Distributed Generation off-line per the requirements of IEEE 1547. For Generation Systems with an aggregate capacity greater then 20 kW, the Distribution Generation shall trip off-line when the frequency drops below 57.0-59.8 Hz. typically this is set at 59.5 Hz, with a trip time of 0.16 seconds, but coordination with the Company is required for this setting.

The Company will provide the reference frequency of 60 Hz. The Distributed Generation control system must be used to match this reference. The protective relaying in the interconnection system will be expected to maintain the frequency of the output of the Generation.

(f) Reverse power relays (IEEE Device 32) (power flowing from the Generation System to the Company) shall operate to trip the Distributed Generation off-line for a power flow to the system with a maximum time delay of 2.0 seconds.

(g) Lockout Relay (IEEE Device 86) is a mechanically locking device which is wired into the close circuit of a breaker or switch and when tripped will prevent any close signal from closing that device. This relay requires that a person manually resets the lockout relay before that device can be reclosed. These relays are used to ensure that a de-energized system is not reenergized by automatic control action and prevents a failed control from auto-reclosing an open breaker or switch.

(h) Transfer Trip – All Generation Systems are required to disconnect from the Company when the Company's system is disconnected from its source to avoid unintentional islanding. With larger Generation Systems, which remain in parallel with the Company, a transfer trip system may be required to sense the loss of the Company source. When the Company source is lost, a signal is sent to the Generation System to separate the Generation from the Company. The size of the Generation System versus the capacity and minimum loading on the feeder will dictate the need for a transfer trip installation. The Company interconnection study will identify the specific requirements.

If multiple Company sources are available or there are multiple points of sectionalizing on the Company system, then more than one transfer trip system may be required. The Company interconnection study will identify the specific requirements. For some installations, the alternate Company source(s) may not be utilized except in rare occasions. If this is the situation, the Interconnection Customer may elect to have the Generation System locked out when the alternate source(s) are utilized if agreeable to the Company Operator.

(i) Parallel limit timing relay (IEEE Device 62PL) set at a maximum of 120 seconds for soft transfer installations and set no longer then 100 ms for quick transfer installations, shall trip the Distributed Generation circuit breaker on limited parallel interconnection systems. Power for the 62 PL relay must be independent of the transfer switch control power. The 62PL timing must be an independent device from the transfer control and shall not be part of the generation PLC or other control system.

TABLE 6A SUMMARY OF RELAYING REQUIREMENTS								
Type of Interconnection	**Over-current (50/51)**	**Voltage (27/59)**	**Frequency (81 0/U)**	**Reverse Power (32)**	**Lockout (86)**	**Parallel Limit Timer**	**Sync-Check (25)**	**Transfer Trip**
Open Transition Mechanically Interlocked (Fig. 1)	—	—	—	—	—	—	—	—
Quick Open Transition Mechanically Interlocked (Fig. 2)	—	—	—	—	**Yes**	**Yes**	**Yes**	—
Closed Transition (Fig. 2)	—	—	—	—	**Yes**	**Yes**	**Yes**	—
Soft Loading Limited Parallel Operation (Fig. 3)	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	—
Soft Loading Extended Parallel < 250 kW (Fig. 4)	**Yes**	**Yes**	**Yes**	—	**Yes**	—	**Yes**	—
Soft Loading Extended Parallel >250 kW (Fig. 4)	**Yes**	**Yes**	**Yes**	—	**Yes**	—	**Yes**	**Yes**
Inverter Connection (Fig. 5)								
< 20 kW	**Yes**	**Yes**	**Yes**	—	**Yes**	—	—	—
20 kW – 250 kW	**Yes**	**Yes**	**Yes**	—	**Yes**	—	—	—
> 250 kW	**Yes**	**Yes**	**Yes**	—	**Yes**	—	—	**Yes**

7. Agreements

A) Interconnection Agreement – This agreement is required for all Generation Systems that parallel with the Company. There may be different interconnection agreements depending upon the size and type of Generation System. This agreement contains the terms and conditions upon which the Generation System is to be connected, constructed, and maintained when operated in parallel with the Company. Some of the issues covered in the interconnection agreement are as follows;

i) Construction Process

ii) Testing Requirements

iii) Maintenance Requirements

iv) Firm Operating Requirements such as Power Factor

v) Access requirements for the Company personnel

vi) Disconnection of the Generation System (Emergency and Non-emergency)

vii) Term of Agreement

viii) Insurance Requirements

ix) Dispute Resolution Procedures

B) Operating Agreement – For larger Generation Systems that normally operate in parallel with the Company, an agreement separate from the interconnection agreement, called the "operating agreement", is usually created. This agreement is created for the benefit of both the Interconnection Customer and the Company Operator and will be agreed to between the Parties. This agreement will be dynamic and is intended to be updated and reviewed annually. For some smaller systems, the operating agreement can simply be a letter agreement. For larger and more integrated Generation Systems, the operating agreement will tend to be more involved and more formal. The operating agreement covers items that are necessary for the reliable operation of the Customer's and Company's systems. The items typically included in the operating agreement are as follows;

i) Emergency and normal contact information for both the Company operations center and for the Interconnection Customer.

ii) Procedures for periodic Generation System test runs.

iii) Procedures for maintenance on the Company system that affect the Generation System.

iv) Emergency Generation Operation Procedures.

