Kosciusko
REMC

DISTRIBUTED GENERATION
- INTERCONNECTION REQUIREMENTS -

Adopted: August 2009

CONTENTS

A. GENERAL

1. Introduction

This document outlines the requirements for generation, transmission, and end-use facilities of Members to be connected to the KREMC electric system. Its purpose is to promote safety of people and equipment, compatibility between Member facilities and KREMC facilities, and maintenance and reliability of the regional electric system when a Member requests an interconnection with KREMC. It complies with the requirements of NERC Planning Standard I C "Facility Connection Requirements" (if applicable). The purpose of the Standard is to promote safety and help assure adequacy and security of the bulk power network. All Distributed Generation interconnections must also fully comply with IEEE 1547 and its amendments which is the "Standard for Interconnecting Distributed Resources with Electric Power Systems."

This section describes requirements for projects involving generation, transmission, and end use facilities. The "Generation" section of this document will describe additional requirements specific to projects involving generating facilities only.

All connections will require the Member to file an application with KREMC for each Member project. In general, the size, connection voltage level, and degree of complexity of the proposed connection and Member's project will determine the extent of detail and studies needed for approval. Large loads and generators, and higher voltage interconnections will need a more comprehensive study and protective design. KREMC will have the right of approval of aspects of a project that may have an effect on its system.

All connections will require an agreement specifying the legal rights and obligations of the Member and KREMC.

The Member's access to and conditions of use of the applicable Transmission Provider's (TP) system for transmission service MAY be governed by the TP's Open Access Transmission Tariff (OATT) filed with FERC. If Member intends to deliver energy to an entity other than KREMC, a Request for Transmission Service must be made as required in the applicable TP's tariff and in accordance with terms specified in the Tariff.

2. Application & Modifications

Member must make application to KREMC for proposed generation, or end use project and associated connections to KREMC's system. Applications must include sufficient information for KREMC to conduct the necessary inspections, evaluations, studies and approvals, and for discussions and changes as necessary.

Sufficient lead-time, considering project scope (complexity, size, location, etc.) is required prior to starting construction to assure a thorough and orderly review process and construction schedule.

The Application will include:

- Member name & address
- Contact person, phone, fax and e-mail
- Project and connection site description
- Design and test specifications
- Schedule for the design and construction of Member's project and connection
- Operation and maintenance plans, including staffing, to the extent coordination with KREMC is affected
- Electrical schematics, which will include but not be limited to:
  a. one line diagram showing the connections between the Member project and KREMC's system;
  b. three-line diagrams showing current and potential circuits for protective relays;
  c. relay tripping and control schematic diagram.
  KREMC reserves the right to approve the proposed settings for relays. If requested by Member, KREMC will provide system data needed to determine the relay settings.
- Communication and control schemes
- Generator and load specifications
- Schedules of intended generation, transfers, and load levels that will affect KREMC's system

Member will also provide to KREMC any other information or documents related to the Project which are necessary for the purpose of ensuring the safety, reliability, security, and protection of the KREMC System and the regional electric system. Examples of such information are detailed in this document.

The Member will provide prior written notice to KREMC of any material modification or change to the project during construction or operation, which may affect the KREMC system. KREMC may require modifications to the Member's project, when necessary for the integrity of its system. Member will not make any modifications to the project without the prior written consent of KREMC. Proposed Member modifications to existing facilities must be mutually planned, coordinated, and integrated into KREMC's distribution system.

3. Confidentiality

It is recognized that certain information relating to the project may be confidential, proprietary or of competitive value. The written agreement will include a confidentiality provision. KREMC will disclose Member information designated as confidential only to its officers, directors, employees, agents and affiliates who need to know such information in order to address KREMC's rights and responsibilities related to the project.

Additional disclosures may be made to the extent required by regulatory or legal authorities and proceedings, or as required for evaluations by NERC, an ISO, or an RTO. If KREMC is required to disclose confidential information, KREMC will give the Member prompt notice of such requirement.

