



**Kansas City Power & Light Company  
Westar Energy**

**Facility Interconnection Requirements**

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## Purpose

This Document was developed to comply with the North American Electric Reliability Corporation (NERC) Reliability Standard FAC-001 Facility Interconnection Requirements.

Facility interconnection and performance requirements are established to avoid adverse impacts on reliability. These requirements address interconnection requirements for Generation facilities, Transmission facilities, and End-User facilities. For ease of use, the initial numbered section headings in this document align with the requirement numbers in the FAC-001 Standard. Additional numbered sections provide specific interconnections requirement details for Evergy operating companies Kansas City Power & Light (KCP&L) and Westar Energy (Westar). Except in cases where specifically delineated, the requirements within the document are applicable to Generation facility, Transmission facility, and End-User facility interconnections.

This Document covers the requirements for interconnection to the transmission system within the KCP&L service territory in Missouri or Kansas, the KCP&L Greater Missouri Operations Company (GMO) service territory in Missouri and the Westar service territory in Kansas.

Requests for interconnection to the KCP&L distribution system are addressed in documentation that is available on the KCP&L Web site at [www.kcpl.com](http://www.kcpl.com). Requests for interconnection to the Westar distribution system are addressed in documentation that is available on the Westar Web site at [www.westarenergy.com](http://www.westarenergy.com).

KCP&L and Westar are members of the Southwest Power Pool, Inc. (SPP). SPP functions as Transmission Service Provider and Planning Coordinator for KCP&L and Westar. The primary responsibility for the interconnection process for generation and transmission is with SPP, with KCP&L and Westar as active participants in the process. The primary responsibility for the interconnection process for End-User facilities is with KCP&L and Westar. The SPP Open Access Transmission Tariff (OATT) and Planning Criteria documents address the interconnection process, planning study requirements, and facility interconnection requirements specific to the SPP transmission system. The SPP OATT and Planning Criteria can be accessed via the SPP website at [www.spp.org](http://www.spp.org). Interconnection Customers should review the SPP documents for specific SPP interconnection requirements and processes.

This Document is intended to highlight KCP&L and Westar requirements and not to fully replicate or replace the SPP documentation. In addition, the SPP OATT provides the Interconnection Agreement (IA) that is utilized by KCP&L/Westar and includes several interconnection requirements. It is expected that all generation and transmission interconnection requests are directed to SPP.

References to NERC Reliability Standards are made throughout this Document. The referenced NERC Reliability Standards can be found at <http://www.nerc.com/>.

All interconnections to the KCP&L and Westar transmission system must be alternating current (AC) at a nominal frequency of 60 hertz (Hz). For KCP&L and Westar, transmission facilities are defined as those electrical facilities operating at 60 kilovolts (kV) or higher. Nominal transmission voltages used by KCP&L and Westar are 345kV, 230kV, 161kV, 138kV, 115kV, and 69kV.

This Document is reviewed and updated by a cross-functional team of subject matter experts within Evergy not less frequently than annually. It will be approved by the Manager of

Transmission Planning and the Senior Director of Transmission Operations and T&S C&M. It will be publicly posted to the KCP&L and Westar OASIS websites and provided on the KCP&L and Westar corporate websites.

## Definition of Capitalized Terms

Capitalized terms used in this Document will follow the definitions in the NERC Glossary of Terms first, the SPP Tariff second, or as defined below, third.

**Company:** Company shall mean Kansas City Power & Light (KCP&L) or Westar Energy (Westar).

**Customer:** Customer shall mean a person or entity responsible for ownership, operation and maintenance of facilities interconnected with Company facilities.

**Distribution:** Distribution shall mean Company facilities less than 60 kV (phase to phase voltage).

**Document:** Document shall mean this Evergy Facility Interconnection Requirements document.

**End-user:** End-user shall mean a retail customer of KCP&L or Westar connecting to the Transmission System of KCP&L or Westar. End-user facilities shall comply with all provisions of General Facility Interconnection Requirements and all provisions of Transmission Facilities Interconnection Requirements. For purposes of Standard FAC-001-3, KCP&L and Westar as a Distribution Providers shall also comply as an End-user.

**Facility Interconnection:** Facility Interconnection shall mean the point where Company and Customer's facilities physically meet.

**Generating Source:** A Generating Source is defined to exist when ANY of the following conditions are met:

- A. Customer's facilities can produce sustained watt or var flow into Company's facilities at the closed Facility Interconnection.
- B. Customer's facilities can energize Company's facilities across the Facility Interconnection at sustained levels of fifty-one (51) volts or more during times when the Company's source is de-energized.
- C. Customer's facilities can energize the Facility Interconnection with sustained voltage magnitude and frequency quantities, which differ from Company values.
- D. Customer's facilities can contribute sustained fault-current to Company's facilities at the Facility Interconnection.

Note: Sustained shall mean to be more than one (1) second duration.

## 1. General Facility Interconnection Requirements

Facility Interconnection with KCP&L/Westar's electric transmission and distribution facilities may be permitted provided such interconnection complies with the procedures and requirements set forth herein.

Interconnection of Customer facilities with KCP&L/Westar's facilities shall be governed by all applicable Local, State, and Federal statutes. In addition, Customer's facilities shall be installed in accordance with all provisions set forth in Company's Facility Interconnection Requirements, KCP&L/Westar's Service Standard, National Electrical Safety Code (ANSIC2), National Electrical Code (NFPA70), North American Electric Reliability Corporation (NERC) Reliability Standards, Regional Reliability Organization, American National Standards Institute (ANSI), Institute of Electrical and Electronics Engineers (IEEE), or other Regulatory or Governing Body having jurisdiction. Interconnection of Customer's facilities with Company's facilities shall further be governed by any applicable statute, rule, order, provision, guide, or code of an organization, council, and institute, regulatory or governing body having jurisdiction over such matters.

Customer shall be responsible for all engineering studies, design, modeling data, and installation, required for interconnection with Company's facilities. System studies shall be completed through the Long-term Planning horizon.

Generation interconnection shall be subject to Attachment V of the SPP Tariff. Transmission interconnection shall be subject to SPP Planning Criteria 5.5 and Appendix PL-6. End-User load additions/modifications shall be subject to Attachment AQ of the SPP Tariff.

Customer shall be responsible for compliance with all permits, licenses, fees, rules, regulations, standards, agreements, ordinances, inspections, and other requirements imposed by KCP&L/Westar or any regulatory or governmental body having jurisdiction. There is no obligation on the part of the Company to interconnect, or to remain interconnected when Customer's facilities are out of compliance. In addition, Customer shall be responsible for and Company shall require Customer facilities or the interconnection between Customer's facilities and Company's facilities to be modified in accordance with all applicable statutes, rules, orders, provisions, guides, or codes of an organization, council, institute, regulatory or governing body having jurisdiction over such matters.

Because of increased risks and potential hazards inherent with operating Customer's facilities interconnected with Company's facilities, overall safety for life, quality of service and property is paramount. Company shall disconnect Customer's facilities anytime Customer's facilities pose a dangerous condition, and such disconnection is appropriate to protect safety of Company's employees, customers, general public, or to maintain integrity of the Company's facilities.

Customer should be aware that under certain circumstances it may be possible for damage to occur to Customer's rotating equipment. This vulnerability to possible equipment damage includes aurora or a nearby fault on the system. Customer shall review Customer's equipment for potential susceptibility.

Customer shall provide Company a minimum, unless otherwise agreed to by the Company, of one hundred and twenty (120) days written notice of its intent to interconnect facilities with the Company's system. Failure to give such notice shall render Customer liable for all damages to

Company property, other customers' property, and injury to persons, or any other damages resulting from unauthorized interconnection.

Notice of intent to interconnect by the Customer shall be made by providing the appropriately completed Interconnection Application to the Company as detailed in Forms A (inverter-based generation up to and including 25 KW) or B (non-inverter based generation and inverter-based generation >25kW) of this document.

Requests to install a Facility interconnection shall be submitted by mail or email to:

**Retail Services:**

Kansas City Power & Light  
Energy Solutions  
P.O. Box 418679 Kansas City, MO 64105  
816-242-5971

**Wholesale Services:**

Kansas City Power & Light  
Manager Transmission Planning  
P.O. Box 418679  
Kansas City, MO 64105  
[longtermplanning@kcpl.com](mailto:longtermplanning@kcpl.com)

Within thirty (30) days of submitting a written request to interconnect facilities, but not less than ninety (90) days prior to facility interconnection, the Company shall submit to Customer preliminary general equipment requirements such as breaker(s), switches, supervisory control and data acquisition (SCADA), and existing Company facility protection scheme, required for Customer to proceed with Facility interconnection design. In addition, Company shall notify Customer of costs to evaluate the proposed Facility Interconnection.