8. Testing Requirements

A) Pre-Certification of Equipment

The most important part of the process to interconnect generation with Customer's and Company's systems is safety. One of the key components of ensuring the safety of the public and employees is to ensure that the design and implementation of the elements connected to the electrical power system operate as required. To meet this goal, all of the electrical wiring in a business or residence is required to be listed by a recognized testing and certification laboratory for its intended purpose. Typically, we see this as "UL" listed. Since Generation Systems have tended to be uniquely designed for each installation, they have been designed and approved by Professional Engineers. As the number of Generation Systems installed increase, vendors are working towards creating equipment packages that can be tested in the factory and then will only require limited field testing. This will allow us to move towards "plug and play" installations. For this reason, this standard recognizes the efficiency of "pre-certification" of Generation System equipment packages that will help streamline the design and installation process.

An equipment package shall be considered certified for interconnected operation if it has been submitted by a manufacture to and tested and listed by a nationally recognized testing and certification laboratory (NRTL) for continuous utility interactive operation in compliance with the applicable codes and standards. The applicable type-testing requirements are given in IEEE 1547.1. An "equipment package" shall include all interface components including switchgear, inverters, or other interface devices and may include an integrated generator or electric source. If the equipment package has been tested and listed as an integrated package that includes a generator or other electric source, it shall not required further design review, testing, or additional equipment to meet the certification requirements for interconnection. If the equipment package includes only the interface components (switchgear, inverters, or other interface devices), then the Interconnection Customer shall show that the generator or other electric source being utilized with the equipment package is compatible with the equipment package and consistent with the testing and listing specified for the package. Provided the generator or electric source combined with the equipment package is consistent with the testing and listing performed by the nationally recognized testing and certification laboratory, no further design review, testing, or additional equipment shall be required to meet the certification requirements of this interconnection procedure. A certified equipment package does not include equipment provided by the Company.

The use of Pre-Certified equipment does not automatically qualify the Interconnection Customer to be

interconnected to the Company. An application will still need to be submitted and an interconnection review may still need to be performed to determine the compatibility of the Generation System with the Company's system.

B) Pre-Commissioning Tests

i) Non-Certified Equipment

Pre-commissioning testing and Commissioning testing are also covered in IEEE 1547.1.

(1) Protective Relaying and Equipment Related to Islanding

(a) Distributed generation that is not Type-Certified (type-tested), shall be equipped with protective hardware and/or software designed to prevent the Generation from being connected to a de-energized Company system.

(b) The Generation may not close into a de-energized Company system and protection must be provided to prevent this from occurring. It is the Interconnection Customer's responsibility to provide a final design and to install the protective measures required by the Company. The Company will review and approve the design, the types of relays specified, and the installation. Mutually agreed upon exceptions may at times be necessary and desirable. It is strongly recommended that the Interconnection Customer obtain Company written approval before ordering protective equipment for parallel operation. The Interconnection Customer will own these protective measures installed at their facility.

(c) The Interconnection Customer shall obtain prior approval from the Company for any revisions to the specified relay calibrations.

C) Commissioning Testing

The following tests shall be completed by the Interconnection Customer. All of the required tests in each section shall be completed prior to moving on to the next section of tests. The Company Operator has the right to witness all field testing and to review all records prior to allowing the system to be made ready for normal operation. The Company shall be notified with sufficient lead time to allow the opportunity for Company personnel to witness any or all of the testing.

i) Pre-testing - The following tests are required to be completed on the Generation System prior to energization by the Generator or the Company. Some of these tests may be completed in the factory if no additional wiring or connections were made to that component. These tests are marked with a "*"

(1) Grounding shall be verified to ensure that it complies with this standard, the NESC, and the NEC.

(2) * CT's (Current Transformers) and VT's (Voltage Transformers) used for monitoring and protection, shall be tested to ensure correct polarity, ratio, and wiring

(3) CT's shall be visually inspected to ensure that all grounding and shorting connections have been removed, where required.

(4) Breaker / Switch tests – Verify that the breaker or switch cannot be operated with interlocks in place or that the breaker or switch cannot be automatically operated when in manual mode. Various Generation Systems have different interlocks, local or manual modes, etc. The intent of this section is to ensure that the breaker or switches controls are operating properly.

(5) * Relay Tests – All Protective relays shall be calibrated and tested to ensure the correct operation of the protective element. Documentation of all relay calibration tests and settings shall be furnished to the Company Operator.

