DISTRIBUTED RESOURCES
INTERCONNECTION GUIDELINES

A Guide to the Interconnection of Distributed Generation or Energy Storage Systems to Oklahoma Gas and Electric Company’s (OG&E) Distribution System
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1.0 Introduction

This document supersedes all points of difference with the previous document (OG&E Generation Interconnection Guidelines Rev 9/21/1999). This document states the minimum requirements for safe and effective operation of Producer-owned electric generation or energy storage systems that are interconnected with the OG&E Distribution System. Producers and OG&E personnel may be guided by this document when planning such installations. It is emphasized that these requirements are general and may not cover all details in specific cases. The Producer should discuss project plans with OG&E before purchasing or installing equipment.

OG&E will only review and comment on technical requirements for interconnection of the distributed resource with OG&E. The Producer is fully responsible for protecting its equipment so that disturbances on the OG&E system do not cause damage to the Producer’s equipment. OG&E review of the Producer’s equipment is not an endorsement of the Producer’s design and OG&E shall not be responsible for the safety or adequacy of such equipment.

Producers planning an electrically isolated installation will not be subject to these guidelines. A generator or energy storage system that can never be paralleled with the OG&E distribution system or is to be temporarily connected in parallel during a load transfer for a period of less than 100 milliseconds (1/10th of a second) is considered to be an electrically isolated system and is not required to meet the requirements of this guide. However, make-before-break transfer schemes must be approved by OG&E and must meet the requirements of Underwriters Laboratories Standard UL 1008.

This guide is not applicable to producers that plan to sell wholesale energy to the bulk electrical transmission system. All requests for interconnection to OG&E transmission facilities should be made through the Southwest Power Pool (SPP) at www.spp.org.

2.0 Definitions

“Distributed Resources” means all sources of electric power, including generators and energy storage facilities, which are operated in parallel with the Utility distribution system. This includes rotating electrical generators, wind turbines, microturbines, Photo Voltaic (PV) systems and fuel cells.

“IEEE 1547 compliant” means equipment that has been tested by a nationally recognized testing laboratory and verified to conform to the Institute of Electrical and Electronics Engineers (IEEE) Standard 1547.

“Induction Machine” means a rotating ac electrical generator similar in design to an induction motor. It is often referred to as an asynchronous machine. An induction machine acts as a motor when rotating slower than the electric system frequency but generates electricity when a prime mover such as an engine rotates the shaft faster than the system frequency.
“Inverter” means a device or system that changes direct current (dc) power into alternating current (ac) power that is compatible with the utility supply line. An inverter is typically composed of electronic components and is not a rotating machine such as an electric generator.

“Islanding” is a condition where the utility source has been disconnected, but the Producer’s equipment continues to serve either its own facility load or the loads of other utility customers connected to the source feeder. Islanding of a Producer’s generation creates a safety hazard for OG&E employees.

“Line Section” means an OG&E feeder line or a part of a line that is connected to the Producer’s equipment and bounded by automatic sectionalizing devices.

“Make-before-break transfer” means load transfer equipment that makes a parallel connection to the utility before breaking the connection to the Distributed Resource or vice versa. During such transfers, the utility and the Distributed Resource are temporarily paralleled.

“OG&E” or “Utility” means Oklahoma Gas and Electric Company.

“Parallel Operation” means the direct connection of the Producer’s power generation or energy storage equipment to the OG&E distribution system for periods longer than 100 millisecond (1/10th of a second).

“Parallel Operating Agreement” is an agreement to allow connection to the OG&E system.

“Producer” means the owner of a non-utility electric power generation or energy storage facility.

“Producer’s close blocked for dead line” means the Producer’s interconnecting circuit breaker cannot be closed if the utility feeder line is not energized.

“Synchronous Machine” means a rotating ac electrical generator that operates in synchronism with the ac power system frequency. Synchronous generators can be severely damaged if connected out of synchronism with a utility ac distribution system.

