Kolbo, Delaine

From: Jeff Rud [JRud@eastriver.coop]
Sent: Monday, May 07, 2007 7:57 AM
To: Kolbo, Delaine
Subject: RE: The SDPUC Agenda for the Commission meeting to be held 5/8/07.

Delaine -

During my presentation Commissioner Johnson asked if I could provide a sample of our Interconnection Requirements. Attached is a copy of what our member cooperatives use, please see that he receives it.

Thanks,

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Subject: The SDPUC Agenda for the Commission meeting to be held 5/8/07.

CLAY-UNION ELECTRIC COOPERATIVE INTERCONNECTION REQUIREMENTS FOR CUSTOMER-OWNED GENERATION

I. INTRODUCTION

This Standard documents the requirements for the interconnection between a member owned/leased generation system and the Clay-Union Electric Cooperative, Inc. distribution system. This Standard describes the interconnection process from the planning of a project through approval and construction. If you have any questions please call the Clay-Union Customer Electrical Service Department and we will be glad to assist you. It is important that any Generation System installed functions reliably and does not adversely affect the safety and reliability of the electrical distribution system.

A. Definitions

1. "Distribution System" is defined as equipment and apparatus owned by Clay-Union, including overhead and underground facilities, service entrance equipment, meters, transformers, etc. which make up the central station energy delivery system.

2. "Generation" is defined as any device producing electrical energy, i.e., rotating generators driven by steam turbines, internal combustion engines, hydraulic turbines, wind turbines, solar, inverters, etc.; or any other electric generating device.

3. "Generation System" is defined as the customer's generator(s), controls, relays, switches, breakers, transformers and associated wiring.

B. This Standard defines the minimum requirements for the implementation of the electrical interconnection. It does not define requirements for the Generation System. The requirements are intended to achieve the following:

1. Insure the safety of Clay-Union personnel, and contractors while working on the Distribution System.

2. Insure the safety of Clay-Union customers and the general public.

3. Protect and minimize the possible damage to the Distribution System and other customers' property.

4. Insure proper operation to minimize adverse operating conditions on the Distribution System.

C. The generator and interconnection shall be designed with proper protective devices to promptly and automatically disconnect the generator from the Distribution System in the event of a fault or other system abnormality. The type of protection required will be determined by:

1. Size and type of the generating equipment.

2. The method of connecting and disconnecting the generator system from the Distribution System.

3. The location of generating equipment on the Distribution System.

4. Requirements to insure the safety of association personnel, and contractors while working on the Distribution System.

D. In addition to the protective devices, certain modifications and/or additions may be required to Clay-Union's system due to the addition of the Generation System. Line switching shall be done in accordance with Clay-Union approved procedures. This will include any "visible open" requirements and compliance with lock-out tag-out procedures. Each request will be handled individually, and the final determination of the protective devices, modifications, and/or additions required will be made by Clay-Union.

E. Clay-Union requires reimbursement, by the customer, of all costs incurred by Clay-Union for additions or changes required to permit operation of the customer's Generation System with the Distribution System, including engineering studies.

F. Clay-Union assumes no responsibility for protection of the generating system's equipment or of any other portion of the customer's electrical system. The customer is solely responsible for protecting their own equipment in such a manner that faults, imbalances, or other disturbances on the electrical system do not cause damage to the customer's equipment. Suggested protection systems are structured to protect the Clay-Union Distribution System and as such, additional protection equipment maybe required to ensure proper operation for the Generation System, this is especially true while operating disconnected from the Clay-Union distribution system.

G. The customer shall be responsible for complying with all applicable local, independent, state and federal codes such as building codes, National Electrical Code (NEC), National Electrical Safety Code and noise and emissions standards. Clay-Union will require proof of complying with the National Electrical Code before the interconnection is made. This is by means of an installation approved by the electrical inspector recognized by the State of South Dakota and the South Dakota Electrical Commission. All other codes and standards shall be complied with for the entire period the generator is connected to Clay-Union's system, and compliance is the responsibility of the customer.

H. The generation may also be required to comply with the applicable requirements of other entities related to owners and operators of electric systems and associated interconnected generation, such as Mid-Continent Area Power Pool (MAPP), the North American Reliability Council (NERC), and any regional transmission organization.

I. It is also recommended that customer's equipment and installation comply with latest revisions of the ANSI/IEEE standards applicable to the installation, except as modified herein.

II. INTERCONNECTION APPROVAL PROCESS

The steps outlined herein shall be followed in processing requests for interconnections.

