

Southern Indiana Gas and Electric Company d/b/a
Vectren Energy Delivery of Indiana, Inc.

Questions regarding Net Metering Programs (“programs”):

Investor-owned Electric Utilities:

- 1) How does your utility presently communicate to potential customers the program’s availability?

Vectren communicates the program’s availability to potential customers via the website at <https://www.vectren.com/information/customer-generation>. We also host an annual meeting for interested contractors to vet issues, and speak to customers individually regarding their net metering application on an as needed basis.

See “Vectren - Attachment 1” for the website content which includes:

- About net metering
- Important solar installation dates & credits
- How to get connected including:
 - 1) Project Checklist
 - 2) Guidelines
- Applications and agreements including:
 - 1) Application for interconnection for Generation less than 10kW
 - 2) Interconnection agreement for Generation less than 10kW
 - 3) Application for interconnection for Generation 10kW or more
 - 4) Interconnection Agreement for Generation 10kW or more

- 2) Does your utility provide public access to program availability on its website?

Yes. See response to question 1.

- 3) How, if at all, does your utility inform potential customers of the remaining availability of the program in terms of the statutory capacity thresholds?

Vectren has not adopted a formal notification procedure regarding the availability of its remaining capacity, however, during Vectren’s last solar installers meeting, Vectren advised that it would continue to accept applications after the total capacity has been met (including pending applications) and that those applications would be processed in the order received in the event pending applications were either declined or canceled. Vectren also notified the installers that Vectren would notify them once Vectren neared any of the capacity thresholds. Vectren sent an email notification to all active installers regarding Vectren’s anticipation that under the statute the availability of net metering would soon transition for commercial customers to a DG tariff offering.

- 4) If so, how often is the availability updated? (weekly, monthly, etc.)

See response to question 3.

- 5) What, if any, limitations are there to providing public access to the program availability in such a context?

To the extent further updates are requested, Vectren would be willing to work with installers/customers to provide such information.

- 6) To what extent does your utility facilitate a queue for requests to participate in the program?

Vectren currently does not have a queue in place, however, Vectren determines program participation via the order in which the applications are received.

- 7) If you use a queue, what are the minimum requirements that must be satisfied by an applicant in order to be added to the queue?

See answer 6. To be considered, a customer must submit a complete application, own both the property at which the net metering facility will be installed and the net metering facility, and have active service with, or have submitted a service request to, Vectren.

- 8) If you use a queue, how is the queue status communicated to the other potential customers?

As stated previously, Vectren does not have a queue in place. While Vectren does communicate to existing applicants, we currently do not have a formal means in place to communicate to other potential customers.

- 9) What, if any, limitations are there to providing public access to the program queue in such a context?

Given the Company has effectively managed the volume of applications and informational requests, there is no queue communication at this time.

- 10) Are there other options your utility has availed itself of to address availability transparency?

The only availability issue to date has been the anticipated end of net metering availability for the commercial class, and Vectren has communicated this issue via email to all installers.

- 11) Are there other approaches your utility would suggest we explore to address availability transparency?

Future program issues can be communicated directly to active installers and the website can also be used to provide information to the public.

- 12) How would your utility suggest customer requests are managed when the availability of net metering to them may be limited because of the statutory reservations?

Customer applications are worked in the order received. To the extent a limitation arises, the potential impact on future applications can be communicated directly to the customers.

Customer Generation (Net Metering)

Section menu

About net metering

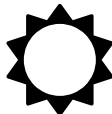
Through a program called net metering, residential, small business and industrial customers can generate their own electricity, up to 1 megawatt, to supplement the supply they get from Vectren. When a net metering customer's renewable generator is producing more power than is being consumed, the customer essentially generates credits toward the bill. When a net metering customer uses more power than is being produced, the meter records the usage in the standard fashion. Net metering customers are charged only for the "net" power they consume from Vectren which has accumulated over a designated period or, if their renewable energy-generating systems make more electricity than is consumed, they may be credited for the excess electricity contributed to the grid over that same period.

Common customer generation systems include:



Wind

Most wind technologies can be used as stand-alone applications, connected to a utility power grid or combined with a photovoltaic system. [Learn more \(http://energy.gov/energysaver/articles/small-wind-electric-systems\)](http://energy.gov/energysaver/articles/small-wind-electric-systems)



Solar

Solar power is commonly produced when photovoltaic (PV) systems convert sunlight into electricity. Roof panels are a popular choice.

[Learn more \(http://energy.gov/energysaver/articles/small-solar-electric-systems\)](http://energy.gov/energysaver/articles/small-solar-electric-systems)



Other options

Some other customer generation options include biomass, hydropower and hybrid systems. [Learn more \(http://energy.gov/buying-making-electricity\)](http://energy.gov/buying-making-electricity)

Important **solar** installation dates & credits

As a result of Indiana Senate Enrolled Act 309 (SEA 309), signed into law in early 2017, customers interested in installing private solar (customer-owned) electric generation systems through Vectren's net metering program, such as rooftop solar panels, are reminded that Dec. 31, 2017, is the deadline by which their private generation unit must be installed to be credited at the full electric retail price for the excess power they generate over the next 30 years. As such, customers, especially businesses planning larger solar installations, are encouraged to apply for interconnection of their private solar generation to Vectren's electric system **no later than mid-October**, to ensure adequate time for their proposed system to meet all requirements and to be installed by year-end. The new laws for customers with existing systems as well as for those who plan to install are as follows:

- **Systems installed by Dec. 31, 2017**

Customers with systems installed by Dec. 31, 2017 will be credited at the full retail price* for excess power put back on the grid until 2047. After 2047, excess power will be credited at the market/wholesale price** plus a 25% premium.

- **Systems installed between 2018 and 2022**

Customers with systems installed between 2018 and 2022 will be credited at the full retail price for excess power put back on the grid until 2032. After 2032, excess power will be credited at the market/wholesale price plus a 25% premium.

- **Systems installed after 2022**

Customers with systems installed after 2022 will be credited at the market/wholesale rate plus a 25% premium for excess power put back on the grid.

Caps impacting credits

Under SEA 309, the net metering cap, or maximum amount of private generation on Vectren's system that will be credited at the full retail price for energy, was increased from 1% to 1.5% of Vectren's retail peak load. Therefore, the total amount of private generation that can qualify for Vectren's net metering program is now 16.5 megawatts (MW). Of the 16.5 MW:

- 40% of the 16.5 MW must be reserved for residential customers
- 15% of the 16.5 MW must be reserved for biomass/agricultural projects

If this 1.5% cap is reached prior to the end of 2022, all customers thereafter who install private generation and interconnect with Vectren will be credited at the market/wholesale rate plus a 25% premium for excess power put back on the grid.

What happens if I buy or sell a property with an existing system?

The policies outlined above apply to the property and power generation system - not the property owner - and will continue regardless of a transfer of ownership.


***Retail price:** The full price per unit a customer would pay Vectren for a kilowatt hour of electricity.


The retail price accounts for the price of the power consumed, including the generation units and fuel costs needed to generate the electricity; costs to access and maintain the entire electric grid; and various customer service fees for billing, metering and energy efficiency programs.

****Wholesale/market price:** The price Vectren would pay if the power the customer generated was purchased on the wholesale market. The wholesale (or purchase in large quantity) price for power is typically 25 to 30% of the retail price.

How to get connected

There are a few key steps you must complete to begin the interconnection process, including a formal application, signing an interconnection agreement, a site drawing and an inspection. Use the project checklist and guidelines before beginning your net metering project.

 [Project checklist \(/assets/downloads/customer-generation/custgen-checklist.pdf\)](/assets/downloads/customer-generation/custgen-checklist.pdf)

 [Guidelines \(/assets/downloads/customer-generation/custgen-interconnect-guidelines.pdf\)](/assets/downloads/customer-generation/custgen-interconnect-guidelines.pdf)

Applications and agreements

Select the documents below which correspond with your project size to get started:

Generation is 10 kW or more

[Application for interconnection \(/assets/downloads/customer-generation/custgen-interconnect-application-10kwplus.pdf\)](/assets/downloads/customer-generation/custgen-interconnect-application-10kwplus.pdf) (PDF)

[Interconnection agreement \(/assets/downloads/customer-generation/custgen-interconnect-agreement-10kwplus.pdf\)](/assets/downloads/customer-generation/custgen-interconnect-agreement-10kwplus.pdf) (PDF)

Generation is less than 10 kW

[Application for interconnection \(/assets/downloads/customer-generation/custgen-interconnect-application-0-10kw.pdf\)](/assets/downloads/customer-generation/custgen-interconnect-application-0-10kw.pdf) (PDF)

[Interconnection agreement \(/assets/downloads/customer-generation/custgen-interconnect-agreement-0-10kw.pdf\)](/assets/downloads/customer-generation/custgen-interconnect-agreement-0-10kw.pdf) (PDF)

Contact us online or at 1-800-990-1930 (tel:18009901930) to learn more or to get the process started. All positions and references are in accordance to Vectren's TARIFF FOR ELECTRIC SERVICE (I.U.R.C. No. E-13) and are subject to future changes.

 [Need more information? Contact us \(/contact\)](/contact)



(<http://www.youtube.com/vectrenlivesmart>)

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Vectren Indiana Net Metering Customer Checklist



1. Prior to purchase or installation, provide a fully completed application for interconnection, including a one-line drawing of the proposed interconnection, equipment specifications and equipment certification by testing laboratory compliance with UL 1741 and/or IEEE 1547, as applicable.
2. One-line drawing must include Vectren metering and its interconnection with the generator/inverter system. Show panel ratings and switch ratings (as applicable).
3. Interconnection agreement must be fully complete and signed by both Vectren and customer before interconnecting the generating equipment with Vectren.
4. Following review of application and execution of interconnection agreement, customer must provide Vectren notice at least 10 days prior to operation to allow for inspection. Operation shall not begin until after the inspection by Vectren (if required) and a net meter being set by Vectren.
5. Insurance requirements must be met per 170 IAC 4-4.2-8.
6. Vectren does not require customers to include an AC Generator Disconnect Switch when the interconnected facility meets ALL of the following conditions:
 - a. Facility is inverter-based, and meets certification requirements of UL 1741 and/or IEEE 1547.
 - b. Vectren's meter is a single phase, 120/240 volt or 120/208 volt unit.
 - c. Vectren's meter is self-contained (not transformer rated).
 - d. Vectren's meter is socket-based.
 - e. Main electrical panel is rated for 320 amps or less of "continuous current".


Note: The customer is responsible for verifying disconnect requirements of their local governmental jurisdiction. In some cases, the local governmental Electrical Inspector may require a disconnect switch before granting a final electrical permit.
7. **If the interconnection does not meet all of the criteria shown in Item 6, a disconnect switch is required. The switch:**
 - a. Must have a visible open gap when in the open position, and be capable of being locked in the open position (include a note on the one-line drawing stating this).
 - b. Must be rated properly for its application, suitable for outdoor use (if applicable), and labeled "GENERATOR DISCONNECT".
 - c. Must be located at the point of common coupling (adjacent to utility meter) for all interconnections and must be accessible to Vectren personnel at all times (include location note on one-line drawing stating this).
 - d. Must be gang-operated, if the interconnection is multi-phase.
8. Total of generator/inverter ratings must be 1000KW or smaller.
9. Generator/inverter must be owned and operated by customer and located on customer's property.
10. The generator system must operate in parallel with the company's distribution facilities.
11. Field inspection (as applicable), review and approval must be completed by appropriate Vectren personnel prior to net meter installation.
12. Customer is responsible to ensure its facilities meet NEC, NESC and any other applicable code requirements.
13. Customer is responsible to obtain electric inspection from local authority prior to interconnection (not required in all localities).



Interconnection Guidelines for Customer- Owned Generation

VEC-006 Control Document Interconnection Guidelines for Customer-Owned Generation

*Please refer questions about this document to the Electric Reliability
Compliance Department (812-491-4012 or 812-491-5878).*

	<p align="center">INTERCONNECTION GUIDELINES FOR CUSTOMER-OWNED GENERATION (VEC)</p>	<p align="center">Revision Number 8</p>
<p align="center">VEC-006 Interconnection Guidelines for Customer-Owned Generation</p>		

Review Policy

ORIGINAL

This document shall be reviewed and revised annually or as necessary due to system changes or changes to the NERC standards. The annual review will be initiated by the Electric Reliability Compliance Department and approved by the Signatory Group. As a result of the annual review, updates to this document will be reflected by redline(s), and the new version of the document will be approved by the Signatory Group listed on the signature page(s) of this document. If no changes are required as a result of the document review process, the Signatory Group will certify an annual review has been conducted and file as evidence in the Electric Reliability Compliance Department Master files.

Approved By:


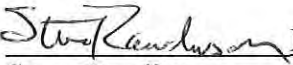
Name	Title	Date
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 Steve Rawlinson	Manager, System Engineering	12-14-15

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Revision Table

Revision Number	Revision Date	Effective Date	Revised By	Summary of Changes
0	05/08/08	05/08/08	R. Tabor	Revised document in new format
1	03/10/09	03/31/09	R. Tabor	<ul style="list-style-type: none"> ▪ Updated Annual Review Table ▪ Standardized document formatting.
2	05/19/10	06/28/10	M. Rose	<ul style="list-style-type: none"> ▪ Annual Review. See Redline.
3	06/01/11	07/06/11	R. Collins	<ul style="list-style-type: none"> ▪ Made content changes based on annual or self-certification review. See redline(s) and summary of document changes.
4	03/01/12	07/16/12	R. Collins	<ul style="list-style-type: none"> ▪ Made content changes based on annual or self-certification review. See redline(s) and summary of document changes.
5	10/31/13	12/17/13	K. Barr	<ul style="list-style-type: none"> ▪ Made content changes based on annual or self-certification review. See redline(s) and summary of document changes.
6	05/27/14	08/05/14	F. Frederick	<ul style="list-style-type: none"> ▪ Made content changes concerning disconnect switch requirements for installations on the electric distribution system of 10 KW or less.
7	04/27/15	07/07/15	K. Barr	<ul style="list-style-type: none"> ▪ Made content changes based on annual or self-certification review. See redline(s) and summary of document changes.
8	10/06/15	12/14/15	K. Barr	<ul style="list-style-type: none"> ▪ Made content changes based on annual or self-certification review. See redline(s) and summary of document changes.