“Transfer Trip” means equipment that sends a trip signal from one location to another via a communications system such as phone line, radio or fiber optics. Transfer trip is normally applied whenever large synchronous generators are connected to a utility feeder that utilizes high-speed breaker reclosing following line disturbances.

“UL certified non-islanding inverter” means equipment that conforms to UL -1741 standards or has been tested by another nationally recognized testing laboratory and verified to conform to applicable sections of UL-1741 for utility interactive (grid connected) inverters.

“Utility Grade Protective Relaying” means relays which meet the requirements of IEEE standards C37.90, C37.90.1, and C37.90.2.
3.0 OG&E Distributed Resource Interconnection Process

- Completed purchase/interconnection agreement packet submitted to OG&E

**Is point of interconnection on a radial feeder?**

- **YES**
  - **Is Nameplate Rating \( \leq 10\text{kW} \), Inverter Based and UL 1741 Certified Non-islanding?**
    - **YES**
      - **Expedited Review Approved**
    - **NO**
      - **Is Aggregate Rating \( \leq 1\text{MW} \) Total and *Passes Screen for Expedited Review?**
        - **YES**
          - **Full Study Process**
        - **NO**
          - **Is Proposed Facility \( > 50\% \) of Circuit \( \text{kVA} \) Rating?**
            - **YES**
              - OG&E Provides Cost Estimate to Modify Existing OG&E Feeder Line to Accommodate Producer’s Facility
            - **NO**
              - OG&E Provides Cost Estimate to Construct Dedicated Distribution Feeder(s) to Accommodate Producer’s Facility

- **NO**

* Requirements to pass the Expedited Review screening:

1. The aggregate generating nameplate kVA rating must be less than 10% of feeder line section peak kVA load. ("Aggregate" includes the proposed equipment and all pre-existing generation on the line section.)

2. The proposed equipment must contribute less than 10% of the total feeder short circuit current at the point of interconnection.

3. The proposed equipment cannot cause the available short circuit current to rise above 80% of equipment interrupting ratings.

4. 120V connection: Winding unbalance must be < 20% of service transformer kVA. Shared secondary: DR rating must be ≤ 20kW.

5. Three Phase connections must be 4 wire grounded-wye on OG&E primary or grounding transformer must be provided.

6. No construction of facilities or expense by OG&E is required.

7. Equipment is certified by a nationally recognized testing laboratory to meet all IEEE Standard 1547 requirements.

- Producer Agrees to Pay For All OG&E System Upgrades or Withdraws Application

- Producer and OG&E Sign Purchase Agreement or Parallel Operating Agreement
4.0 Details of the Interconnection Process

The objective of the OG&E Interconnection Process is to meet all applicable federal, state and local regulations while conforming to all industry standards and accepted industry practices. OG&E policy adheres to the latest revision of the Institute of Electrical and Electronics Engineers (IEEE) Standard 1547, Standard for Interconnecting Distributive Resources with Electric Power Systems and IEEE Standard 1547.2, the accompanying application guide and the Oklahoma Administrative Code, Title 165. Corporation Commission Chapter 35: Electric Utility Rates and Chapter 40: Standard Terms of Purchases from Purchasers of 100 KW or Less.

All applications will be screened and evaluated based on the rated nameplate kW of the Producer’s proposed equipment, not the kW the Producer plans to generate or sell. Upon receipt of a completed application form and required information, OG&E shall perform an initial screening of the application using the following criteria.

4.1 Inverter Based Units No Greater Than 10kW

UL-1741 Certified, non-islanding inverter based generating facilities of 10kW or less will be automatically approved for interconnection when the following provisions are met:

(1) A completed application has been received by OG&E including the inverter manufacturer’s proof of UL-1741 testing and certification.

(2) A visible break isolation device is provided by the producer between the inverter source and the OG&E supply circuit and shall be located outdoors within 10 feet of the main utility meter. The disconnect shall be capable of being padlocked open by OG&E personnel during emergencies and/or for equipment maintenance.