A. PRELIMINARY DESIGN SUBMITTAL AND APPROVAL

1. Clay-Union will review the information provided and after clarification of any questions, respond with a Clay-Union distribution system modification cost estimate and additional requirements (if necessary). At a minimum, the following shall be submitted to Clay-Union for the preliminary design submittal:

    a. A preliminary one-line electrical diagram, illustrating the proposed connection, including type and size of the generation, system voltage, service entrance equipment at the facility, transfer switch and / or switchgear, CT's, VT's and the protective relaying. Provide as much detail as available on the proposed generating equipment and facility.

b. Physical layout of proposed site, illustrating placement of the generator, switchgear and approximate dimensions.

c. Proposed project schedule.

d. Completed Application for Operation of Customer-owned Generation.

B. **CUSTOMER APPROVAL - FOR CLAY-UNION TO PROCEED** - The Customer will notify Clay-Union of their intent to proceed in writing. If required, the customer shall pay a 20% down payment on the estimated Clay-Union costs and sign and return an agreement to pay the rest of Clay-Union's estimated costs. The customer will be responsible for some or all of Clay-Union's costs incurred to engineer, design, procure equipment and construct facilities necessary for this generation installation.

C. **FINAL PROJECT DESIGN** - Clay-Union will work with the customer and it's agent to complete detailed work to properly plan and design the interconnection. Depending upon the size and complexity of the Generation System, advanced Interconnection Studies may be required by Clay-Union. These Interconnection Studies will determine what additions and/or modifications may be required to Clay-Union's system and the customer's proposed interconnection plans. An Interconnection Study will address several items such as: protective relaying requirements and coordination, Distribution System required modifications, and other factors, which may be affected by the proposed generation. (For example: Distribution System voltage regulation, harmonics, system ampacity, line losses, metering, interaction with other customer owned generation in the areas) Clay-Union may assess engineering fees to recover the cost of these studies. For larger and more complex Generation Systems this step in the process could take as long as 3 months. For most projects this should be able to be completed within 2-4 weeks.

D. **FINAL PHYSICAL INFORMATION SUBMITTAL** - Upon completion of the final design, specific documentation shall be submitted and written approval received from Clay-Union before any work on the project will begin.

For typical generation systems, Clay-Union will require a minimum of 4 weeks between written Clay-Union approval of the final physical submittal and field testing of the generation installation. During this time Clay-Union will design and install the monitoring and control system and complete the preliminary checkout. For generation systems which are designed to operate in parallel with the Clay-Union system for extended times, longer times will be necessary. It is important that the generation installer and Clay-Union develop a construction schedule to avoid unnecessary delays.

Final physical information submittal shall include:

1. Building drawings, showing the location of the generation, controls, switchgear, metering, doors, etc.

2. Generator data in accordance with the Clay-Union Application for Operation of Customer-owned Generation.

3. Information describing the type of protective relays and other protection and switching equipment. Proposed protective relay settings for all required relays.

4. A detailed one-line diagram of the generation facility, including the generator, transfer switch/switchgear, service entrance, visual disconnect, metering, protection and metering CT's, VT's, protective relaying and control for the generator and interconnection system.

5. Clay-Union interface drawing, showing the terminal block where the monitoring and control points will be available to the Clay-Union monitoring system.

6. Other drawings as required illustrating the design, operation, interconnection and coordination of the customer's Generation System with the Distribution System.

7. Any required State of South Dakota Electrical Commission Wiring Certificate forms filed with Clay-Union.

8. An Interconnection Agreement between Clay-Union and the customer or its agent.

E. **CONSTRUCTION PROCESS**

1. NO PARALLEL OPERATION, INCLUDING OPERATING FOR TESTING, OF THE GENERATION SYSTEM WITH THE CLAY-UNION DISTRIBUTION SYSTEM SHALL BE ALLOWED WITHOUT AUTHORIZATION.

2. The customer or its agent shall inform Clay-Union of any changes in design or scheduling which may occur once the final design has been established. Design changes that may affect the interconnection must be reviewed by Clay-Union and approved in writing.

3. Prior to energizing the customer's equipment, Clay-Union will inspect the installation to assure it meets the requirements set forth in the agreement. An inspector recognized by the State of South Dakota Electrical Commission must also approve the installation.

4. Certification and testing of the Generation System shall be completed as specified in Section VII of this Standard.

5. The customer shall maintain liability insurance that insures the customer against all claims for property damage and personal injury or death caused by the generator in amounts specified in the Interconnection Agreement.

F. **FINAL DOCUMENT SUBMITTAL** – Within 60 days following the completed Clay-Union generation testing, the customer / installer shall supply the following information to Clay-Union.

1. A step-by-step procedure for start-up and shut-down of the generation in the event of the need to manually accomplish these tasks shall be posted at the generation site and a copy provided to Clay-Union.