1 Introduction

1.1 Purpose

These guidelines provide preliminary technical information to parties interested in modifying existing generating facilities on or interconnecting new customer-owned generation to Vectren's electric system. Vectren makes facility interconnection requirements available to entities seeking to interconnect upon request.

However, Vectren requires a fully executed agreement with a third party planning to interconnect to a Vectren generation facility prior to providing the respective facility interconnection requirements. Upon request, Vectren will provide within 45 calendar days of the fully executed agreement. The agreement states Vectren will conduct a study on the reliability impact of the interconnection.

Throughout this document, the term "Producer" refers to the owner of the customer-owned generating system.

These guidelines are recommendations only and do not dismiss the Producer from independently evaluating the customer-owned generating system's performance, compliance, and safety. It is the Producer's sole responsibility to evaluate and ensure safety with respect to its facilities and employees. Vectren assumes no liability or responsibility with respect to the accuracy or completeness of these guideline recommendations contained herein.

These guidelines state general Vectren recommendations to ensure that the interconnection of customer-owned generation to the Vectren electric system does not adversely impact reliability or quality of electric service to Vectren or its customers.

Producer and Vectren personnel are to use these guidelines when planning installations or modifications for customer-owned generation to identify proper design, analysis and coordination in the pursuit of a comprehensive, interconnection feasibility study. Vectren personnel will review all proposed modifications to the interconnected electric systems to determine the level of impact. The following requirements are general and may not cover all details in specific cases. The Producer should discuss project plans with Vectren prior to purchasing or installing equipment. The Producer must notify Vectren of any planned generation installations or modifications so that all entities responsible

for the reliability of the distribution systems and the interconnected transmission systems can also be notified as soon as feasible.

The Producer pays all interconnection costs because the generating system shall not impose an economic burden to Vectren or its customers. These costs may include, but not limited to, the following : design and installation, metering and communications, protective and safety devices, power-factor-correction, power quality and reliability mitigation, power system studies, reviewing submitted plans, inspection and maintenance services, modifications to the existing Vectren electric system, administrative and insurance costs; however, limited to only those costs actually incurred by Vectren. These guidelines do not address federal or state regulatory requirements, transmission access, or other commercial terms and conditions to transport or sell energy.

1.2 Vectren Policy on Customer-Owned Generation

Vectren permits any Producer to operate generating equipment in parallel with the Vectren electric system with written approval from Vectren and without adverse effects to Vectren personnel, equipment, or its customers. Protective devices, such as relays, circuit breakers, etc., specified by Vectren, must be installed at any location where a Producer desires to operate generation in parallel with the Vectren electric system. The purpose of these devices is to promptly disconnect the Producer's generating system from the Vectren electric system whenever electrical faults or abnormal operating conditions occur.

1.2.1 Hot Transfer Standby Generation

Hot Transfer Standby Generation is when the Producer's generation can be interconnected to the Vectren electric system on a short-term basis. The purpose of this interconnected system is to transfer load from the Vectren electric system to the Producer's generating system and back again without an interruption. The duration of the interconnection is not to exceed ten minutes. This type of interconnection is often referred to as a "closed transition." The closed transition is used exclusively to prevent interruption of the Producer's critical loads. A transfer of power from the Producer's generating system to the Vectren electric system may be prevented by a sensitive directional power relay, shown in Figure 10.5 as Device 32.

1.2.2 Demand Reducing Generation

Demand Reducing Generation is when the customer-owned generator is interconnected to the Vectren electric system; however, no power is intentionally transferred to or purchased by Vectren. The local demand is reduced, i.e. "peak shaving." Since the Producer's rate may not permit peak shaving, the Vectren Field Sales and/or Rate departments shall be contacted for initial approval. If approved, the interconnection requirements shall be based on the generator rating. Refer to Sections 5.1 through 5.6.

1.2.3 Net Metering

Net Metering is available to Vectren electric customers as described in Rider NM, Net Metering Rider, within Vectren's Tariff for Electric Service. Customers must meet the availability and applicability listed in Vectren's Net Metering Rider as well as the rules of Net Metering specified in the Indiana Administrative Code (170 IAC, Article 4, Rule 4.2). Total participation in this service is limited and shall be available on a first come, first served basis.

1.3 Requirements for Interconnection

The operation of a customer-owned generator, interconnected to the Vectren electric system, presents several issues of concern for the Vectren electric system. These concerns include: safety, reliability, quality of service, protection planning and operations problems. Vectren must maintain the integrity of its system to ensure a reliable supply of electricity to its customers and the bulk electric system. Therefore, any interconnected generating system must include equipment dedicated to protecting the electric system from problems that originate within the interconnected generating system. These concerns and problems are evaluated by completing steady state, short circuit, and dynamics studies.

Producers requesting to connect generators to the electric distribution system must also meet the Customer-Generator Interconnection Standards as specified in Indiana Administrative Code (170 IAC, Article 4, Rule 4.3) and the conditions listed in the Vectren Tariff Rate CSP, Cogeneration and Small Power Production. If the existing distribution transformer is unacceptable, the generator owner must install a dedicated transformer for the generator. Any generator over 50kW, except an

inverter connected generator, shall be connected to the Vectren system using a dedicated generator step-up transformer whenever possible.

For interconnection to the Vectren electric transmission system, Vectren requires the Producer to comply with Vectren's **VEC-007 Requirements for Transmission or End-User Facilities Interconnection to the Vectren Electric Transmission System (VEC-007)**. This document, VEC-007, provides general requirements for the transmission facilities needed to interconnect the Producer's generating facility to the Vectren electric transmission system. The Producer must also comply with any NERC Reliability Standards, regional and Transmission Owner planning criteria, and Facility interconnection requirements.

Vectren is a member of the Midcontinent Independent System Operator, Inc. (MISO), which performs as Vectren's Transmission Provider, Planning Coordinator, and Reliability Coordinator. The Producer must first file a request with MISO for an interconnection to the Vectren electric transmission system. MISO will notify transmission owners who may be impacted by the generation addition or modification. MISO will also perform coordinated joint studies to evaluate the impact of the generation addition or modification and identify any upgrade requirements. In addition, these studies will address plans to achieve the required system performance throughout the planning horizon. The Producer may be responsible for some or all of these costs, including the costs to perform the studies.

After interconnecting, Vectren and MISO require the Producer to notify them of any proposed modifications to facilities that could impact the operation and maintenance of the Producer's facilities or that could impact the reliability of the interconnected electric system.

These guidelines are for informational purposes only and do not relieve the Producer from complying with the National Electrical Safety Code, the National Electrical Code, and all relevant IEEE Standards, including IEEE 1547 - IEEE Standard for Interconnecting Distributed Resources with Electric Power Systems.

1.3.1 Safety Issues

Safety concerns focus first on isolating the interconnected generator from the Vectren electric system when a Vectren electric system line is opened. Isolation shall be both automatic and manual. When a Vectren circuit is damaged, such as when a power line falls to the ground during a storm, a hazard to the

public exists until all power sources are isolated from that circuit. Because speed is critical, this type of isolation must be automatic. The method for accomplishing automatic isolation may vary depending on size, electrical characteristics, and other factors of the interconnected generating system and the Vectren electric system. A lockable, manually operated switch or disconnect with visible breaks between the Vectren electric system and all customer-owned energy sources is required. This switch or disconnect shall be subject to Vectren lock-out and tag-out procedures. One exception to this rule is for installations with a total capacity of 10 kW or less interconnected to the Vectren electric distribution system and meets IEEE 1547 requirements and the requirements of 170 Indiana Administrative Code (IAC) Rule 4.3 Level 1 review. For these installations a disconnect switch is recommended but not required.

Another concern with isolating an interconnected generator is self-excitation of the generator. When an induction generator is isolated from the Vectren electric system, because of a downed line or a breaker opening the line, the generator will usually shut down. However, if there is sufficient capacitance in nearby circuits, e.g., power-factor-correcting capacitors, the induction generator can continue to operate independently of the Vectren electric system. The power produced by the self-excited induction generator will not be regulated by the Vectren electric system, and the customer's electricity-using equipment can be damaged. More importantly, an isolated self-excited induction generator that re-energizes a downed transmission or distribution line can endanger Vectren employees and the public. Voltage and frequency relays and automatic disconnect circuit breakers shall be used to protect the customer's equipment, Vectren employees, and the public.

The third safety concern is preventing the isolated generator from energizing a de-energized Vectren electric system circuit. Energizing a de-energized circuit can endanger the public, rescue workers, Vectren employees and others who may have determined that the circuit is de-energized and were in contact with the circuit. In this situation, energizing a de-energized circuit shall be blocked for all automatic and manual isolation schemes.

1.3.2 Reliability Issues

Reliability of electric service should be as important to the Producer as to Vectren. The Producer is also a Vectren customer and desires reliable service. Therefore, the Producer shall ensure that the interconnected generating system does not impact the reliability of electric service by causing unnecessary interruptions. This consideration may influence the equipment protection scheme designs, discussed later. Vectren may require a greater margin of protection for its system in order to maintain service to other customers. Thus, protective relay settings shall be coordinated so that the safety and reliability of electric service are not compromised.

Another consideration, which impacts Vectren electric system reliability, is the location of the interconnected generating system on the Vectren electric system. If the interconnection location is at a transmission level, then interruptions of service have a greater impact than when located at a distribution level. Vectren may require more stringent protection requirements for an interconnected generating system located at a transmission level to protect other customers “downstream” of the generator.

A final consideration is the generator size compared to the interconnected generating system load and the load on the Vectren electric system line. If the interconnected generator output capacity is much smaller than the interconnected generating system load, the impact of disturbances created by the generator may not be electrically significant to the rest of the generating system and the Vectren electric system. The more on-site load, the more damping there will be to minimize effects of generator disturbances. However, as generator output capacity approaches or exceeds the generating system load, the impact of generator disturbances may become more significant. This will result in more stringent protective requirements.

1.3.3 Quality of Service Issues

Vectren customers expect electric service to meet certain tolerances of voltage, frequency, and duration so that their loads function efficiently and reliably and are not damaged by normal operating conditions. Power supplied to the Vectren electric system by an interconnected generating system shall also be within certain tolerances so that the overall power quality of the Vectren electric system remains satisfactory.

One problem may be lagging or leading power factor (pf). Capacitors can be used to correct lagging power factor. If too much capacitance is used, the power factor will change from lagging to leading. Undesirable power factor is likely with induction generators and with some types of dc-to-ac inverters. The results of undesirable power factor can be an increase in power losses, larger voltage drops in supply circuits and equipment overheating. Careful placement and control of capacitors is necessary for proper power factor management.

Another problem may be harmonic currents. Harmonic currents occur at frequencies other than the desired 60 Hz of the power signal. When transmitted along transmission or distribution lines, these harmonics distort the desired voltage and current waveforms. Harmonic currents can cause improper operation of ground-fault and other protective relays, carrier communication systems, motors, sensitive electronic equipment and computers; they can also cause capacitor overloading. Sources of these harmonic currents can include solid-state switching devices: dc-to-ac inverters, variable-speed drives, ac-to-dc-to-ac converters, etc., generator winding faults and generator pitched for stand-alone operation.

Another problem may be voltage control in areas near the interconnected generating system. Voltage variations “flicker” can occur when there are sudden changes of current flowing in a circuit. Voltage flicker can be caused by generation suddenly coming on or off line or by starting generators or motors. Voltage flicker can cause misoperation of sensitive equipment or visual irritation. Resonant over-voltages can typically be two to three times normal voltage for long durations. Voltages of this level can damage Vectren and customer-owned equipment.

1.3.4 Protection Issues

Both the Producer and Vectren must protect their respective personnel and systems from injury or damage, which may be caused by the malfunction of a customer-owned generator. This protection often utilizes automatic equipment to detect and isolate faulted sections of a system so that the remainder of the system can continue to operate without interruption. This equipment also attempts to protect the system from damage to improve reliability and quality of electric service to the

interconnected generating system, and to the Vectren electric system and its customers.

1.3.5 Planning and Operations Issues

Where customer-owned generators are present, several areas of Vectren electric system planning can be affected for two reasons: first, is that a dispersed generator exists, as opposed to centralized generators, and second, is the assumption of unidirectional power flow from the Vectren electric system to customers may no longer be valid.

Vectren will need to account for deviations from expected load surveys and load factors caused by dispersed generation. Both of these are affected by dispersed generation. Load surveys are done to determine electrical demands Vectren must meet for the present and for the future. These surveys form the foundation of system planning. Load factors reflect the utilization of Vectren electric system equipment, the ratio of average usage to the peak usage. The Producer shall be required to pay for any increased costs resulting from changes in Vectren operating procedures.

Operations, for both the interconnected, generating system and the Vectren electric system, is effected by the customer-owned generator. The impact on Vectren electric system operations may include extra records and communications required to work safely on circuits with dispersed generation and increased time to do repair work. If the customer-owned generator is very large, Vectren may choose to include the generator in its dispatch of generating units and retain some control over the generator operation. The control system may use telemetering. Also, very large generators can impact the Vectren electric system stability, the ability of the system to stay synchronized after any disturbance, and Vectren may require even more stringent protection requirements or special equipment to maintain stability margins.

1.4 Generating System Sources

The Producer may elect to use any of a variety of energy sources including: solar, wind, hydro or other types of sources, in addition to conventional fossil fuels. For interconnection to the Vectren electric system, the generating system shall generate 60 Hz sinusoidal alternating current at a Vectren standard voltage and phase rotation.

1.5 Generating System Operation

The Producer may elect to operate the generator as a separate system with the capability of non-parallel load transfer between the two independent systems or in parallel with the Vectren electric system. These two methods of system operation are discussed below.

1.5.1 Separate System Operation

A separate system is a system to which there is no possibility of interconnecting the Producer's generating system in parallel with the Vectren electric system. Un-interruptible Power Supply Systems (UPS) may not meet the separate system operating criteria and should not be considered unless they are designed for and meet the separate system operating criteria.

