

# CLAVERACK RURAL ELECTRIC COOPERATIVE, INC.

## Policy Bulletin No. B-19

**SUBJECT:** Alternate Energy Production

**POLICY:**

This policy, along with ***Appendix A, Safety & Interconnection Requirements for Alternate Energy Production*** and ***Appendix B, Alternate Energy Systems Service Rate for Member Alternative Energy Production***, outlines the cooperative's policy on member interconnection of Alternate Energy Systems and Qualifying Facility as herein defined.

**RESPONSIBILITY:** President & CEO or Delegate

**PROCEDURE:**

It is the policy of ***Claverack Rural Electric Cooperative, Inc.*** ("the Cooperative") to permit and encourage Alternative Energy System (AES)/Qualifying Facility (QF) Owners to operate cogeneration and small power production facilities and safely and reliably interconnect them with the Cooperative's electric distribution system. The term AES/QF shall be used throughout this document to define any form of generation that is not owned and operated by the Cooperative, and is interconnected to the Cooperative. Alternative Energy Systems are defined under Pennsylvania's Alternative Energy Portfolio Standards Act of 2004 (Act 213-2004). Qualifying Facilities are defined under the Public Utility Regulatory Policies Act of 1978 (PURPA). This policy will enable the AES/QF Owner to deliver total or excess energy into the Cooperative's distribution system. Compensation for such delivered energy shall be based on Allegheny Electric Cooperative's (Allegheny) avoided costs. The interconnection of an AES/QF and the Cooperative's distribution system is subject to the following conditions:

- A. If the AES/QF has nondiscriminatory access to one of the following: (1) independently administered, auction-based day ahead and real time energy markets and wholesale markets for long-term capacity sales, or (2) an open access transmission and interconnection service provided by a FERC-approved regional transmission organization and competitive wholesale markets that provide an opportunity to sell capacity and energy, then Allegheny's obligation to purchase the energy and capacity generated by a AES/QF may be waived by petitioning FERC for relief from the obligation to purchase energy and capacity on a service territory-wide basis by demonstrating that options (1) or (2) are available to the AES/QF.
- B. Prior to the time of interconnection, the AES/QF Owner must submit to the Cooperative complete and detailed drawings including a site diagram and an electrical line diagram of the proposed installation. Such submittal shall be in sufficient detail to provide reasonable assurance that the AES/QF complies with all Cooperative and Allegheny requirements. The cooperative reserves the right to require the AES/QF Owner to submit electrical drawings signed by a licensed Pennsylvania Professional Engineer. Any new or proposed AES/QF should be evaluated by the Cooperative to determine system impacts. The AES/QF Owner

shall notify the Cooperative when the unit is ready to be energized. The Cooperative may require additional documentation evidencing satisfactory level of completion including but not limited to results of equipment testing and inspections. Approval must be received from the Cooperative prior to the physical interconnection of the AES/QF to the Cooperative's electric system. The *SAFETY & INTERCONNECTION REQUIREMENTS FOR ALTERNATE ENERGY PRODUCTION Document-Appendix A* provides additional details regarding the technical evaluation of proposed generators.

The AES/QF Owner shall be responsible for payment of any incremental costs incurred by the Cooperative or Allegheny to interconnect with, synchronize, or accept output from the AES/QF. This would include, but not be limited to:

1. The costs associated with an engineering or evaluation study to accommodate the AES/QF interconnection.
2. Increase in service size (transformer capacity, service conductor size, meter base)
3. Change or addition of type of service; e.g.
  - a. Single-phase to three-phase.
  - b. Voltage change (120/240 to 240/480, etc.).
  - c. Metering or disconnect devices.
4. Line extension or system upgrade for an AES/QF.
  - a. Single-phase line extension to the facility
  - b. Three-phase line extension to the facility
  - c. Reconductoring a circuit to increase current carrying capability
  - d. Replacement/upgrade/installation of circuit protective or regulating equipment including associated communications required to accommodate AES/QF

All AES/QF wiring must be in compliance with the National Electrical Code (NEC) and all other applicable codes and ordinances, and must be approved by an electrical inspection agency acceptable to the Cooperative. Any reference in this Policy to a code, standard, regulation, or guideline shall be construed to mean the then-current version of that document.

- C. The interconnection equipment must be of a "fail safe" design to ensure that in the event of any electric supply or equipment failure the AES/QF's protective equipment will automatically separate the AES/QF from the cooperative's electric system in accordance with IEEE 1547-2017 requirements.

The interconnection equipment must include an approved manual, visible load break safety switch lockable in the open position, and be accessible at all times to the Cooperative's personnel. The AES/QF Owner shall agree that the Cooperative may open the disconnect switch without prior notice for the following reasons:

1. Emergency conditions on the Cooperative's electric system.

2. Inspection of the AES/QF by the Cooperative reveals a hazardous condition or lack of proper maintenance of AES/QF facilities.
  3. The AES/QF interferes with electrical service to Cooperative Members or with the Cooperative's electrical system. Interference may include, but not be limited to: over or under voltage or frequency, harmonics, etc.
  4. Repair work on the Cooperative's system. Where time permits, the Cooperative will attempt to provide advance notice to the AES/QF Owner of imminent disconnection of the AES/QF and the reasons for same.
- D. The AES/QF electric system should be able to withstand all expected electric transients that occur on Cooperative's electric distribution and transmission systems, including outages. The AES/QF owner shall have the sole responsibility for the safety and electrical protection of his/her AES/QF, without regard to the condition of the Cooperatives facilities.
- E. The AES/QF must be operated so that no adverse effect(s) or power quality issue(s) occur to the Cooperative's electrical system or to others connected thereto. If such adverse effect(s) occur, the AES/QF Owner must discontinue operation of the AES/QF and take corrective action(s) at the AES/QF Owner's sole expense, as deemed necessary by the Cooperative, and/or industry standards, including IEEE Standard 1547-2017, IEEE 929-2000, and UL 1741-2010. Adverse effect(s) and power quality issues include, but are not limited to, voltage regulation, flicker, power factor and/or harmonics.