(3) OG&E has installed appropriate metering for the installation. An additional meter base will be provided by OG&E to be installed by the Producer adjacent to the isolation device for metering the power production.

(4) The Producer and OG&E have signed a Purchase Agreement.

4.2 Expedited Review of Installations Less Than or Equal to 1 Megawatt (1000kW)

After receipt of a completed application and all necessary information, OG&E will screen the application to determine if the proposed facility qualifies for Expedited Review.

For an Expedited Review of a proposed interconnection to an OG&E feeder, the total nameplate capacity of all proposed generation must be no larger than 1MW and meet ALL of the following requirements:

(1) The aggregate total of all non-utility generation (including the proposed facility and other pre-existing facilities) must be less than 10% of the line section’s maximum peak load as last measured or calculated by OG&E.
(2) The short circuit current contribution of the proposed facility, at the point of interconnection, must be less than 10% of the total available short circuit current.

(3) The addition of the proposed facility shall not cause the available short circuit current to rise above 80% of the short circuit interrupt ratings of OG&E or the Producer's equipment, nor can any addition be approved (during the expedited review process) to a circuit that already exceeds this level.

(4) Single phase installations that are to be interconnected on the center tap of a 240V secondary service shall not create an imbalance between windings of greater than 20% of the service transformer nameplate rating. If the secondary is to be shared with another customer, the aggregate of all generation on the shared secondary cannot exceed 20kW.

(5) Proposed three phase interconnections to OG&E's primary distribution feeder must be connected four wire, grounded-wye with ground overcurrent protection. A Producer-supplied grounding transformer may be substituted for a grounded-wye connection.

(6) No construction of facilities or expense by OG&E (other than metering) is required to accommodate the Distributed Resource interconnection.

(7) Equipment must be certified by a Nationally Recognized Testing Laboratory to meet all IEEE Std. 1547 requirements.

If the proposed facility fails the Expedited Review screening, the Producer may withdraw the application or continue to the Full Study Process. OG&E may elect to present options that could allow the Producer to pass the Expedited Review screening with only minimal cost to the Producer.

4.3 Full Study Process

The Full Study process is used by OG&E for review of proposed interconnection facilities:

1. with aggregate nameplate capacity above 1 MW.
2. that did not meet the 10kW and below Inverter based system requirements.
3. that are not greater than 1 MW but did not pass the Expedited Review Process.

If the parties agree to proceed, OG&E will perform detailed studies as required to investigate the feasibility, impact and the facilities cost of the interconnection. OG&E may elect to ask for earnest money to cover the cost of such studies. The interconnection analysis will include the preparation of a site specific technical document and detailed cost analysis for presentation to the Producer. This document will become an appendix to a Parallel Operating Agreement (POA) to be negotiated with the Producer.

Proposed facilities larger than 1MW (1000kW) will be evaluated by OG&E on a case by case basis. Appendix 2 lists some of the possible system impacts that OG&E may consider. Additional protective equipment may be required at the OG&E substation or sectionalizing device to transfer trip the
Producer’s generator breaker or interconnect circuit breaker for OG&E feeder faults or when the source substation becomes isolated from the OG&E transmission grid.

Proposed facilities rated more than 50% of the OG&E feeder circuit kVA rating will require an OG&E feeder circuit dedicated solely to the Producer. OG&E will perform a feasibility analysis and determine availability at the requested location. If the location is viable, OG&E will provide a cost estimate to the Producer for constructing the new feeder. Refer to Appendix B-4 for typical requirements.

For installations where the Producer wishes to sell energy to OG&E, a communications channel with telemetering of continuous generated kW to the OG&E System Control Center is required for installations with aggregate generation above 5,000kW (5MW). Supervisory Control and Data Acquisition (SCADA) indication and/or control may be required in some circumstances.

Facilities greater than 20MW must connect to a substation that is dedicated solely to the Producer. While such installations are beyond the scope of this guide, Appendix B-5: Typical Technical and Protection Requirements for Dedicated Substations has been included for reference.