For this design to be practical, the Producer must be capable of transferring load in an "open transition," or non-parallel mode, between the Producer's generating system and the Vectren electric system. This can be accomplished by either an electrical or mechanical "fail safe" interlocked switching arrangement, which prevents operation of both switches in the closed position simultaneously.

If the Producer has a separate system, Vectren shall require verification that a transfer scheme exists and meets non-parallel mode requirements. Verification will be accomplished by the approval of drawings by Vectren in writing and, if Vectren so chooses, by field inspection of the transfer scheme. Vectren shall not be responsible for approving the Producer's generating system equipment and assumes no responsibility for its design, operation or effects on the Producer's loads.

1.5.2 Parallel System Operation

A parallel system is a system to which the Producer's generating system can be connected to the Vectren electric system. A transfer of power between the two systems is a direct and often desired result.

The Vectren electric system is subject to a variety of natural and man-made hazards, which can cause system disturbances. Electrical disturbances that can result from these hazards are typically fault conditions: short circuits, grounded conductors and broken conductors. These fault conditions require that the damaged equipment is de-energized immediately due to the hazards they may pose to the public and to the operation of the Vectren electric system. A parallel system operated generator shall have adequate protective devices installed, which will detect fault conditions on the Vectren electric system and will operate to disconnect the generator. The protective devices must be properly designed and sized appropriately by the Producer to withstand the fault levels and voltage surges that may occur.

Parallel system operated generation can cause a condition known as "accidental isolation" where a portion of the Vectren electric system load becomes isolated from the Vectren electric system source and remains interconnected to the paralleled generator. In this condition, the isolated system can continue to operate independently from the Vectren electric system and develop abnormal voltage or frequency.

Protective device requirements are discussed in the following sections and are intended to disconnect the paralleled generator when Vectren electric system disturbances occur. The scope of protective equipment is, in part, based on the size of the generator. General and specific requirements for parallel generation installations of various generator sizes are discussed in the following sections.

In order to properly parallel the Producer's equipment with the Vectren electric system, the Producer must incorporate automatic synchronizing equipment that can smoothly interconnect the Producer's generating equipment with the Vectren electric system.

Improper synchronizing can cause significant damage to the Producer's equipment, and possibly Vectren and other customers' equipment. The Producer will be held liable for any damage caused by improper synchronizing of Producer's equipment.

2 Vectren Electric System Information

2.1 Voltage

Vectren transmission line voltages are 69 kV, 138 and 345 kV. Common primary distribution line voltages are 12.47 kV and 4.16 kV, depending on the geographic area. These distribution circuits are effectively grounded and are normally used for four-wire distribution phase-to-neutral and phase-to-phase connected loads. The Producer should contact Vectren for information on specific circuit voltages available to the Producer's generating system.

Voltages are normally held within 95 to 105 percent of nominal voltage. Under certain conditions the voltage on transmission system may drop to 90 percent. However, the Producer should design its system to protect against low or high voltage conditions in excess of these values that may occur under abnormal conditions.

2.2 Circuit Restoration

Because most short circuits on overhead lines are of a temporary nature, it is Vectren's practice to reclose circuit breakers on transmission and distribution lines after they have automatically tripped. Protective relays, specified by Vectren for parallel generation interfaces, are intended to disconnect the generator from faulted or isolated lines before reclosing occurs. On-site relaying is not always adequate to ensure separation when the Producer's generator is capable of supplying most or all of the line or line segment load. It is the responsibility of the Producer to install necessary equipment to ensure a proper disconnection exists before reclosing occurs. Vectren costs for installing, maintaining, and/or rearranging such equipment shall be borne by the Producer.

2.3 Effective Grounding

Vectren maintains effective grounding on its distribution system. A general definition for an effectively grounded system is where the ratio of zero-sequence reactance to positive-sequence reactance is less than or equal to three ($X_0/X_1 \leq 3.0$), and the ratio of zero-sequence resistance to positive-sequence reactance is less than or equal to one ($R_0/X_1 \leq 1.0$), for any condition of operation and for any amount of generator capacity.

Vectren uses effective grounding to limit the range of voltage rise on unfaulted phases during fault conditions and to provide a source of ground current to operate protective relays. This is done to protect customer phase-to-ground connected loads.

3 Vectren Electric System Integrity

3.1 General

Interconnection of the Producer's generating equipment to the Vectren electric system shall not cause any reduction in the quality of service provided to Vectren customers. No abnormal voltages, frequencies, or interruptions shall be permitted. If steady state or transient voltage complaints result from operation of Producer generation, such generating equipment shall be disconnected until the problem is resolved at the Producer's expense.

3.2 Harmonic Distortion and Power Quality

Voltage and current harmonic distortion and other power quality disturbances on a power system, from any source, shall be kept to a minimum. Periodically, Current Total Harmonic Distortion (I_{THD}), generated by the Producer's generating system, and Voltage Total Harmonic Distortion (V_{THD}), developed by the Producer's generating system, will be measured by Vectren employees at the Producer's point of common coupling, the Vectren metering point. Under no circumstances, shall V_{THD} of the voltage waveform or I_{THD} of the current waveform be allowed to exceed levels established in **IEEE Std. 519**. If a Producer's generating system is found to be interfering with other customers, Producers, Vectren, or public communications equipment, the Producer shall be required to install filtering, or other corrective measures, including bringing the harmonic output of the generating system to an acceptable level and shall be resolved at the Producer's expense.

3.3 Voltage

Operation of the Producer's generator shall not adversely affect voltage stability on the Vectren electric system. Adequate voltage control shall be provided, by the Producer, to minimize voltage regulation on the Vectren electric system caused by changing generator loading conditions. Automatic power factor or reactive power (VAR) controllers shall be provided for installations utilizing synchronous generators.

All generator installations over 10 kW shall maintain at least a power factor of 0.9 leading (VARs going into the machine) over an operating range of 25% to 100% of the generators rating. Inverter connected and synchronous machines shall maintain a power factor of 1.0 at their terminals unless otherwise directed by Vectren. All synchronous machines shall be capable of operating at between 0.9 leading to 0.9 lagging power factor.

For synchronous generators, sufficient generator reactive power capability shall be provided to withstand normal operating voltage changes on the Vectren electric system. The generator voltage-VAR schedule, voltage regulator and transformer ratio settings shall be jointly determined by Vectren and the Producer to ensure proper coordination of voltages and regulator action.

No synchronous generator shall regulate the voltage at its terminals on the distribution system unless agreed to by Vectren. All synchronous generators on the distribution system shall be operated in power factor control mode unless a study determines voltage control is advantageous and will not cause problems with regulators and tap changers in Vectren's system.

All induction generators shall match speed to within 5% of synchronous speed before their breakers are closed. Across the line starting and electrically accelerating of induction generators, without first accelerating the machine to within 5% of synchronous speed using the prime mover before closing the breaker shall be permitted only when agreed to by Vectren.

In cases where starting or load changing on induction generators will have an adverse impact on Vectren electric system voltage, step-switched capacitors or other techniques may be required, at the Producer's expense, to bring voltage changes to synchronous speed before connecting to the Vectren electric system. In some cases, a closer speed match will be required.

4 Generating System Operating Requirements

4.1 De-Energized Circuits

The Producer shall not be permitted to energize a de-energized Vectren circuit under any circumstances without prior Vectren permission. Failure to observe this requirement is cause for immediate and permanent disconnection of the generating system. In addition, the Producer shall be held responsible for all damages and injuries resulting from such actions.

4.2 Operational Log

The Producer shall maintain an operational log at each generating system location over 20 kW indicating changes in operating status, available or unavailable, maintenance outages, trip indications or other unusual conditions found upon inspection. For generators that are "block-loaded" to a specific kW level, changes in this setting shall also be logged. The operational log shall be available for inspection upon request by Vectren.

4.3 Discontinuation of Operation

The Producer shall discontinue paralleled system operation when requested by Vectren for the following reasons:

1. To facilitate maintenance, testing or repair of the Vectren electric system.
2. During any emergency condition.
3. When the Producer's generating equipment is interfering with other customers connected to the Vectren electric system.
4. When a Vectren inspection of the Producer's generating system equipment reveals a condition hazardous to the Vectren electric system or a lack of scheduled maintenance or maintenance records for equipment necessary to protect the Vectren electric system.

4.4 Synchronous Generators

Producers with synchronous generators greater than 10 kW shall provide the following:

1. Voice communication, at all times, to the generating facility via communication circuits.
2. Name and telephone number of the designated operating agent. Designated operating agent and other operating personnel shall be familiar with Vectren line clearance and operating procedures.
3. Notification to Vectren's designated operating center prior to bringing the generator on line and time of interconnection.
4. Notification to Vectren's designated operating center at the time the generator is disconnected from the Vectren electric system.
5. A droop setting on the governor of 5% is required.
6. All machines shall be capable of operating at between 0.9 leading to 0.9 lagging power factor.

4.5 Generation Over 1 MW

All generating systems in this category, induction, inverter, or synchronous, must comply with the requirements of Section 4.4. The generating system in this category shall provide telemetering to Vectren's designated operating center (and MISO if applicable) for continuous kilowatt, kilovar and hourly generation values in kilowatt-hours.

4.6 Telemetry (i.e. telecommunications)

The design, purchase, installation, testing, maintenance, and replacement of telemetry equipment and circuits from the Producer's generating system to Vectren's designated operating center (and MISO if applicable) shall be the responsibility of the Producer and must be approved by Vectren to insure correct operation and system compatibility.

4.7 Communications

Normal Operations - At Vectren's request, the Producer may be required to provide a dedicated voice communication circuit to the Vectren Transmission System Operations (TSO). Such a dedicated voice communication circuit would originate from the Producer's office staffed 24 hours a day and would be typically required for generation facility synchronization and operation within Vectren's Control Area. All other normal voice communication concerning facility operations shall be conducted through the public telephone network to the TSO phone number(s) issued by Vectren.

Emergency Operations - Voice communications in the event of a transmission system or capacity emergency shall use the dedicated voice circuits, or public telephone network and phone number(s) designated for emergency use.

In the event of an electric system or capacity emergency, the Producer may be notified by Vectren. Specific instructions may also be given regarding the operation of the Producer's unit(s) depending on the nature of the emergency. These instructions may consist of voltage schedule changes, real and/or reactive dispatch changes, or instructions to shut down or start-up the Producer's unit(s). It is the Producer's responsibility to ensure that the unit operators follow all instructions given by Vectren during system emergencies.

5 Generating System Design Requirements

5.1 Codes

Producer installations shall meet Indiana Utility Regulatory Commission rules for customer-owned generation systems and all applicable national, state and local construction and safety codes including the National Electrical Safety Code, the National Electrical Code, and all relevant IEEE Standards.

5.2 Protective Devices

Protective devices: relays, circuit breakers, etc. for the protection of Vectren's system, metering equipment and synchronizing equipment shall be provided by the Producer as required by Vectren. Protective devices differ with the size of the generating system. Producer shall ensure that the equipment ratings are sufficient to operate under normal and contingency states. Consideration must be given to maximum continuous operating voltage, continuous current ratings, over current duty ratings. Refer to Section 7 for information concerning protective relaying requirements.

A manual-disconnecting device, capable of interrupting the generator and/or rated load current, shall be provided by the Producer and approved by Vectren. The form of this device will vary with the service voltage and capacity. This disconnecting device shall be accessible to Vectren personnel at all times. The device shall be of a design that can be locked open for line clearances.

If it is determined that ground fault, or other line protection is required on the high voltage side of the transformer, a 3-phase interrupting device may need to be installed on the transformer high-voltage side. If needed, this device will be supplied and installed by Vectren at the expense of the generator owner.

The Producer will provide surge protection for its equipment. This surge protection equipment is to be coordinated with Vectren's equipment to ensure protection against voltage surges on both the Producer's and Vectren's systems.

5.3 Effective Grounding

All systems shall maintain effective grounding. Refer to Section 2.3. Systems over 100 kW shall have an X_0/X_1 ratio within the range of 2.5 to 3.0 during islanding, loss of Vectren source conditions. For systems over 1 MW, this is easily accomplished with a delta-delta step-up transformer and a grounding bank on the distribution feeder side. The grounding bank is sized so that its reactance divided by the sum of the sub-transient reactance of the generator and the reactance of the step-up transformer is between 2.5 and 3.0. If a grounding resistor is used, it shall restrain voltage on un-faulted phases to 120% or less. The

grounding bank shall have an adequate continuous rating to withstand the range of system unbalance permitted by existing regulations.

A grounded wye-grounded wye step-up transformer is only acceptable for systems less than 1 MW. For any step-up transformer configuration, the ratio of the sum of zero-sequence reactances of the step-up transformer, generator sub-transient and any generator or step-up transformer neutral grounding and grounding bank shall be between 2.5 and 3.0 during islanding conditions. If a generator neutral reactor is used, it shall be sized in accordance with this formula. If a generator neutral resistor is used, it shall be sized to limit the overvoltage on unfaulted phases to 120% of nominal, during single line-to-ground faults.

The reactor or resistor will limit generator damage due to single line-to-ground faults as well as minimize the effect on Vectren grounding. The reactor, resistor, or grounding transformer shall be capable of carrying at least 20% of generator rated current on a continuous basis. Since many generators create excessive harmonics if their neutral is grounded, care must be exercised in generator selection or a grounding transformer should be used. If the generator cannot tolerate severe phase current unbalance, a grounding transformer is recommended.

5.4 Insulation

The insulation of the Producer's equipment shall be of suitable design to ensure that all equipment is properly protected against lightning, switching, and fundamental-frequency over-voltages and coordinated with Vectren's system.

5.5 Design Specifications

The Producer shall submit detailed design specifications and engineering information, usually 180 days prior to interconnection. The design specifications shall include the following:

1. The service voltage and location of the point of interconnection.
2. An electrical one-line diagram of the Producer's generating system, beginning at the interconnection point, and the AC and DC schematics.
3. A detailed description of how and where the Producer's load will be connected and disconnected.

4. The capacity and ownership of all equipment and circuits.
5. Capacity and interrupting ratings for all equipment and safety devices, including detailed information of all protective relaying.
6. A detailed description of any special control equipment required.
7. Sufficient information to establish all necessary rights-of-way and easements to install, operate, maintain, replace, and remove Vectren's system.
8. Machine characteristics, ratings and other technical information specified in the Appendix 1 and 2 of this document.