4. Agreement

A written agreement will be required to specify the legal rights and responsibilities of the Member and KREMC related to the project. The agreement will include: Cost and work responsibilities; reasonable security deposits, communications, liability, insurance, penalties for non-performance, responsibilities under normal and emergency conditions, and other provisions as required.

The Member will be responsible for any and all costs which KREMC incurs as a direct or indirect result of the project. This includes installation, operating and maintenance expenses, study costs, and administrative costs which would not have been incurred but for the Member's project.

Member will reimburse KREMC for all costs incurred by KREMC resulting from the project and will pay all other charges or amounts payable by Member under the agreement.

5. Adherence to Standards

All facilities designed and installed by Member and KREMC must be designed, installed, maintained and operated in accordance with the agreement; good utility practices; the National Electrical Code; the National Electrical Safety Code; the practices and guidelines of KREMC; IEEE Standard 1547 and its amendments (Standard for Interconnecting Distributed Resources with Electric Power Systems); UL1741 Standard for Inverters, Converters, and Controllers for Use in Independent Power Systems; NERC (if applicable) and an ISO; and all applicable laws and regulations.

If applicable, Member will comply with all practices, methods, policies, procedures, guidelines, criteria, tariffs and other requirements of the TP's Open Access Transmission Tariff and/or an ISO with respect to the construction, installation, maintenance and operation of the Member's facility, delivery of energy to the KREMC System and access to and use of the TP's system.

During construction and start-up, KREMC will monitor construction of the Member's facility to assure compliance with KREMC safety and construction standards. KREMC reserves the right during system start-up and operation to witness all service checks, protection and control device calibrations, settings and routine testing. KREMC's review process does not relieve the Member of its obligation to perform and document these activities.

KREMC may periodically review pertinent aspects of the project's operation, maintenance, and condition during the project's life, in order to assure continuing safety and reliability of KREMC's system.

If the Member's testing and maintenance program is not performed to the satisfaction of KREMC or at the required maintenance interval (i.e. in accordance with good utility practice), KREMC reserves the right to inspect, test, or maintain devices required for the protection of the bulk transmission system at the Member's expense. If the Member's protective equipment is determined to be unsatisfactory, KREMC reserves the right to disconnect the Member from the KREMC System until the protective equipment is brought into conformance at the Member's expense.

6. Reliability Studies

KREMC will evaluate the impact of the Member's project on its system, and on the electric system in the region. Studies will be made before project startup and periodically during its operation. Studies may include load flow, short circuit, stability, torsional oscillations, and power quality impacts. The types and extent of necessary studies will be determined by the nature and size of the project.

The studies may identify system problems and alternative solutions. Modifications to the project may be required. If KREMC system modifications are needed, these system facilities will be provided only if they are acceptable to the applicable regulatory authorities and KREMC believes the improvements are a prudent business decision.

The Member's project may require other design, planning, or operational studies to assure the desired performance of the integrated facilities, depending upon size, location and type of facility characteristics and systems. Such studies may be done jointly with entities responsible for regional reliability, such as FERC, an RTO or an ISO.

Studies, analyses, reviews, testing, witness checks or audits, requested by or required due to the project, performed or contracted by KREMC will be at the Member's expense.

7. Regional Review

Review of the Project's impact on the regional electric system may be required. Projects that are large, and/or have characteristics that may have potentially significant effects on the system of KREMC or the region, will be reviewed by appropriate NERC, RTO, or ISO technical assessment panels prior to startup, and ongoing thereafter.

8. Governmental Approvals

Filings at, and approvals from, regulatory agencies may be required for interconnection facilities associated with the project. Possible agencies include FERC, the IURC, local governmental agencies, and environmental agencies, depending on the nature of the project and associated KREMC facilities.