(6) Trip Checks - Protective relaying shall be functionally tested to ensure the correct operation of the complete system. Functional testing requires that the complete system is operated by the injection of current and/or voltage to trigger the relay element and proving that the relay element trips the required breaker, lockout relay, or provides the correct signal to the next control element. Trip circuits shall be proven through the

entire scheme (including breaker trip)

For factory assembled systems, such as inverters, the setting of the protective elements may occur at the factory. This section requires that the complete system including the wiring and the device being tripped or activated is proven to be in working condition through the injection of current and/or voltage.

(7) Remote Control, SCADA, and Remote Monitoring tests – All remote control functions and remote monitoring points shall be verified operational. In some cases, it may not be possible to verify all of the analog values before energization. Where appropriate, those points may be verified during the energization process.

(8) Phase Tests – the Interconnection Customer shall work with the Company Operator to complete the phase test to ensure proper phase rotation of the Generation and wiring.

(9) Synchronizing test – The following tests shall be done across an open switch or racked out breaker. The switch or breaker shall be in a position that it is incapable of closing between the Generation System and the Company for this test. This test shall demonstrate that at the moment of the paralleling-device closure, the frequency, voltage, and phase angle are within the required ranges as stated in IEEE 1547 and 1547.1. This test shall also demonstrate that if any of the parameters are outside of the ranges stated, the paralleling-device shall not close. For inverter-based interconnected systems, this test may not be required unless the inverter creates fundamental voltages before the paralleling device is closed.

ii) On-Line Commissioning Test – the following tests will proceed once the Generation System has completed Pre-testing and the results have been reviewed and approved by the Company Operator. For 20 kW and under Generation Systems, the Company may waive joint interconnection tests. On larger and more complex Generation Systems, the Interconnection Customer and the Company Operator will get together to develop the required testing procedure. All on-line commissioning tests for larger facilities shall be based on written test procedures agreed to between the Company Operator and the Interconnection Customer.

Generation System functionally shall be verified for specific interconnections as follows:

(1) Anti-Islanding Test – For Generation Systems that parallel with the utility for longer then 100 msec

(a) The Generation System shall be started and connected in parallel with the Company source.

(b) The Company source shall be removed by opening a switch, breaker, etc.

(c) The Generation System shall either separate with the local load or stop generating.

(d) The device that was opened to remove the Company source shall be closed and the Generation System shall not re-parallel with the Company for at least 5 minutes.

iii) Final System Sign-off

(1) To ensure the safety of the public, all interconnected customer owned generation systems which do not utilize a Type-Certified system shall be certified as ready to operate by a Professional Electrical Engineer registered in the State prior to the installation being considered ready for commercial use.