2. Documentation that final testing punch-list items have been completed.

3. As-Built Drawings (any drawing submitted by the customer or contractor that was modified during design and/or construction)

4. A Certificate of Insurance documenting that a customer is adequately insured as outlined in the Interconnection Agreement.

III. GENERAL RULES, RIGHTS AND OBLIGATIONS

A. **NO INTERFERENCE** - The parallel operation of the Generating Party's generating equipment with the Clay-Union Distribution System shall not cause any reduction in the quality of service being provided to other customers, and abnormal voltages, frequencies or interruptions are not permitted. If high or low voltage complaints or flicker complaints result from operation of the Generating Party's generation, such generating equipment shall be disconnected until the problem is resolved.

B. **AUTHORIZATION REQUIRED TO OPERATE** - A Producer must comply with this Standard, execute an Interconnection Agreement with Clay-Union, and receive Clay-Union's express written permission before Parallel Operation of its Generating Facility with Clay-Union's Distribution System. Clay-Union

shall apply this Standard in a non-discriminatory manner and shall not unreasonably withhold its permission for a Parallel Operation of Producer's Generating Facility with Clay-Union's Distribution System.

C. **SEPARATE ARRANGEMENTS REQUIRED FOR OTHER SERVICES** - A Producer requiring other electric services from Clay-Union including, but not limited to, Distribution Service provided by Clay-Union during periods of curtailment or interruption of the Producer's Generating Facility, shall be subject to terms and conditions contained within cooperative-approved tariffs.

D. **TRANSMISSION SERVICE NOT PROVIDED WITH INTERCONNECTION** - Interconnection with Clay-Union's Distribution System under this Standard does not provide a Producer any rights to utilized Clay-Union's Distribution System for the transmission, distribution or wheeling of electric power, nor does it limit those rights.

E. **COMPLIANCE WITH LAWS, RULES AND TARIFFS** - A Producer shall ascertain and comply with applicable approved tariffs of Clay-Union; applicable Federal Energy Regulatory Commission (FERC) approved rules, tariffs, and regulations; and any local, state or federal law, statute or regulation which applies to the design, siting, construction, installation, operation or any other aspect of the Producer's Generating Facility and Interconnection Facilities.

F. **DESIGN REVIEWS AND INSPECTIONS** - Clay-Union shall have the right to review the design of a Producer's Generating and Interconnection Facilities and to inspect a Producer's Generating and/or Interconnection Facilities prior to the commencement of Parallel Operation with Clay-Union's Distribution System. Clay-Union may require a Producer to make modifications as necessary to comply with the requirements of this Standard. Clay-Union's review and authorization for Parallel Operation shall not be construed as confirming or endorsing the Producer's design or as warranting the Generating and/or Interconnection Facility's safety, durability or reliability. Clay-Union shall not, by reason of such review or lack of review, be responsible for the strength, adequacy or capacity of such equipment.

G. **RIGHT TO ACCESS** - A Producer's Generating Facility and Interconnection Facility and Interconnection Facilities shall be reasonably accessible to Clay-Union personnel as necessary for Clay-Union to perform its duties and exercise its rights under cooperative policy and any Interconnection Agreement between Clay-Union and the Producer.

H. **CONFIDENTIALITY OF INFORMATION** - Any information pertaining to the Generating and/or Interconnection Facilities provided to Clay-Union by a Producer shall be treated by Clay-Union in a confidential manner.

I. **PRUDENT OPERATION AND MAINTENANCE REQUIRED** - A Producer shall operate and maintain its Generating Facility and Interconnection Facilities in accordance with Prudent Electrical Practices and shall maintain compliance with this Standard.

J. **CURTAILMENT AND DISCONNECTION** - Clay-Union may limit the operation or disconnect or require the disconnection of a Producer's Generating Facility from Clay-Union's Distribution System at any time, with or without notice, in the event of an Emergency, or to correct Unsafe Operating Conditions. Clay-Union may also limit the operation or disconnect or require the disconnection of a Producer's Generating Facility from Clay-Union's Distribution System upon reasonable written notice:

1. To allow for routine maintenance, repairs or modifications to Clay-Union's Distribution System

2. Upon Clay-Union's determination that a Producer's Generating Facility is not in compliance with this Standard

3. Upon termination of the Interconnection Agreement.

IV. TECHNICAL REQUIREMENTS

A. **PREVENTION OF INTERFERENCE** - The Producer shall not operate Generating or Interconnection Facilities that superimpose a voltage or current upon Clay-Union's Distribution System that interferes with Clay-Union operations, service to Clay-Union's Customers, or communication facilities. If such interference occurs, the Producer must diligently pursue and take corrective action at its own expense after being given notice and reasonable time to do so by Clay-Union. If the Producer does not take corrective action in a timely manner, or continues to operate the facilities causing interference without restriction or limit, Clay-Union may, without liability, disconnect the Producer's facilities from Clay-Union's Distribution System, in accordance with Section III.J. of this Standard. To eliminate undesirable interference caused by operation, each Generating Facility shall meet the criteria contained in this Standard. All Producers on a substation/feeder maybe asked to modify their operation if interference is being caused by the number of Producers on a substation/feeder.