Member and KREMC will assist one another and use all reasonable efforts in making necessary filings and obtaining any necessary approvals of the agreement as promptly as practicable. In the event any agency requires changes in the agreement as a condition to its acceptance or, if applicable, approval of the agreement, the parties will negotiate in good faith with respect to revising the agreement to reflect such changes.

9. Technical Requirements

a. System Protection and Coordination

The Member's protection and control systems must be designed, installed, operated and maintained to coordinate properly with KREMC protection and control systems for all normal and potential abnormal power system conditions. These systems must prevent or limit damage to the project and to the KREMC system. They must provide acceptable redundancy; be easily maintained; accurate; fast; reliable (dependable and secure); sensitive; selective; meet KREMC, IEEE and NERC guidelines; protect the general public; minimize damage to facilities; prevent cascading outages; minimize unnecessary outages; and provide the flexibility for rapid restoration of service.

KREMC will have the right to review and accept the Member's proposed grounding design and voltage transformations to avoid adverse impact upon KREMC and Member facilities, operations and safety.

The Member's interconnection protective devices should conform to ANSI/IEEE Standard C37.90, "Relays and Relay Systems Associated with Electric Power Apparatus" and IEEE 1547 (Standard for Interconnecting Distributed Resources with Electric Power Systems), UL1741 Standard and have appropriate test plugs/switches for testing the operation of the relay, and have targets to indicate relay operation.

KREMC will review and approve relay settings for the Member's relays to assure coordination between the Member's protective equipment and the KREMC system relays. It is the Member's responsibility to determine that their other protective equipment coordinates with the required KREMC protective equipment and is adequate to meet all applicable standards to which the project is subject. KREMC further reserves the right to modify interconnection relay settings when deemed necessary to avoid safety hazards to utility personnel or the public and to prevent any disturbance, impairment, or interference with KREMC's ability to serve other Members.

b. Metering

All electrical energy delivered to and received from the interconnection will be measured by suitable metering equipment. The metering interface equipment must be compatible with the data acquisition systems of both KREMC and the Member. KREMC shall install, own, operate and maintain all metering equipment at Member's expense. Member will

provide suitable accessible space for the installation of the metering equipment at no cost to KREMC. These meters will measure and record peak and integrated real and reactive power including KW, KWH, KVAR, KVARh, pf, etc. into and out of the interconnection every 15 minutes.

Metering equipment installed by KREMC will be tested by KREMC at regular intervals and at any other reasonable time upon request by either party, at the requesting party's expense. Member will have the right to witness all testing and will be furnished all test results on a timely basis.

Member may, but will have no obligation to, install, own, operate and maintain at its own expense meters and associated equipment used to back up metering equipment maintained by KREMC.

If, for any reason, any metering equipment is out of service or malfunctioning, the electrical energy delivered during the period of outage will be estimated and agreed upon using the best data available.

c. Telemetering

If, at the discretion of KREMC, the Member's project necessitates real-time telemetry to the KREMC control center, the Member will install and operate at its expense the necessary supervisory control and data acquisition equipment, communication channel, the telemetry equipment and all associated devices.

Telemetry equipment will include transducers, remote terminal units, modems, telecommunication lines, and any other equipment necessary to transmit information necessary for the proper operation of the KREMC system. The remote terminal unit, or equivalent device, may need to have multiple communication ports to allow simultaneous communications with third parties, such as ISOs or other regional reliability control centers. That device will accommodate data communication requirements specified by each party's control center, including communication protocol, rate and mode (either synchronous or asynchronous).

All metered values provided to the telemetry equipment will originate from common metering equipment. All transducers used for telemetry will meet industry standard accuracy. As part of real-time data to be provided, KREMC has the right to require the status and remote control of switching devices at the project.

d. Visual Disconnect

Member shall pay for a manual disconnect device whose open condition is visibly verifiable, readily accessible and lockable to separate Member's connection and related equipment and facilities from interconnection with the KREMC system. This device shall have a means for padlocking in the open position. The location of this device will be determined by mutual agreement and be readily accessible to KREMC at all times. Where the disconnect device is a part of or directly connected to the KREMC System, the disconnect device will be operated only after authorization from KREMC's dispatcher or its designated representative.