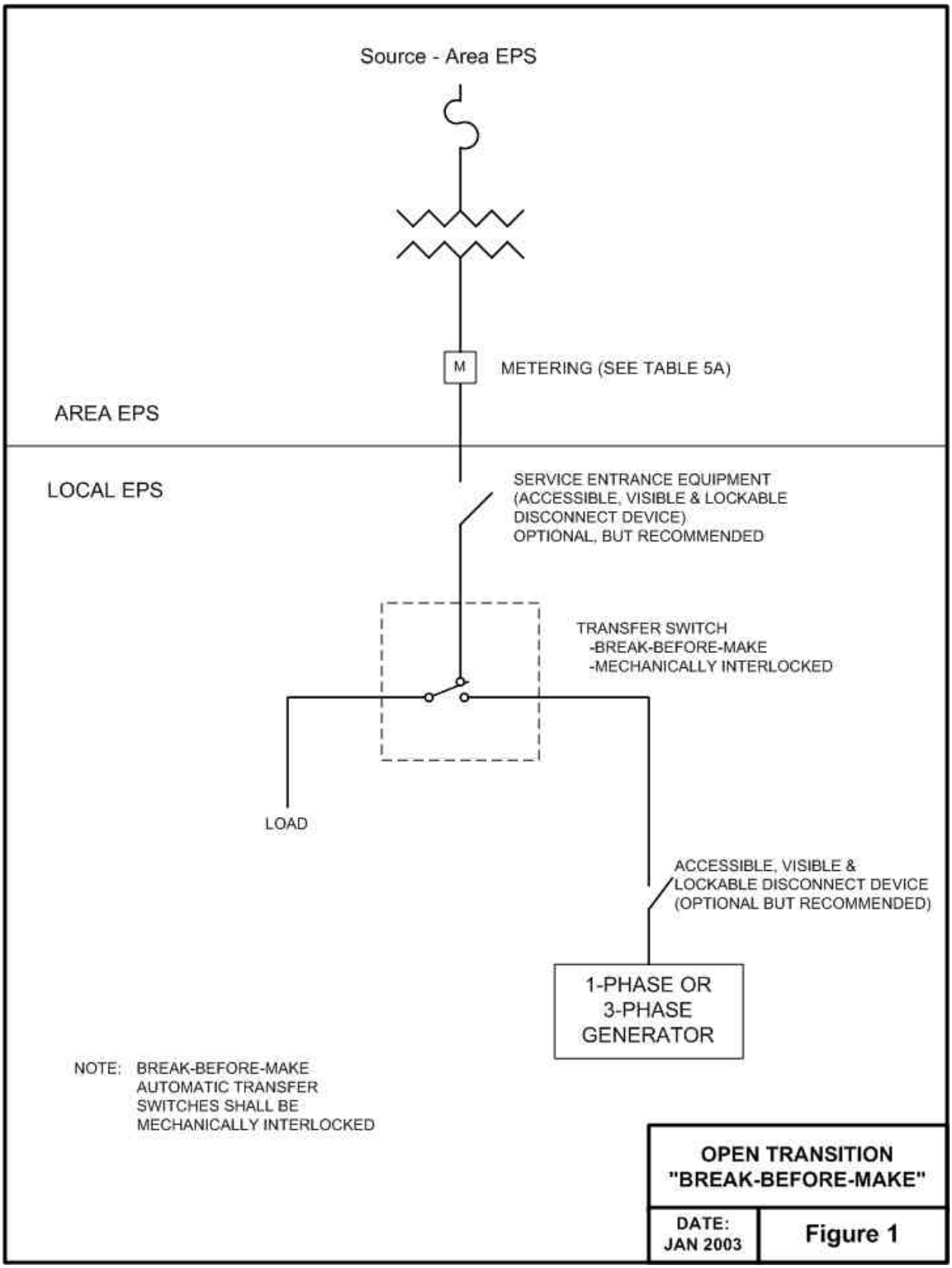
iv) Periodic Testing and Record Keeping

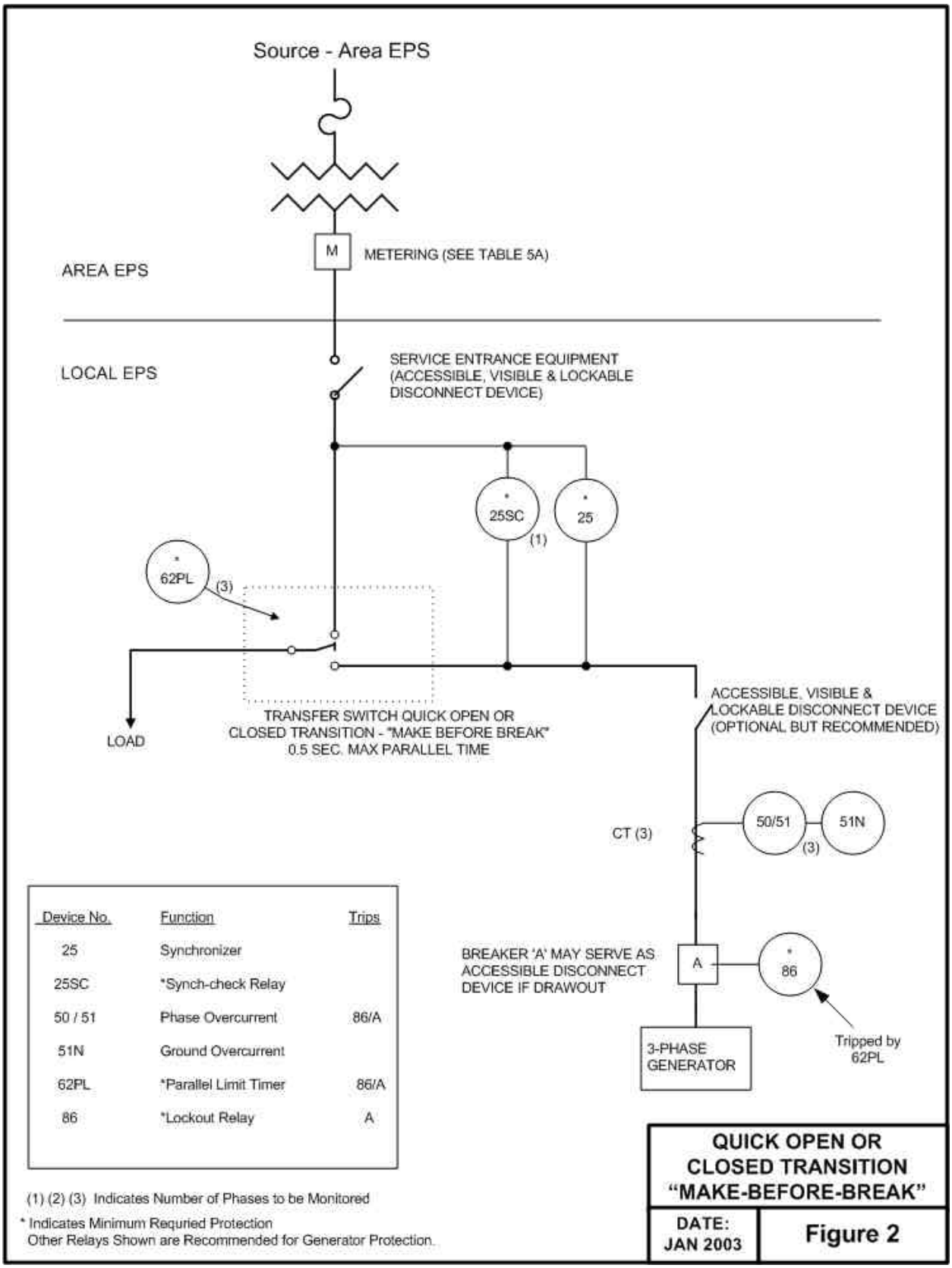
(1) Any time the interface hardware or software, including protective relaying and generation control systems are replaced and/or modified, the Company Operator shall be notified. This notification shall, if possible, be with sufficient warning so that the Company personnel can be involved in the planning for the modification and/or witness the verification testing. Verification testing shall be completed on the replaced and/or modified equipment and systems. The involvement of the Company personnel will depend upon the complexity of the Generation System and the component being replaced and/or modified. Since the Interconnection Customer and the Company Operator are now operating an interconnected system, it is important for each to communicate changes in operation, procedures, and/or equipment to ensure the safety and reliability of the Customer's and Company's systems.