Within sixty (60) days of receipt of a complete copy of Customer's detailed engineering studies, design specifications, proposed protective relaying schemes, and payment of costs for evaluation, Company shall review, perform analysis, and notify Customer of approval and/or conditions for acceptance. The engineering analysis shall include a review/evaluation of the following (as applicable):

- A. After the customer supplies SPP and Company with the approximate geographic location and the desired megawatt (MW) and megavolt-amp reactive (MVAR) capacities at the point of interconnection, SPP and Company will exercise engineering judgment and the results of engineering studies to determine appropriate voltage levels, interconnection points, and system capabilities for the point of interconnection, since the most practical voltage and interconnection points are site and project specific.
- B. Breaker duty – All facilities and equipment must equal or exceed the fault duty capability necessary to meet system short-circuit requirements as determined through short-circuit analyses and should fully comply with the latest American National Standards Institute (ANSI)/Institute for Electrical and Electronics Engineers (IEEE) C37 collection of standards for circuit breakers, switchgear, substations, and fuses. To maintain transmission reliability, each fault-interrupting device must be rated for full fault-interrupting capability to satisfy the short-circuit level requirements at the point of interconnection. Full fault-interrupting capability is per the latest IEEE C37 and C57

collections of standards. Generally, neither party should depend on the other for the protection of their respective equipment.

- C. Insulation coordination - Insulation coordination must be done properly to ensure electric system reliability and personnel safety. Basic switching surge levels, surge arrester, conductor spacing and gap application, substation and transmission line insulation strength, protection, and shielding shall be documented and submitted for evaluation as part of the interconnection plan.

Interconnection facilities to be constructed in areas with salt spray contamination or other type of contamination shall be properly designed to meet or exceed the performance of facilities not in a contamination area with regard to contamination caused outages.

Equipment basic impulse surge levels (BIL) shielding and surge protection shall be designed to meet the latest IEEE C62 standards, along with Company standards.

Surge Protection shall be installed to ensure that damage to Company or to Customer resulting from transient disturbances is minimized to the extent practical. Surge protection shall conform to NESC Section 19, Section 124A, and Section 171 as applicable.

- D. System protection and coordination – Protective relaying systems and associated communications systems for all facility interconnections shall be planned, designed, constructed, and maintained in accordance with applicable NERC, SPP, and Company standards. Utility grade protective relays and fault clearing systems are to be provided on the interconnected power system. All protective relays shall meet or exceed ANSI/IEEE Standard C37.90.

Adjoining power systems may share a common zone of protection between two parties. The design must provide coordination of speed and sensitivity to maintain power system security, stability, and reliability.

The protection system (protective relays, associated communication systems, voltage and current sensing devices, station batteries and DC control circuitry) arrangement selected by the Customer must be compatible with the protections system used by Company to protect the transmission grid. Compatible relaying equipment must be used for a given zone of protection. Compatibility includes protection application, redundancy, operating speed, communication type, and communication medium.

A power source for tripping and control must be provided for the protection system by a DC storage battery. The battery is to be sized with enough capacity to operate all tripping devices after eight hours without a charger, per IEEE standards. An under-voltage alarm must be provided for remote monitoring by the facilities owners, who shall take immediate action to restore power to the protective equipment.

Mechanical and electrical logic and interlocking mechanisms are required between interconnected facilities to ensure safe and reliable operation. These include, but are not limited to, breaker and switch auxiliary contacts, synch-check relays, and physical locking devices.

The Customer (generator, transmission, end-user) is responsible for providing a protection system that will protect its equipment against disturbances on Company system and minimize the effects of disturbances from its facilities on Company equipment and transmission system. Entities connecting to the Company transmission

system shall investigate and keep a log of all protective relay actions and mis-operations, as required by NERC and SPP. In addition, the interconnecting entities must have a maintenance program for their protection systems in accordance with NERC Reliability Standards. Documentation of the protection maintenance program shall be supplied to Company, SPP, and NERC upon request. As outlined in the maintenance program, test reports are to be made available for review by Company. At intervals described in the documented maintenance program and following any apparent malfunction of the protection equipment, the Interconnecting Customer shall perform both calibration and functional trip tests of its protection equipment as outlined by NERC.

#### Generator Protection Requirements

Generators interconnecting to the Company transmission system are responsible for protecting those facilities from electrical faults and other hazardous conditions.

Generator interconnections must be equipped with circuit breakers or other appropriate interrupting devices to protect those facilities. The generator owner is required to provide and own the primary circuit breaker or other interrupting device that protects the facility and disconnects it from the Company transmission system. The primary purpose of this interrupting device is to protect the generating plant facility. GI is required to follow IEEE standard C37.102 for generator relay settings.

Synchronous or wind turbine generators connected to the Company transmission system shall be able to withstand certain temporary excursions in voltage, frequency, and reactive and real power output without tripping. A System Impact Study will determine if the generator will trip during temporary excursions. Generation must ride through temporary excursions to support the grid and avoid cascading events.

It is recognized that certain circumstances may exist that necessitate the imposition of performance criteria that is considered more stringent than the default criteria specified above. Such circumstances shall be identified during the conduct of the System Impact Study or operational study for each particular generator.

#### Transmission Protection Requirements

All transmission power systems shall have a dual protective relaying scheme that provides both primary and backup coverage of the remote bus. Communications-aided tripping using a dedicated communications channel may be required based on system stability determination. Communications redundancy may be required depending on critical clearing time. A transfer trip may be required for backup protection and islanding schemes. TI is required follow IEEE standard C37.113 for transmission line relay settings.

Backup protective systems should provide additional coverage for breaker and relay failure outside the primary zone. Backup systems shall operate for failures on either side of an interconnection point. Time and sensitivity coordination must be maintained to prevent mis-operations.

Fiber optics is the preferred means of relay communications; however, microwave and power line carrier may also be used for relay communications. Audio tone over phone line is the least preferred method because it may not meet requirements for speed and reliability.



Each fault-interrupting device must be rated for full fault-interrupting capability to satisfy the short-circuit level requirements at the point of interconnection. Neither party shall depend on the other for the protection of their respective equipment. All protective devices shall coordinate as described in Attachment A or Attachment B of this Standard depending upon the type of interconnection.

- E. Metering and telecommunication requirements – Metered data shall be telemetered to a location designated by SPP and location as designated by Company unless alternate satisfactory telemetered locations are agreed to by the Company and Interconnection Customer.

Interconnecting Customers that will be a market participant shall install metering that shall be of sufficient quality to meet the requirements as defined by SPP OATT.

For interconnections in the state of Kansas, Interconnection Customer may be required to take service for auxiliary use/station power from the local retail electric service provider.

#### Revenue Metering Guidelines

For the purposes of this document, revenue metering shall refer to the meter or meters used for billing purposes and the associated current transformers and potential transformers (collectively known as “instrument transformers”), communications equipment, and wiring between these devices. The basic configuration consists of directional revenue grade metering (import and export) at each point of interconnection with the Company system. Additional separate revenue metering for the gross output of the generation and for auxiliary retail loads may be required, depending on the generation capacity, telemetry requirements, applicable contractual provisions and associated tariffs. All generation and auxiliary retail load metering shall have the ability to connect to an Automated Meter Reading (AMR) system.

Before the purchase or fabrication of revenue metering equipment, four sets of each of the following information is required to be submitted to Company for review and acceptance:

- Overall Electrical Single-Line Drawing, showing location of revenue metering equipment.
- Switchgear Single-Line Drawing, showing location of revenue metering transformer compartment.
- Physical Metering Transformer Compartment drawing, showing the layout of revenue metering current transformers and potential transformers.
- If the installation utilizes a stand-alone current transformer cabinet, the manufacturer’s drawing, showing the catalog number and address at which its use is intended.
- Estimated generation capacity and auxiliary retail loads.

Company shall install, calibrate, test, and maintain revenue quality metering in accordance with applicable ANSI Standard C12. Interconnections for Wholesale Service shall utilize revenue quality metering in accordance with applicable ANSI Standard C12, Form B of the Southwest Power Pool Market Protocols and all such data shall be telemetered to the Transmission Customer or Distribution Service Provider as applicable.

- F. The ratings of Customer’s facilities connecting at 60 kV or higher voltage shall be determined in accordance with SPP Planning Criteria 7 and provided to Company for verification. Company’s facilities are rated according to the KCP&L/Westar Facility Rating Methodology posted on OASIS.
- G. Phasor Measurement Unit requirements - Company shall review the PMU design. See Attachment C for PMU specs.

Should Company be unable to evaluate Customer’s request to interconnect as submitted, Company shall provide Customer a written explanation of information required to complete the evaluation.