KREMC reserves the right without liability to open this disconnecting device or other devices under its control, isolating Member's connection and related equipment and facilities, if in its sole judgment an emergency has occurred or is imminent.

Except in the case of an emergency, KREMC will provide to Member oral or written notice prior to any disconnection. As soon as reasonably practicable after occurrence of an emergency, KREMC will provide to Member oral or written notice of the nature thereof, together with the expected duration of the disconnection from the KREMC system.

e. Insulation Coordination

The Member must coordinate its switching surge and lightning protection systems with KREMC lightning protection systems. Careful attention needs to be given to the proper insulation levels and grounding techniques employed. If switching surges are expected to be a problem, circuit breakers may need to be equipped with closing and/or opening resistors and/or zero crossing switching capability.

f. Voltage, Reactive, and Power Factor Control

The Member will not cause excessive voltage variations and will remain within +/- 5 % of nominal voltage ratings during normal and single contingency operation. Further restriction may be necessary to prevent harm to other Members' equipment.

Other requirements for Members with generation are outlined in Section B.

g. Power Quality Impacts

In cases where it is determined by KREMC in its sole reasonable judgment that starting of induction motors, control of electric motors, variable frequency drives, other harmonic generating equipment or load changes on other equipment at the facility could have an adverse impact on the KREMC system voltage, Member will take such action as reasonably required by KREMC to bring voltage changes to acceptable levels.

Members with unusual load characteristics which create damaging torsional oscillations on motors and generators shall install the requisite electrical equipment (filtering and/or damping) needed to modify their load characteristic so their resulting load characteristic at the point of interconnection does not harm KREMC or its members.

The maximum voltage wave distortion caused by the Member will be less than 5.0% (Including a 1.0 % phase voltage unbalance). Voltage unbalance is defined as the maximum phase deviation from average as specified in ANSI C84.1, "American National Standard for Electric Power Systems and Equipment – Voltage Ratings, 60 Hertz."

The Member shall limit harmonic voltage and current distortion and/or voltage flicker (objectionable low voltage fluctuation) caused by the project. Limits for harmonic distortion (including inductive telephone influence factors) are consistent with those published in the current version of ANSI/IEEE 519, "Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems". Flicker occurring at the point of interconnection shall remain below the Borderline of Visibility curve on the IEEE/GE curve for fluctuations less than 1 per second or greater than 10 per second. However, in the range of 1 to 10 fluctuations per second, voltage flicker shall remain below 0.4%. Depending upon the nature of the Project and its location, KREMC may require the installation of a monitoring system to permit ongoing assessment of compliance with these criteria. The monitoring system, if required, will be installed at the Member's expense.

h. Equipment Ratings

The Member's project should be consistent with KREMC ratings, and be able to operate in its expected mode without undue maintenance or life reduction.

i. Maintenance Coordination

The Member's project should be designed to permit safe routine and emergency maintenance on all components. Redundancy levels should be consistent with the project's operational obligations.

Project maintenance schedules should be provided to KREMC with enough lead time to resolve coordination issues.

Except in the case of an emergency, the parties will use commercially reasonable efforts to schedule planned and unplanned inspection and maintenance of interconnection facilities. Planned and unplanned clearance and maintenance of equipment that requires disconnection of the facility from the KREMC system will be, to the extent feasible, at mutually agreed upon times designed to avoid disruption of the operation of the facility and KREMC's operations and service to its other members.

j. Emergency Conditions

KREMC reserves the right (without consultation when time doesn't permit) to open the interconnecting facilities or curtail flows for compliance with safety and reliability standards, abnormal operating conditions or characteristics (including system disturbances, open conductors, etc.), and operating emergencies until such time as compliance is achieved. In some instances the Member may be required to interrupt or curtail service under the operating authority of KREMC to avoid injury to life or property.