5.6 Induction Generators

For generation aggregating less than or equal to 10 kW capacity, Vectren will supply the VAR requirements from general system sources without a specific charge to the Producer. Installations over 10 kW capacity shall require capacitors to be installed to maintain a power factor of at least 0.9. See Section 3.3. Such capacitor installations shall be at the Producer's expense.

The self-excited induction generator can produce abnormally high voltages that can cause damage to Vectren and customer equipment. Overvoltage relays can limit the duration of such over-voltages but cannot control their magnitude. Because of these problems, the reactive power supply for large induction generators must be studied on an individual basis. In general, self-excitation problems are most likely in rural areas where the Vectren electric system capacity and load density are low. It is particularly important to contact Vectren to determine if an induction machine can be connected to an existing distribution line. Where self-excitation problems appear likely, special service arrangements will be required. In many cases, the additional expense for such special service methods will outweigh the cost savings associated with induction generators. Especially during self-excitation, effective grounding is important to restrict the range of voltage unbalance. Refer to Section 5.3.

5.7 Inverter Systems

Total harmonic distortion (THD) from the generating system will be measured at the interconnection metering point. Under no circumstances, shall V_{THD} of the voltage waveform or I_{THD} of the current waveform be allowed to exceed levels established in **IEEE Std. 519**. If a Producer's inverter system is found to be interfering with other customers, Producers, Vectren, or public communications, the Producer shall be required to install filtering or other corrective measures to bring the harmonic output of the inverter to an acceptable level, and shall be resolved at the Producer's expense.

5.8 Design Review

Vectren shall review submitted plans and either accept the plans or outline specific additional functions which must be provided along with supportive data within a reasonable period of time according to existing regulating agency requirements. A rejected plan shall be modified and re-submitted for review. Vectren costs for reviewing submitted plans shall be borne by the Producer.

Vectren's concern is to protect its system and customers from damage or hazards due to the operation of interconnected generation. To this end, Vectren's protection requirements do not directly concern the protection of the Producer's generator and associated equipment from short circuits, overload, equipment failures or other malfunctions caused by the Producer's loads or equipment.

6 Metering Requirements

6.1 General

Metering installation requirements, for each interconnected generating system category, are outlined in the Vectren Electric Service Manual and in the MISO Open Access Transmission Tariff, if applicable. Unless agreed to otherwise, Vectren will furnish, install and own the meter for the registration of all electrical energy. The Producer shall provide a suitable place for the installation of the metering equipment and shall consult Vectren regarding the location of the metering equipment. The Producer shall provide Vectren employees access, at all times, to the metering installation to modify, operate, maintain and read the metering equipment.

When the Producer owns the interconnection transformer, transformer high-side metering or loss-compensated metering shall be used, as required by Vectren. When Vectren owns the interconnection transformer, transformer low-side metering with transformer loss compensation shall be utilized for power deliveries to Vectren. Vectren costs for installing, maintaining, and/or rearranging the metering equipment shall be borne by the Producer.

Two metering scheme options are available for Producers who have contracted to sell power to Vectren with generating systems greater than 10 kW:

Option "A" shall be used when the Producer's load requirements are served directly by the Producer's generator. This metering option will measure the power leaving the Producer's generating system, and will measure the power entering the Producer's generating system.

Option "B" shall be used when Vectren serves the Producer's load requirements. This metering option will measure the net output of the generator, which is the gross output of the generator minus the power consumed by the power production process, station service, and will measure all other loads not associated with the power production process.

6.2 Generation 10 KW & Under

A single meter shall be applied for this category and located as shown in Figure 10.1. Installation requirements as outlined in the Vectren Electric Service Manual are applicable.

6.3 Generation Over 10 KW to Less Than 100 KW

Metering options “A” or “B” shall be applied for this category as shown in Figure 10.2. Installation requirements as outlined in the Vectren Electric Service Manual are applicable.

6.4 Generation 100 KW to Less Than 1 MW

Metering options “A” or “B” shall be applied for this category as shown in Figure 10.3. Most of these meters will require dedicated instrument transformers and installation requirements shall conform to the **Vectren Electric Service Manual**.

If the nominal voltage of the metered circuit exceeds 480 volts, a transformer type primary meter installation, using both current and voltage transformers, is required, regardless of the load current. This is referred to as a primary meter and may be installed either in the Producer-owned switchgear, indoor or outdoor, or on a Producer-owned pole, outdoor. Such installations require coordination between the Producer and Vectren regarding accuracy class, technical details and locations.

For metering option “A”, "generation" metering shall be connected so that energy from the generator is measured, and energy to the generator, from the Vectren electric system, is measured. For metering option "B", "load" metering shall be measured in addition to “generation” metering.

6.5 Generation 1 MW and Above

Metering options “A” or “B” shall be applied for this category as shown in Figure 10.4. The Producer must coordinate with Vectren for units or systems larger than 10 MW. In general, these meters shall require dedicated instrument transformers and the installation requirements shall conform to the Vectren Electric Service Manual.

If the nominal voltage of the metered circuit exceeds 480 volts, a transformer-type primary meter installation, using both current and voltage transformers, is required, regardless of the load current. This is referred to as a primary meter and may be installed either in Producer-owned switchgear, indoor or outdoor, or on a Producer-owned pole, outdoor. Such installations require coordination between the Producer and Vectren regarding accuracy class, technical details and locations.

For metering option “A”, "generation" metering shall be connected so that energy from the generator is measured, and energy to the generator, from the Vectren electric system, is measured. For metering option "B", "load" metering shall be measured in addition to “generation” metering. For metering option "B", the Producer shall consult Vectren regarding metering requirements.

The generating system in this category shall provide telemetering to Vectren’s designated operating center (and the MISO if applicable) for continuous kilowatt, kilovar, and hourly generation values in kilowatt-hours.

7 Protective Relaying Requirements

7.1 Protection Classes

Vectren has established seven different classes of protective relaying for interconnected customer-owned generation. These classes are:

1. 0 - 10 kW
2. 10 kW - 100 kW
3. 100 kW - 1 MW
4. 1 MW - 10 MW
5. Over 10 MW
6. Hot Transfer Standby Generation
7. Demand Reduction Generation

The protective relaying schemes are shown in Figure 10-1 through Figure 10-5. The installation must be permanently wired within a suitable load center and a lockable disconnect switch shall be provided which is readily accessible to Vectren personnel at all times. This switch shall be located at the meter unless an alternate location is readily accessible and easily identifiable. The alternate location must be approved by Vectren. One exception to this rule is for installations with a total capacity of 10 kW or less interconnected to the Vectren electric distribution system and meet IEEE 1547 requirements and the requirements of 170 IAC Rule 4.3 Level 1 review. For these installations a disconnect switch is recommended but not required.

The Producer's protective relaying schemes must be coordinated with Vectren's schemes.

Relay protection classes are based upon the generator or inverter nameplate ratings. When multiple generators are connected to the Vectren electric system through a single service point, the class shall be determined by the sum of the generator ratings.

These classes have been established for convenience and are based on circuits with normal load density. The final decision as to the requirements for each installation will be made depending on concerns such as: the Producer's generating system's load magnitude, the magnitude of other loads connected to that circuit, available short circuit contribution, source substation size and line conductor size. Vectren cost for installing, maintaining, and/or rearranging such relaying equipment shall be borne by the Producer.

7.2 Generation 10 kW & Under

All installations in this class shall require a site review by Vectren personnel. Those installations that are a standard package will be reviewed once. No further package review will be required for additional installations provided no changes in configuration or equipment are made to the package. Installations that are not a standard package shall be reviewed individually.

7.3 Generation Over 10 kW to Less Than 100 kW

All installations in this class shall require a site review by Vectren personnel. Those installations that are a standard package shall be reviewed once. No further package review will be required for additional installations provided no changes in configuration or equipment are made to the package. Installations that are not a standard package shall be reviewed individually.

The protective relaying schemes are shown in Figure 10.2. The larger installations in this class shall use industrial grade relays or utility grade relays. The larger installations may vary somewhat from the layout shown in Figure 10. 2. Some variation in the specifics, but not of the intent of the requirements, will be allowed. All variations shall be approved by Vectren.

7.4 Generation 100 kW to Less Than 1 MW

All installations in this class shall require a full protective relaying and site review by Vectren personnel. The protective relaying schemes are shown in Figure 10.3. For some of the larger installations, the transformer and associated equipment may be owned by the Producer instead of Vectren. Utility grade protective relays, such as those normally found in utility switchgear and utility grade equipment shall be required. The following manufacturers, as well as some others, produce utility grade protective relays: Schweitzer Engineering Laboratories, General Electric, ABB Power T & D Company, Inc. and Basler Electric.

7.5 Generation 1 MW to Less Than 10 MW

All installations in this class shall require a full protective relaying and site review by Vectren personnel. The protective relaying schemes are shown in Figure 10.4. For some of the larger installations, the transformer and associated equipment may be owned by the Producer instead of Vectren. Utility grade protective relays, such as those normally found in utility switchgear and utility grade equipment shall be required. The following manufacturers, as well as some others, produce utility grade protective relays: Schweitzer Engineering Laboratories, General Electric, ABB Power T & D Company, and Basler Electric.

Many rural systems will not accept this class of generation and, as such, shall be treated in the same manner as the over 10 MW class. Most circuits will most likely require modifications to be compatible with this class of installation.

7.6 Generation Over 10 MW

In general, the Vectren distribution system is designed to handle load and generation up to 10 MW. Generation in excess of 10 MW shall be served from the transmission system. Each installation is unique so that no general requirements are possible. Each installation shall be discussed and reviewed by Vectren personnel on an individual basis. Vectren shall be contacted, by the Producer, to determine the feasibility of any proposal, due to the restrictive nature and cost of interconnection to the Vectren electric system.

7.7 Battery Power & DC Fusing

1. A battery power system may be required to provide DC for powering control systems, breaker control, and powering protective relays if determined to be needed for proper system protection by Vectren. The cost of this system is the responsibility of the Producer.
2. Adequate protection for the loss of a DC fuse shall be provided. Figure 10.6 illustrates an example of a DC fusing scheme utilizing a loss of potential relay to trip the breaker. A loss of potential relaying scheme shall be required when there is no relaying redundancy. In installations where relaying redundancy exists, the DC fusing scheme shall prevent common mode failure of the sensing, tripping and interruption equipment. The entire tripping scheme shall not become disabled by a single DC fuse operation. Relay redundancy can be achieved through a combination of relays or an exact duplication of relays.

8 Demonstrations/Inspections of Protective Devices

8.1 General

The Producer shall demonstrate to Vectren personnel the correct operation of all protective devices. Vectren shall not be responsible for performing these demonstrations. The Producer shall provide qualified personnel to perform these demonstrations/inspections.

Demonstrations/inspections shall be performed on all new equipment and modified equipment, and on existing equipment as circumstances warrant or when requested by Vectren.

These demonstrations shall be divided into three sections: Calibration, Trip Checks and On-Line Testing. The Calibration section shall demonstrate that agreed upon settings, between the Producer and Vectren, are used on each of the relays required by Vectren. This section also demonstrates that the relays are functional and calibrated to their manufacturer's tolerances. The Trip Checks section shall demonstrate that both the required relays and their interlocks correctly operate. The On-Line Tests section shall demonstrate the expected operation of relays and interlocks specific to the interconnection interface.

The following Calibration, Trip Checks and On-Line Testing sections are intended to serve as guidelines. These demonstrations are designed to be non-destructive; however, Vectren shall not be responsible for any equipment damage or injury resulting from these demonstrations. It shall be the Producer's responsibility to demonstrate operation of all protective devices in a safe manner. These demonstrations should not adversely affect the generator or any equipment associated with the interconnection. Vectren costs for witnessing these demonstrations shall be borne by the Producer.

8.2 Calibration

Proper testing and verification of CTs and VTs and relay settings shall be demonstrated to Vectren personnel in the following manner:

1. Four tests shall be performed for CT verification and are as follows:

- a. Ratio check shall be performed according to the [ANSI/IEEE C57.13.1](#), Section 6.
- b. Polarity check shall be performed according to the [ANSI/IEEE C57.13.1](#), Section 7.
- c. Excitation Test, Saturation Test, reports from the manufacturer or in lieu of the reports, shall be performed according to the [ANSI/IEEE C57.13.1](#), Section 9.
- d. Insulation Resistance Test, meggering, shall be performed according to the [ANSI/IEEE C57.13.1](#), Section 5.

2. Two tests shall be performed for VT verification and are as follows:

- a. Ratio Check shall be performed in a manner described under "Ratio Tests" in the [ANSI/IEEE C57.13.1](#), Section 6, using voltage method.
- b. Polarity Check shall be performed in a manner described under "Polarity Checks" in the [ANSI/IEEE C57.13.1](#), using DC or AC voltage tests under Section 7.1 and 7.2.

3. Relays shall be tested as follows:

- a. Tested according to their manufacturer's acceptance specifications.
- b. Tested at on-line setting values to verify calibration. If possible, this can be completed as part of the relay acceptance test.

All testing and calibration of CTs, VTs and relays shall be performed with test equipment of current calibration according to manufacturer's calibration specifications and intervals. Proof of test equipment calibration must be produced upon request from Vectren prior to relay calibration. All systems over 1 MW must have Vectren's Electric Test Department personnel witness the synchronizing relay and sync-check relay calibration and operation.

8.3 Trip Checks

1. All required relays shall be functionally operated to demonstrate correct operation. Tests can be performed off-line if possible. Tests that cannot be performed off-line shall be demonstrated to functionally operate on-line. Trip outputs from the relay may be either by manually operating all appropriate contacts, dictated by design, or by injecting an electrical signal to cause a trip output. If an 86 device is used with a blocking relay, then the relay(s) shall be tripped a minimum of one time through the entire scheme. All other trips may then be performed in such a manner so only the 86 device trips.
2. Verify that breaker(s) cannot be manually or automatically closed with the trip relay in the latched or trip position.
3. Demonstrate that the synchronism check and synchronizing relays wiring is correct and interlocks operate correctly.
4. Demonstrate that interlocks between the generator and Vectren breaker(s) operate properly; i.e., the Producer cannot re-energize a de-energized the Vectren electric system supply and can only tie to an energized the Vectren electric system supply via a synchronizing device.
5. Demonstrate that the breaker cannot be closed either manually or automatically without resetting the 86 device.
6. For inverters with anti-islanding protection, proper operation shall be demonstrated.