5.0 Technical Requirements

A manual disconnecting device accessible to OG&E, which can be locked with an OG&E padlock and verified open by OG&E, shall be installed at the Point of Interconnection. All 3 phase disconnect switches shall be 3 pole - gang operated.

Interconnected Distributed Resource installations shall conform to all applicable safety standards, rules and guidelines contained in the National Electric Code, NFPA 70.

All Interconnected Distributed Resource installations must conform to the safety, protection and power quality requirements of IEEE 1547 - Standard for Interconnecting Distributed Resources with Electric Power Systems.

Inverter Based Distribution Resources with nameplate ratings 100kW or less must be certified to meet UL Standard 1741 - Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources.

The Producer will be responsible for providing reactive power supply requirements for any induction generator installed on the distribution system. The generator power factor at the interconnection point shall be 100%. Any power factor correction equipment must be accessible by the utility, and must have the capability to be disconnected for safety concerns. Power factor correction equipment should be placed on the DG source side of the production meter.

When required, the Producer shall provide an easement to OG&E for any property required to establish the interconnection. The easement shall be at no cost to OG&E.

Interference Complaints. When it is determined that the Producer’s generation system is the source of interference to the Company, its customers, or other utilities and their customers, it shall be the
responsibility of the Producer to bear the cost of making necessary modifications to its system or to discontinue parallel operation until the problem is resolved.

The Producer shall be aware that changes to the OG&E system or the addition of other customers with generation in the vicinity may require modifications to the interconnection protective devices. If such changes are required, the Producer may be subject to future charges for these modifications.

**TABLE 1**

<table>
<thead>
<tr>
<th>REQUIREMENTS FOR AUTOMATIC APPROVAL OF 10KW OR LESS INVERTER BASED SYSTEMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visible break lockable disconnect switch outdoors within 10 ft. of meter.</td>
</tr>
<tr>
<td>Proof of UL-1741 Non-Islanding Certification.</td>
</tr>
<tr>
<td>Shared secondary (OG&amp;E 120/240V service transformer shared with neighbors)</td>
</tr>
</tbody>
</table>

**TABLE 2**

<table>
<thead>
<tr>
<th>REQUIREMENTS FOR SMALL SYSTEMS - 300KW OR LESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>300kW or less aggregate capacity and 10kW or less Inverters not qualified for automatic approval.</td>
</tr>
<tr>
<td>IEEE Std. 1547 Compliant</td>
</tr>
<tr>
<td>Visible break lockable disconnect switch outdoors within 10 ft. of meter.</td>
</tr>
<tr>
<td>Under &amp; Over voltage protection</td>
</tr>
<tr>
<td>Under &amp; Over frequency protection</td>
</tr>
<tr>
<td>Overcurrent protection</td>
</tr>
<tr>
<td>Synchronizing provisions</td>
</tr>
<tr>
<td>Shared secondary (OG&amp;E 120/240V service transformer shared with neighbors).</td>
</tr>
</tbody>
</table>

Table 2 Notes:
1. UL 1741 certification assures compliance with this requirement.
### Table 3

**Requirements for Medium Systems Greater Than 300kW and Up to 1000kW (1MW)**

<table>
<thead>
<tr>
<th>Requirement</th>
<th>UL – 1741 Certified Non-Islanding Inverter</th>
<th>Self Excited / Stand Alone Inverters</th>
<th>Induction Machine</th>
<th>Synchronous Machine</th>
</tr>
</thead>
<tbody>
<tr>
<td>IEEE Std. 1547 Compliant</td>
<td>(1)</td>
<td>√</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>Visible break lockable disconnect switch</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>Under &amp; Over voltage protection</td>
<td>(1)</td>
<td>√</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>Under &amp; Over frequency protection</td>
<td>(1)</td>
<td>√</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>Overcurrent protection</td>
<td>(1)</td>
<td>√</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>Synchronizing provisions</td>
<td>(1)</td>
<td>Automatic</td>
<td>Automatic</td>
<td></td>
</tr>
<tr>
<td>Reverse power protection</td>
<td>(2)</td>
<td>(2)</td>
<td>(2)</td>
<td>(2)</td>
</tr>
<tr>
<td>Effectively grounded on utility side</td>
<td>(3)</td>
<td>(3)</td>
<td>(3)</td>
<td>(3)</td>
</tr>
<tr>
<td>OG&amp;E dead line reclose restriction</td>
<td>(4)</td>
<td>(4)</td>
<td>(4)</td>
<td>(4)</td>
</tr>
<tr>
<td>Producer’s close blocked for dead line</td>
<td></td>
<td>√</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>Fault detection at OG&amp;E substation and Transfer Trip of Producer’s equip.</td>
<td>(5)</td>
<td>(5)</td>
<td>(5)</td>
<td>(5)</td>
</tr>
</tbody>
</table>