Member will not energize or maintain energization to disconnected KREMC facilities unless directed to do so by KREMC. Normal energization and manual restoration of service to KREMC

and Member-interconnected facilities will be directed by KREMC. The Member's protection and control schemes must recognize the loss of source(s) at the interconnection point and initiate automatic disconnection from the point of interconnection.

Member transactions may be curtailed if KREMC or regional facilities become overloaded, in accordance with established line loading relief practices.

k. Inspections

Before the facility is interconnected with the KREMC system, Member will provide KREMC with reasonable notice and opportunity to inspect and test Member's interconnection facilities. This inspection and testing may include, but need not be limited to:

(1) the acceptance testing of all protective equipment according to KREMC minimum requirements;
(2) the placement of in-service relay taps according to settings
(3) the operability of the protective equipment; and
(4) the phasing and synchronizing checks of all related equipment.

Member will provide KREMC with test and maintenance data as reasonably required by KREMC.

l. Communications

The Member will establish voice communication channels with KREMC so that responsible and authorized personnel can issue requests and/or orders that may impact project reliability as well as the security and stability of the KREMC System. The Member will be expected to notify KREMC of the occurrence or expectation of any event that may affect the KREMC system.

The Member will maintain redundant communication links to KREMC. Standard telephone lines may be used for communications. The telephone numbers to be used are as follows:

KREMC 24 Hour Dispatch 574-267-6331

An alternate office for the KREMC control center maybe used as a backup in the event that the normal office is not operational. Contact information for a backup office will be provided in these events. KREMC may change these numbers as needed from time to time by providing written notice to Member.

Member will notify KREMC as soon as possible of any disruption, malfunctioning or unavailability of the communication link

m. Available Capacity

Transmission facility connection requirements are for balanced three phase 60 Hertz alternating current connections. Network power flows with normal and emergency conditions may be made to determine system capability at particular locations.

Site specific limitations affect the available transmission, sub-transmission system, and distribution system capacities. These include the electrical characteristics and use of facilities already connected or being planned for connection to the transmission system. Other examples of site specific issues include: availability or proximity of KREMC facilities; local zoning and other ordinances; environmental regulations; availability of permits, easements and rightsof-way; Member electrical characteristics; pre-existing and projected line loading in the area; and margins to provide for abnormal system conditions.

B. GENERATION

1. Size Considerations

When the Member's project includes generation, the size and other characteristics of the project will determine the extent of the requirements for connection to the KREMC system. In general, small generators will have fewer or less exhaustive study and technical requirements. However, safety and coordination dictate certain minimum standards for all facilities. In general, the generator may not exceed 1 MW (1,000 kW) depending upon the location in KREMC's system and the facilities available.

For small generators, protection requirements are outlined in the KREMC document "Protection Requirements For Members With Small Generating Facilities Operating In Parallel With Utility's System", attached as Appendix II to this document.

2. Application Requirements

The Member will provide to KREMC electrical static and dynamic characteristics of the facility's generators and associated control systems and transformers, including generator capability curves and all turbine, generator step-up, voltage regulator and governor data, promptly after receipt thereof by Member. Member will notify KREMC promptly in writing of any change to such characteristics.

3. Studies

KREMC may perform, or cause to be performed, stability analyses in order to verify that the generating units at the facility meet KREMC system stability requirements. If any such analysis shows that such equipment loses or could lose synchronization under any reasonable scenario, Member will install at its expense out-of-step protection or special generator trip schemes as reasonably required by KREMC. If detailed stability simulations are required, Member will provide data pertaining to the generator(s) and related control systems. Stability studies performed by or for KREMC will not evaluate the risk to the facility or equipment of Member due to unstable operation of Member's generator(s). It is the responsibility of Member to assess these risks and protect accordingly.