B. **VOLTAGE REGULATION** - The Generating Facility shall not degrade the voltage provided to the customers served by the Cooperative to service voltages outside the limits of ANSI C84.1, Range A.

Apart from the effect on the voltage of the area electric power system due to the real power generation of the generating facility, the generating facility shall not attempt to oppose or regulate changes in the prevailing voltage level of the area electric power system at the point of common coupling, except that generating facility shall be permitted to use automatic voltage regulation when such regulation can be accomplished without detriment to either the area electric power system or local electric power system.

C. **INTEGRATION WITH AREA ELECTRIC POWER SYSTEM GROUNDING** - The interconnection of the generating facility with the Clay-Union Distribution System shall be coordinated with the neutral grounding method in use by Clay-Union as follows.

For generating facility interconnections, directly or through a transformer, to primary feeders of multi-grounded or uni-grounded four wire construction, or to tap lines of such systems, the maximum unfaulted phase (line-to ground) voltages on the primary feeder, during single line-to-ground fault conditions with the area electric power system source disconnected, shall not exceed those voltages that would occur during the fault with the same area electric power system source connected and no distributed resource generation.

The ground-fault current contribution of the generating facility, including the effect of any transformers between the generating facility and the primary feeder, shall not be greater than 100% of the fault current contribution of the generating facility to the three-phase fault at the same primary feeder fault location. This ground fault current limitation shall not apply to any generating facility interconnected through the existing distribution transformer provided that neutral grounding, if any, of the high voltage winding is not changed.

D. **SYNCHRONIZATION** - The Generating facility unit shall synchronize with the area electric power system without causing a voltage fluctuation at the point of common coupling greater than +/-3% of operating voltage.

E. **INADVERTENT ENERGIZING OF THE CLAY-UNION DISTRIBUTION SYSTEM**

Inadvertent Energization - The Generating facility shall not energize the point of common coupling when the Clay-Union Distribution System has been de-energized for any reason.

Reconnection after Clay-Union Distribution System Outage - No reconnection shall take place until the Distribution System voltage and frequency are within the operating voltage range of 118V - 126V, and frequency range of 59.3Hz - 60.5Hz, respectively. The generating facility shall include an

adjustable delay (or a fixed delay of five minutes) that can delay reconnection for up to five minutes after Distribution System restoration of continuous normal voltage and frequency.

F. **MONITORING** - Each generating facility of 500 kVA or more or aggregated 500 kVA or more at a single point of common coupling planned for parallel operation shall have provisions for real-time, remote monitoring of its availability, connection status, real power output and imaginary power output at the point of distributed resource connection.

G. **ISOLATION DEVICE** - A readily accessible, lockable, visible-break isolation device shall be located between the Clay-Union Distribution System and the generating facility.

H. **VOLTAGE DISTURBANCES** - The protection functions of the Interconnection Facilities shall measure the effective (RMS) or fundamental frequency value of each phase-to-neutral or, alternatively, each phase-to-phase voltage. When any of the measured voltages are within any voltage range given below, the generating facility shall cease to energize the Distribution System within the clearing time as indicated. Clearing time is the time between the start of the abnormal condition and the generating facility ceasing to energize the Distribution System. For generating facility less than or equal to 40 kW in peak capacity, the voltage set points and clearing times shall be either fixed or field adjustable. For generating facility greater than 40 kW the voltage set points shall be field adjustable.

The voltages shall be measured at the point of common coupling when any of the following conditions exist:

1. The aggregated capacity of generating facility systems connected to a single point of common coupling is less than or equal to 40 kW

2. The Interconnection facilities are certified to pass a non-islanding test

3. The aggregate distributed capacity is less than 50% of the total local electric power system minimum electrical demand, and export of real or reactive power to the area electric power system is not permitted.

Interconnection System Response to Abnormal Voltages (on a 120 V, 60 Hz base)

Voltage Range (Volts)	Clearing Time (seconds)*
$V < 60$	.16
$60 \leq V < 106$	2
$132 < V < 144$	1
$144 \leq$	.16

*DR≤ 40 kW, Maximum Clearing times; DR > 40 kW, Default Clearing times, unless islanding is a concern and a more limited voltage and time limit as determined by the engineering study.