Grounding and safety issues - All new interconnecting Facilities shall strictly adhere to established Company switching, tagging and grounding procedures as required for the safety of people and equipment. Any work carried out within a facility shall be performed in accordance with all applicable laws, rules, and regulations and in compliance with Occupational Safety and Health Administration (OSHA), National Electric Safety Code (NESC) and good utility practice. The interconnecting facility ground grid shall, where applicable, be designed to IEEE 80 - “IEEE Guide for Safety in AC Substation Grounding”, and shall be measured in accordance with IEEE 81 - “Part 1: Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Potentials” and Part 2: “Measurement of Impedance and Safety Characteristics of Large, Extended or Interconnected Grounding Systems”. Interconnection Facility grounding requirements shall also comply with the NESC Section 9 “Grounding Methods, and, where appropriate, IEEE 665 - “Guide for Generating Station Grounding”, IEEE 837 - “Standard for Qualifying Permanent Connections Used in Substation Grounding”, IEEE 487 - “Protection of Wire-Line Communication Serving Electric Power Stations”, IEEE 367 - “IEEE Recommended Practice for Determining the Electric Power Station Ground”. This grid shall also limit the ground potential gradients to such voltage and current levels that will not endanger the safety of people or damage equipment which are within, or immediately adjacent to, the station under normal and fault conditions. All transmission line structures shall be adequately bonded and grounded to control step and touch potential in compliance with the NESC, and shall provide adequate lightning protection performance. Customer shall obtain ground resistance measurements using procedures specified by IEEE 81 and shall submit information to Company for review and verification.

Power Quality impacts - At no time shall the operation of the Interconnecting Customer facility, including associated generators or any of their auxiliary devices as applicable, result in an electrical output in which harmonic distortion exceeds the recommended limits contained in IEEE Standard 519, which defines voltage waveform and harmonic content. Planning Level indices for voltage flicker will be governed by IEEE Standard 1453. Company criteria for voltage flicker and harmonic distortion at 161kV, 138kV, 115kV, or 69kV bus must meet the following criteria.

Flicker level (short term)	$P_{st95\%} \leq 0.8$
Flicker level (long term)	$P_{lt95\%} \leq 0.6$
Total harmonic voltage distortion	$THVD \leq 2.5 \%$
Individual harmonic voltage level	$\leq 1.5 \%$

Inductive power factor, monthly average	$\cos \phi \geq 0.98$
Voltage fluctuation	$\Delta U \leq 1.0 \%$

Only written notice shall constitute acceptance by Company. Written approval by Company does not waive any requirements pertaining to Customer's installation which may be governed directly by other jurisdictional bodies. Company's specifications and requirements are designed towards protecting the safety of life, quality of service and the Company's property, and do not assume nor ensure proper protection of Customer's facilities equipment during electrical fault.

When Company is required to incur expenses necessary to make extensions or improvements of its lines or additions to its disconnecting devices, transformers, meters, breakers, relays, controls, data systems, or to make any other equipment modifications relating to its circuits, substations, or apparatus necessary to connect Customer's facilities, and such expenses made are attributable to this application, then all costs incurred by Company for Facility Interconnection shall be borne by Customer as set forth in the interconnection agreement.

Customer and Company shall execute appropriate agreements for interconnected service prior to installation of any equipment. Energy supplied to Company, as well as energy used by Customer, shall be compensated in accordance with applicable tariffs, rules, and regulations currently on file with the regulatory body having jurisdiction, or which may be filed and approved by the regulatory body having jurisdiction.

Company may require Customer's facility design to include an appropriate automatic disconnecting device to be controlled by any or all of the following: overcurrent relays, automatic synchronizing relays, voltage relays, frequency relays, ground fault detection relays, or any other automatic relaying equipment necessary to ensure proper protection and safety of Company employees customers, equipment, and overall system integrity. The Company reserves the right to review, inspect, and approve Customer's design and shall not give approval to connect until any concerns relating to Customer's design has been remedied. Refer to Attachment A, "Relay Standard for Connected Generating Facilities", and Attachment B, "Relay Standard for Connected Load Facilities" for assistance in fulfilling the requirements of this paragraph.

Company shall procure, install, and maintain all metering equipment required to measure energy exchanged between Customer and Company across the Facility Interconnection, unless otherwise agreed to by Company. Energy shall normally be measured at delivery voltage; however, Company reserves the right to locate its metering at a place other than the Facility Interconnection and adjust for losses as appropriate.

## 1.1. Generator Interconnection Requirements

The Customer that is requesting a Generating Source Interconnection (GI) that may inject current on to the Company transmission system must follow the Generator Interconnection Procedures of Attachment V of the Southwest Power Pool Open Access Transmission Tariff.

Company functional relay requirements will be provided to the Customer during the detailed design phase of the project. The information for the specific project will indicate the protective functions for which the Customer is to provide relays and related equipment.

The Customer will indicate the specific relay type(s) and range proposed for each function.

The Customer must also provide proposed current and potential transformer ratios, connections, and locations as related to the electrical one-line diagram.

Customer design documents (electrical prints, relay settings, etc.) will be reviewed by Company in coordination with SPP. Project delays due to untimely submittal of complete design documents are the responsibility of the GI. These must be of good engineering quality and include the following:

- One-line diagram showing the interconnections between the generator(s) and the Company system
- Three-line diagrams showing current and potential circuits for protective relays
- Relay tripping and control schematic diagram
- Relay setting files
- Instruction books for relays
- Completed Form A or Form B of this Document as applicable

Additional engineering meetings may be necessary to discuss the design documents. If changes are necessary, the Customer is required to incorporate all changes and corrections and submit three sets of corrected prints to Company before proceeding with construction.

### 1.1.1 General Requirements for interconnection of Generating Sources

- 1.1.1.1. Generating Source(s) 25 kW and larger shall be three (3) phase to qualify for Facility Interconnection with Company's facilities.
- 1.1.1.2. Generating Source(s) shall not supply sustained fault current to Company facilities.
- 1.1.1.3. Generating Source(s) shall not close or reclose automatically onto a de-energized Company Facility Interconnection.
- 1.1.1.4. Disconnecting equipment shall have a visible break between Customer and Company facilities for connections 600 volts and above.
- 1.1.1.5. Company shall determine the acceptable minimum aggregate power factor at Facility Interconnection. Appropriate billings,

payments, or adjustments to compensate Company shall be specified in the Facility Interconnection agreement.

- 1.1.1.6. Customer Standby or Emergency Generating Sources will require no special relaying or metering when installation is designed to prevent “hot transfer of Customer’s load” going “on” or “off” from the Standby source to the Company’s facilities, provided all requirements can be handled with control circuit interlocks.
- 1.1.1.7. Supervisory Control and Data Acquisition (SCADA) may be required by Company to connect Generating Source(s) to Company facilities.
- 1.1.1.8. Generating sources that participate in the Southwest Power Pool Energy Imbalance Market shall install metering and telecommunications equipment compliant with Form B of the Southwest Power Pool Market Protocols.
- 1.1.1.9. Any electrical structure or equipment utilized for high-voltage service shall be connected to an earth-ground grid that measures no more than 0.6 ohms resistance to earth. Such value shall be measured with equipment and techniques approved by the Company and shall be certified by a measuring contractor qualified for this service. The connectors and components of the grounding grid shall be adequate for the anticipated short-circuit current magnitude and duration.
- 1.1.1.10. Generating sources requesting Wholesale Service shall comply with the Southwest Power Pool Attachment V of the Regional Open Access Transmission Tariff.
- 1.1.1.11. In instances where the Customer installs PMU equipment, it shall be designed to the specifications as described in Appendix C.
- 1.1.2. Synchronous Generating Source(s) shall utilize three-phase circuit breakers that meet or exceed the following requirements:
  - 1.1.2.1. Rated for 2.0 per unit voltage across open contacts.
  - 1.1.2.2. Interrupt maximum available fault currents between Customer’s Generating Source(s) and Company’s facilities.
  - 1.1.2.3. Open for frequency and voltage deviations specified by Company.
  - 1.1.2.4. Utilize synchronism check within +/- 10 degrees and +/- 5 percent of nominal voltage on each side of the breaker prior to closing the breaker between Company and Customer’s facilities.
  - 1.1.2.5. Provide ground fault detection and tripping for breaker anytime an ungrounded circuit configuration exists as the result of opening the Company’s source to the Facility Interconnection.