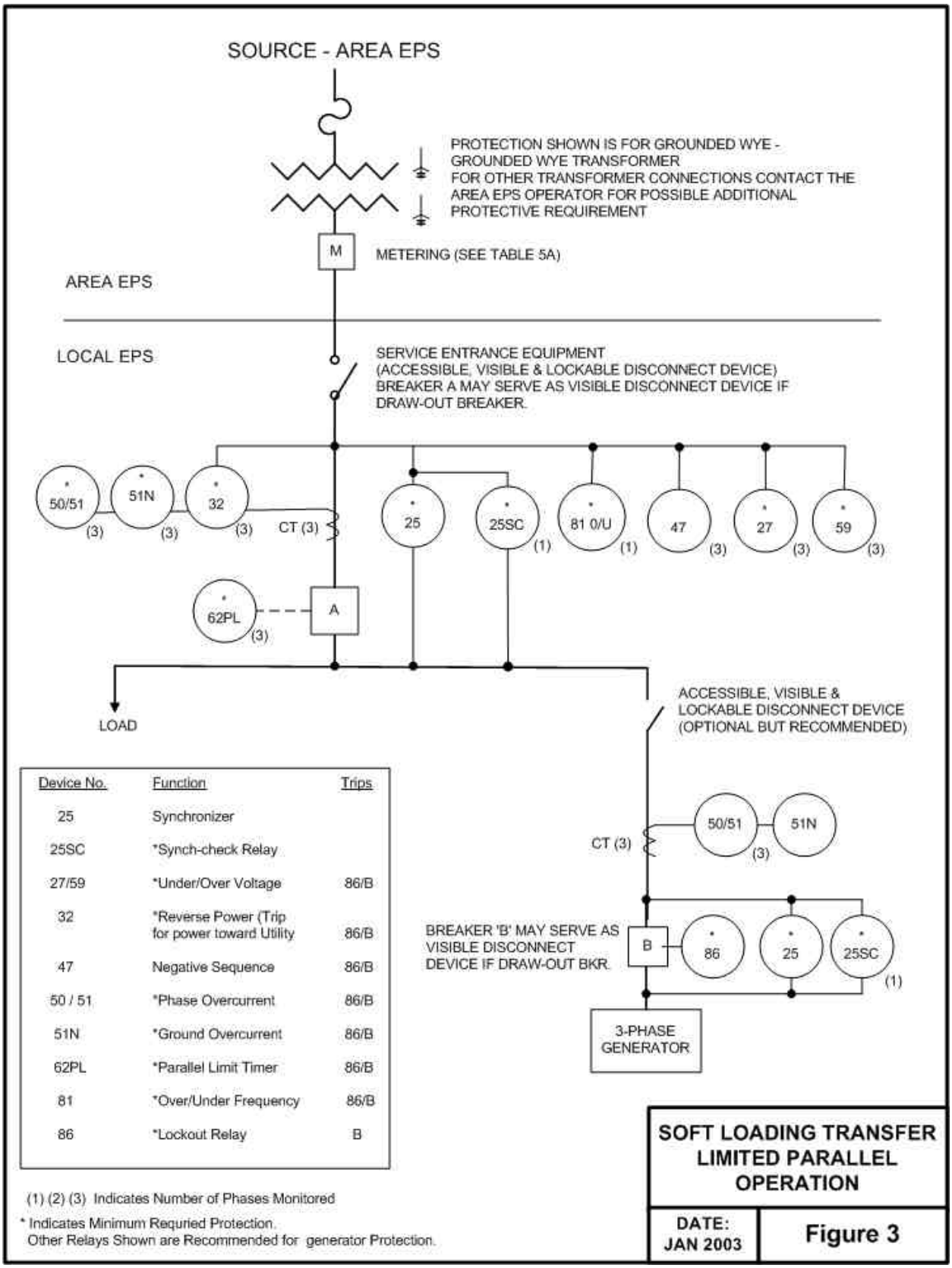
(2) All interconnection-related protection systems shall be periodically tested and maintained by the Interconnection Customer at intervals specified by the manufacture or system integrator. These intervals shall not exceed 5 years. Periodic test reports and a log of inspections shall be maintained by the Interconnection Customer and made available to the Company Operator upon request. The Company Operator shall be notified before the periodic testing of the protective systems so that Company personnel may witness the testing if so desired. Testing notification for Facilities 20 kW and under is not required.