I. **FREQUENCY DISTURBANCES** - All generating facility units shall follow the interconnected area electric power system frequency within range 59.3 Hz to 60.5 Hz (on a 60 Hz base). The frequency measurements shall be either at the point of generating facility connection or point of common coupling. A generating facility unit <40 kW shall cease to energize the Clay-Union Distribution System within 0.16 second if the frequency goes outside the range above. A generating facility unit > 40 kW shall 1) cease to energize the Clay-Union Distribution System within 0.16 second if the frequency exceeds 60.5 Hz, 2) be capable of time delayed disconnection with adjustable under-frequency settings in the range of 59.3 Hz to 57 Hz, and 3) disconnect within 0.16 second if the frequency is less than 57.0 Hz. If islanding is a concern, a more limited frequency range maybe required as determined by the engineering study.

J. **DISCONNECTION FOR FAULTS** - The generating facility unit shall cease to energize the Clay-Union Distribution System for faults on the Distribution System circuit to which it is connected.

With a stiffness ration of 10 or less, the Generating Facility shall be equipped with current-based protection and current-based or voltage-based ground fault protection suitable for the detection of Distribution System faults.

Stiffness Ratio. This ratio is calculated at the point of common coupling, except when there is a transformer(s) dedicated to one customer in which case the stiffness ratio is calculated on the high-voltage side of the dedicated transformer(s).

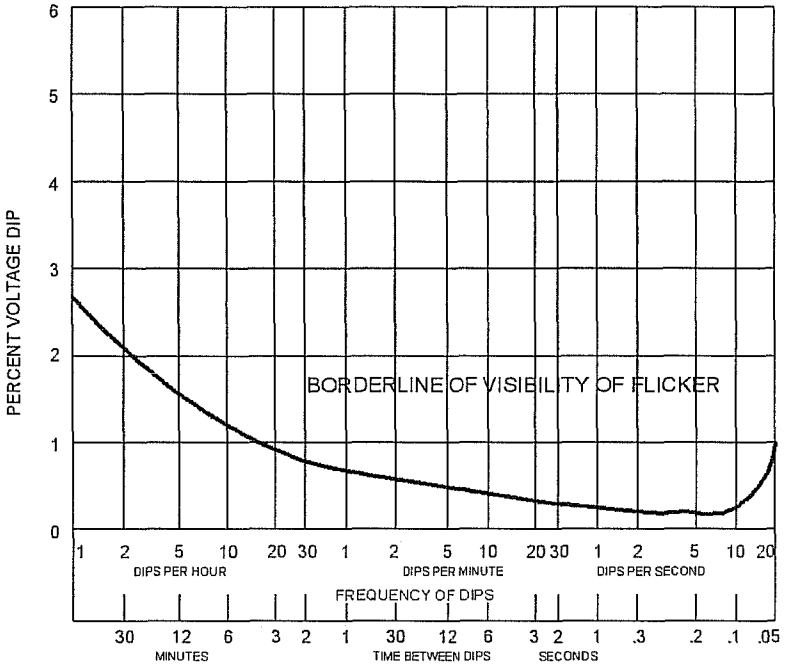
$$\text{Stiffness Ratio: } \frac{\text{SC kVA (Area EPS)+SC kVA(DR)}}{\text{SC kVA (DR)}} = \frac{\text{SC kVA (Area EPS)}}{\text{SC kVA (DR)}} + 1$$

K. **LOSS OF SYNCHRONISM** - Synchronous generator distributed resources in applications with a stiffness ration of 20 or less shall be equipped with loss of synchronism (out-of-step) protective functions to isolate the generating facility from the Clay-Union Distribution System without any intentional time delay.

L. **FEEDER RECLOSING COORDINATION** - In the case of Clay-Union Distribution System protection function initiating a trip of a Distribution System protective device in reaction to a fault on the Distribution System, the generating facility must be designed to coordinate with the Clay-Union Distribution System reclosing practices of that protective device.

M. **LIMITATION OF DC INJECTION** - The generating facility shall not inject dc current greater than .5% of the full rated output current at the point of connection.

N. **LIMITATION OF VOLTAGE FLICKER INDUCED BY THE GENERATING FACILITY** - The generating facility shall not create objectionable flicker for other customers on the Clay-Union Distribution System. The maximum permissible shall be an amount represented by the line plotted in the chart below.



O. **HARMONICS** - When the generating facility is serving balanced linear loads, harmonic current injection into the Clay-Union Distribution System at the point of common coupling shall not exceed the limits stated below.

The harmonic current injections shall be exclusive of any harmonic currents due to harmonic voltage distortion present in the Distribution System without the generating facility connected.