- 1.1.2.6. Continuously monitor breaker control power source.
- 1.1.3. Induction Generating Source(s) shall utilize three-phase circuit breakers that meet or exceed the following requirements:
  - 1.1.3.1. Company shall specify frequency and voltage deviations to Customer for which circuit breaker shall open.
  - 1.1.3.2. Breaker control power source shall be continuously monitored.
- 1.1.4. Generating Source(s) Facility Interconnections - 5000 kVA and Greater
  - 1.1.4.1. Generating Source(s) shall operate with excitation systems in automatic voltage-control mode.
  - 1.1.4.2. Generating Source(s) shall maintain reactive power output as required by the Company within the demonstrated reactive capability of the unit.
  - 1.1.4.3. Generating Source(s) shall be capable of operation at over-excitation power factor of 0.9 and under-excitation power factor of 0.95 at all rated continuous power output levels as measured at the generator terminals.
  - 1.1.4.4. In addition to the protection described in 6.15, Generating Source(s) shall include current differential protection around the generator and/or the generator step-up transformation as well as protective functions designed for the specific type of generator. For example, protection for rotating generators shall include reverse power, loss of field, negative sequence current, and inadvertent energization. Refer to IEEE C37.102 – “IEEE Guide for AC Generator Protection.”
- 1.1.5. Generating Source(s) Facility Interconnections – Distribution
  - 1.1.5.1. Customer shall protect Generating Source(s) from the effects of automatic reclosing of Company facilities.
  - 1.1.5.2. No distribution circuit shall have greater than 10% of its rated capacity as installed generation unless otherwise approved by Company.
  - 1.1.5.3. Where network protectors (in lieu of circuit breakers), are utilized by Company, Customer shall not inject power onto Company’s system.
- 1.1.6. Transitional Switching of Generating Source(s)
  - 1.1.6.1. Customer may be permitted to utilize approved methods of transitional switching for the purpose of making a synchronized transfer of Customer’s load between Customer’s Generating Source(s) and Company’s facilities. Such transitional switching shall require automatic synchronizing equipment and high-speed switching devices specifically designed to synchronize Customer’s Generating Source(s)

to the Company for the sole purpose of “hot” transferring the Customer’s load “On” or “Off” the Company’s facilities.

1.1.6.2. All Customer requests for transitional switching shall be approved by Company and accomplished in such a manner as not to exceed one (1) second as the maximum time Customer’s Generating Source(s) operates connected with Company’s facilities.

1.1.6.3. Customer shall be responsible for all costs associated with transitional switching.

#### 1.1.7. Commissioning of Generating Source Interconnection

1.1.7.1. Company may measure and document the harmonics present at the Facility Interconnection before and after such connection is made.

1.1.7.2. Company reserves the right, but does not assume the duty, to inspect, test, or check Customer’s equipment in any way deemed appropriate to confirm operation and verify system protection characteristics. Company does not assume any responsibility regarding Customer’s equipment or the inspection thereof.

1.1.7.3. Metering equipment shall be verified by Company or its designated agent.

1.1.7.4. Only after all required inspection or testing is complete shall Generating Source be synchronized to Company’s facilities.

#### 1.1.8. Generating Source Operating Requirements

1.1.8.1. Customer agrees to respond to Company requests during abnormal conditions, including abnormal frequency and abnormal voltage.

1.1.8.2. Customer agrees to coordinate maintenance activities with Company as defined.

1.1.8.3. Customer shall ensure competent personnel are available to operate, maintain, and repair connected generating equipment at all times when such equipment operates in parallel with Company’s facilities.

1.1.8.4. Company may require connected generating sources to have both normal and emergency paths for supervisory control, metering, or voice communications systems.

1.1.8.5. Automatic under-frequency load shedding may be required by the Company. Load serving providers shall be required to provide the Company with a documented manual load shed plan.

1.1.8.6. Customer shall provide all available operating data upon request.

## 1.2. Transmission Interconnection Requirements

Company's electrical facilities include transmission lines operating at voltage levels of 60 kV and higher. Higher voltage levels require stringent standards of security, reliability, quality, and controllability of the electrical facilities.

### 1.2.1. Transmission Facilities - General Requirements

- 1.2.1.1. Any electrical structure or equipment utilized for high-voltage service shall be connected to an earth-ground grid that measures no more than 0.6 ohms resistance to earth. Such value shall be measured with equipment and techniques approved by the Company and shall be certified by a measuring contractor qualified for this service. The connectors and components of the grounding grid shall be adequate for the anticipated short-circuit current magnitude and duration. Transmission facility grounding shall be designed to IEEE 80. Depending upon the application, grounding shall also comply with IEEE 665 - Guide for Generation Station Grounding, IEEE 837 - Standard for Qualifying Permanent Connections Used in Substation Grounding, IEEE 487 - Protection of Wire-Line Communications Serving Electric Power Stations, and IEEE 367 - Recommended Practice for Determining the Electric Power Station Ground.
- 1.2.1.2. Supervisory remote control and electrical metering shall be provided using devices and communications paths specified by the Company. Such equipment shall be proven operational before electrical operation begins.
- 1.2.1.3. Maintenance at the Facility Interconnection shall be coordinated with the Company.
- 1.2.1.4. Customer's facility will be supplied from Company's Transmission System, which generally under system normal steady state conditions can have voltages that range between 95 percent and 105 percent of nominal. If the Customer's supply voltage requirements are more restrictive than the 95 percent to 105 percent range Company recommends that the Customer install appropriate voltage regulation equipment in Customer's facility.
- 1.2.1.5. Customer's facility when interconnected to Westar's Transmission system, which under single transmission element outage conditions can have steady state voltages that range between 93 percent and 105 percent of nominal for transmission voltages between 69-200 kV and 95 percent and 105 percent of nominal for voltages above 200 kV. If the Customer's supply voltage requirements are more restrictive than the ranges above, Company recommends that the Customer install appropriate voltage regulation



equipment in Customer's facility. Customer's facility when interconnected to KCP&L's Transmission system can experience steady state voltages that range between 90 percent and 105 percent of nominal for transmission voltages during single transmission element outage conditions. If the Customer's supply voltage requirements are more restrictive than the ranges above, Company recommends that the Customer install appropriate voltage regulation equipment in Customer's facility

- 1.2.1.6. Customer's facility will be supplied from Company's Transmission system, which under abnormal or fault conditions (and special configurations) will provide temporary under or over voltages. These voltages could be in the range of 0-180% of nominal. Customer's and Company's systems will be designed to safely "ride-through" these occurrences. The Customer's system shall be designed and maintained to minimize these occurrences. If more than five events occur in a rolling year period and are attributed to the Customer's system, then a review by the Company will be performed to determine if there is system reliability or system integrity issue. If the Customer's system is found to be at issue, the Customer will provide a plan to repair/upgrade their system, or remove the cause of the events.
- 1.2.1.7. Customer's facility will be supplied from Company's Transmission System and Customer should plan and design their systems to operate at a power factor within the range of 0.98 lagging to 0.98 leading at all times.
- 1.2.1.8. Switched shunt capacitors generally provide an effective means of controlling the power factor of an Customer's facility. Factors to be addressed when applying capacitors include, but are not limited to, transient overvoltages due to capacitor switching and steady state increases in voltage distortion due to resonance conditions. Transient overvoltages shall be limited to less than 130% of nominal zero-to-peak voltage and decay within one 60Hz cycle. Specialized switch types shall be used to mitigate capacitor switching transients. The services of a qualified consultant should be obtained by Customer to review the specific application and provide recommendation in regard to control of these phenomena.
- 1.2.1.9. Certain electrical equipment located at the Customer's facility will generate voltage flicker, notching and / or harmonic distortion that can negatively impact other transmission users. Definitions and limits for current and voltage harmonic distortion are as published in the latest issuance of IEEE 519 - "Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems."
- 1.2.1.10. Company requires that voltage flicker occurring at Facility Interconnection shall remain below the Border Line of Visibility curve on the IEEE/GE curve, referenced for example in IEEE 141 - "IEEE Recommended

Practice for Electric Power Distribution for Industrial Plants” and IEEE 519, for fluctuations less than 1 per second or greater than 10 per second and shall remain below 0.4 percent in the range 1 to 10 fluctuations per second. Further, Customer may be required to meet specific requirements of the IEEE 1453 - “IEEE Recommended Practice for Measurement and Limits of Voltage Fluctuations and Associated Light Flicker on AC Power Systems” in special cases dictated by Customer’s load or generation profile.