Cooperative observation, review, inspection, or testing shall not be considered either as an endorsement or confirmation of any aspect, feature, element, or condition of the AES/QF or associated interconnection equipment or the operation thereof, nor as a warranty as to the fitness, safety, desirability, or reliability of same. The inspection does not impose any obligation upon the Cooperative or Allegheny to warrant or ensure in any manner the AES/QF's safety or compliance with this Agreement. Further, the Cooperative and Allegheny make no representations concerning, and expressly disclaim any expertise or specialized knowledge relating to the particular type of generation employed by the Generator or the equipment associated with such generation.

- F. The AES/QF Owner must inform the Cooperative of any changes to the AES/QF and obtain the Cooperative's approval, before changes are made to the AES/QF in order to address the adverse effect(s) referred to in Paragraph D above. Prior to reconnecting, the AES/QF Owner must inform the Cooperative of their intent to reconnect.
- G. The AES/QF Owner will own, install, and maintain at his expense, all safety and interconnection equipment as specified by the Cooperative. Minimum required interconnection facilities are described in Appendix A hereto. (The Cooperative reserves the right to observe and witness the installation and testing of interconnection facilities pursuant to industry practices, codes, and IEEE 1547-2017, IEEE 929-2000, and UL 1741-2010.)

- H. The Cooperative or Allegheny reserves the right to inspect the AES/QF and interconnection equipment at any time. Such inspections shall not relieve the AES/QF Owner from his/her obligation to operate and maintain the AES/QF in a safe and satisfactory manner.
- I. Residential consumer-members that are AS/QF owners are encouraged to maintain a current liability insurance policy adequate in the amount to cover all forms of liability that may arise from the interconnection of the AES/QF interconnected to the Cooperative's electric system. Non-residential members who are AES/QF Owners must have a current liability insurance policy adequate in amount to cover all forms of liability that may arise from the operation of the AES/QF interconnected to the Cooperative's electric system. The policy should list the Cooperative and Allegheny as additional named insureds. A copy of this policy must be on file with the Cooperative. Lapse of the policy must be automatically reported to the Cooperative by the insurer, and shall result in the immediate disconnection of the AES/QF from the Cooperative's electrical system. In general, a minimum of one million dollars (\$1,000,000.00) in liability insurance is required, but a more specific amount can be based on the Cooperative's review of the specific AES/QF. The owner or operator of the AES/QF shall pay all costs of changes for safety purposes or repairs or losses due to adverse effects on the equipment or facilities of other consumer members or the Cooperative itself caused by the connection or operation of an AES/QF.
- J. The AES/QF Owner shall agree to hold the Cooperative and/or Allegheny harmless and indemnify the Cooperative and/or Allegheny in connection with any damages or injury affecting any party, resulting from the installation or the interconnection of the AES/QF to the Cooperative's or Allegheny's system, and the purchase of any output from the AES/QF, or operation of the AES/QF. The AES/QF Owner agrees to indemnify the Cooperative and/ or Allegheny for any money damages, liabilities, administrative and/or legal expenses incurred by the Cooperative and/ or Allegheny as a result of the failure of the AES/QF Owner's equipment to meet any requirement or condition set forth herein.
- K. The AES/QF Owner shall sell it's output to Allegheny, pursuant to PURPA or ACT 213-2004 (as applicable) requirements, or upon written notification to Allegheny, to another entity. If another power purchasing entity is selected, a transmission or other charge may apply to wheel or transport the electrical power over the Cooperative's or Allegheny's electric facilities. The Cooperative will sell electric energy and capacity to the AES/QF at rates and upon terms and conditions as specified in the Cooperative's applicable rules, regulations, policies, and rate schedules.
- L. The AES/QF Owner is responsible for executing a contract with Allegheny to receive compensation for it's output delivered into the Cooperative's electrical system. See Appendix B – AES Service Rate for member alternative energy production.

The Cooperative requires that any AES/QF interconnected to a residential account be designed to generate no more than 110% of the member's annual electric generation consumption as determined during the 12 months immediately preceeding the year of interconnection and may not have a nameplate capacity greater than 25 kW unless otherwise approved by the Cooperative.

If the account associated with the AES/QF is purchasing electric generation from an alternate electric generation supplier (EGS), the member will not receive credits or compensation from the Cooperative for energy produced by the AES/QF.

Administrative, application and/or service fees may be charged to any account with an interconnected AES/QF to avoid inter-class or intra-class cost shifting as a result of the costs associated with administering an AES/QF.

- M. For AES/QF facilities of more than 150 kW, Allegheny will evaluate the proposed facility and negotiate potential purchase rates, administrative fees and other related costs to prevent intra system cost shifting. Allegheny's purchase of facility output will be based on: (1) Allegheny's avoided costs for contracts with terms of one year or less; or (2) negotiated pricing for contracts with longer terms. If a net metered generator with more than 150 kW in capacity produces generation that results in a 10% or greater reduction in the member's purchase of electricity from the Cooperative compared to the year immediately preceding the interconnection then the member shall be responsible for its share of stranded costs obligation as determined by the Cooperative.
- N. Allegheny may refuse to purchase output from a AES/QF from time to time so the Cooperative can (1) construct, install, maintain, repair, replace, remove, investigate or inspect any of the Cooperative's equipment or any part of the Cooperative's System; or (2) if the Cooperative and/or Allegheny determine(s) that curtailment, interruption, or reduction of deliveries of energy or energy and capacity is appropriate because of emergencies, forced outages, operating conditions on the Cooperative's system, or as otherwise required by industry standard electrical practices.
- O. Synchronous Generators will operate in the lagging VAR area of the capability curve at a power factor recommended by the Cooperative.
- P. The aggregated generation on a circuit including the AES/QF, connected to a radial distribution circuit, may not exceed 15% of the line section annual peak load. A line section is defined as that portion of the cooperatives distribution system connected to an AES/QF and bounded by automatic sectionalizing devices or the end of the distribution line.

# CLAVERACK RURAL ELECTRIC COOPERATIVE, INC.

## Policy Bulletin No. B-19

### *Appendix A*

#### **SAFETY & INTERCONNECTION REQUIREMENTS FOR ALTERNATE ENERGY PRODUCTION**

The Cooperative recognizes the various electric industry standards and safety codes as they pertain to Alternative Energy System (AES) or Qualifying Facilities (QF). The standards and codes to be followed include, but are not limited to: Institute of Electronic and Electrical Engineers (IEEE), the Mid-Atlantic Distributed Resource Initiative (MADRI), PJM Interconnection, National Electrical Safety Code (NESC), National Electrical Code (NEC), National Fire Protection Association (NFPA), Underwriters Laboratories (UL), state, and local entities. Any reference in this Policy to a code, standard, regulation, or guideline shall be construed to mean the then-current version of that document.