Maximum Harmonic Current Distortion in Percent of Current (I)

Individual Harmonic Order (Odd Harmonics)	< 11	11 ≤ h, 17	17 ≤ h <23	23≤ h <35	35 ≤ h	TDD
Percent (%)	4.0	2.0	1.5	0.6	0.3	5.0

A. I = the greater of the Local electric power system maximum load current integrated demand (15 or 30 min) without the distributed resource unit, or the distributed resource unit rated current capacity (transformed to the point of common coupling when a transformer exists between the distributed resource unit and the point of common coupling).

B. Even harmonics are limited to 25% of the odd harmonic limits above.

P. **IMMUNITY PROTECTION** - The influence of electromagnetic interference (EMI) shall not result in a change in state or misoperation of the Generating Facility.

Q. **SURGE CAPABILITY** - The Generating Facility shall have the capability to withstand voltage and current surges in accordance with the environments defined in IEEE/ANSI C62.41 or IEEE C37.90.1 as appropriate.

R. **ISLANDING** - For an unintentional island in which the generating facility and a portion of the Clay-Union Distribution System remain energized through the point of common coupling, the generating facility shall cease to energize the distribution system within five seconds of the formation of an island.

S. **GROUNDING** – Grounding of sufficient size to handle the maximum available ground fault current shall be designed and installed to limit step and touch potentials to safe levels as set forth in "IEEE Guide for Safety in AC Substation Grounding", ANSI/IEEE Std. 80. All electrical equipment shall be grounded in accordance with local, state and federal electrical and safety codes and applicable standards.

V. PROTECTIVE DEVICES AND SYSTEMS

A. GENERAL – Protective devices required to permit safe and proper operation of Clay-Union's distribution system while interconnected with customer's Generation System are shown and labeled on the attached one-line diagram. The customer shall be responsible for the purchase, installation and maintenance of these devices. Clay-Union shall review and approve those protective functions which apply to Clay-Union's system.

B. RELAYS – Utility grade relays meeting IEEE Standards C37.90 for relays associated with electric power apparatus are required for systems over 40 KW. All relays shall be equipped with setting limit ranges and other requirements that may be necessary to comply with these interconnection requirements and as are specified in the design details. Typical protection devices, which may be required to satisfy these requirements, are:

C. Under/over voltage relay (Device 27/59)

D. Under/over frequency relay (Device 81)

E. All required protective relays should be visually inspected for any obvious signs of damage or inoperability at least once per month, and shall be tested and calibrated at a minimum of four-year intervals. These are typical relays. Specific devices required are to be determined in the interconnection study.

VI. METERING

A. The customer will be responsible for metering costs that are in addition to Clay-Union's standard revenue metering installations. All metering will be owned and maintained by Clay-Union Electric Cooperative.

B. For generation systems that sell power and are greater than 150 KW in size, separate metering of the generation and of the load is required (including generator station service).

C. For generation systems which are less than 50 KW and are qualified facilities under PURPA, bi-directional energy metering at the point of common coupling will be the standard

D. The metering shall be remotely read. For generation systems 1000 KW and larger, real-time, remote monitoring is required.

E. Thirty-minute time registration demand and energy metering will be used for generation systems that are 50 KW and larger.

F. The meter shall be located at mutually agreed upon locations, which can accommodate all requirements. When the meter location is not at the point of common coupling, loss factors will be used to adjust metered quantities to the point of common coupling.

G. For generation systems that sell power and are 50 KW and greater in size, metering shall be designed to meet Western Area Power Authority (WAPA) metering standards for accuracy and communications.

VII. CERTIFICATION AND TESTING CRITERIA

A. This section covers the Clay-Union required testing of equipment and generators used with interconnected generation. Testing of the equipment and associated devices will be required to ensure proper operation. Testing shall be performed prior to initial interconnection and at periodic intervals as requested by Clay-Union, but not less than every four years thereafter. All required testing of customer equipment shall be done at customer expense. A copy of a certified test report shall be provided to Clay-Union as documentation that the test was completed.

B. Pre-qualifying Testing – Pre-qualifying testing is defined as testing of individual components or systems prior to installation or connection at the generation installation site. Such testing shall be complete on all equipment and devices that are required and included in the system for connecting and disconnecting the Generation System to and from the Distribution System. Such testing shall be completed at the factory of the equipment being tested or on-site by a competent testing firm or installer.

C. The ability to demonstrate complete shut down following loss of power is required.

D. Copies of manufacturer testing and field tests shall be made available to Clay-Union Electric Cooperative.

E. Re-Qualification Testing: At periodic intervals requested by Clay-Union, but not less than every four years thereafter, re-qualification testing will be required.