4. Integration into the Control Area

Member will operate the facility with its speed governors and voltage regulators in operation whenever the facility is connected to or operated in parallel with the KREMC system. If the facility's voltage regulators are out-of-service, the Member will immediately notify KREMC's dispatcher or its designated representative and will maintain voltage as prescribed by KREMC's dispatcher or its designated representative and ensure that generator MVar levels are within the capability of the facility's generators and steady state stability limits. Member will not cause the facility to disconnect automatically or instantaneously from the KREMC system or trip any generating unit comprising the facility for an under or over frequency condition unless the abnormal frequency condition persists in time beyond the limits set forth in ANSI/IEEE Standard C37.10

Member will be solely responsible for properly synchronizing with the KREMC system all generator(s) that are a part of the facility in accordance with the synchronization procedures provided by Member and approved by KREMC for generators interconnected to the KREMC System. KREMC will have the right to review, approve and monitor such synchronization procedures.

Member will not energize a de-energized circuit owned by KREMC except in accordance with all KREMC safety and operational protocols, as in effect from time to time and then only with the full knowledge and permission of KREMC.

The Member with generation will provide KREMC with immunity from consequences of torsional oscillations resulting from transmission system operations, and insure that the turbine-generator is not excited into resonance by normal system operations.

5. Protection Systems and Controls

Member will install and maintain protective equipment that will open the connection of Member's facilities to the KREMC system prior to the action of KREMC's protective equipment, upon the occurrence of a disturbance on or at the facility. This equipment shall be tested annually and a certified test report furnished to KREMC on an annual basis.

6. Abnormal System Conditions

It is the sole responsibility of Member to protect its equipment from excessive negative sequence currents, system faults, voltage or frequency excursions or other abnormal system conditions, and KREMC will have no responsibility or liability to Member for any consequence thereof.

Upon loss of KREMC supply the Member will separate from KREMC’s distribution system. The Member will coordinate synchronization and operation of the Facility with KREMC. The Member is solely responsible for all synchronizing damages that may ensue from improperly synchronizing their generation to the KREMC system.

Abnormal frequency relays may be required. Settings will be reviewed with KREMC. The Member will consult with the turbine manufacturer to assure this capability.

Large generating facilities may be required to maintain some amount of spinning reserve during normal operation, to allow its participation in area load balancing.

7. Voltage, Reactive, and Power Factor Control

The Member will provide automatic reactive control and coordinate its control with KREMC's system.

The facility's generating unit(s) will not cause voltage variations outside of the range of 95% to 105% nominal. Member will operate the facility to maintain voltage levels reasonably prescribed by KREMC. Without limiting the generality of the foregoing, the generating units at the facility will be capable of operating at a power factor of 90% lagging and 95% leading when the generating units are at full gross power output, as measured on the low side of the facility's main transformer, it being understood that steady state stability limits may restrict leading power factor operation to levels higher than 95% leading power factor. So that voltage levels are maintained at the levels prescribed by KREMC, Member will monitor and adjust the reactive output of the generators at the facility to maintain such voltage levels. Such adjustment will be subject to the limitations imposed by line voltages, generator capability curves and other in-plant system limitations.

8. Flicker, Harmonics & Interference

Power output at the facility will be in accordance with the power quality standards contained in the Institute of Electrical and Electronics Engineers Standard 519, and the facility will not introduce any distortion of KREMC's waveform, telephone or carrier interference that is inconsistent or conflicts with such standard.

Projects including inverters to convert DC output to AC connected to the KREMC system shall comply with the IEEE Standard 929-2000.

In cases where it is determined by KREMC in its sole reasonable judgment that starting of induction motors or load changes on other equipment at the facility could have an adverse impact on the KREMC system voltage, Member will take such action as reasonably required by KREMC to bring voltage changes to acceptable levels.