At a minimum, the Cooperatives require the use of AES/QF equipment that meets the intent of the IEEE 1547-2017, and/ or IEEE 929-2000, and/ or UL 1741-2010, and any other current industry standards.

#### **GENERAL TECHNICAL REQUIREMENTS**

##### Overview

The technical requirements for connection of AES/QF will be those necessary to assure the safety and integrity of the Cooperative's electric system, and to maintain the quality and reliability of service to the Cooperative's electrical system or to others connected thereto. If an adverse effect(s) occurs in the sole opinion of the Cooperative, the AES/QF Owner must discontinue operation and take corrective action.

##### Disconnecting Device

The technical requirements require a lockable manually operable, visible load-break disconnecting device, installed at a Cooperative approved location, with an appropriate control and protective scheme that automatically isolates the AES/QF from the utility system for, but not necessarily limited to, the following conditions:

- An electrical or mechanical fault on the AES/QF.
- An electrical or mechanical fault on the Cooperative's electrical system.
- An abnormal operating voltage and/or frequency on either system.
- A separation of the Cooperative's main system from the circuit that is interconnected with the AES/QF.

The reconnection of the AES/QF to the Cooperative distribution system shall not occur until normal system conditions are present for a minimum of five minutes in accordance with IEEE 1547-2017.

### **Installation**

The AES/QF units are to be installed in a workmanlike manner. Minimum Interconnection requirements will include, but may not be limited to, meeting or exceeding IEEE 1547-2017 and/or UL 1741-2010 functionality requirements, or any other code or ordinance listed in this document. Facilities shall be installed to current NFPA 70-2014 codes or applicable electrical/building codes. Additional operational or equipment requirements may be imposed on the AES/QF depending on the point of connection on the Cooperative's electrical facilities and the impact of the AES/QF on the Cooperatives' system. The Cooperative reserves the right to observe Generator start-up testing procedures to verify the proper system AES/QF interaction, or testing after modifications have been made to the Member's system.

### **Related Information**

Depending on the size of the AES/QF, guidelines established by the PJM Interconnection L.L.C. will need to be followed. The PJM website at [www.pjm.com](http://www.pjm.com) contains details on IEEE 1547-2017, and other interconnection information.

If the electrical output of the AES/QF will be transmitted over the electric system of another entity, the AES/QF may need to meet additional requirements of that entity.

### **Assumptions and Limitations**

IEEE 1547-2017 is not all-encompassing in its coverage of AES/QF interconnections. Limitations and assumptions affecting its application include:

- The assumption that the AES/QF operates at 60 Hz.
- The assumption that the aggregate capacity of the AES/QF is 10 MVA or less at the point of common connection.
- The assumption that IEEE 1547-2017 is focused on the activities of a AES/QF on radial primary and secondary distribution systems.
- The limitation that IEEE 1547-2017 does not address the protection or operating requirements, planning, designing, or maintenance of the utility distribution system.

### **Monitoring Provisions / Other Communications / Control**

Depending on the intended use and application of the AES/QF, monitoring provisions may be needed. Small units providing supplemental residential power likely will not need monitoring, whereas larger units generating power in excess of local use may require additional metering, or the use of an indicator sent either to the Cooperative or another entity controlling the electric system. The communication capabilities required to coordinate the AES/QF with protective or monitoring devices, may include but not be limited to, a Remote Terminal Unit (RTU), and shall be installed at the AES/QF Owners expense.

Net Metering will require the use of metering equipment, located between the Cooperative's source and the Owner's electrical load, that will measure the flow of electricity from the Cooperative to the Owner. The metering will also measure the flow of electricity supplied by the AES/QF Owner to the Cooperative. These independent meter registers will be used to determine the amount of energy provided to the Cooperative, and will be the basis for potential monthly billing credits.

## **SPECIFIC TECHNICAL REQUIREMENTS**

- A. The interconnection equipment must be of a "fail safe" design to ensure, in the event of any electrical supply or equipment failure, that the AES/QF's and the Cooperative's electrical system will be physically separated automatically. The AES/QF will remain separated until the Cooperative's electrical system returns to its normal operating status. The AES/QF will synchronize with the Cooperative's electrical system only when the Cooperative electrical facilities' voltage and frequency are within acceptable industry tolerances. Adherence to IEEE 1547-2017 relaying guidelines is required.
- B. Fault protection can be provided by various methods, but must be capable of detecting and clearing faults that can occur in AES/QF and/or Cooperative facilities. Typical schemes are shown in, but are not limited to, Exhibit 1.
- C. Isolation protection is required to immediately and automatically disconnect AES/QF generation from the Cooperative system upon the loss of Cooperative power.

This protection generally can be accomplished by either a synchronous inverter used in DC generation or by applying the following isolation relays:

- 1. Undervoltage relay which may be time-delayed and instantaneous overvoltage relay.
- 2. Underfrequency relay where generators equal to or greater than 100 kW are utilized.
- 3. Overfrequency relay on certain installations.
- 4. In some cases direct transfer trip of the AES/QF generation from the upstream Cooperatives protective device may be required.

Typical protection schemes are illustrated in Figures 1 through 5 of Exhibit 1 for AES/QF of 100 kW or less. Requirements for AES/QF of greater than 100 kW will be developed on a case by case basis.

- D. AES/QF fault protection must coordinate with Cooperative system protective devices for faults in AES/QF equipment. The Cooperative will provide the characteristics of the protective device with which the AES/QF must coordinate.