8.4 On-Line Tests

Items "1" through "6" shall be performed with the generator breaker racked out in the test position and the line breaker closed, energizing the transformer.

1. Under-voltage Relay - Device 27: Prior to putting the generator on-line, lift the potential to the relay. Expected result is the operation of Device 27 after the specified time delay.
2. Ground Overvoltage Relay - Device 59N: Verify proper voltage present at relay input (relay may not be used on smaller generation units).
3. Frequency Relay - Device 81 O/U: Verify proper voltage present at relay input.
4. Phase-Sequence and Voltage Balance Relay - Device 47/60 or 47/27: Interchange two of the potential inputs to this relay to simulate a negative-phase sequence condition. Expected result is the operation of this relay after the specified time delay. Also, lift one potential lead and observe relay trip output. Once testing of this device is completed, restore the potential input connections to their original polarities.
5. Synchronous generators - Phase out and check the rotation of the primary potential on both incoming and running sides of the generator breaker with the generator running unloaded, i.e. between the generator and the Vectren electric system. While performing the phase out and rotation check, test phasing and rotation across the open generator breaker using synchroscope and voltmeter for VT secondary verification. Verify a single sync path through the sync-select switch on multi-unit operations. Verify correct phase and polarity of VT inputs to sync-check relay. Verify proper synchronizing potential sources.

6. Induction generators - Allow the prime mover to rotate the generator with generator breaker open. Then, with the prime mover removed, briefly "motor" the generator by closing the generator breaker. Expected result is the same direction of rotation. Upon completion of "4.", with the generator breaker still racked out in the test position, verify that the synchronizer/sync-check or speed relays give a breaker close output signal at the appropriate synchronized conditions, proper voltage magnitude match, phase rotation, phase angle match, and proper slip rate.
7. Flicker and Harmonics test - With the generator breaker open, close the Vectren line breaker, start up the generator and synchronize the generator to the Vectren-energized transformer. Verify that acceptable minimal flicker of room lights occurs at the close of the generator breaker and that the generator runs in a stable unloaded condition in parallel with the Vectren electric system. Synchronizing should normally take place while the synch-scope is moving in the "fast" direction, clockwise. An oscillograph shall be used to verify proper breaker pole alignment and the absence of harmonics.
8. Directional Power Relay – Device 32: With the generator on-line, cause the generator to motor. The expected result is the operation of 32 device after the specified time delay. An alternate test is to phase check, under load, at the directional relay, with a phase angle meter.
9. Voltage Supervised or Directional Overcurrent Relay - Device 51V: With the generator on-line, run the generator above zero voltage current pick-up level with voltage applied; lift the potential. Expected result is the operation of 51V device after the specified time delay.

10. Power Factor Controller Test shall be done with a plant load that can be interrupted during test procedures:
 - a. With the generator off-line, measure the power factor of the full house power kW load. The measured value will usually be lagging, not unity.
 - b. Set the generator power factor controller to a more leading pf, usually unity. This creates a var mismatch between the load and generator. Also, block the 81 O/U relay.
 - c. Bring the generator on-line. The station service load shall be served by the generator.
 - d. Match the generator kW to the house power load.
 - e. Trip the Vectren line breaker.
 - f. The generator should trip on low voltage, due to power factor mismatch, by means of the under-voltage relay. A Producer-provided oscillograph will monitor all three-phase currents, bus voltages, neutral current or generator neutral current, and a contact off the generator and Vectren line breakers.
11. A demonstration of compliance with contracted power factor shall be performed for induction generators and inverters.
 - a. VAR Capacity Tests: For generators which possess adjustable voltage regulation, a demonstration that the generator is capable of operation at a 90% leading and lagging power factor shall be performed. These tests shall be conducted at 25%, 50%, 75%, and 100% of rated generator load. The capacity tests into the lead can be limited or waived because of operational limitations due to manufacturer's design criteria or stator end turn heating concerns.

9 Periodic Demonstrations/Inspections of Protective Devices

9.1 Maintenance

The Producer shall maintain its equipment in good order. Vectren reserves the right to inspect the Producer's generating system, at the Producer's expense, whenever it appears that the generating system is operating in a manner detrimental to the integrity of the Vectren electric system. The Producer shall annually perform functional testing of all breakers, relays, and transformers. Installations must have a full relay calibration check performed every three years and certified test reports shall be forwarded to Vectren.

If the Producer's generating system is interconnected directly to the Vectren electric system, or if the interconnection to the Vectren electric system could adversely affect the integrity of the Vectren electric system, because of abnormal operation of the Producer's generating equipment, the Producer shall demonstrate the proper testing of the interface protective devices to Vectren. Otherwise, interface protective devices shall be tested and may or may not have to be demonstrated. The Producer shall provide qualified personnel to perform these demonstrations. Vectren costs for this demonstration shall be borne by the Producer.

Maintenance of the Producer's generating system shall be coordinated with Vectren and, if required, with the MISO. The Producer shall schedule a minimum of one year in advance with Vectren (and MISO if applicable) all planned maintenance which would impact the output of the Producer's facilities. The Producer shall contact the Vectren TSO as soon as practical should an unscheduled outage be needed or if one should occur.

9.2 Annual Demonstrations/Inspections

It shall be the Producer's responsibility to conduct an annual demonstration/inspection of interconnection trip schemes and generator synchronization. The Producer shall provide qualified personnel to perform these demonstrations. These demonstrations are designed to be non-destructive, and it shall be the Producer's responsibility to conduct these demonstrations in a safe manner. Vectren shall not be responsible for any equipment damage or injury resulting from these demonstrations. These demonstrations should not adversely affect the generator or any equipment associated with the interconnection. Vectren costs for witnessing these demonstrations shall be borne by the Producer. These annual demonstrations shall consist of the following:

1. All interconnection trip schemes and interlocks shall be demonstrated annually for proper operation. All interface protective devices shall be trip tested in such a manner so that a trip signal originates from the protecting device. The trip command can be simulated by closing a mechanical contact, or relay device secondary circuit injection of voltage, current, or frequency to cause a trip, or by the removal or change of a protective device's sensing circuit input, without lifting wiring, to cause a trip.
2. Anti-islanding protection shall be tested annually for generators rated 100 kW and under.

If an 86 device is used with a blocking relay, then the relay(s) shall be tripped a minimum of one time through the entire scheme. All other trips may then be performed in such a manner so that only the 86 device trips.

Synchronizing shall be demonstrated annually in automatic and manual mode, if applicable. With the breaker in the test position, verify that close is blocked for an out-of-phase condition, allows close in an in-phase condition and blocks close on a dead bus condition.

9.3 Three-Year Demonstrations/Inspections

In addition to the annual demonstrations/inspections, it shall be the Producer's responsibility to conduct three-year demonstrations of relay operation and generator VAR capacity performance. The Producer shall provide qualified personnel to perform these demonstrations. These demonstrations are designed to be non-destructive, and it shall be the Producer's responsibility to conduct these demonstrations in a safe manner. Vectren shall not be responsible for any equipment damage or injury resulting from these demonstrations. These demonstrations should not adversely affect the generator or any equipment associated with the interconnection. Vectren costs for witnessing these demonstrations shall be borne by the Producer. These annual demonstrations shall consist of the following:

1. Relays are functional and calibrated at approved settings and within their manufacturer's tolerances. Refer to manufacturer's literature for test procedures.
2. The VAR capacity test shall be demonstrated on generators that have adjustable voltage regulation. Operation at 90% leading and lagging power factor shall be performed. Tests shall be conducted at 25%, 50%, 75%, and 100% of rated generator output. The capacity tests into the lead can be limited or waived because of operational limitations due to manufacturer's design criteria or stator end turn heating concerns.

9.4 Design Changes After Commercial Operation

Design changes that could jeopardize the integrity of the interconnection protection and synchronizing schemes shall be reviewed and approved by Vectren, at the Producer's expense. Demonstrations/inspections of relay calibration, trip tests and on-line testing may be required depending on the extent of the design change. Changes to the Vectren electric system can be necessary and may be extensive. The cost of these changes shall be borne by the Producer.

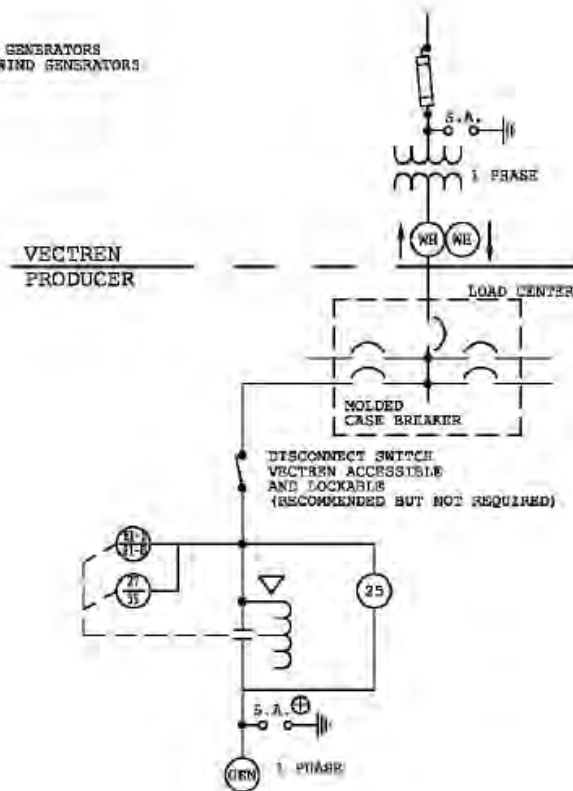
Setting changes of any interconnection protection or synchronizing device, or any "Field Modification" or "As Built" protection and synchronizing schematics associated with any interconnection device shall be reviewed and approved by Vectren, at the Producer's expense.

10 Figures

10.1 Relaying and Metering 10 kW & Under

INDUSTRIAL GRADE RELAYS

- 25 SYNCHRONIZING REQUIRED FOR SYNCHRONOUS GENERATORS
- 27 UNDERVOLTAGE
- 59 OVERVOLTAGE
- 81-O OVERFREQUENCY
- 81-U UNDERFREQUENCY
- 8.A. SURGE ARRESTER
- WH WATT-HOUR METER
- ⊕ REQUIRED FOR EXPOSED GENERATORS SUCH AS ROOFTOP AND WIND GENERATORS
- ▽ CONTACTOR



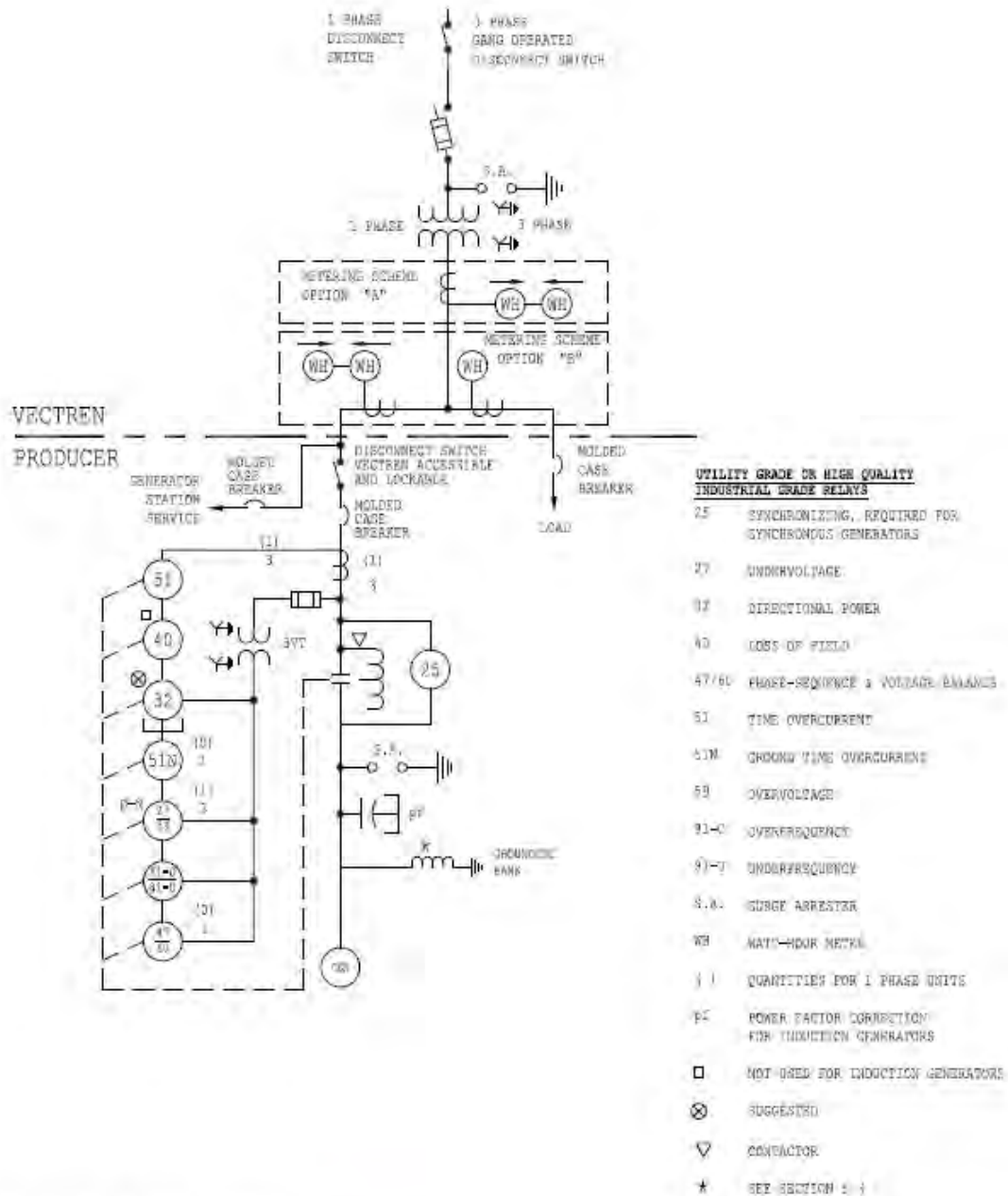
REV. 3 BY FJF DATE 05-23-14
 REV. 2 BY FJF DATE 02-14-12
 REV. 1 BY FJF DATE 09-21-07