**Table 3 Notes:**

1. UL 1741 certification assures compliance with this requirement.
2. Reverse power protection is not required if Producer is selling electricity to OG&E. Directional overcurrent relays may be used in lieu of reverse power protection.
3. If a 3 phase transformer is utilized as part of the interconnection equipment, it must have a grounded neutral or grounding transformer on the utility side and have neutral overcurrent protection.
4. If DR nameplate kW is greater than 10% of the line section peak kVA load, but less than 10% of the total feeder load, OG&E may elect to install a pole mounted reclosing device with a dead line reclose restriction in lieu of transfer trip from the substation.
5. Transfer Trip is normally not required if aggregate generating capacity (including pre-existing capacity of other Producers) is less than 10% of the total circuit peak load as last measured.
### TABLE 4

#### REQUIREMENTS FOR LARGE SYSTEMS ABOVE 1000KW (1MW) UP TO 20MW

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Inverters</th>
<th>Induction Machine</th>
<th>Synchronous Machine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Producer’s aggregate nameplate capacity greater than 1000kW.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dedicated OG&amp;E feeder circuit required.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Visible break lockable disconnect switch.</td>
<td>√</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>Utility Grade Protective Relaying</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Under &amp; Over voltage protection (27/59)</td>
<td>(1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Under &amp; Over frequency protection (81 U/O)</td>
<td>(1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phase Overcurrent protection (50/51)</td>
<td>(1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neutral overcurrent protection (50/51N)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negative Phase sequence current &amp; voltage (46/47)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Synchronizing provisions (25A)</td>
<td>Automatic</td>
<td></td>
<td>Automatic</td>
</tr>
<tr>
<td>Reverse power protection (32)</td>
<td>(2)</td>
<td>(2)</td>
<td>(2)</td>
</tr>
<tr>
<td>Effectively grounded on utility side</td>
<td>(3)</td>
<td>(3)</td>
<td>(3)</td>
</tr>
<tr>
<td>OG&amp;E dead line reclose restriction</td>
<td>(4)</td>
<td>(4)</td>
<td>(4)</td>
</tr>
<tr>
<td>Producer’s close blocked for dead line</td>
<td>√</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>Fault detection at OG&amp;E substation and Transfer Trip of Producer’s equip.</td>
<td>kW&gt;10% cct. peak load or &gt;1MW (12 or 24kV) or &gt; 2.5MW (34.5kV)</td>
<td></td>
<td>kW&gt;10% cct. peak load or &gt;1MW (12 or 24kV) or &gt; 2.5MW (34.5kV)</td>
</tr>
<tr>
<td>Telemetering / SCADA</td>
<td>If &gt;5MW</td>
<td>If &gt;5MW</td>
<td>If &gt;5MW</td>
</tr>
</tbody>
</table>