All required protection design and associated settings must be provided to and approved formally by the Cooperative prior to connecting AES/QF equipment to the Cooperative system. The following information must be supplied to the Cooperative:



1. One-line relay application diagram.
  2. Connection diagrams showing all external connections to individual components of the protective scheme.
  3. Instruction manuals for all protective components. Component specifications and internal wiring diagrams must be provided, if not included in manuals.
  4. Generator data - equivalent impedances, time constants, etc. required to analyze fault contributions and load current flows.
  5. All protective equipment ratings.
  6. All protective relay / device settings.
- E. All relay settings for isolation protection must be coordinated and consistent with Cooperative equipment.
- F. Utility grade relays are required for AES/QF interconnections with total aggregate generation capacity greater than 500 kW.
- G. All relays must be equipped with targets or other visible indicators to indicate that the relay has operated.
- H. If the protective system uses AC power as the control voltage, it must be designed to disconnect the generation from the Cooperative system if the AC control power is lost.
- I. The tripping control of any installed circuit interrupting device shall be powered by a battery or stored energy device to permit operation upon loss of the Cooperative system connection.
- J. All relaying must be connected into instrument transformers. The Cooperative has the following requirements related to instrument transformers:
1. All current connections shall be connected into current transformers (CTs). All CTs shall be rated to provide no more than five amperes secondary current for all normal loading conditions and must be designed for relaying use with an accuracy class of at least C50. For three-phase systems, all three phases must be equipped with CTs.
  2. Except where the relay has the capability to accept the available voltage input without the use of an instrument transformer, all potential connections must be connected into voltage transformers (VTs). For single-phase connections, the VTs shall be provided such that the secondary voltage does not exceed 120 volts for normal operations. For three-phase connections, the VTs shall be provided such that the line-to-line voltage does not exceed 120 volts for normal operation.
- K. Maintenance for required fault and isolation protection must be performed and documented by the AES/QF Owner at specified intervals and specifications

established by the equipment manufacturer or at intervals acceptable to the Cooperative.

- L. The AES/QF will contain or employ a disconnecting device to automatically isolate the AES/QF generation from the Cooperative system when the Cooperative's circuit is either partially energized or fully de-energized. The disconnecting device also must be blocked from closing in on a partially energized or a de-energized Cooperative circuit.
- M. The Cooperative has the right, as required, to inspect all required protective equipment associated with the AES/QF interconnection.
- N. The AES/QF is responsible for properly synchronizing the Facility's generation with the Cooperative system.
- O. The AES/QF is responsible for providing a phase protection device on three-phase generators that will prevent damage to the generator or the Cooperative's system or Cooperative Members' equipment due to the loss of energy in any phase of a poly-phase system.
- P. The AES/QF electrical system should be able to withstand any and all electrical transients that occur on Cooperative's electrical distribution and transmission systems, including but not limited to, voltage surges, sags, swells, and outages. For instance, fuse coordination and operation of Cooperative reclosers three-phase or single-phase should not cause damage that would require repair of the AES/QF's electrical system. Manual or automatic reset of system protective devices, either by the Cooperative or the AES/QF Owner, is acceptable.
- Q. It is acknowledged that AES/QF technologies continue to evolve. While the latest industry standard may not be specifically listed in this document, the Cooperative expressly reserves the right to use the latest industry standards in the interconnection evaluation process for any AES/QF technology.
- R. The AES/QF must be installed to meet the C2-2017 National Electrical Safety Code (NESC) or other applicable code requirements for clearances from the nearest Cooperative electric facility, or such other distance as the Cooperative deems necessary for safety or electric operation-related reasons.
- S. Additional resources on protection systems:
  - ANSI/IEEE 1001-1988 "IEEE Guide for Interfacing Dispersed Storage and Generation Facilities with Electric Power Systems."
  - PJM Manual 14A: Generation and Transmission Interconnection Process.
  - NFPA 70-2014 National Electrical Code. *Note: Attention is directed to Article 250 – Grounding and Bonding.*
  - IEEE Green Book – ANSI C114.1-1973/IEEE 142-1972 "IEEE Recommended Practice for Grounding of Industrial and Commercial Power Systems."

- IEEE Orange Book – ANSI/IEEE 446-1980 "IEEE Recommended Practice for Emergency and Standby Power Systems for Industrial and Commercial Applications."

**T. Specific Technical Requirements - Grounding:**

- A. The AES/QF electrical system shall be grounded in accordance with all applicable codes.
- B. Grounding of sufficient size to handle the maximum available ground fault current shall be designed and installed.
- C. The interconnection of the AES/QF electrical system with the Cooperative system shall be compatible with grounding methods in use on the Cooperative system.
- D. The maximum unfaulted phase (line-to-ground) voltages on the Cooperative system during single line-to-ground fault conditions with the AES/QF connected shall not be greater than those voltages which would occur without the AES/QF connected. If the preceding condition cannot be met, in addition to other protection requirements specified in this document, overvoltage protection shall be required to detect a situation where a device has operated on the Cooperative system due to a phase-to-ground fault and to initiate high speed disconnection of the AES/QF generation from the Cooperative system.

**PROJECT REVIEW**

Additionally, to ensure that other Cooperative Members' electric service is not negatively affected by one (or more) operating AES/QF units, the Cooperative will perform a technical review of the AES/QF unit. The review process is intended to reveal potential problems prior to the operation of the AES/QF, as well as provide a cost estimate for the necessary work to interconnect AES/QF generation. Any cost of studies associated with the proposed installation of a AES/QF shall be borne by the AES/QF Owner. The AES/QF owner shall also bear all costs associated with upgrades to the Cooperatives distribution that are necessary to accommodate the AES/QF.

The Cooperative, however, reserves the right to reevaluate the continued operation of the AES/QF if any actual or potential safety, quality, or reliability issues arise or occur. Any corrective actions recommended by the Cooperative or its agent must be implemented at the AES/QF Owner's expense. This may include termination of the operation of one or more AES/QF units interconnected on the same line section.

**RESPONSIBILITY**

It shall be the responsibility of the AES/QF Owner to design and operate a system adequate to meet the technical requirements generally set forth above and to assure reliability of the protection scheme as predicated by the design and location of Member generation. In addition, this protection must be compatible with Cooperative system protective devices. Paralleling Member generation with the Cooperative system will be permitted only upon obtaining formal Cooperative approval in advance.

The AES/QF Owner is solely responsible for providing adequate protection for his equipment.