(a) Verification of inverter connected system rated 20 kW and below may be completed as follows: The Interconnection Customer shall operate the AC load break disconnect switch and verify the Generator automatically shuts down and does not restart for at least 5 minutes after the switch is closed.

(b) Any system that depends upon a battery for trip/protection power shall be checked and logged once per month for proper voltage. Once every four years, either the battery(s) must be replaced or a discharge test performed. Longer intervals are possible with “station class batteries” and Company Operator approval.


Source - Area EPS
M
METERING (SEE TABLE 5A)
AREA EPS
LOCAL EPS
SERVICE ENTRANCE EQUIPMENT
(ACCESSIBLE, VISIBLE & LOCKABLE
DISCONNECT DEVICE)
OPTIONAL, BUT RECOMMENDED
TRANSFER SWITCH
-BREAK-BEFORE-MAKE
-MECHANICALLY INTERLOCKED
LOAD
ACCESSIBLE, VISIBLE &
LOCKABLE DISCONNECT DEVICE
(OPTIONAL BUT RECOMMENDED)
1-PHASE OR
3-PHASE
GENERATOR
NOTE: BREAK-BEFORE-MAKE
AUTOMATIC TRANSFER
SWITCHES SHALL BE
MECHANICALLY INTERLOCKED
OPEN TRANSITION
"BREAK-BEFORE-MAKE"
DATE:
JAN 2003
Figure 1


Source - Area EPS
M
METERING (SEE TABLE 5A)
AREA EPS
LOCAL EPS
SERVICE ENTRANCE EQUIPMENT
(ACCESSIBLE, VISIBLE & LOCKABLE
DISCONNECT DEVICE)
* 25SC
(1)
* 25
* 62PL
(3)
LOAD
TRANSFER SWITCH QUICK OPEN OR
CLOSED TRANSITION - "MAKE BEFORE BREAK"
0.5 SEC. MAX PARALLEL TIME
ACCESSIBLE, VISIBLE &
LOCKABLE DISCONNECT DEVICE
(OPTIONAL BUT RECOMMENDED)
CT (3)
50/51
(3)
51N
BREAKER 'A' MAY SERVE AS
ACCESSIBLE DISCONNECT
DEVICE IF DRAWOUT
A
* 86
Tripped by
62PL
3-PHASE
GENERATOR
Device No. | Function | Trips
25 | Synchronizer |
25SC | *Synch-check Relay |
50 / 51 | Phase Overcurrent | 86/A
51N | Ground Overcurrent |
62PL | *Parallel Limit Timer | 86/A
86 | *Lockout Relay | A
(1) (2) (3) Indicates Number of Phases to be Monitored
* Indicates Minimum Requried Protection
Other Relays Shown are Recommended for Generator Protection.
QUICK OPEN OR
CLOSED TRANSITION
"MAKE-BEFORE-BREAK"
DATE:
JAN 2003
Figure 2



Device No.	Function	Trips
25	Synchronizer	
25SC	*Synch-check Relay	
27/59	*Under/Over Voltage	86/B
32	*Reverse Power (Trip for power toward Utility	86/B
47	Negative Sequence	86/B
50 / 51	*Phase Overcurrent	86/B
51N	*Ground Overcurrent	86/B
62PL	*Parallel Limit Timer	86/B
81	*Over/Under Frequency	86/B
86	*Lockout Relay	B