9. Frequency

All Energy delivered at the interconnection point will be in the form of three-phase alternating current having a nominal frequency of sixty cycles per second, and a harmonic content not in excess of and consistent with the requirements of the Institute of Electrical and Electronic Engineers Standard No. 519.

Member will provide and maintain operable governor systems that are responsive to system frequency deviations. Overspeed protection in the event of load rejection is the responsibility of the Member.

10. Reporting Requirements

Member will report generation schedules to KREMC as needed for area operational control.

At the discretion of KREMC, generation control facilities and supervisory control and data acquisition of specific electrical devices may be necessary to integrate the Member's generation into KREMC's control area. Such facilities, including required communication channels, will, if required, be furnished and installed at the Member's expense. The requirement for data acquisition and control will depend on the generation capacity, system location and voltage, and the net generation delivered at the point of interconnection to KREMC's system.

For KREMC and regional planning purposes, historical and projected long-term future capability, output, availability, and other records may need to be compiled and reported.

APPENDIX I

Definitions:

Agreement	The document specifying the legal rights and responsibilities of the parties regarding a particular project.
ANSI	The American National Standards Institute
Application	Member information provided to KREMC, data necessary for the evaluation and coordination of a project with KREMC's system
Connection	The electrical interconnection of the project to KREMC's system, including auxiliary equipment such as controls and protective devices necessary for proper operation of the interconnection
Member	The entity owning and controlling a project connected or proposed to be connected to KREMC's system
Emergency	An event or condition in which safety or the reliability of the local or regional electric system has or may imminently be compromised
FERC	The Federal Energy Regulatory Commission
IURC	The Indiana Utility Regulatory Commission
IEEE	The Institute of Electrical and Electronic Engineers
IEEE 1547	Standard for Interconnecting Distributed Resources with Electric Power Systems
ISO	An Independent System Operator … an organization concerned with the reliability, operation, and use of the transmission systems of its members
KREMC	Kosciusko REMC
NERC	The North American Electric Reliability Council, or its successors
Party(ies)	The Member and/or KREMC
Project	A facility including an electrical interconnection to KREMC's system, generation and/or load, and associated auxiliary equipment including controls and protective devices

RTO	Regional Transmission Operator
TP	Transmission Provider
UL1741	Standard for Inverters, Converters, and Controllers for use in Independent Power Systems

APPENDIX II

Protection Requirements for Members with SMALL GENERATING FACILITIES Operating in Parallel with Kosciusko REMC's System

Kosciusko REMC (KREMC) does not assume any responsibility for protection of the Member's generator(s), or any other portion of the Member's electrical equipment. The Member is solely responsible for protecting its equipment in such a manner that faults or other disturbances on the KREMC system do not cause damage to the Member's equipment.

To protect the integrity of KREMC's system and to maintain a safe operating condition, the Member shall provide, install, own, and maintain protective and control equipment capable of:

(a) immediately deactivating the generating equipment or disconnecting it from the utility's system in event of partial or total disruption of the utility's normal source of supply;

(b) protecting utility's equipment from damage due to overload or fault conditions;

(c) preventing re-energizing of the utility's system by Member's generating facilities; and

(d) preventing out-of-synchronization generation into the utility's system.

The actual equipment required to accomplish these functions depends on many factors including:

(a) Type of generator - induction, synchronous, DC plus inverter,

(c) Size of generator - A small generator is defined as any generator 10 kW or smaller; however, the deciding factor in interconnection protection would be the size of the generator relative to the Member's load and the amount of load that could be isolated with the generator,

(c) Voltage of KREMC system to which generator is connected,

(d) Grounding of Member's system or transformer at interconnection point and configuration of KREMC's distribution system.

<u>Induction Generator</u>

Induction generators receive their excitation from the utility system and, therefore, usually will not function when disconnected from the utility system. However, if power factor correction

capacitors are present which will supply excess VARS of from 1 to 5 times the induction generator excitation requirements, the generator is capable of self-excited operation if the connected load is within the capability of the prime mover. The voltage and frequency are determined by the load and excitation, not the speed of the generator, and may be far outside of normal limits.