BY ABC DATE 12/16/98
 DWN. RFL DATE 1/14/99
 CHK. DATE
 APP. FJF DATE 2/1/99



FIGURE 10.1 REV. 3
 RELAYING AND METERING - 10 KW & UNDER

10.2 Relaying and Metering Over 10 kW to Less Than 100 kW



REV. 2 BY FJF DATE 05-14-12
 REV. 1 BY FJF DATE 03-21-07

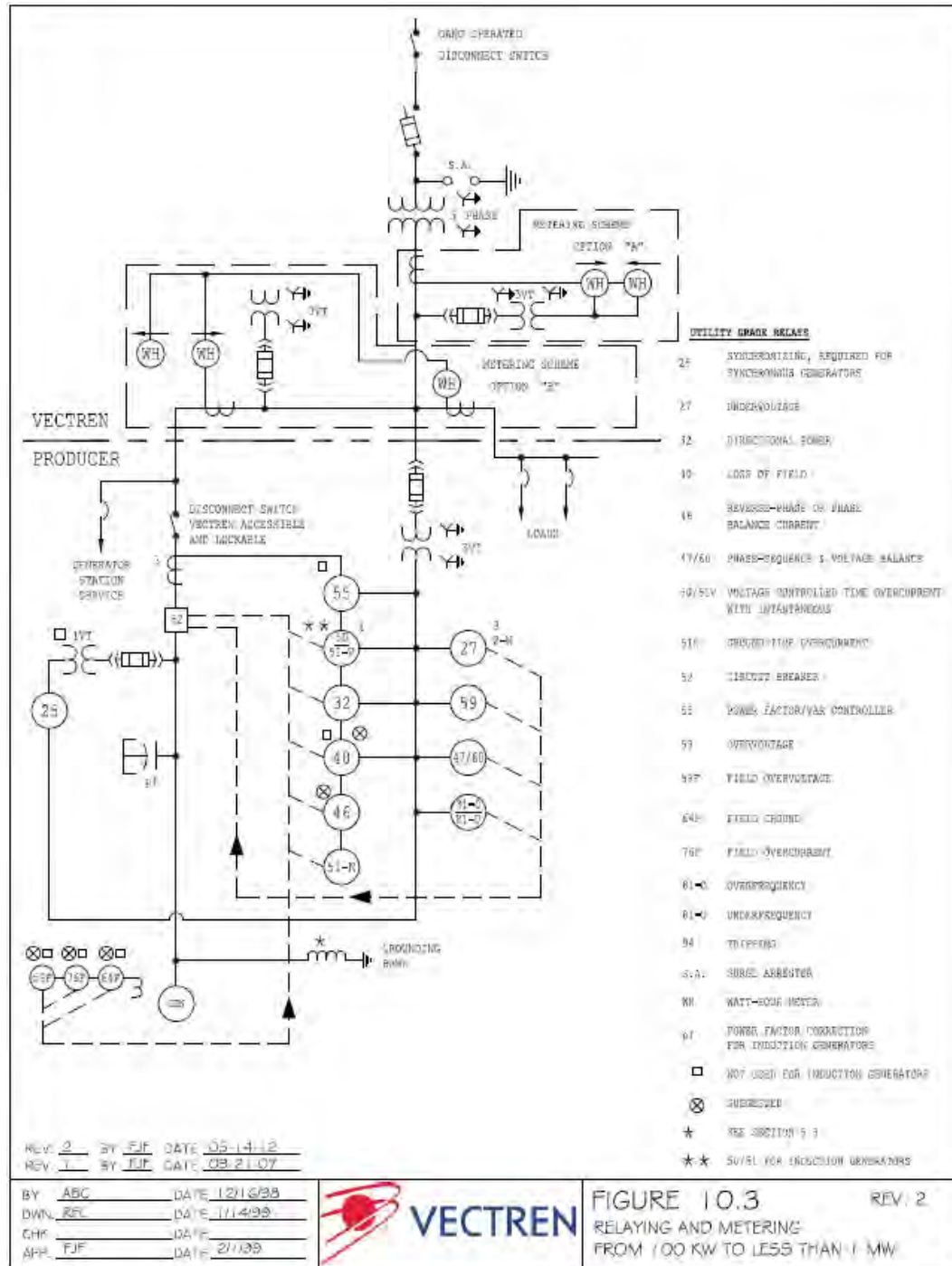
BY ABC DATE 12/16/99
 DWN. EPL DATE 1/14/99
 CHK. DATE
 APP. TUP DATE 3/1/99



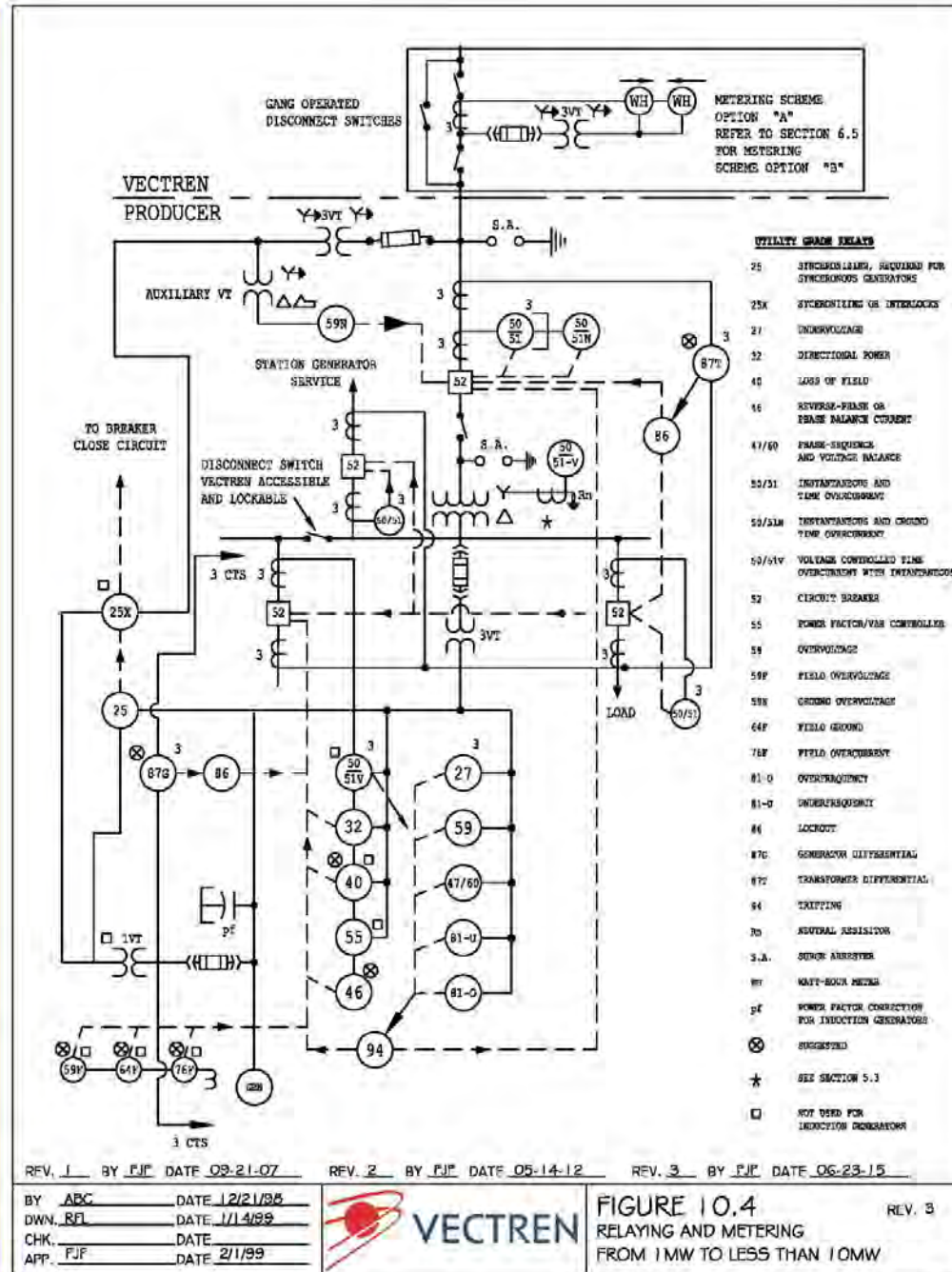
FIGURE 10.2
 RELAYING AND METERING
 OVER 10kW TO LESS THAN 100kW

REV. 2

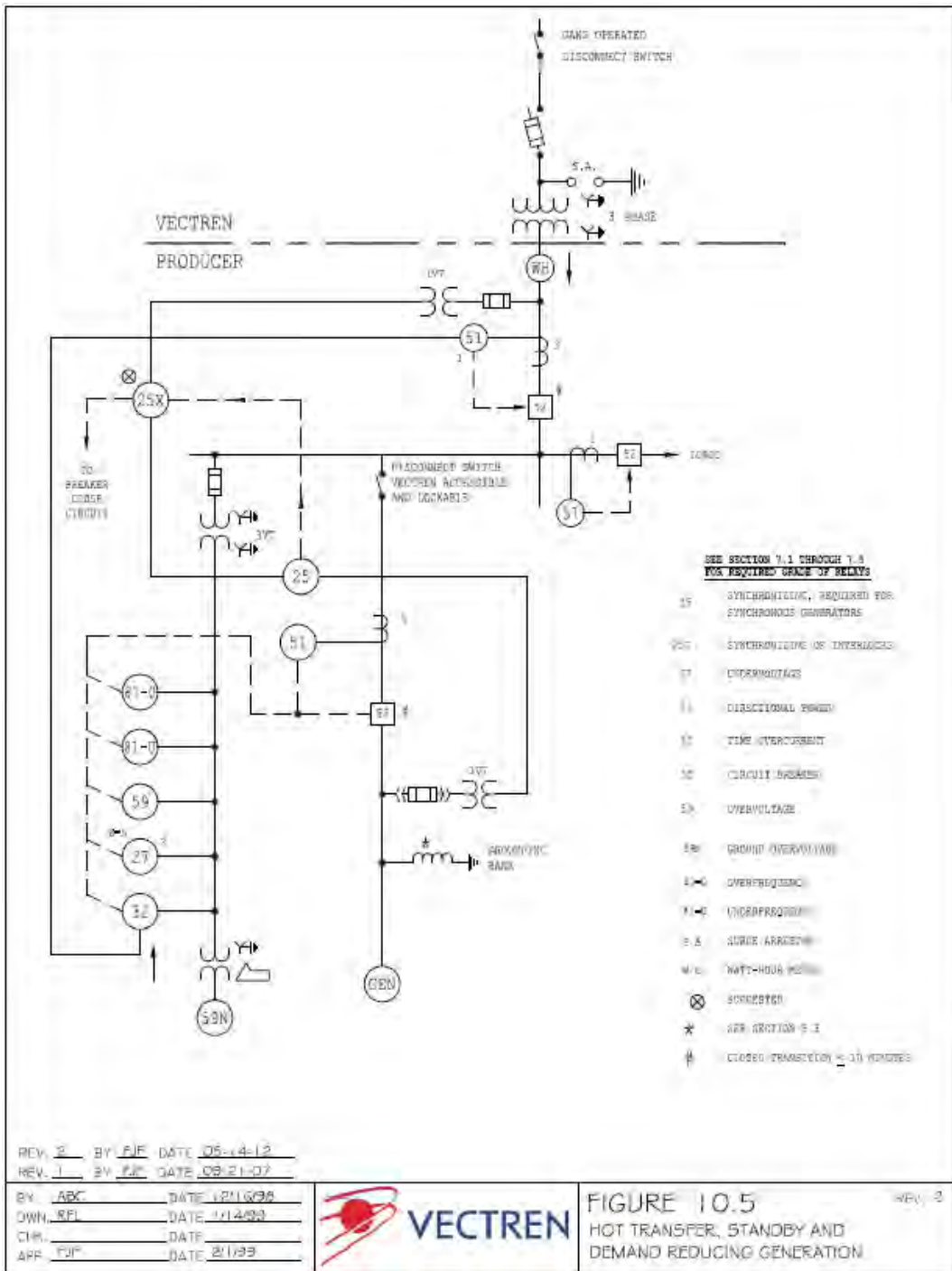
10.3 Relaying and Metering From 100 kW to Less Than 1 MW