F. Electric Service Interruptions During Testing: Customer shall be aware that interruptions to electric service are required to perform the above testing. If a customer fails to allow testing as required in this document, Clay-Union will provide written notice to the customer that all allowed generation operation and interruptible rates shall cease immediately and further generation operation is prohibited until the required testing is completed in a manner satisfactory to Clay-Union. If the customer is not able to tolerate the possibility of short interruptions to the electric service in order to facilitate testing, a means of bypassing may be installed by the customer. The bypass shall meet all requirements of the National Electrical Code and be approved by the electrical inspector and shall be approved by Clay-Union prior to installation and connection.

GLOSSARY

Active Anti-Islanding Scheme - A control scheme installed as part of the Generating or Interconnection Facility that senses and prevents the formation of an Unintended Island.

Applicant – The entity submitting an Application for Interconnection pursuant to this Standard.

Application – A form submitted to Clay-Union for Interconnection of a Generating Facility.

Customer - The entity that receives or is entitled to receive Distribution Service through the Distribution System.

Dedicated Transformer; Dedicated Distribution Transformer – A transformer that provides electricity service to a single Customer. The Customer may or may not have a Generating Facility.

Disconnecting Device - Either a physical device such as a breaker/relay or switch, or a computer-controllable capability in electronic power equipment, designed to isolate a portion of the area electric power system and/or distributed resource systems.

Distributed Resource (DR) - A device converting mechanical, chemical, or solar energy into electrical energy, generally under 40MW and interconnected to an Area EPS.

Distribution Service – All services provided to a Customer pursuant to the approved tariffs of Clay-Union other than services directly related to the Interconnection of a Generating Facility under this Standard.

Distribution System – All electrical wires, equipment, and other facilities owned or provided by Clay-Union other than Interconnection Facilities, by which Clay-Union provides Distribution Service to its Customers.

Electric Power System, Area (Area EPS) – An electric power system (EPS) that serves Local EPS's. Typically an Area EPS has primary access to public rights-of-way, priority crossing of property boundaries, etc., and is subject to regulatory oversight.

Electric Power System, Local (Local EPS) – The local electric power system (Local EPS) is a system contained entirely within a single premises or group of premises. The Local EPS can include distributed sources of power, including both generators and energy storage technologies.

Emergency – An actual or imminent condition or situation, which jeopardizes Clay-Union's Distribution System integrity.

Generating Facility – All Generators, electrical wires, equipment, and other facilities owned or provided by Producer for the purpose of producing electric power.

Generator – A device converting mechanical, chemical or solar energy into electrical energy, including all of its protective and control functions and structural appurtenances. One or more Generators comprise a Generating Facility.

Gross Nameplate Rating - The total gross generating capacity of a Generator or Generating Facility as designated by the manufacture(s) of the Generator(s).

Harmonic distortion - Non linear distortion of a system or transducer characterized by the appearance in the output of harmonics other than the fundamental component when the input wave is sinusoidal.

Host Load – Electrical power that is consumed by the Customer at the property on which the Generating Facility is located.

In-Rush Current – The current determined by the In-rush Current test.

Interconnection Agreement – An agreement between Clay-Union and the Producer that gives certain rights and obligations to effect or end Interconnection.

Interconnection; Interconnected – The physical connection of a Generating Facility in accordance with the requirements of this Standard so that Parallel Operation with Clay-Union's Distribution System can occur (has occurred).

Interconnection Facilities - The electrical wires, switches and related equipment that are required in addition to the facilities required to provide electric Distribution Service to a Customer to allow Interconnection. Interconnection Facilities may be located on either side of the point of Common Coupling, as appropriate to their purpose and design. Interconnection Facilities may be integral to a Generating Facility or provided separately.

Interconnection Study – A study to establish the requirements for Interconnection of a Generating Facility with Clay-Union's Distribution System.

Island: Islanding - A condition on Clay-Union's Distribution System in which one or more Generating Facilities deliver power to Customers using a portion of Clay-Union's Distribution that is electrically isolated from the remainder of Clay-Union's Distribution System.

Isolation Device – A device in one circuit that prevents the malfunctions in one section of the circuit from causing unacceptable influences in other sections of the circuit or other circuits.

Metering – The measurement of electrical power flow in kW and/or kWh, and/or energy in kWh, and, if necessary, kVAR at a point, and its display, as required by this Standard.

Metering Equipment – All equipment, hardware, software including meter cabinets, conduit, etc. that are necessary for Metering.

Momentary Parallel Operation – The Interconnection of a Generating Facility to the Distribution System for one second (60 cycles) or less.