**Table 4 Notes:**

1. UL 1741 certification assures compliance with this requirement.
2. Reverse power protection is not required if Producer is selling electricity to OG&E. Directional overcurrent relays (67) shall be used in lieu of reverse power protection.
3. If a 3 phase transformer is utilized as part of the interconnection equipment, it must have a grounded neutral or a grounding transformer with neutral overcurrent protection.
4. If DR nameplate kW is greater than 10% of the line section peak kVA load, but less than 10% of the total feeder load, OG&E may elect to install a pole mounted reclosing device with a dead line reclose restriction in lieu of transfer trip from the substation.
5. Induction generators may be able to stand alone / Island when enough power factor correction capacitors are present. OG&E reserves the right to witness an Anti-Islanding test in accordance with IEEE 1547-2003 Section 4. Transfer Trip will be required for installations failing the test.
6.0 Energization and Disconnect

Upon completion, the customer’s facility will be inspected and certified by a municipal, state, or federal government authority having jurisdiction. If self-installed or no government party has jurisdiction, the facility shall be inspected by a licensed electrician or licensed professional engineer. OG&E reserves the right to witness commissioning tests or operation of interconnect and related equipment, as well as inspect the producer’s facilities during normal business hours. At the time of energization, OG&E will collect a certificate of completion signed by the producer and inspector.

The utility reserves the right to refuse connection or to disconnect the producer for failure to comply with these guidelines or the applicable law, rules, and regulations. The utility also reserves the right to shed customer’s load or generation to stabilize the system during emergencies, or as part of system maintenance. The producer is liable if an inability to disconnect creates hazardous conditions resulting in damage or injury.

7.0 Customer Responsibilities

The producer is responsible for complying with all applicable laws, rules and regulations. Producer is also responsible for synchronization with the distribution system, and OG&E is not responsible for damages resulting from out-of-phase reclosing. The customer shall never energize a de-energized distribution circuit. The customer shall not authorize anyone to change, remove, or tamper with OG&E property, including tags or locks used for utility operations procedures.

The customer is responsible for the easement, licensing, design, equipment, studies, protection, maintenance, and operation by qualified personnel required to accommodate power generation and/or storage. The customer will be responsible for the cost of adverse system affects, investigation, and system hardening required, as well as future modifications due to utility changes in system protection, system load, or type of service provided. After an application has been approved, any changes in project scope including but not limited to equipment type, size or rating will require that an updated application be resubmitted for approval.

Commissioning tests and maintenance of interconnection and related equipment shall conform to the requirements of IEEE 1547-2003, Section 5. For large installations using utility grade interconnecting protective equipment, OG&E will require testing on a regular basis. All distribution generation certifications, maintenance, test results, production outage records, technical drawings, design specifications, equipment, and equipment settings must be kept up to date and be provided to OG&E upon request.
Appendix 1

Applicable Industry Standards

The Producer’s equipment and operation must comply with all applicable sections of the following industry standards:

- IEEE Std. 1547 Standard for Interconnecting Distributed Resources with Electric Power Systems
- IEEE Std. 1547.1 Standard Conformance Test Procedures for Equipment Interconnecting Distributed Resources with Electric Power Systems
- IEEE Std. 1547.2 Application Guide for IEEE Standard 1547 - Standard for Interconnecting Distributed Resources with Electric Power Systems
- UL Std. 1741 Inverters, Converters, Controllers and Interconnection System Equipment for Use with Distributed Energy Resources.
- UL Std. 1008 Transfer Switch Equipment
- IEEE Std. 519 Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems
- IEEE Std. 929 Recommended Practices for Utility Interface of Photovoltaic (PV) Systems
- NFPA 70 National Electrical Code
- NEMA MG 1 Motors and Generators
Appendix 2

Effect of Large DRs on Feeder Protection and Power Quality

During the Full Study Process, OG&E will evaluate the system impact of large (>1MW) Distributed Resources, considering (but not limited to) the items listed below. Some impacts may not be apparent until the DR is commissioned and in service. If such problems arise, additional study will be required and the Producer may be required to cease operation until a solution is implemented.

Possible Impacts and Considerations:

1. The sum total of fault current from the Producer’s generation and that from the OG&E substation may exceed the short circuit interrupt rating of OG&E’s and/or the Producer’s equipment.