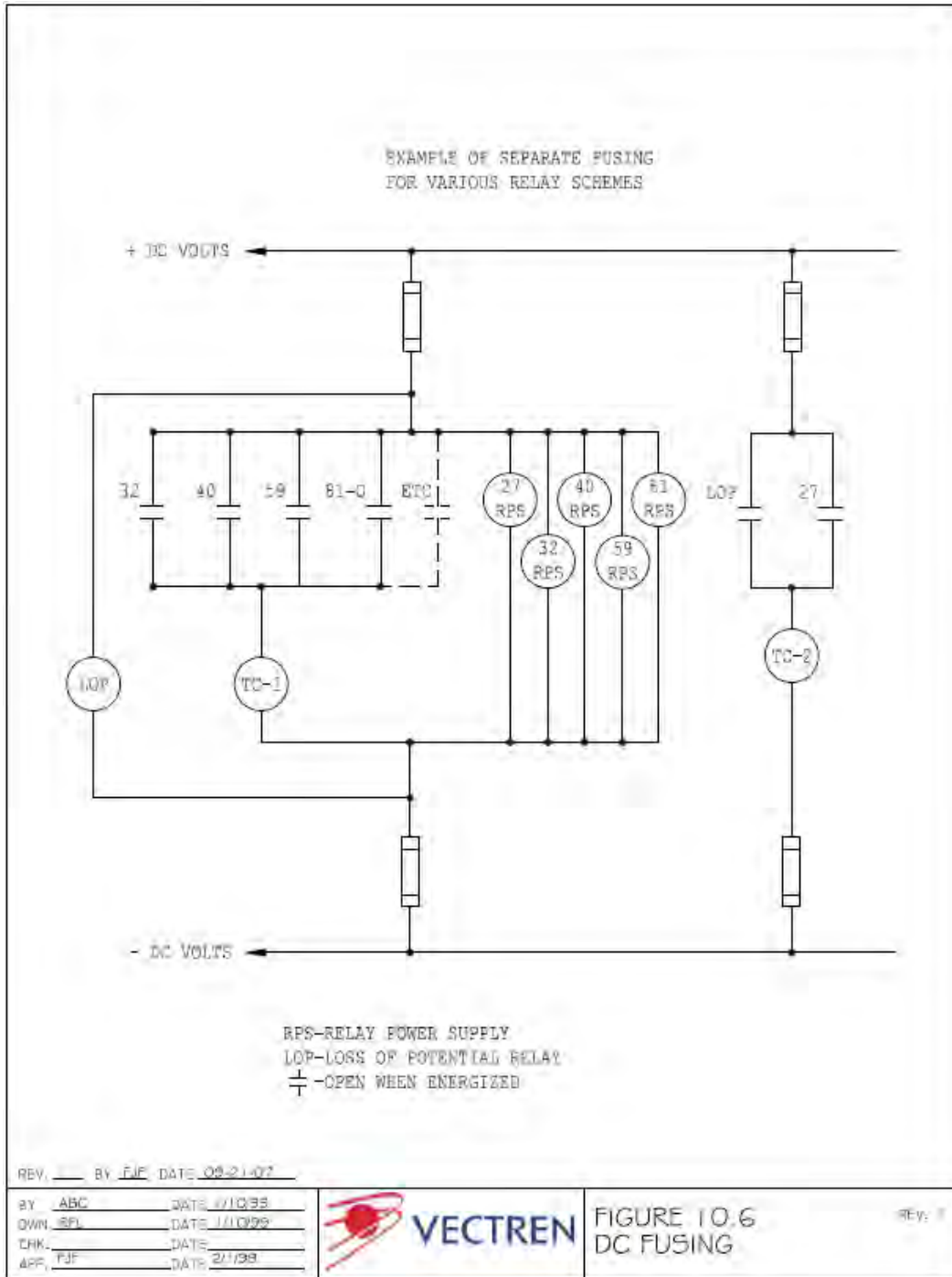
10.4 Relaying and Metering From 1 MW to Less Than 10 MW



10.5 Hot Transfer, Standby, and Demand Reducing Generation



10.6 DC Fusing



11 Appendix 1

11.1 Induction Generator Characteristics Survey

Name of Project _____

Manufacture _____

Type _____

Model _____

Number of Phases _____

Rated KW Output _____

Rated KVA Output _____

Rated Voltage (line to line) _____

Rated Current _____

Maximum KW Output (prime mover & Generator) _____

Power Factor or Rated Load (KVAR):

At maximum KW Output _____

At 100 % of Rated Output _____

At 75 % of Rated Output _____

At 50 % of Rated Output _____

At 25 % of Rated Output _____

Connection (wye or delta) _____

Is the wye point grounded? _____

Impedance in ground connection _____

Rotor Resistance (R_r) _____

Rotor Reactance (X_r) _____

Stator Resistance (R_s) _____

Stator Reactance (X_s) _____

Magnetizing Branch Reactance (X_m) _____

Short Circuit Time Constant (T) _____

Slip at Rated Output (s) _____

Synchronous Speed _____

Inertia of Combined Machine _____

12 Appendix 2

Synchronous Generator Characteristics Survey

Name of Project _____

Manufacture _____

Type _____
 Model _____
 Number of Phases _____
 Rater KW Output _____
 Rated KVA Output _____
 Rated Voltage (line to line) _____
 Rated Current _____
 Rated Power Factor: leading _____
 Rated Power Factor: lagging _____
 Maximum KW Output (prime mover & Generator) _____
 Maximum KW Output (prime mover & Generator) _____

With generator at this maximum KW,
 What is the maximum leading power factor?

What is the maximum lagging power factor? _____

Connection (wye or delta) _____

Is the wye point grounded? _____
 Impedance in ground connection _____
 Synchronous Reactance (X_d) _____
 Transient Reactance (X'_d) _____
 Sub-Transient Reactance (X''_d) _____
 Negative-Sequence Reactance (X_2) _____
 Zero-Sequence Reactance (X_0) _____
 Transient Time Constant (T'_d) _____
 Sub-Transient Time Constant (T''_d) _____
 Inertia Constant (W_r^2) _____
 Synchronous Speed _____

13 Cross References

Documents Cross Reference Table

Document Name	References To Document Name
VEC-007 Requirements for Transmission or End-User Facilities Interconnection to the Vectren Electric Transmission System	Section 1.3 – Requirements for Interconnection
IEEE Std. 519	Section 3.2 – Vectren Electric System Integrity, Harmonic Distortion Section 5.7 - Generating System Design Requirements, Inverter Systems
Vectren Electric Service Manual	Section 6 – Metering Requirements
ANSI/IEEE C57.13.1, Sections 5,6,7,7.1,7.2,9	Section 8.2 – Demonstrations/Inspections of Protective Devices, Calibration
IEEE 1547 Standard for Interconnecting Distributed Resources with Electric Power Systems	1.3.1 - Safety Issues 7.1 - Protection Classes

Vectren Indiana Net Metering Application for Interconnection (Level 1)



(Level 1*-Certified Inverter-Based Generation Equipment 10 kW or Smaller)**

I. PROVIDE CUSTOMER & PROJECT INFORMATION

1. Customer

Customer Name	Home/Business Phone	Daytime Phone	Email Address (Optional)	
Customer Address	City	State	Zip Code	

2. Facility

Reason for Application (Select one)	If there are multiple meters at this address, specify which location will be net-metered		
New Facility Increased Capacity Transfer Ownership	Example: "House", "Garage", etc.		
Type of Facility (Select one)	Inverter Manufacturer and Model Number		
Solar Photovoltaic Wind Turbine Other (Specify) _____			
Inverter AC Power (kW) (Each)	Inverter Quantity	Total Max. Inverter Power (kW)	

3. Contractor/Installer

Contractor/Installer Name	Daytime Phone	Email Address		
Contractor/Installer Address	City	State	Zip Code	

II. ATTACH REQUIRED DOCUMENTATION

1. Attach/Include Equipment Documentation

Attach or include documentation confirming that a nationally recognized testing and certification laboratory has listed the equipment.

2. Attach/Include Equipment Diagram

Attach a single-line diagram that includes all electrical equipment from the point where service is taken from Vectren Energy Delivery of Indiana to the inverter, which includes the main panel, sub panels, breaker sizes, fuse sizes, transformers, and disconnect switches (as required). Refer to the "Customer Checklist for Establishing Customer-Owned Generation" to determine if a disconnect switch is required by Vectren.

Note: A Net Metering customer is required to maintain insurance on the net metering facility. Proof of insurance shall be required by Vectren prior to installing the net meter, as part of the Interconnection Agreement process. Refer to 170 Indiana Administrative Code 4-4.2-8 for specific details.

III. SUBMIT YOUR APPLICATION

Submit application electronically

Select the button below and attach all required documentation.

Note: This option may not be available in some PDF viewers.

Submit application manually

Please send your completed application and all required documentation by email to newservice@vectren.com or by fax to **(888) 287-2770**.

* Level 1 as defined in 170 Indiana Administrative Code 4-4.3-4(a) ** Certified as defined in 170 Indiana Administrative Code 4-4.3-5
 All positions and references are in accordance to Vectren's TARIFF FOR ELECTRIC SERVICE (I.U.R.C. No. E-13) and are subject to future changes.

Vectren Indiana Net Metering Interconnection Agreement (Level 1)



THIS INTERCONNECTION AGREEMENT (“Agreement”) is made and entered into this _____ day of _____, _____, by and between Southern Indiana Gas and Electric Company d/b/a Vectren Energy Delivery of Indiana, Inc. (“Company”), and _____ (“Customer”).

Customer is installing, or has installed, inverter-based Customer-generator facilities and associated equipment (“Generation Facilities”) to interconnect and operate in parallel with Company’s electric distribution system, which Generation Facilities are more fully described as follows:

Location		Type of Facility		
		Solar	Wind	Other _____
Inverter Power Rating	Inverter Manufacturer & Model Number			
(Must have individual inverter name plate capacity of 10kW or less)				
Description of electrical installation of the Generation Facilities, including any field adjustable voltage and frequency settings (Select one)				
As shown on a single line diagram attached hereto as "Exhibit A" and incorporated herein by this reference; or				
Described as follows: <i>(provide description in box below:)</i>				

Customer represents and agrees that the Generation Facilities are, or will be prior to operation, certified as complying with:

- The requirements of the Institute of Electrical and Electronics Engineers (“IEEE”) Standard 1547-2003, “Standard for Interconnecting Distributed Resources with Electric Power Systems”, as amended and supplemented as of the date of this Agreement, which standard is incorporated herein by this reference (“IEEE Standard 1547-2003”); or
- The requirements of the Underwriters Laboratories (“UL”) Standard 1741 concerning Inverters, Converters and Controllers for Use in Independent Power Systems, as amended and supplemented as of the date of this Agreement, which standard is incorporated herein by this reference.

Customer further represents and agrees that:

- Customer will qualify as a customer as defined in Company’s Retail Electric Tariff prior to the date the Generation Facilities are interconnected or operating.
- The Generation Facilities are, or will be prior to operation, designed and installed to meet all applicable requirements of IEEE Standard 1547-2003, the National Electrical Code and local building codes, all as in effect on the date of this Agreement;
- The voltage and frequency settings for the Generation Facilities are fixed or, if field adjustable, are as stated above.

Customer agrees to maintain reasonable amounts of insurance coverage against risks related to the Generation Facilities for which there is a reasonable likelihood of occurrence, as required by the provisions of 170 Indiana Administrative Code (“IAC”) 4-4.3-10, as the same may be revised from time to time by the Indiana Utility Regulatory Commission (“Commission”). Customer agrees to provide Company from time to time with proof of such insurance upon Company’s request.

(Continued on back)



With respect to the Generation Facilities and their interconnection to Company’s electric system, Company and Customer, whichever is applicable, (the “Indemnifying Party”) shall indemnify and hold the other harmless from and against all claims, liability, damages and expenses, including attorney’s fees, based on any injury to any person, including the loss of life, or damage to any property, including the loss of use thereof, arising out of, resulting from, or connected with, or that may be alleged to have arisen out of, resulted from, or connected with, an act or omission by the Indemnifying Party, its employees, agents, representatives, successors or assigns in the construction, ownership, operation or maintenance of the Indemnifying Party’s facilities, as required by the provisions 170 IAC 4-4.3-10(b)(2), as the same may be revised from time to time by the Commission.

Company agrees to allow Customer to interconnect and operate the Generation Facilities in parallel with Company’s electric system in accordance with the provisions of 170 IAC 4-4.3, as the same may be revised from time to time by the Commission, which provisions are incorporated herein by this reference.

In the event that Customer and Company are unable to agree on matters relating to this Agreement, either Customer or Company may submit a complaint to the Commission in accordance with the Commission’s applicable rules.

For purposes of this Agreement, the term “certify” (including variations of that term) has the meaning set forth in 170 IAC 4-4.3-5, as the same may be revised from time to time by the Commission, which provision is incorporated herein by this reference.

Customer’s use of the Generation Facilities is subject to the rules and regulations of Company, including Company’s General Terms and Conditions for Electric Service, as contained in Company’s Retail Electric Tariff, as the same may be revised from time to time with the approval of the Commission. Both Company and this Agreement are subject to the jurisdiction of the Commission. To the extent that Commission approval of this Agreement may be required now or in the future, this Agreement and Company’s commitments hereunder are subject to such approval.

IN WITNESS WHEREOF, the Parties have executed this Agreement, effective as of the date first above written.

Company representative

Customer representative

Signature

Signature

Name (please print)

Name (please print)

Title

Title (if applicable)

Date

Date

Please send completed agreement by email to newservice@vectren.com or by fax to (888) 287-2770.

Vectren Indiana Net Metering Application for Interconnection (Levels 2 & 3)



Levels 2 & 3* (Generation Greater Than 10kW)

I. PROVIDE CUSTOMER & PROJECT INFORMATION

1. Customer

Customer Name	Project Contact Person	Contact Phone	Contact Email Address (Optional)	
Customer Address	City	State	Zip Code	
Project Contractors & Firms				
Provide names and contact information for other contractors and engineering firms involved in the design and installation of the generation facilities.				

2. Facility

Reason for Application	If there are multiple meters at this address, specify which location will be net-metered
New Facility Increased Capacity Transfer Ownership	Example: "House", "Garage", etc.
Type of Generator	Power Source
Inverter-based Synchronous Induction	Gas Turbine Microturbine Diesel-fueled reciprocating engine Gas-fueled reciprocating engine Solar Wind Other _____
Total Generating Capacity of Customer-Generator Facility (kW)	Equipment Certification
	Is the equipment "certified" as defined by 170 Indiana Administrative Code ("IAC") 4-4.3-5? Yes No
Operating Modes	
Indicate all possible operating modes for this generator facility. Emergency / Standby - Operated when Vectren Energy Delivery of Indiana ("Vectren") service is not available. Paralleling is for short durations. Peak Shaving - Operated during peak demand periods. Paralleling is for extended times. Base Load Power - Operated continuously at a pre-determined output. Paralleling is continuous. Cogeneration - Operated primarily to produce thermal energy. Paralleling is extended or continuous. Renewable Non-dispatched - Operated in response to an available renewable resource such as solar or wind. Paralleling is for extended times. Other _____	
Will the customer-generator facility export power?	Level of Interconnection Review Requested
Yes (If Yes, How much? (kW) _____) No	Level 2* Level 3*
Fees (Please describe the application fee due)	

II. REQUIRED DOCUMENTATION

For this application to be considered complete, adequate documentation and information must be submitted that will allow Vectren Energy Delivery of Indiana to determine the impact of the generation facilities on Vectren's electric system and to confirm compliance by Customer with the provisions of 170 IAC 4-4.3 and Vectren's requirements. Typically this should include the following:

(Continued on back)

* Level 2 & Level 3 as defined in 170 IAC 4-4.3-4(a)
 All positions and references are in accordance to Vectren's TARIFF FOR ELECTRIC SERVICE (I.U.R.C. No. E-13) and are subject to future changes. 1 OF 2

II. REQUIRED DOCUMENTATION (CONTINUED)

1. **Single-line diagram of the customer's system** showing all electrical equipment from the generator to the point of interconnection with Vectren's distribution system, including generators, transformers, switchgear, switches, breakers, fuses, voltage transformers and current transformers.
2. **Control drawings for relays and breakers.**
3. **Site Plans** showing the physical location of major equipment.
4. **Relevant ratings of equipment.** Transformer information should include capacity ratings, voltage ratings, winding arrangements and impedance.
5. **If protective relays are used, settings applicable to the interconnection protection.** If programmable relays are used, a description of how the relay is programmed to operate as applicable to interconnection protection.
6. **For certified* equipment, documentation confirming that a nationally recognized testing and certification laboratory has listed the equipment.**
7. **A description of how the generator system will be operated,** including all modes of operation.
8. **For inverters, the manufacturer name, model number, and AC power rating, operating manual** or link to manufacturer's web site containing such manual.
9. **For synchronous generators, manufacturer and model number, nameplate ratings and impedance data (Xd, X'd, & X''d).**
10. **For induction generators, manufacturer and model number, nameplate ratings and locked rotor current.**

This application is subject to further consideration and study by Vectren and the possible need for additional documentation and information from Customer.