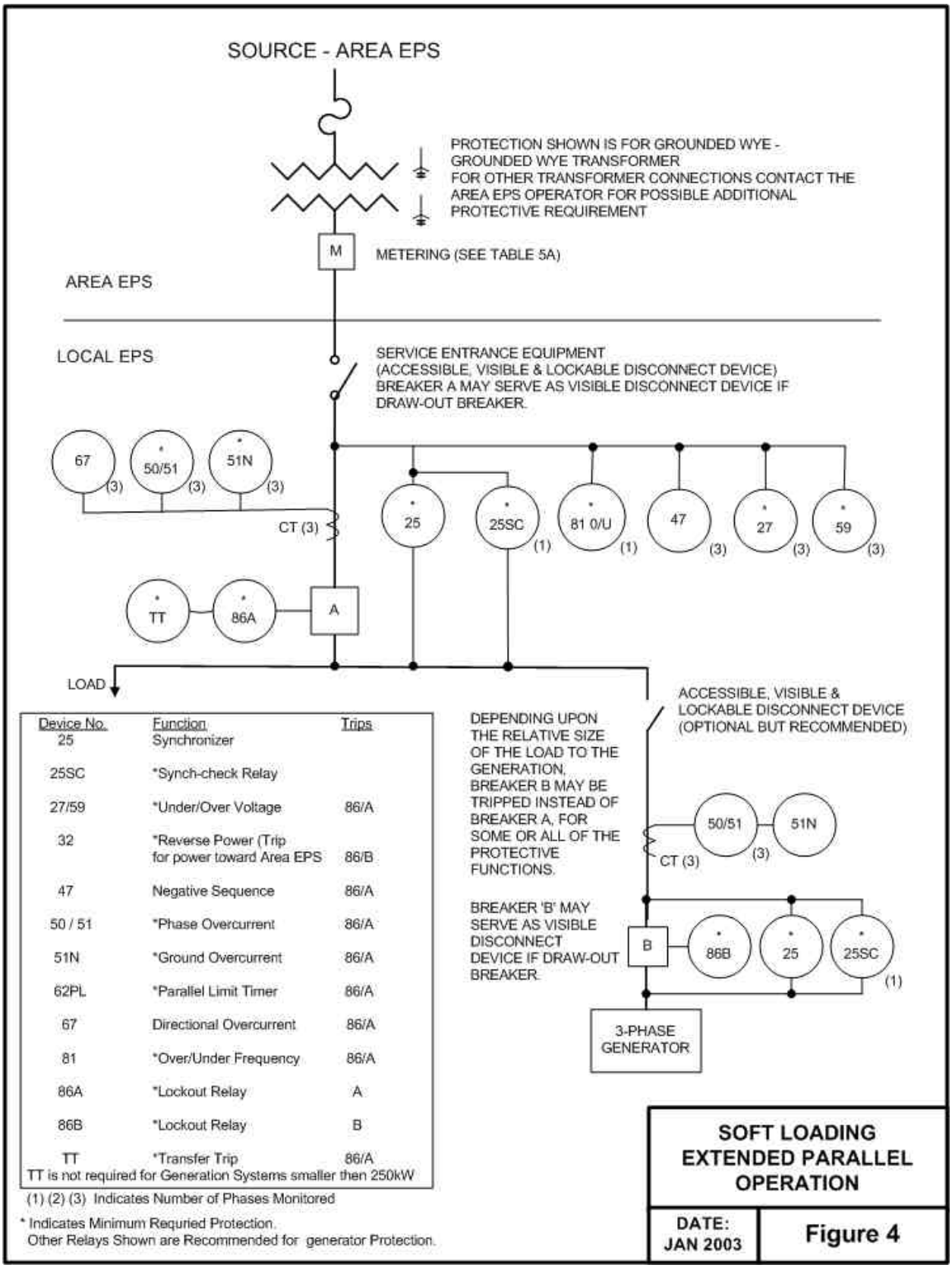
(1) (2) (3) Indicates Number of Phases Monitored

* Indicates Minimum Requried Protection.
Other Relays Shown are Recommended for generator Protection.

SOFT LOADING TRANSFER LIMITED PARALLEL OPERATION

DATE: JAN 2003

Figure 3



Device No.	Function	Trips
25	Synchronizer	
25SC	*Synch-check Relay	
27/59	*Under/Over Voltage	86/A
32	*Reverse Power (Trip for power toward Area EPS	86/B
47	Negative Sequence	86/A
50 / 51	*Phase Overcurrent	86/A
51N	*Ground Overcurrent	86/A
62PL	*Parallel Limit Timer	86/A
67	Directional Overcurrent	86/A
81	*Over/Under Frequency	86/A
86A	*Lockout Relay	A
86B	*Lockout Relay	B
TT	*Transfer Trip	86/A