## EXHIBIT 1

### GENERAL PROTECTION REQUIREMENTS

#### Figure

- 1 Protection for a three-phase synchronous generator
- 2 Protection for a single-phase induction generator
- 3 Protection for a three-phase induction generator
- 4 Protection for a single-phase inverter
- 5 Protection for a three-phase inverter



## M COOPERATIVE REVENUE METER PROTECTIVE RELAYS

- 24 VOLTS / HZ RELAY  
27 UNDERVOLTAGE RELAY  
32 REVERSE POWER (ANTI - MOTORING ) RELAY  
40 LOSS OF FIELD RELAY  
46 NEGATIVE SEQUENCE OVERCURRENT RELAY  
50 INSTANTANEOUS OVERCURRENT RELAY  
50N INSTANTANEOUS OVERCURRENT GROUND RELAY

- 15N TIME OVERCURRENT GROUND RELAY  
16V VOLTAGE CONTROLLED TIME OVERCURRENT RELAY  
59 OVERVOLTAGE RELAY  
89F FUSE LOSS DETECTION RELAY  
OUI OVER / UNDER FREQUENCY RELAY  
86 LOCKOUT RELAY  
87 DIFFERENTIAL RELAY  
CONTROL RELAYS :  
25 AUTOMATIC SYNCHRONIZER OR SYNC - CHECK RELAY  
52 BREAKER

**CONTROL RELAYS:**

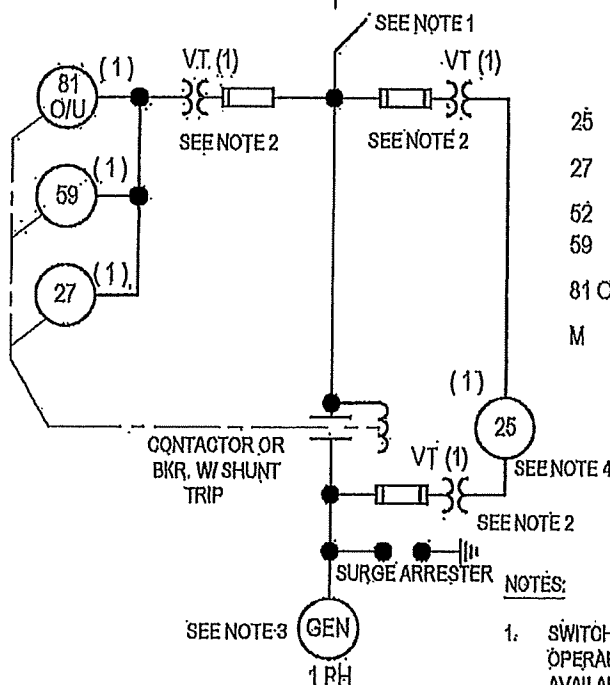
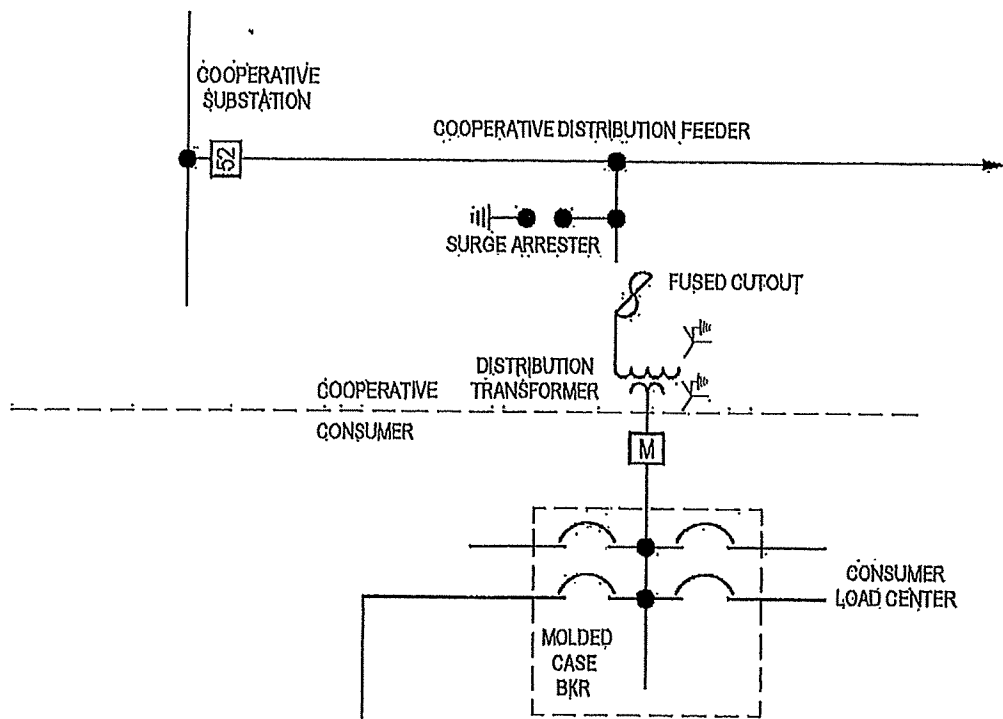
23 ACTION

## NOTE:

1. VT's CAN BE CONNECTED WYE OR OPEN DELTA.
2. GENERATOR GROUNDING SHOWN IS LOW IMPEDANCE, HIGH IMPEDANCE GROUNDING CAN BE USED IF DESIRED; HOWEVER A VT AND NEUTRAL OVER VOLTAGE RELAY (DEVICE 58N) MAY BE REQUIRED TO BE ADDED.
3. RELAYING DEVICES SHOWN ARE ALL PART OF A MULTI-TIME FUNCTION RELAY EXCEPT FOR DEVICES 25 AND 86. FUNCTIONS CAN BE INCREASED OR DECREASED AS DICTATED BY THE PARTICULAR APPLICATION.
4. IF 82U IS RECLOSING CIRCUIT BREAKER, RECLOSING SHOULD BE SUPERVISED BY A VOLTAGE INPUT INSTALLED ON THE GENERATION SIDE OF THE RECLOSER (I.E. NO RECLOSING AS LONG AS VOLTAGE IS PRESENT, INDICATING THAT THE GENERATION IS STILL ONLINE, TO AVOID AN OUT-OF-SYNC RECLOSE). ALL SYNCHRONIZATION SWITCH MUST BE PAD LOCKABLE, MANUALLY OPERABLE, HAVE A VISIBLE LOAD BREAK AND AVAILABLE TO THE COOPERATIVE AT ALL TIMES.
5. A CURRENT TRANSFORMER AND INSTANTANEOUS / TIME OVERCURRENT NEUTRAL RELAY MAY BE REQUIRED WITH THE INTERCONNECTION TRANSFORMER.
6. PROTECTION SPECIFICALLY FOR GENERATOR NOT SHOWN.
7. OTHER REQUIREMENTS MAY BE NEEDED ON THE COOPERATIVE DISTRIBUTION SYSTEM TO ACCOMMODATE THE INTERCONNECTION. THESE REQUIREMENTS WILL BE IDENTIFIED BY THE COOPERATIVE THROUGH ANY NEEDED STUDIES.
- 8.