III. SUBMIT YOUR APPLICATION

Submit application electronically

Select the button below and attach all required documentation.

Note: This option may not be available in some PDF viewers.

Submit application manually

Please send your completed application and all required documentation by email to newservice@vectren.com or by fax to **(888) 287-2770**.

* Level 2 & Level 3 as defined in 170 IAC 4-4.3-4(a)

All positions and references are in accordance to Vectren's TARIFF FOR ELECTRIC SERVICE (I.U.R.C. No. E-13) and are subject to future changes.

Vectren Indiana Net Metering Interconnection Agreement (Levels 2 & 3)



THIS INTERCONNECTION AGREEMENT (“Agreement”) is made and entered into this _____ day of _____, _____, by and between Southern Indiana Gas and Electric Company d/b/a Vectren Energy Delivery of Indiana, Inc. (“Company”), and _____ (“Customer”). Company and Customer are hereinafter sometimes referred to individually as “Party” or collectively as “Parties”.

WITNESSETH:

WHEREAS, Customer is installing, or has installed, generation equipment, controls, and protective relays and equipment (“Generation Facilities”) used to interconnect and operate in parallel with Company’s electric system, which Generation Facilities are more fully described in Exhibit A, attached hereto and incorporated herein by this Agreement, and as follows:

Location
Generator Size & Type

NOW, THEREFORE, in consideration thereof, Customer and Company agree as follows:

- 1. Application.** It is understood and agreed that this Agreement applies only to the operation of the Generation Facilities described above and on Exhibit A.
- 2. Interconnection.** Company agrees to allow Customer to interconnect and operate the Generation Facilities in parallel with Company’s electric system in accordance with any operating procedures or other conditions specified in Exhibit A. By this Agreement, or by inspection, if any, or by non-rejection, or by approval, or in any other way, Company does not give any warranty, express or implied, as to the adequacy, safety, compliance with applicable codes or requirements, or as to any other characteristics, of the Generation Facilities. The Generation Facilities installed and operated by or for Customer shall comply with, and Customer represents and warrants their compliance with: (a) the National Electrical Code and the National Electrical Safety Code, as each may be revised from time to time; (b) Company’s rules and regulations, including Company’s Riders and Company’s General Terms and Conditions for Electric Service, each as contained in Company’s Retail Electric Tariff and as each may be revised from time to time with the approval of the Indiana Utility Regulatory Commission (“Commission”); (c) the rules and regulations of the Commission, including the provisions of 170 Indiana Administrative Code 4-4.3, as such rules and regulations may be revised from time to time by the Commission; and (d) all other applicable local, state, and federal codes and laws, as the same may be in effect from time to time.

Customer shall install, operate and maintain, at Customer’s sole cost and expense, the Generation Facilities in accordance with the manufacturer’s suggested practices for safe, efficient and reliable operation of the Generation Facilities in parallel with Company’s electric system. Customer shall bear full responsibility for the installation, maintenance and safe operation of the Generation Facilities. Customer shall be responsible for protecting, at Customer’s sole cost and expense, the Generation Facilities from any condition or disturbance on Company’s electric system, including, but not limited to, voltage sags or swells, system faults, outages, loss of a single phase of supply, equipment failures, lightning or switching surges.

Customer agrees that without the prior written permission from Company no changes shall be made to the configuration of the Generation Facilities, as that configuration is described in Exhibit A, and no relay or other control or protection settings specified in Exhibit A shall be set, reset, adjusted or tampered with, except to the extent necessary to verify that the Generation Facilities comply with Company approved settings.

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3. Operation by Customer. Customer shall operate the Generation Facilities in such a manner as not to cause undue fluctuations in voltage, intermittent load characteristics or otherwise interfere with the operation of Company's electric system. At all times when the Generation Facilities are being operated in parallel with Company's electric system, Customer shall so operate the Generation Facilities in such a manner that no disturbance will be produced thereby to the service rendered by Company to any of its other customers or to any electric system interconnected with Company's electric system. Customer understands and agrees that the interconnection and operation of the Generation Facilities pursuant to this Agreement is secondary to, and shall not interfere with, Company's ability to meet its primary responsibility of furnishing reasonably adequate service to its customers.

Customer's control equipment for the Generation Facilities shall immediately, completely and automatically disconnect and isolate the Generation Facilities from Company's electric system in the event of a fault on Company's electric system, a fault on Customer's electric system, or loss of a source or sources on Company's electric system. The automatic disconnecting device included in such control equipment shall not be capable of reclosing until after service is restored on Company's electric system. Additionally, if the fault is on Customer's electric system, such automatic disconnecting device shall not be reclosed until after the fault is isolated from Customer's electric system. Upon Company's request, Customer shall promptly notify Company whenever such automatic disconnecting devices operate.

Customer shall coordinate the location of any disconnect switch required by Company to be installed and maintained by Customer.

4. Access by Company. Upon reasonable advance notice to Customer, Company shall have access at reasonable times to the Generation Facilities whether before, during or after the time the Generation Facilities first produce energy, to perform reasonable on-site inspections to verify that the installation and operation of the Generation Facilities comply with the requirements of this Agreement and to verify the proper installation and continuing safe operation of the Generation Facilities. Company shall also have at all times immediate access to breakers or any other equipment that will isolate the Generation Facilities from Company's electric system. The cost of such inspection(s) shall be at Company's expense; however, Company shall not be responsible for any other cost Customer may incur as a result of such inspection(s). Company shall have the right and authority to isolate the Generation Facilities at Company's sole discretion if Company believes that: (a) continued interconnection and parallel operation of the Generation Facilities with Company's electric system creates or contributes (or will create or contribute) to a system emergency on either Company's or Customer's electric system; (b) the Generation Facilities are not in compliance with the requirements of this Agreement, and the non-compliance adversely affects the safety, reliability or power quality of Company's electric system; or (c) the Generation Facilities interfere with the operation of Company's electric system. In nonemergency situations, Company shall give Customer reasonable notice prior to isolating the Generating Facilities.

5. Rates and Other Charges. This Agreement does not constitute an agreement by Company to purchase or wheel power produced by the Generation Facilities, or to furnish any backup, supplemental or other power or services associated with the Generation Facilities, and this Agreement does not address any charges for excess facilities that may be installed by Company in connection with interconnection of the Generation Facilities. It is understood that if Customer desires an agreement whereby Company wheels power, or purchases energy and/or capacity produced by the Generation Facilities, or furnishes any backup, supplemental or other power or services associated with the Generation Facilities, then Company and Customer may enter into another mutually acceptable separate agreement detailing the charges, terms and conditions of such purchase or wheeling, or such backup, supplemental or other power or services. It is also understood that if any such excess facilities are required, including any additional metering equipment, as determined by Company, in order for the Generation Facilities to interconnect with and operate in parallel with Company's electric system, then a separate Excess Facilities Agreement shall be executed by Company and Customer in accordance with Company's Riders contained in Company's Retail Electric Tariff, which riders detail the charges and terms of such excess facilities, as the same may be revised from time to time with the approval of the Commission.

6. Insurance. Customer shall obtain and maintain, for as long as they are interconnected with Company's electric system, homeowners, commercial, or other approved insurance on the premises where the Customer's Generation Facility is located. The insurance shall provide coverage of at least \$100,000 against loss arising out of the use of the Customer's Generation Facilities.

Customer shall furnish a properly executed certificate of insurance to the Company clearly evidencing the required coverage and any exclusion applicable to such coverage. Customer shall further replace such certificates for policies expiring during the period its Generation Facility is interconnected with Company's system.

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Customer shall deliver at least fifteen (15) days prior to any interconnection of the Generation Facilities with Company's electric system, and thereafter as requested by Company, a CERTIFICATE OF INSURANCE verifying the required coverage to:

Vectren Energy Delivery of Indiana, Inc.
Attention: Vectren Customer Planning and Sales
1 N. Main St.
Evansville, IN 47711-5456

Company has the right to refuse to establish or continue the interconnection of Customer's generation facility to Companies system if proof of applicable insurance is not supplied.

- 7. Indemnification.** Each Party (the "Indemnifying Party") shall indemnify and hold harmless the other Party from and against all claims, liability, damages and expenses, including attorney's fees, based on any injury to any person, including the loss of life, or damage to any property, including the loss of use thereof, arising out of, resulting from, or connected with, or that may be alleged to have arisen out of, resulted from, or connected with, an act or omission by the Indemnifying Party, its employees, agents, representatives, successors or assigns in the construction, ownership, operation or maintenance of the Indemnifying Party's facilities used in connection with this Agreement. Upon written request of the Party seeking relief under this Section 7, the Indemnifying Party shall defend any suit asserting a claim covered by this Section 7. If a Party is required to bring an action to enforce its rights under this Section 7, either as a separate action or in connection with another action, and said rights are upheld, the Indemnifying Party shall reimburse such Party for all expenses, including attorney's fees, incurred in connection with such action.
- 8. Effective Term and Termination Rights.** This Agreement shall become effective when executed by both Parties and shall continue in effect until terminated in accordance with the provisions of this Agreement. This Agreement may be terminated for the following reasons: (a) Customer may terminate this Agreement at any time by giving Company at least sixty (60) days' prior written notice stating Customer's intent to terminate this Agreement at the expiration of such notice period; (b) Company may terminate this Agreement at any time following Customer's failure to generate energy from the Generation Facilities in parallel with Company's electric system within twelve (12) months after completion of the interconnection provided for by this Agreement; (c) either Party may terminate this Agreement at any time by giving the other Party at least sixty (60) days' prior written notice that the other Party is in default of any of the material terms and conditions of this Agreement, so long as the notice specifies the basis for termination and there is reasonable opportunity for the Party in default to cure the default; or (d) Company may terminate this Agreement at any time by giving Customer at least sixty (60) days' prior written notice in the event that there is a change in an applicable rule or statute affecting this Agreement.
- 9. Termination of Any Applicable Existing Agreement.** From and after the date when service commences under this Agreement, this Agreement shall supersede any oral and/or written agreement or understanding between Company and Customer concerning the service covered by this Agreement and any such agreement or understanding shall be deemed to be terminated as of the date service commences under this Agreement.
- 10. Force Majeure.** For purposes of this Agreement, the term "Force Majeure" means any cause or event not reasonably within the control of the Party claiming Force Majeure, including, but not limited to, the following: acts of God, strikes, lockouts, or other industrial disturbances; acts of public enemies; orders or permits or the absence of the necessary orders or permits of any kind which have been properly applied for from the government of the United States, the State of Indiana, any political subdivision or municipal subdivision or any of their departments, agencies or officials, or any civil or military authority; unavailability of a fuel or resource used in connection with the generation of electricity; extraordinary delay in transportation; unforeseen soil conditions; equipment, material, supplies, labor or machinery shortages; epidemics; landslides; lightning; earthquakes; fires; hurricanes; tornadoes; storms; floods; washouts; drought; arrest; war; civil disturbances; explosions; breakage or accident to machinery, transmission lines, pipes or canals; partial or entire failure of utilities; breach of contract by any supplier, contractor, subcontractor, laborer or materialman; sabotage; injunction; blight; famine; blockade; or quarantine.

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If either Party is rendered wholly or partly unable to perform its obligations under this Agreement because of Force Majeure, both Parties shall be excused from whatever obligations under this Agreement are affected by the Force Majeure (other than the obligation to pay money) and shall not be liable or responsible for any delay in the performance of, or the inability to perform, any such obligations for so long as the Force Majeure continues. The Party suffering an occurrence of Force Majeure shall, as soon as is reasonably possible after such occurrence, give the other Party written notice describing the particulars of the occurrence and shall use commercially reasonable efforts to remedy its inability to perform; provided, however, that the settlement of any strike, walkout, lockout or other labor dispute shall be entirely within the discretion of the Party involved in such labor dispute.

11. Dispute Resolution. In the event that Customer and Company are unable to agree on matters relating to this Agreement, either Customer or Company may submit a complaint to the Commission in accordance with the Commission's applicable rules.

12. Commission Jurisdiction and Company Rules. Both Company and this Agreement are subject to the jurisdiction of the Commission. To the extent that Commission approval of this Agreement may be required now or in the future, this Agreement and Company's commitments hereunder are subject to such approval. Customer's use of the Generation Facilities is subject to the rules and regulations of Company, including Company's General Terms and Conditions for Electric Service, as contained in Company's Retail Electric Tariff, as the same may be revised from time to time with the approval of the Commission.

IN WITNESS WHEREOF, the Parties have executed this Agreement, effective as of the date first above written.

Company representative

Customer representative

Signature

Signature

Name (please print)

Name (please print)

Title

Title (if applicable)

Date

Date

Please send completed agreement by email to newservice@vectren.com or by fax to (888) 287-2770.