- 1.2.1.11. Total Harmonic Voltage Distortion shall be in compliance with IEEE 519.
  - 1.2.1.12. The ratings of Customer’s facilities shall be consistent with the requirements of SPP Planning Criteria 7.2. The ratings of Customer’s facilities shall be provided to Company upon request.
  - 1.2.1.13. Voltage Unbalance, as calculated using the ANSI C84.1 formula, shall be limited to 1% or less at all times during system normal operation by the Customer.
  - 1.2.1.14. Customer and Company have the obligation to ensure that Facility Interconnection is configured in such a way to mitigate the probability of a ferroresonance event. Ferroresonance is a complex electrical phenomenon. It occurs on the power system (usually at distribution voltage levels) under certain system configurations that may damage high voltage equipment. Some mitigation measures on the transmission system that will be used are coordinated relay protection, redundant primary relay protection, and installing gang operated switches. The Customer will be knowledgeable of conditions that increase the possibility of ferroresonance as well as procedures and equipment that mitigate and/or lessen the chances for this system condition to occur.
  - 1.2.1.15. Revenue interconnection metering shall not use CCVTs.
  - 1.2.1.16. In instances where the Customer installs PMU equipment, it shall be designed to the specifications as described in Appendix C.
- 1.2.2. Transmission Facilities - 60 kV through 200 kV Requirements
- 1.2.2.1. Multiple remote-controllable line-sectionalizing switches or circuit breakers with protective relays may be required at Facility Interconnection.
  - 1.2.2.2. Transformers capable of serving load greater than 14.0 MVA shall be controlled by a primary circuit-switcher or circuit-breaker with appropriate protective relaying.
  - 1.2.2.3. Structures at the Facility Interconnection may be required to be of steel construction.
  - 1.2.2.4. Sectionalizing devices may require load breaking and/or fault interrupting capability.
  - 1.2.2.5. Protective relay schemes of Customer shall be integrated to operate with protective relay schemes on Company facilities.

- 1.2.2.6. Protective relaying shall include both primary and backup schemes.
- 1.2.2.7. The BIL of equipment installed shall conform to the minimum of: 69 kV – 350 kV BIL; 115 kV – 550 kV BIL; 138 kV – 650 kV BIL; and 161 kV – 750 kV BIL.

#### 1.2.3. Transmission Facilities - 200 kV and Higher Requirements

- 1.2.3.1. All requirements for lower-voltage transmission facilities shall apply. In addition, the following requirements shall apply:
- 1.2.3.2. Substation design shall be ring-bus or breaker-and-a-half configuration.
- 1.2.3.3. Control power shall be supplied from redundant DC supply systems.
- 1.2.3.4. Protective relaying shall include dual primary schemes.

### 1.3. End-User Interconnection Requirements

The Customer that is requesting End User Interconnection (EU) is responsible for designing, installing, operating, and maintaining its own equipment in accordance with Good Utility Practice(s), the National Electrical Code, the National Electrical Safety Code (NESC), NERC, SPP, any applicable independent system operator, and all applicable laws and regulations. This includes installing, setting, and maintaining all protective devices necessary to protect the customer's facilities. The requirements specified in this Document are designed to only protect Company facilities and to maintain transmission system reliability. The EU is responsible to coordinate with Company during the engineering / detailed design phase of the project in order to ensure coordination of protective relay devices.

End-user facilities shall comply with all provisions of General Facility Interconnection Requirements (Section 1 above) and all provisions of Transmission Facilities Interconnection Requirements (Section 1.2 above).

End-user facilities shall be documented and coordinated by specific System Planning studies, and by studies performed pursuant to Southwest Power Pool Open Access Transmission Tariff – Attachment AQ.

## 2. Generator Owner Interconnection Requirements

Company shall maintain and update this Document as required and will make it available upon request within 45 calendar days of full execution of an Agreement to conduct a study on the reliability impact of interconnecting a third-party Facility to the Company's existing Facility that is used to interconnect to the Transmission System.

## 3. Transmission Owner Procedures & Notifications

Procedures and Notifications associated with Customer interconnections with Company transmission system are detailed in the following sections.

### 3.1. Procedures for Coordinated Studies

Company is member of SPP Regional Transmission Organization (RTO). One of the many functions of SPP is to coordinate joint studies of new facilities and their impacts on the interconnected transmission system. Company actively participates in these processes. The process is described in the SPP OATT which is available on the SPP website.

The impact of the Customer interconnection on the reliability of the interconnected transmission system shall be evaluated. Studies are performed by SPP in conjunction with Company and in accordance with established NERC, SPP and Company Transmission Planning Criteria. The SPP OATT includes attachments that define the data requirements for interconnection Feasibility and System Impact Studies. Generators and Transmission Interconnection Customers should refer to the SPP OATT for specifics. Data is to be submitted as provided in the SPP OATT.

Generator Interconnection (GI) requests must proceed through the SPP generator interconnection process. Generator Interconnection Procedures (GIP) are detailed in the SPP OATT Attachment V, Generator Interconnection Procedures Including Generator Interconnection Agreement. Three levels of system studies are defined in the GIP; 1) Feasibility, 2) System Impact, and 3) Facilities. These series of studies are performed to determine the impact of the generator interconnection request on the transmission system. The study results include identification of solutions to any identified reliability violations. The results of these targeted studies are posted to the SPP website.

Transmission interconnections are analyzed as SPP performs annual studies to evaluate transmission system reliability as part of its Integrated Transmission Planning (ITP) process. As part of the evaluation process it may be determined there is a need for additional system reliability support across multiple interconnected transmission owner facilities. Solutions to identified reliability issues are developed by the affected transmission owners in coordination with SPP. The study results and resultant solutions identified are documented in the annual SPP Transmission Expansion Plan (STEP) and posted to the SPP website. Transmission Owner to Transmission Owner interconnections are evaluated in accordance with SPP Planning Criteria<sup>1</sup> 5.5 and Appendix PL-6.

End-Users looking to interconnect to the Company transmission system are required to complete a Service & Meter application. For KCP&L, reference the *Electric Service Standards* on the KCP&L website (<http://www.kcpl.com/customer-service/construction-standards>). For Westar reference the electric service manual at this location: <https://www.westarenergy.com/new-construction-information>. Information such as the type of service requested and load levels expected are captured by the form on the website. End-User interconnection requests are evaluated by Company to determine if any system reliability impacts may result from the interconnection of the Customer to the transmission system. Studies are primarily conducted to determine if there is available capacity at the interconnection point to accommodate the request. If additional system reinforcements are identified during the study the results will be made known to the EU and solutions will be proposed to address the issue. Load additions will be submitted to SPP to be evaluated as part of the SPP OATT, Attachment AQ, Delivery Point Addition Process.

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<sup>1</sup> SPP Planning Criteria, Rev. 1.4, effective July 25, 2017.

### **3.2. Procedures for Notification of Affected Systems**

SPP Generator Interconnection Procedures include provisions for notifying affected systems of the reliability impacts of new or modified generator interconnection requests. Company will adhere to those provisions for notification of affected systems.

For transmission interconnections, Company will follow the notification requirements of SPP Planning Criteria Appendix PL-6.

Reliability impacts from End-user interconnections will be identified by SPP through the analysis processes of the Attachment AQ. SPP will communicate any reliability issues to all affected systems.

### **3.3. Confirm Facility Interconnections within BA**

Generation interconnections within the SPP BA are subject to the provisions and procedures established in the SPP OATT, SPP Business Practices, and SPP Planning Criteria. The Company directs all generation interconnection customers to contact the SPP in order to establish a new or materially modify generator interconnection within the SPP BA. The generation interconnection customer, Transmission Owner, and the SPP negotiate and execute an interconnection agreement prior to the energization of any new generation interconnections. Metering for Generator Interconnections will follow the provisions of Article 7 of the Generator Interconnection Agreement as defined in the SPP OATT.

Transmission interconnections within the SPP BA are subject to the provisions and procedures established in the SPP OATT, SPP Business Practices, and SPP Planning Criteria. The Company directs all transmission interconnection customers to contact the SPP in order to establish a new or materially modify transmission interconnection within the SPP BA. The transmission interconnection customer, Transmission Owner, and the SPP negotiate and execute an interconnection agreement prior to the energization of any new transmission interconnections. Metering locations will be identified in these interconnection agreements. Meter Agent will ensure that metering data is collected and communicated to SPP and affected systems.

End-user interconnections within the SPP BA are subject to the provisions and procedures established in the SPP OATT, SPP Business Practices, and SPP Planning Criteria. The Company directs all End-user interconnection customers to contact the SPP in order to establish a new or materially modify end-user interconnection within the SPP BA. The end-user interconnection customer, Transmission Owner, and the SPP follow the process outlined in Attachment AQ of the SPP Tariff prior to the energization of any new end-user interconnections. End-User interconnections for Retail Service shall follow applicable Company retail service tariff. Company shall install, calibrate, test, and maintain revenue quality metering in accordance with applicable ANSI Standard C12. Interconnections for Wholesale Service shall utilize revenue quality metering in accordance with applicable ANSI

Standard C12, Form B of the Southwest Power Pool Market Protocols and all such data shall be telemetered to the Transmission Owner or Distribution Service Provider as applicable.

## **4. Generator Owner Procedures & Notifications**

Procedures and Notifications associated with Customer interconnections with Company Generator Owner Facilities are detailed in the following sections.

### **4.1. Procedure for Coordinated Study of Customer Facility Interconnections**

Company will follow same procedures in Section 3.1 above.