# PROTECTION FOR A THREE-PHASE SYNCHRONOUS GENERATOR

CLAVELACK RURAL ELECTRIC COOPERATIVE  
Waynes, Pennsylvania



### LEGEND

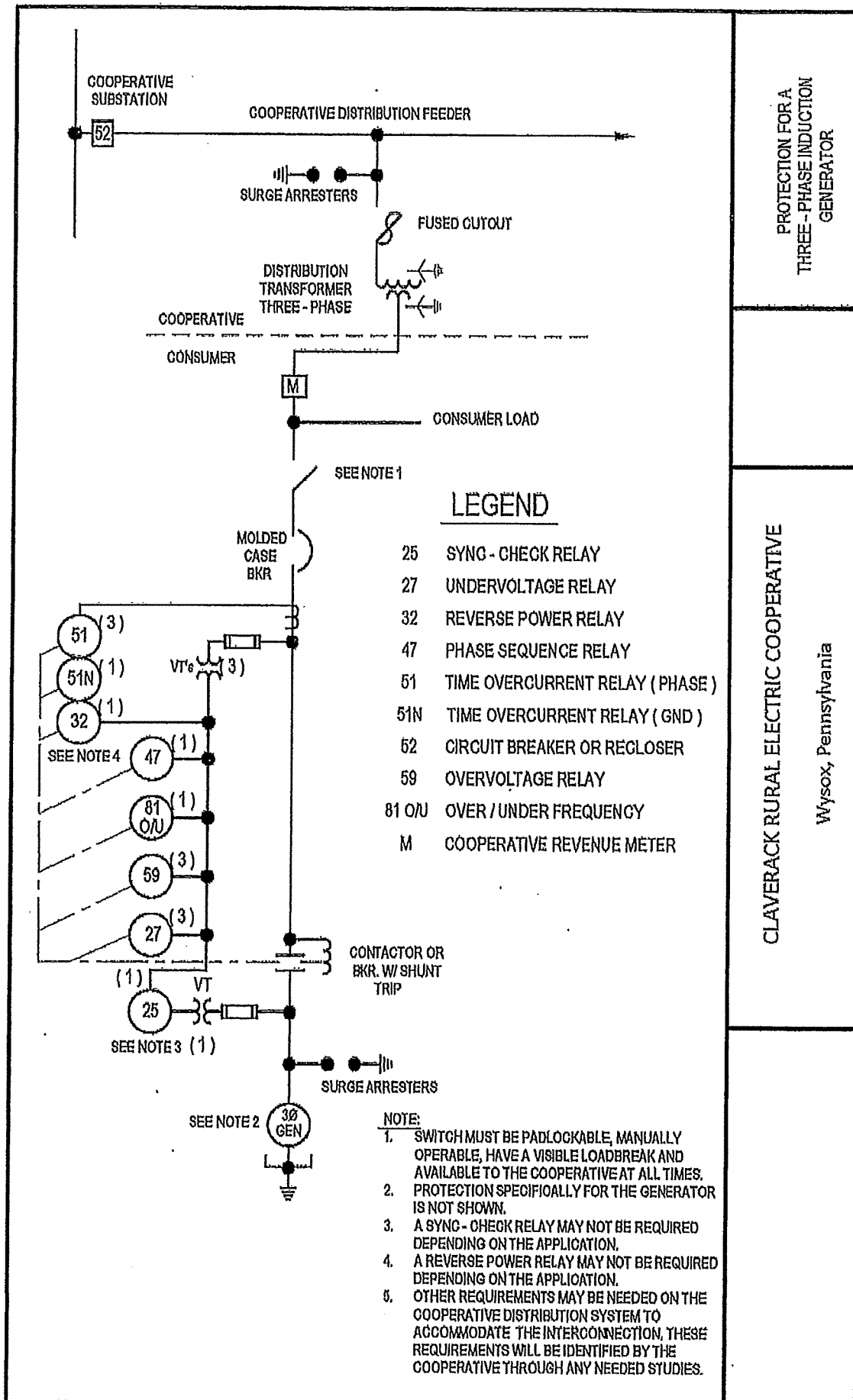
- 25 SYNC - CHECK RELAY
- 27 UNDERVOLTAGE RELAY
- 52 CIRCUIT BREAKER OR RECLOSER
- 59 OVERVOLTAGE RELAY
- 81 O/U OVER / UNDER FREQUENCY
- M COOPERATIVE REVENUE METER