Net Generation Metering – Metering of the net electrical power or energy output in kW or energy in kWh, respectively, from a given Generating Facility. This may also be the measurement of the difference between the total electrical energy produced by a Generator and the electrical energy consumed by the auxiliary equipment necessary to operate the Generator.

Net Nameplate Rating – The Gross Nameplate Rating minus the consumption of electrical power of a Generator or Generating Facility as designated by the manufacturer (s) of the Generator(s).

Non-Export; Non-Exporting – Designed to prevent the transfer of electrical energy from the Generating Facility to Clay-Union.

Non-Islanding – Designed to detect and disconnect from a stable Unintended Island with matched load and generation. Reliance solely on under/over voltage and frequency trip is not considered sufficient to qualify as Non-Islanding.

Parallel Operation- The simultaneous operation of a Generator with power delivered or received by Clay-Union while Interconnected. For the purpose of this Standard, Parallel Operation includes only those Generating Facilities that are Interconnected with Clay-Union's Distribution System for more than 60 cycles (one second).

Penetration Ratio - The ratio of distribution resource nameplate capacity to the maximum feeder load.

Phase Angle – The measure of the progression of a periodic wave in time or space from a chosen instant or position.

Point of Common Coupling (PCC) – The transfer point for electricity between the electrical conductors of Clay-Union and the electrical conductors of the Producer.

Point of Interconnection – The electrical transfer point between a Generating Facility and the Distribution System. This may or may not be coincident with the Point of Common Coupling.

Power Factor – The ratio of the resistance to the impedance at power frequency of an equivalent circuit supposed to be formed by an inductance and a resistance in series.

Power Purchase Agreement (PPA) – An agreement for the sale of electricity by the Producer to Clay-Union.

Producer - The entity that executes an Interconnection Agreement with Clay-Union. The Producer may or may not own or operate the Generating Facility, but is responsible for the rights and obligations related to the Interconnection Agreement.

Prudent Electrical Practices – Those practices, methods, and equipment, as changed from time to time, that are commonly used in prudent electrical engineering and operations to design and operate electric equipment lawfully and with safety, dependability, efficiency and economy.

Rated Torque – The shaft torque necessary to produce rated power output at rated-load speed.

Reactive Power – The square root of the square of the apparent power minus the square of the active power. Reactive power is developed when there are inductive, capacitive, or nonlinear elements in the system.

Root Mean Square (rms) – Refers to the most common mathematical method of defining the effective voltage or current of an AC waveform. To determine rms value, three mathematical operations are carried out on the function representing the AC waveform.

1. The square of the waveform function (usually a sine wave) is determined.
2. The function resulting from step (1) is averaged over time.
3. The square root of the function resulting from step (2) is found.

In a circuit whose impedance consists of a pure resistance, the rms value of an AC wave is often called the effective value or DC-equivalent value.

Single Line Diagram; Single Line Drawing – A schematic drawing, showing the major electrical switchgear, Protective Function devices, wires, Generators, transformers and other devices, providing sufficient detail to communicate to a qualified engineer the essential design and safety of the system being considered.

Starting Voltage Drop – The percentage voltage drop at a specified point resulting from In-rush Current. The Starting Voltage Drop can also be expressed in volts on a particular base voltage, (e.g. 6 volts on a 120-volt base, yielding a 5% drop).

Stiffness Ration - This ratio is calculated at the point of common coupling, except when there is a transformer(s) dedicated to one customer in which case the stiffness ratio is calculated on the high-voltage side of the dedicated transformer(s).

$$\text{Stiffness Ratio: } \frac{\text{SC kVA (Area EPS)} + \text{SC kVA (DR)}}{\text{SC kVA (DR)}} = \frac{\text{SC kVA (Area EPS)}}{\text{SC kVA (DR)}} + 1$$

Synchronous Speed - The speed of rotation of the magnetic flux, produced by or linking the primary winding.

Tap Changer – A selector switch device used to change transformer taps with the transformer energized. A load tap-changer is functionally equivalent to a voltage regulator.

Telemetering – The electrical or electronic transmittal of Metering data in real-time basis to Clay-Union and others.

Unintended Island – The creation of an Island, usually following a loss of a portion of Clay-Union's Distribution System, without the approval of Clay-Union.

Unsafe Operating Conditions – Conditions that, if left uncorrected, could result in harm to personnel, damage to equipment, loss of System Integrity or operation outside pre-established parameters required by the Interconnection Agreement.

Visible Disconnect – An electrical switching device that can separate the Generating Facility from Clay-Union's Distribution System and is designed to allow visible verification that that separation has been accomplished. This requirement can be met by opening the enclosure to observe the contact separation.

Windings – An assembly of coils designed to act in consort to produce a magnetic flux field or to link a flux field.