### **4.2. Procedure to Notify Affected Systems**

Company will follow same procedures in Section 3.2 above.

### **4.3. Confirm Customer Facility Interconnections within BA**

Company will follow same procedures in Section 3.3 above.

## Appendix A - Table of Codes and Standards Incorporated by Reference

The following Table of Codes and Standards Incorporated by Reference is intended to be informative but not determinative as to all statutes, regulations, standards, and codes that may apply to the interconnection of non-utility generation, transmission, and/or end-use facilities connected to the Company's electric system inclusive of distribution or transmission facilities.

For example, it is not practical to list all potential county and city municipal codes. Also, relevant orders and requirements may have more current versions not yet recognized in this table. Company does not assume any expressed or implied warranty the information is correct and accurate. In the event the table contains errors or omissions, the Interconnecting Customer is not relieved from its duty to comply with all current applicable laws, codes, and standards of all regulatory or governing bodies having jurisdiction.

Citation	Title	Initial FIR Reference Date
Electric Service Standards	KCP&L <i>Electric Service Standards</i> (Formerly known as <i>New Business Service Handbook</i> ) Westar electric service manual: <a href="https://www.westarenergy.com/new-construction-information">https://www.westarenergy.com/new-construction-information</a>	04-08-2004
FAC-001-2	NERC Reliability Standard: Facilities Design, Connections, and Maintenance-Facility Connection Requirements	11-15-2013
FAC-002-2	NERC Reliability Standard: Facilities Design, Connections, and Maintenance-Coordination of Plans For New Generation, Transmission, and End-User Facilities	06-28-2012
Good Utility Practice	FERC, Order No. 888, 75 FERC 61,080 (1996); FERC <i>Policy Statement on Matters Related to Bulk Power System Reliability</i> , 107 FERC ¶ 61,052, <i>clarified</i> , 108 FERC ¶ 61,288 (2004), <i>Supplement to Policy Statement On Matters Related to Bulk Power System Reliability</i> , 110 FERC ¶ 61,096 (2005).	04-08-2004
IEEE 1547.7	Standard for Interconnecting Distributed Resources with Electric Power Systems	06-28-2015
IEEE 519	IEEE Recommended Practice and Requirements for Harmonic Control in Electric Power Systems	04-08-2004
IEEE 1453	IEEE Recommended Practice for the Analysis of Fluctuating Installations on Power Systems	09-03-2015
IEEE 80	IEEE Guide for Safety in AC Substation Grounding	04-08-2004
IEEE 81	Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Potentials	11-1-2018

<b>Citation</b>	<b>Title</b>	<b>Initial FIR Reference Date</b>
IEEE 141	Recommended Practice for Electric Power Distribution for Industrial Plants	11-1-2018
IEEE 367	Recommended Practice for Determining the Electric Power Station Ground	11-1-2018
IEEE 487	Protection of Wire-Line Communication Serving Electric Power Stations	11-1-2018
IEEE 665	Guide for Generating Station Grounding	11-1-2018
IEEE 837	Standard for Qualifying Permanent Connections Used in Substation Grounding	11-1-2018
IEEE C37	Institute for Electrical and Electronics Engineers (IEEE) Standard – C37 <i>et seq.</i>	04-08-2004
IEEE C57	IEEE Standard – C57	04-08-2004
IEEE C62	IEEE Standard – C62	04-08-2004
ANSI C12		11-1-2018
ANSI 84.1		11-1-2018
ITP	SPP Integrated Transmission Planning	04-08-2004
NEC	NFPA 70 National Electrical Code	04-08-2004
NESC	National Electrical Safety Code	04-08-2004
OATT	SPP Open Access Transmission Tariff	04-08-2004
OSHA	29 C.F.R. § 1900 <i>et seq.</i>	06-28-2012
SPP Planning Criteria	SPP Planning Criteria and Appendices	04-08-2004
STEP	SPP Transmission Expansion Plan	06-28-2012



## Appendix B - Document History

The following table documents changes to this document.

<b>Date</b>	<b>Document</b>	<b>Description</b>
2018-11-1	Evergy Facility Interconnection Requirements 11-1-18.pdf	merged facility connection requirements for KCP&L and Westar

# Form A - GENERATION INTERCONNECTION APPLICATION

(Inverter Based Generation up to and including 25 kW)

Preface: This Facility Interconnection Standard applies to any connection to Company's electric system regardless of voltage.

This application is complete when it provides all applicable information required below and includes a one-line diagram.

**Applicant:**

Name: \_\_\_\_\_

Address: \_\_\_\_\_

City, State, Zip: \_\_\_\_\_

Telephone (Day): \_\_\_\_\_ (Evening): \_\_\_\_\_

Fax: \_\_\_\_\_ E-mail Address: \_\_\_\_\_

Company Customer Account Number: \_\_\_\_\_

**Contact (If different from Applicant):**

Name: \_\_\_\_\_

Address: \_\_\_\_\_

City, State, Zip: \_\_\_\_\_

Telephone (Day): \_\_\_\_\_ (Evening): \_\_\_\_\_

Fax: \_\_\_\_\_ E-mail Address: \_\_\_\_\_

**Generating Facility:**

Location (If different from above): \_\_\_\_\_

Facility Owner: \_\_\_\_\_

Inverter Manufacturer/Model: \_\_\_\_\_

Nameplate Rating (kW, kVA, Voltage, Frequency): \_\_\_\_\_

Single Phase: \_\_\_\_\_ Three Phase: \_\_\_\_\_ (check one)

System Design Capacity: \_\_\_\_\_ (kW) \_\_\_\_\_ (kVA)

Prime Mover (Photovoltaic, Turbine, Fuel Cell, Other): \_\_\_\_\_ (describe)

Energy Source (Solar, Wind, Hydro, Other): \_\_\_\_\_ (describe)

Is the equipment UL1741 Listed? Yes \_\_\_\_\_ No \_\_\_\_\_

If yes, attach evidence of UL1741 listing.

Estimated Installation Date: \_\_\_\_\_ Estimated In-Service Date: \_\_\_\_\_

List components of the Interconnection Equipment Package that are certified:

Equipment Type:	Certifying Entity:
1. _____	_____
2. _____	_____
3. _____	_____

**Attach a one-line diagram of the Generating Facility**

**Applicant Signature:**

I hereby certify that, to the best of my knowledge, the information provided in this application is true. I agree to abide by the terms and conditions specified in this Interconnection Agreement.

Signed: \_\_\_\_\_

Title: \_\_\_\_\_ Date: \_\_\_\_\_

Operation is contingent on Company Energy’s approval to interconnect the Generating Facility.

**Utility Signature:**

Interconnection of the Generating Facility is approved contingent upon the terms and conditions specified in this Interconnection Agreement.

Utility Signature: \_\_\_\_\_

Title: \_\_\_\_\_ Date: \_\_\_\_\_

Application ID Number: \_\_\_\_\_

Utility waives inspection/witness test?	Yes	No
	_____	_____

Written applications should be submitted by mail or email:

**Retail Services:**

Kansas City Power & Light  
Energy Solutions  
P.O. Box 418679  
Kansas City, MO 64105

**Wholesale Services:**

Kansas City Power & Light  
Manager Transmission Planning  
P.O. Box 418679  
Kansas City, MO 64105  
longtermplanning@kcpl.com



**2.0 Generating Facilities Specifications**

Prime Mover:

Photovoltaic \_\_\_\_\_

Reciprocating Engine \_\_\_\_\_

Fuel Cell \_\_\_\_\_

Gas Turbine \_\_\_\_\_

Steam Turbine \_\_\_\_\_

Microturbine \_\_\_\_\_

Other (specify) \_\_\_\_\_

Energy Source:

Solar \_\_\_\_\_

Wind \_\_\_\_\_

Hydro (state type i.e. Run of River) \_\_\_\_\_

Diesel \_\_\_\_\_

Natural Gas \_\_\_\_\_

Fuel Oil \_\_\_\_\_

Other (state type) \_\_\_\_\_

Type of Generating Facility: \_\_\_\_\_ Inverter \_\_\_\_\_ Synchronous \_\_\_\_\_ Induction

Generating Facility Nameplate Rating: \_\_\_\_\_ kW or \_\_\_\_\_ kVA

Applicant Site Load: \_\_\_\_\_ kW (if none, so state)

Typical Reactive Load (if known): \_\_\_\_\_

Maximum Physical Export Capability Requested: \_\_\_\_\_ kW

List components of the Interconnection Equipment Package that are UL listed or IEEE certified:

Equipment Type:

Certifying Entity:

1. \_\_\_\_\_

\_\_\_\_\_

Everygy

Facility Interconnection Requirements

\_\_\_\_\_

2. \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

3. \_\_\_\_\_

\_\_\_\_\_

Is the prime mover compatible with the Interconnection Equipment Package?  
\_\_\_\_\_ Yes \_\_\_\_\_ No