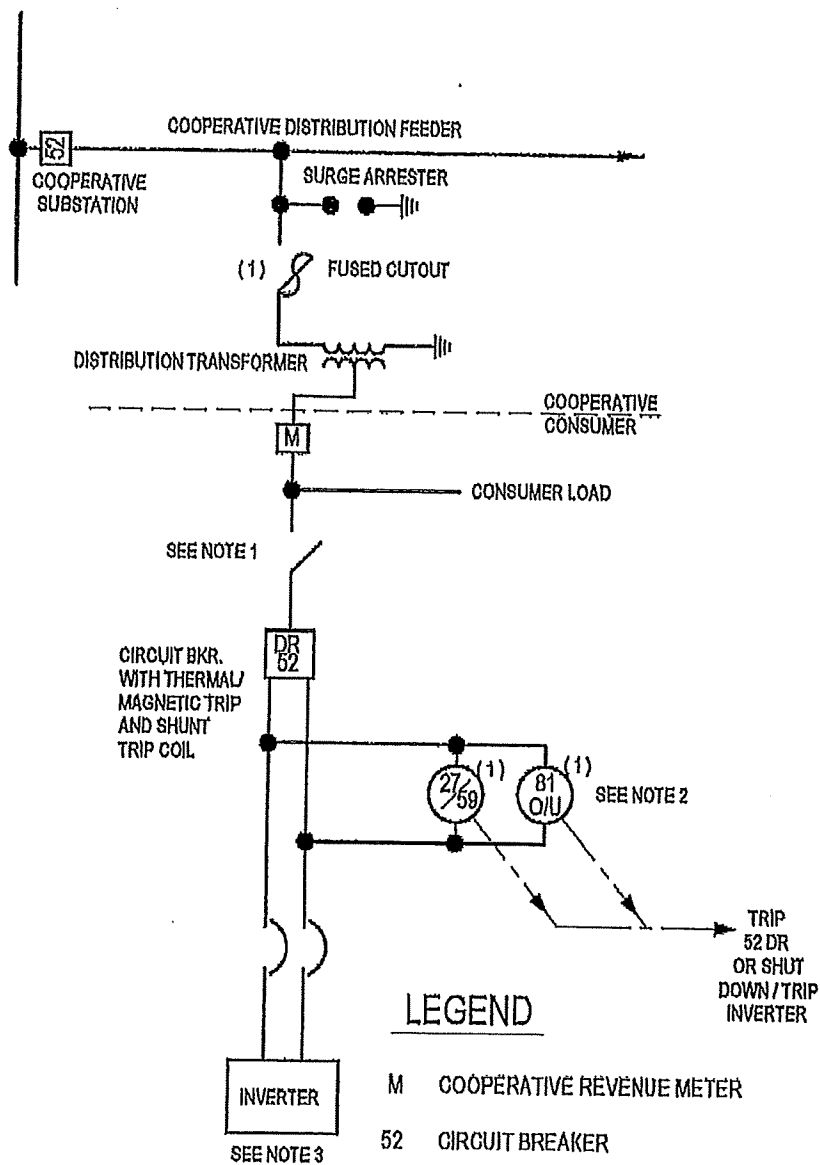
### NOTES:

1. SWITCH MUST BE PADLOCKABLE, MANUALLY OPERABLE, WITH A VISIBLE LOAD BREAK AND AVAILABLE TO THE COOPERATIVE AT ALL TIMES.
2. A VT MAY BE REQUIRED DEPENDING ON THE VOLTAGE AND RELAY RATINGS.
3. PROTECTION SPECIFICALLY FOR THE GENERATOR IS NOT SHOWN.
4. A SYNC-CHECK RELAY MAY NOT BE REQUIRED DEPENDING ON THE APPLICATION.
5. OTHER REQUIREMENTS MAY BE NEEDED ON THE COOPERATIVE DISTRIBUTION SYSTEM TO ACCOMMODATE THE INTERCONNECTION. THESE REQUIREMENTS WILL BE IDENTIFIED BY THE COOPERATIVE THROUGH ANY NEEDED STUDIES.

PROTECTION FOR A  
SINGLE-PHASE  
INDUCTION GENERATOR

CLAVELACK RURAL ELECTRIC COOPERATIVE  
Wysox, Pennsylvania





### LEGEND

- M COOPERATIVE REVENUE METER
- 52 CIRCUIT BREAKER
- 27/59 TIME UNDER/OVER VOLTAGE RELAY
- 81 O/U OVER/UNDER FREQUENCY RELAY

### NOTE:

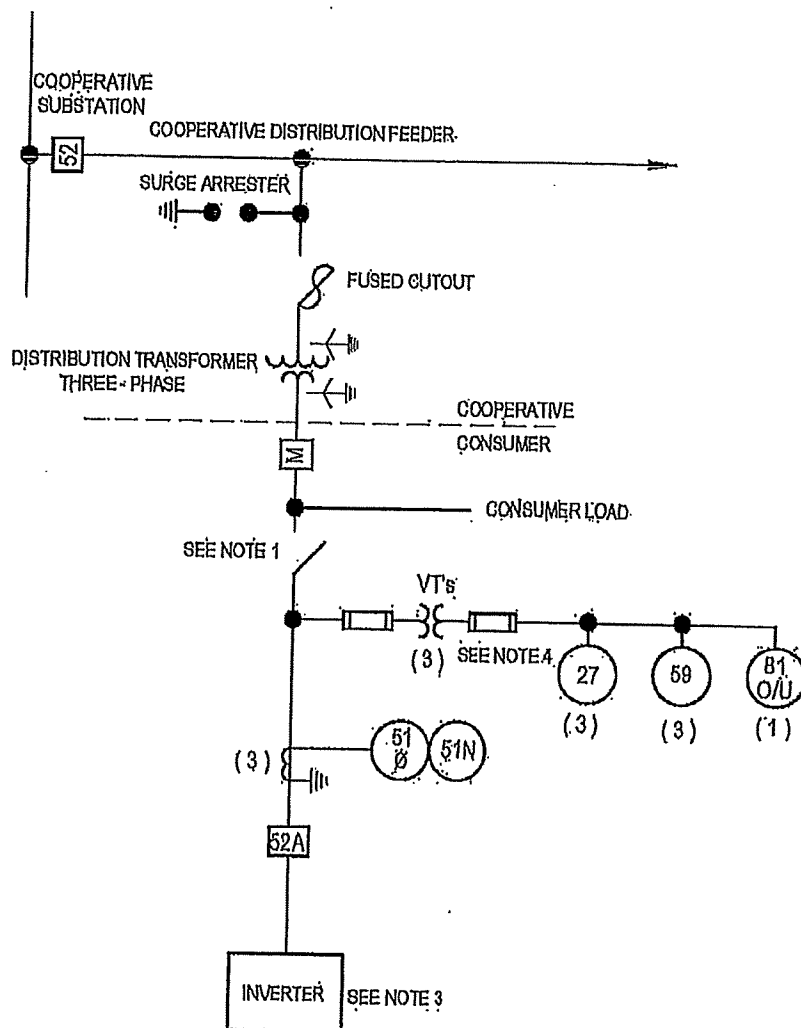
1. SWITCH MUST BE PADLOCKABLE, MANUALLY OPERABLE, WITH A VISIBLE LOAD BREAK AND AVAILABLE TO THE COOPERATIVE AT ALL TIMES.
2. 27, 59 AND 81O/U PROTECTION ELEMENTS TYPICALLY INCLUDED WITH INVERTER.
3. SOURCE BEHIND INVERTER CAN BE BATTERY, FUEL CELL, PV OR OTHER DC SOURCE. POWER CONDITIONING SHOULD BE DONE BEFORE INVERTER AC OUTPUT.
4. OTHER REQUIREMENTS MAY BE NEEDED ON THE COOPERATIVE DISTRIBUTION SYSTEM TO ACCOMMODATE THE INTERCONNECTION. THESE REQUIREMENTS WILL BE IDENTIFIED BY THE COOPERATIVE THROUGH ANY NEEDED STUDIES.