TT is not required for Generation Systems smaller then 250kW

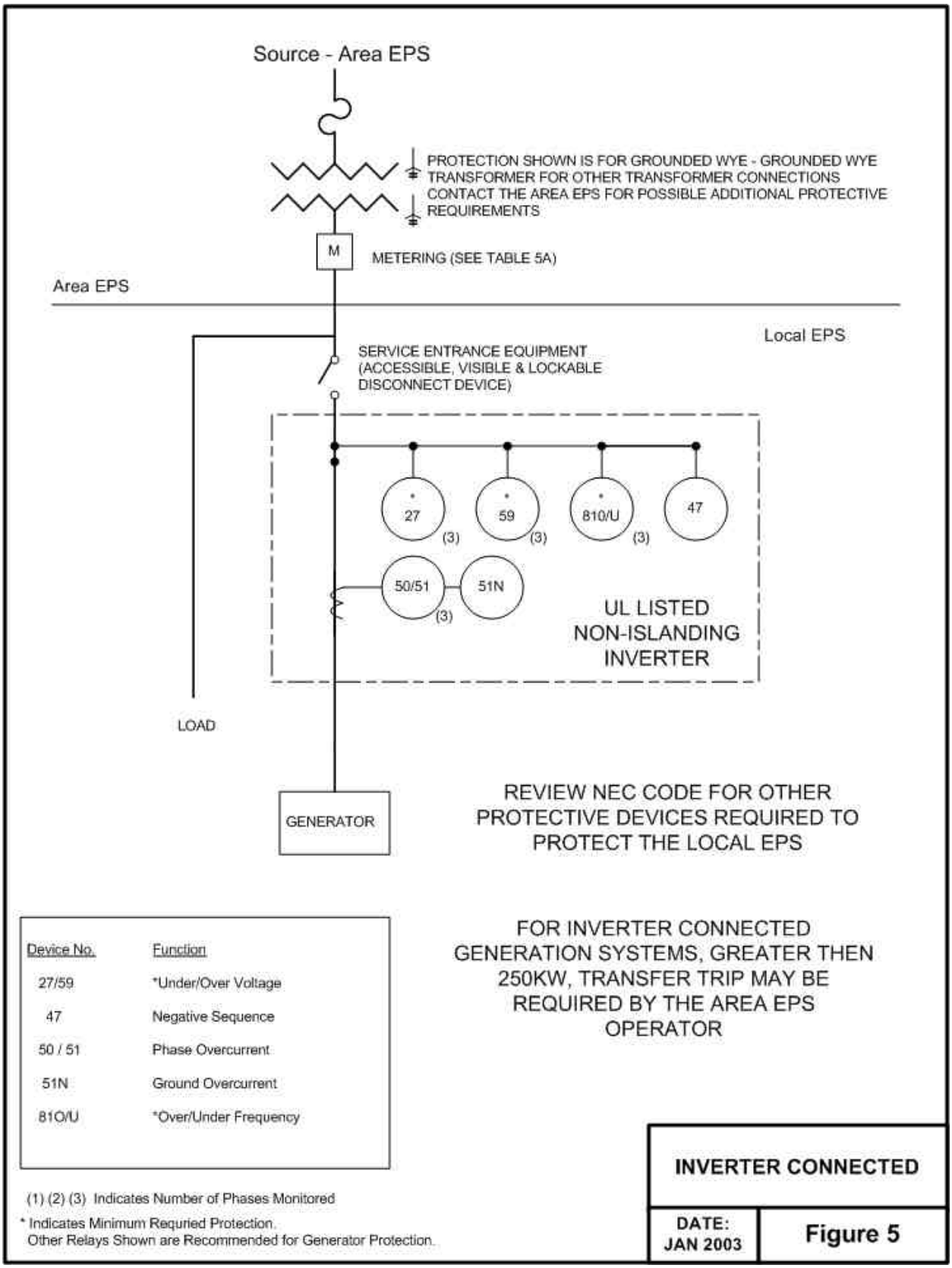
(1) (2) (3) Indicates Number of Phases Monitored

* Indicates Minimum Requried Protection.
Other Relays Shown are Recommended for generator Protection.

SOFT LOADING EXTENDED PARALLEL OPERATION

DATE: JAN 2003

Figure 4


Source - Area EPS
PROTECTION SHOWN IS FOR GROUNDED WYE - GROUNDED WYE TRANSFORMER FOR OTHER TRANSFORMER CONNECTIONS CONTACT THE AREA EPS FOR POSSIBLE ADDITIONAL PROTECTIVE REQUIREMENTS
M
METERING (SEE TABLE 5A)
Area EPS
Local EPS
SERVICE ENTRANCE EQUIPMENT (ACCESSIBLE, VISIBLE & LOCKABLE DISCONNECT DEVICE)
27
(3)
59
(3)
810/U
(3)
47
50/51
(3)
51N
UL LISTED NON-ISLANDING INVERTER
LOAD
GENERATOR
REVIEW NEC CODE FOR OTHER PROTECTIVE DEVICES REQUIRED TO PROTECT THE LOCAL EPS
FOR INVERTER CONNECTED GENERATION SYSTEMS, GREATER THEN 250KW, TRANSFER TRIP MAY BE REQUIRED BY THE AREA EPS OPERATOR
Device No. Function
27/59 *Under/Over Voltage
47 Negative Sequence
50 / 51 Phase Overcurrent
51N Ground Overcurrent
81O/U *Over/Under Frequency
(1) (2) (3) Indicates Number of Phases Monitored
* Indicates Minimum Requried Protection.
Other Relays Shown are Recommended for Generator Protection.
INVERTER CONNECTED
DATE: JAN 2003
Figure 5