**Individual generator data (attach additional sheets if needed)**

Manufacturer, Model Name & Number: \_\_\_\_\_

Version  
Number: \_\_\_\_\_

Nameplate Output Power Rating in kW: \_\_\_\_\_ (Winter)  
(Summer) \_\_\_\_\_

Nameplate Output Power Rating in kVA: \_\_\_\_\_ (Winter)  
(Summer) \_\_\_\_\_

Rated Power Factor: (Leading) \_\_\_\_\_ (Lagging) \_\_\_\_\_

Total number of generators to be interconnected pursuant to this application: \_\_\_\_\_

Elevation: \_\_\_\_\_

Single Phase: \_\_\_\_\_ Three Phase: \_\_\_\_\_ (check one)

List of adjustable set points for the protective equipment or software: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**Inverter based Generating Facilities**

Inverter Manufacturer, Model Name & Number: \_\_\_\_\_

Max design fault current contribution (choose one):

Asymmetrical \_\_\_\_\_ Amps

Symmetrical \_\_\_\_\_ Amps

Harmonics Characteristics: \_\_\_\_\_

Start-up requirements: \_\_\_\_\_

**Rotating Machines (of any type)**

RPM Frequency: \_\_\_\_\_

(\* Neutral Grounding Resistor (If applicable): \_\_\_\_\_

**Synchronous Generators**

Direct Axis Synchronous Reactance, Xd: \_\_\_\_\_ P.U.

Direct Axis Transient Reactance, X'd: \_\_\_\_\_ P.U.

Direct Axis Sub transient Reactance, X''d: \_\_\_\_\_ P.U.

Negative Sequence Reactance, X2: \_\_\_\_\_ P.U.

Zero Sequence Reactance, X0: \_\_\_\_\_ P.U.

kVA Base: \_\_\_\_\_

Field Volts: \_\_\_\_\_

Field Amperes: \_\_\_\_\_

For synchronous generators, provide appropriate IEEE model block diagram of excitation system, governor system, and power system stabilizer (PSS in accordance with the Regional Reliability Council criteria). A PSS may be determined to be required by applicable studies. A copy of the manufacturer's block diagram may not be substituted.

**Induction Generators**

Motoring Power (kW): \_\_\_\_\_

I<sup>2</sup>t or K (Heating Time Constant): \_\_\_\_\_



Rotor Resistance, Rr: \_\_\_\_\_ Rotor Reactance, Xr: \_\_\_\_\_

Stator Resistance, Rs: \_\_\_\_\_ Stator Reactance, Xs: \_\_\_\_\_

Magnetizing Reactance, Xm: \_\_\_\_\_

Short Circuit Reactance, Xd: \_\_\_\_\_

Exciting Current: \_\_\_\_\_

Temperature Rise: \_\_\_\_\_

Frame Size: \_\_\_\_\_

Design Letter: \_\_\_\_\_

Reactive Power Required in Vars (No Load): \_\_\_\_\_

Reactive Power Required in Vars (Full Load): \_\_\_\_\_

Total Rotating Inertia, H: \_\_\_\_\_ Per Unit on kVA Base

**3.0 Transformer and Protective Relay Specifications**

Will a transformer be used between the generator and the Facility Interconnection?

\_\_\_\_\_ Yes \_\_\_\_\_ No

Will the transformer be provided by the Owner? \_\_\_\_\_ Yes \_\_\_\_\_ No

Transformer: \_\_\_\_\_ percent on \_\_\_\_\_ kVA Base

If Three Phase:

Transformer Primary Grounded: \_\_\_\_\_ Volts \_\_\_\_\_ Delta \_\_\_\_\_ Wye \_\_\_\_\_ Wye Grounded

Transformer Secondary: \_\_\_\_\_ Volts \_\_\_\_\_ Delta \_\_\_\_\_ Wye \_\_\_\_\_ Wye Grounded

Transformer Tertiary Grounded: \_\_\_\_\_ Volts \_\_\_\_\_ Delta \_\_\_\_\_ Wye \_\_\_\_\_ Wye Grounded

Transformer Fuse Data (if applicable, for Owner’s fuse)  
(Attach copy of fuse manufacturer’s Minimum Melt and Total Clearing Time-Current Curves)

Manufacturer: \_\_\_\_\_ Type: \_\_\_\_\_ Size: \_\_\_\_\_ Speed: \_\_\_\_\_

**Interconnecting Circuit Breaker (if applicable):**

Manufacturer: \_\_\_\_\_ Type: \_\_\_\_\_

Load Rating (Amps): \_\_\_\_\_ Interrupting Rating (Amps): \_\_\_\_\_ Trip Speed (Cycles): \_\_\_\_\_

**Interconnection Protective Relays (if applicable):**

If Microprocessor-Controlled:

List of Functions and Adjustable Set points for the protective equipment or software:

Set point Function	Minimum	Maximum
_____	_____	_____
_____	_____	_____
_____	_____	_____

**Discrete Components (if applicable):**

(Enclose Copy of any Proposed Time-Overcurrent Coordination Curves)

Manufacturer: \_\_\_\_\_ Type: \_\_\_\_\_

Style/Catalog No: \_\_\_\_\_

Proposed Setting: \_\_\_\_\_

Manufacturer: \_\_\_\_\_ Type: \_\_\_\_\_

Style/Catalog No: \_\_\_\_\_

Proposed Setting: \_\_\_\_\_

Manufacturer: \_\_\_\_\_ Type: \_\_\_\_\_

Style/Catalog No: \_\_\_\_\_

Proposed Setting: \_\_\_\_\_

**Current Transformer Data (if applicable):**

(Enclose Copy of Manufacturer’s Excitation and Ratio Correction Curves)

Manufacturer: \_\_\_\_\_

Type: \_\_\_\_\_ Accuracy Class: \_\_\_\_\_ Proposed Ratio Connection: \_\_\_\_\_

**Potential Transformer Data (if applicable):**

Manufacturer: \_\_\_\_\_

Type: \_\_\_\_\_ Accuracy Class: \_\_\_\_\_ Proposed Ratio Connection: \_\_\_\_\_

**4.0 General Information**

Enclose copy of site electrical one-line diagram showing the configuration of all Generating Facility Equipment, current and potential circuits, and protection and control schemes. This one-line diagram must be signed and stamped by a licensed Professional Engineer if the Generating Facility is larger than 200 kW.

Is one-line diagram enclosed? \_\_\_\_\_ Yes \_\_\_\_\_ No

Enclose copy of any site documentation that indicates the precise physical location of the proposed Generating Facility and all protective equipment (e.g. USGS topographic map or other diagram or documentation).

Is site documentation enclosed? \_\_\_\_\_ Yes \_\_\_\_\_ No

Enclose copy of any site documentation that describes and details the operation of the protection and control schemes.

Is available documentation enclosed? \_\_\_\_\_ Yes \_\_\_\_\_ No

Enclose copies of schematic drawings for all protection and control circuits, relay current circuits, relay potential circuits, and alarm/monitoring circuits (if applicable).

\_\_\_\_\_

Are schematic drawings enclosed? \_\_\_\_\_ Yes \_\_\_\_\_ No

**5.0 Applicant Signature**

I hereby certify that to the best of my knowledge, all the information provided in this Facility Interconnection Standard Application is true and correct. Generating Facilities must be compliant with IEEE, NEC, ANSI, and UL standards, where applicable. By signing below, the Applicant also certifies that the installed generating equipment meets the appropriate proceeding requirement(s) and can supply documentation that confirms compliance.

Signature of Applicant: \_\_\_\_\_

Date: \_\_\_\_\_

Written applications should be submitted by mail or email:

**Retail Services:**

Kansas City Power & Light  
Energy Solutions  
P.O. Box 418679  
Kansas City, MO 64105

**Wholesale Services:**

Kansas City Power & Light  
Manager Transmission Planning  
P.O. Box 418679  
Kansas City, MO 64105  
longtermplanning@kcpl.com

## Attachment A - Relay Standards for Interconnected Generating Facilities

### A1.0 NERC RELIABILITY STANDARD PRC-001 System Protection Coordination:

“All facilities involved in the generation, transmission and use of electricity must be properly connected to the interconnected transmission systems to avoid degrading the reliability of the electric systems to which they are connected.”

### A2.0 Requirements for generating facilities defined under Company's Facility Interconnection Standards:

A2.1 “Customer’s facility design shall include an appropriate automatic disconnecting device to be controlled by any or all of the following: overcurrent relays, automatic synchronizing relays, voltage relays, frequency relays, ground fault detection relays, or any other automatic relaying equipment necessary to ensure proper protection and safety of Company employees, customers, equipment, and overall system integrity.”