If capacitors are used with the generator and associated facilities, they should be connected on the utility side of the generator circuit breaker. The protective equipment should be the same as normally used for an induction-motor of the same size. In addition, if the generator may become isolated by disconnection either in the member's or utility's system with load and capacitors that may permit self-excited operation, over-and-under voltage and over-and-under frequency relaying should be included.

Most three-phase distribution circuits employ singe-phase relaying and fault-clearing. Where a three-phase generator is served from a distribution circuit, one phase may be disconnected due to a fault. The generator will continue to receive excitation from the unfaulted phases and supply fault or load current to the isolated phase. The generator should be provided with a phase failure, voltage or current balance, or negative sequence voltage or current relay, which will detect the isolated phase condition and immediately disconnect the generator.

DC Generator and Inverter

The inverter used with a DC generator must be line commutated, if operated in parallel with the utility system, so that it is not capable of energizing a circuit that becomes disconnected from the utility system. Some invertors have an output current, which is high in harmonic content. This must not cause any adverse effect to other KREMC members. The inverter manufacturer should supply information on harmonic content which will be needed to assess system impact.

Synchronous-Generators

Synchronous-generators are capable of supplying fault current to the KREMC distribution system and supplying the connected load within the capability of the prime mover, if it becomes isolated from the KREMC distribution system.

The method of relaying the utility-member interconnection will vary substantially with the size of the generator, the amount of the Member's load, the method of connecting the generator into the Member's electric system, and the method of connecting the Member's system to the utility system.

If the generator is small compared to the total Member load, relaying may be provided to separate the Member's system upon loss of the utility service to allow the generator to continue serving part of the Member's load. This may be accomplished by directional overcurrent and underfrequency relays.

If the Member is served by a single line, relaying and a circuit breaker are required to clear faults on the Member's system from the utility system and to disconnect the generator from an isolated or faulted utility line. This may include any of the following:

- Phase and ground time and instantaneous overcorrect relays,
- Directional overcurrent relay,
- Voltage relays to detect a ground fault on ungrounded system,
- Underfrequency relay,
- Undervoltage or voltage balance relay.

If the Member's transformer is delta-connected on the utility side, the generator will supply no fault current after the utility terminals have opened for a ground-fault on the line. The generator terminal may be relayed by:

(a) voltage relays if the fault remains, or

(b) by directional overcurrent, undervoltage, or underfrequency relays if other utility loads remain on the isolated line, or

(c) by a directional relay detecting the exciting current of the transformer if the generator is able to maintain voltage and frequency.

The Member must sense a de-energized utility line and trip the interconnection breaker. The breaker must not reclose until voltage is restored to the line by the utility. The interconnection breaker should only reclose when the Member bus is dead and the utility source (KREMC transformer) is hot. The Member will be responsible for the necessary precautions before the breaker is reclosed, including synchronization of the cogenerator with the KREMC system.

If service is from a bus with two or more supply lines, the utility will specify the relaying required depending on the line and system configuration and Member requirements.

<u>Other Requirements</u>

Member shall provide, install, own, and maintain a switch capable of disconnecting the Member's generator from the utility's system without damage to the Member's or utility's equipment. This switch shall be accessible to and capable of exclusive control by KREMC at all times.

KREMC may elect to install, own, operate, and maintain a circuit breaker and protective relaying associated with the interconnection. If the Member is backfeeding a considerable amount of its excess power into KREMC, other system changes to the utility's facilities may be necessary. The Member shall bear that portion of the costs resulting from the additional equipment that must be installed to allow for parallel operation.

KREMC maintains the right to review the Member's interconnection plans to insure compliance with the stated requirements. The Member must submit such plans to KREMC for review prior to construction. KREMC should also be informed of the Member's construction schedule, including any changes thereto, and the initial testing of the generator and relays.