2. Increased fault current from the Producer’s generation may desensitize the existing feeder protection for phase faults. OG&E protective equipment may need to be adjusted to “reach”, i.e. protect to the end of the feeder when generators are on-line.

3. Interconnection transformers connected delta on the Producer’s side and Grounded-Wye on the Utility side may increase ground fault currents and desensitize protective equipment response to ground faults.

4. A fuse coordination study on the entire interconnected feeder may be required to assure that the increase in available fault current from the Producer does not cause nuisance fuse blowing or line recloser miscoordinations.

5. OG&E Voltage Regulators or Load Tap Changers may not work properly when power flows from the Distributed Resource towards the OG&E substation. Line drop compensation in the regulator controls may require adjustment or disabling or the regulator station may need to be moved downstream of the DR point of interconnection.

6. Wind turbines or other Distributed Resources that have rapidly varying output may cause excessive operations of Voltage Regulators, Load Tap Changers or Switched Capacitors. Switching setpoints and time delays may require adjustment.

7. Single phase equipment such as fuses, switches or reclosers that are upstream of the Producer (between the OG&E substation and the Producer) may cause operating problems for the Producer. OG&E may elect to relocate single phase equipment or replace single phase equipment with 3 phase, gang operated devices.

8. The possibility of transferring the Producer’s generation to one or more other feeder circuits during maintenance or emergencies will require that any special protection installed on the normal source feeder be duplicated for all other possible sources.

9. The Producer’s voltage regulation may require adjustment to assure feeder voltage is maintained between +/- 5% of nominal.
10. Inverter based Distributed Resources may cause voltage flicker or harmonic distortions that are objectionable to other OG&E customers on the interconnected feeder. OG&E may require the Producer to work with the equipment manufacturer to bring voltage flicker and harmonic content within the acceptable levels established in IEEE Standard 519.

11. Induction machines that require starting power from OG&E to bring the machine rotor up to system frequency speed may require a motor starting calculation to assure voltage flicker will be within acceptable limits.

12. OG&E’s technical requirements are fashioned to greatly reduce the possibility of the Producer’s Distributed Resource “Islanding” with other customer loads on the interconnected line section. However, if Islanding should occur, OG&E may require the installation of additional protective equipment at the Producer’s expense.
Appendix 3

Labeling Requirements

Figure 1 - Label for Customer Disconnect Switch

Figure 2 - Label for Net Meter Base

Figure 34 - Label for Generation (DER) Meter Base

Figure 45 - Label for Generation (DER) Disconnect Switch
Appendix 4

Typical Metering Diagram

400 Amp service or Less

Utility Source

Visible Break Disconnect Switch

<10 feet

Net Meter

Breaker Panel

Visible Break Disconnect Switch

DER Meter

UL-1741 Inverter

Battery Storage

Photovoltaic Panels

House
Appendix B-4: Typical Technical and Protection Requirements for Dedicated Feeders

**OG&E Distribution System (34.5kV and Below)**

- **OG&E Substation**
- **Transfer Trip Initiate**
- **Distribution Feeder**
- **Transfer Trip Initiate**

**To OG&E Transmission System**

**Legend**

- **Device No.**
- **Function**
  - 21: Phase Distance
  - 25: Synchronizing
  - 27: Undervoltage
  - 32: Power Directional
  - 46: Negative Phase Sequence
  - 47: Phase Sequence
  - 50: Instantaneous Overcurrent
  - 51: Time Overcurrent
  - 52: Circuit Breaker
  - 59: Overvoltage
  - B1: Over-Underfrequency
  - C: Capacitor Bank (for Induction Units)
  - M: Metering
  - TTT: Transfer Trip Transmitter
  - TTR: Transfer Trip Receiver

**Notes**

- *Possible locations for accessible and lockable disconnect devices*
- **Transmission Line Fault Protection for Producer**

**OG&E Electric Services**

OG&E Generation Interconnection Guidelines
Appendix B, Sheet 4

**OG&E Distribution System**

- >50% of Circuit MVA Rating
- Generation
- Typical Interconnection

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