PROTECTION FOR A  
SINGLE PHASE  
INVERTER

CLAVELACK RURAL ELECTRIC COOPERATIVE

Wysox, Pennsylvania





## LEGEND

### NOTE:

1. SWITCH MUST BE PADLOCKABLE, MANUALLY OPERABLE, WITH A VISIBLE LOAD BREAK AND AVAILABLE TO THE COOPERATIVE AT ALL TIMES
2. ALL PROTECTIVE RELAYING TRIPS BREAKER 52A OR SHUTS DOWN / TRIP INVERTER.
3. SOURCE BEHIND INVERTER CAN BE BATTERY, FUEL CELL, PV OR OTHER DC SOURCE, POWER CONDITIONING SHOULD BE DONE BEFORE INVERTER AC OUTPUT.
4. 27, 59 AND 81 O/U PROTECTION ELEMENTS TYPICALLY INCLUDED WITH INVERTER.
5. OTHER REQUIREMENTS MAY BE NEEDED ON THE COOPERATIVE DISTRIBUTION SYSTEM TO ACCOMMODATE THE INTERCONNECTION. THESE REQUIREMENTS WILL BE IDENTIFIED BY THE COOPERATIVE THROUGH ANY NEEDED STUDIES.

- |        |                           |
|--------|---------------------------|
| 27     | TIME UNDERVOLTAGE         |
| 51     | TIME OVERCURRENT - PHASE  |
| 51N    | TIME OVERCURRENT - GROUND |
| 52     | CIRCUIT BREAKER           |
| 59     | TIME OVERVOLTAGE          |
| 81 O/U | OVER / UNDER FREQUENCY    |
| M      | COOPERATIVE REVENUE METER |

PROTECTION  
FOR A THREE - PHASE  
INVERTER

CLAVERACK RURAL ELECTRIC COOPERATIVE

Wysox, Pennsylvania

# **CLAVERACK RURAL ELECTRIC COOPERATIVE, INC.**

## **Policy Bulletin No. B-19**

### ***Appendix B***

## **AES SERVICE RATE FOR MEMBER ALTERNATIVE ENERGY PRODUCTION**

### **AVAILABILITY**

Available in all territories served by the Cooperative. Subject to the established rules and regulations of the Cooperative, the aggregate capacity of members' alternative energy systems (AES) may be limited by the Cooperative's system, substation area and/or circuit. Availability of the AES Service rate is contingent upon the availability of the Pennsylvania Rural Electric Cooperative Association's (PREA's) Renewable Energy Assistance Program (REAP) funding.

### **APPLICABILITY**

Applicable to all members of the Cooperative. The member's AES must: (1) be owned, operated, leased, or otherwise controlled by the member; (2) be operated in parallel with the Cooperative's distribution system; (3) have a nameplate capacity no greater than 25 kilowatts (kW) for residential service and up to 150 kilowatts (kW) for all other rate classes, and (4) be primarily intended to offset part or all of the member's electric generation requirements; and (5) be on the regular residential (excluding time of use), seasonal, or applicable commercial rate.

Member AESs that qualify under this Service Rate are: solar photovoltaic or other solar energy, solar thermal energy, wind power, hydropower, biomass, and bio-digester gas and fuel cells as defined in Pa. Act 213 (Alternative Energy Portfolio Standards Act of 2004).

The member's AES must meet or exceed the standards and requirements of the National Electrical Code, the National Electrical Safety Code, the Institute of Electrical and Electronics Engineers, Underwriters Laboratories, and Pennsylvania Public Utility Commission, as well as the Cooperative's Policy on Alternative Energy Production; Safety and Interconnection Requirements for Alternative Energy Production; and local requirements.

The member must have executed a Power Purchase Contract with Allegheny Electric Cooperative (Allegheny) to sell excess energy produced by the member's AES to Allegheny.

### **TYPE OF SERVICE**

60 cycles, at available secondary voltage.

Service under this rate schedule requires metering equipment that can measure the flow of electricity in both directions.

## **COOPERATIVE MONTHLY BILLING**

The Cooperative bills the member on a monthly basis according to the applicable billing and rate schedules. The Cooperative shall credit an AES at the full retail rate for each kilowatt-hour produced by an AES installed on the member's side of the electric revenue meter, up to a total amount of electricity used by the member during an annual period. If the AES supplies more electrical energy to the cooperative distribution system than the Cooperative delivers to the member in a given billing period, the excess kilowatt hours shall be carried forward and credited against the member's usage in subsequent billing periods at the full retail rate. Any excess kilowatt hours shall continue to accumulate until the end of the production year. A production year shall be from June 1<sup>st</sup> through May 31<sup>st</sup>. For AES's involved in virtual meter aggregation, a credit shall be applied first to the meter through which the Cooperative supplies electricity to the distribution system, then through the remaining meters for the AESs account equally at each meter's designated rate. At the end of each annual period, Allegheny shall compensate the AES for kilowatt-hours generated by the AES over the amount of kilowatt-hours delivered by the Cooperative during the billing period at Allegheny's avoided cost of wholesale power. If the calculated amount is under \$50, the excess kWh shall be carried forward.

## **METER AGGREGATION**

The combination of readings from, and billing for, all meters regardless of rate class on properties owned or leased and operated by a member operating an AES within the Cooperative's service territory whether the aggregation is completed through physical or virtual meter aggregation within two miles of the member's property.