A2.2 “Protective relay schemes of Customer shall be integrated to operate with protective relay schemes of Company facilities. Generating Sources shall:

A2.2.1 not supply sustained fault current to Company facilities.”

A2.2.2 open for frequency and voltage deviations specified by Company.”

A2.2.3 utilize synchronism check within +/- 10 degrees and voltage limits of +/- 5 percent of nominal on each side of the disconnecting device prior to connecting Owner’s and Company’s facilities.”

A2.2.4 provide ground fault detection and tripping for disconnecting device whenever an ungrounded circuit configuration exists as the result of opening the Company’s source to the Interconnection.”

A2.2.5 continuously monitor disconnecting device control-power source.”

A2.2.6 not reclose automatically.”

A2.2.7 accept transferred-tripping initiated from Company facilities”

A2.2.8 be capable of transferring data to and from Company SCADA system.

### A3.0 Outline of generating facility protective-relay features:

### A3.1 Protective relay features shall include:

A3.1.1 alternate modes of operation for generating and non-generating conditions. Voltage, frequency, synchronism, and backfeed requirements will differ between modes.

A3.1.2 tripping for all faults on Company source while in generating mode. This protects Company equipment from inadvertent energization and non-synchronous recloser, and other Company customers from unpredictable electrical quality.

A3.1.3 acceptance of direct-trip signal from Company source while in generating mode.

A3.1.4 closure of the interconnecting device through direct or indirect supervision of the protective relay for all modes of operation. This assures that the interconnection will be protected by a viable relay before closure.

A3.1.5 closure of the interconnecting device through permissive synchronism-checking supervision of the protective relay. Hot-source / dead-bus supervision should be utilized in the non-generating mode.

A3.1.6 waveform and event-capture of all opening and closing events.

A3.1.7 digital communication compatibility with Company SCADA system. This is presently DNP-3, level two implementation.

A3.1.8 alarm capability to Company dispatch for DC- or relay failure.

A3.1.9 real-time telemetry capability of interconnection watt and var flows when generating.

### A4.0 Required generic protective-relay functions:

#### A4.1 Inputs:

- ◆ 3-phase AC potentials and currents
- ◆ Close command
- ◆ Trip command
- ◆ Transferred-trip command
- ◆ Synchronism-check permissive
- ◆ Alternate-settings mode
- ◆ Breaker trip-coil monitor
- ◆ Breaker-indication contact

#### A4.2 Algorithms:

- ◆ Breaker state

- ◆ Non directional overcurrent trip
- ◆ Directional overcurrent trip
- ◆ Negative-sequence overcurrent trip
- ◆ 3-phase over- and under-voltage trip
- ◆ 3-phase over- and under-frequency trip
- ◆ Breaker failure-to-trip alternative protection scheme
- ◆ Breaker trip-circuit “open” alarm
- ◆ Malfunctioning or inoperative protective-relay alarm
- ◆ Loss of control power alarm
- ◆ Synchronism-check of breaker “close” command
- ◆ Event-capture of each breaker operation
- ◆ Waveform-capture of each breaker operation
- ◆ DNP-3, Level 2 communication protocol

#### A4.3 Outputs:

- ◆ TRIP Command
- ◆ CLOSE Command or synchronism-check permissive
- ◆ LOCKOUT Command for failure-to-trip or malfunction
- ◆ Alarms defined in section A4.2
- ◆ Metering values for voltage and frequency
- ◆ RS-232 or RS-485 communications port

## **Attachment B - Relay Standards for Interconnected Load Facilities**

### **B1.0 NERC RELIABILITY STANDARD PRC-001 System Protection Coordination:**

“All facilities involved in the generation, transmission and use of electricity must be properly interconnected to the transmission systems to avoid degrading the reliability of the electric systems to which they are connected.”

### **B2.0 Requirements for facilities defined under Company's Interconnection Standards:**

B2.1 “Protective relay schemes of Customer shall be integrated to operate with protective relay schemes of Company facilities.”

B2.2 Customer equipment shall be capable of transferring data to and from Company SCADA system.

### **B3.0 Outline of connection protective-device features:**

B3.1 Connection with Company electrical system shall be appropriate for the requirements of the electrical-system protective schemes. Such connection may utilize fuses, circuit-switchers or circuit breakers with appropriate control schemes.

B3.2 Fuse ratings shall be in accordance with Company standards.

B3.3 Protective-relay response shall not exceed transformer-damage specifications.

B3.4 Protective relay characteristics shall coordinate with Company schemes.

B3.5 Digital communication protocol shall be compatible with Company SCADA system. This is presently DNP-3, level two implementation.

### **B4.0 Required generic protective relay functions:**

#### **B4.1 Inputs:**

- ◆ 3-phase AC potentials and currents
- ◆ Close command
- ◆ Trip command
- ◆ Breaker trip-coil monitor
- ◆ Breaker-indication contact

#### **B4.2 Algorithms:**



- ◆ Breaker state
- ◆ Non directional overcurrent trip
- ◆ Breaker failure-to-trip
- ◆ Breaker trip-circuit “open” alarm
- ◆ Malfunctioning or inoperative protective-relay alarm
- ◆ Loss of control power alarm
- ◆ Event-capture of each breaker operation
- ◆ DNP-3, Level 2 communication protocol

B4.3 Outputs:

- ◆ TRIP Command
- ◆ CLOSE Command or synchronism-check permissive
- ◆ LOCKOUT Command for failure-to-trip or malfunction
- ◆ Alarms defined in section B4.2
- ◆ RS-232 or RS-485 communications port

## Attachment C - Phasor Measurement Units Specifications

### C1.0 Scope

The purpose of this specification is to provide information about Company's requirements for Phasor Measurement Units (PMU) and associated hardware.

### C2.0 Electrical Hardware

The Phasor Measurement Unit (PMU) shall meet or exceed the following criteria:

1. IEEE C37.118-2005 Protocol:
  - a. Up to 60 Messages per Second.
  - b. Level 1 at maximum message rate when phasor has the same frequency as phase A voltage, frequency-based phasor compensation is enabled (PHCOMP = Y), and the narrow-bandwidth filter is selected (PMAPP = N). Out-of-band interfering frequency (Fs) test,  $10 \text{ Hz} \leq F_s \leq (2 \cdot \text{NFREQ})$ .
2. Current Range: 0.5 – 10 Amps secondary.
3. Frequency Range:  $\pm 5$  Hz of nominal.
4. Voltage Range: 30 V-250 V.
5. Phase Angle Range:  $-179.99^\circ$  to  $180^\circ$ .

The installation will have one Phasor Data Concentrator (PDC) that shall meet or exceed the following criteria:

1. Concentrate up to 120 IEEE C37.118-2005 or C37.118-2011 PMUs at rates up to 240 messages/second via 2 Ethernet and up to 26 RJ45 serial ports.
2. Configure up to ten independent output streams to provide data to Company or the SPP.
3. Have continuous, local data storage up to 250 GB SDD in either COMTRADE or CSV formats.

The installation may need to include an Ethernet Gateway switch if one is not already present.

The Ethernet Gateway switch shall meet or exceed the following criteria:

1. Deny-by-default firewall with Internet Protocol Security (IPsec) VPNs.
2. User-based access controls and detailed activity logs.
3. HTTPS web interface for secure setup and management.

The installation may need to include a GPS satellite-synchronized clock if one is not already present. The GPS satellite-synchronized clock shall meet or exceed the following criteria:

1. Demodulated IRIG-B outputs with  $\pm 100$  nanosecond accuracy.
2. Six demodulated IRIG-B time-code outputs.

### C3.0 Recommended and Proven Equipment

The following equipment has been proven and found to be acceptable by Company:

1. PMU: SEL-351A – Part Number 0351A1R2X3E54X1 – Key Code 7438
2. PDC: SEL-3573 Station Phasor Data Concentrator – Configuration Number 3573#JB8J
3. Ethernet Gateway: SEL-3620 Ethernet Security Gateway – Configuration Number 3620#0101
4. GSP Satellite-Synchronized Clock: SEL-2407 – Part Number 24070001B

## **Attachment D - Generator Interconnection Data Requirements for Synchronous Machines**

### **Data Request Background**

By interconnecting to the KCP&L/Westar transmission system, KCP&L/Westar is designated as the interconnection facility and Customer's Transmission Planner (TP). A TP is an entity defined by the North American Electric Reliability Corporation (NERC) that has certain requirements and obligations (requirements) to meet Electric Utility Industry Standards (Standards). Among other things, these requirements involve developing a model of the interconnecting facility for use in transmission studies.

To adequately assess the transmission system for the proposed facility interconnect (plant), a Generator Interconnection (GI) study must be performed. While the Customer must make a formal data submission to the Southwest Power Pool (SPP) and participate in an SPP regional GI study, KCP&L/Westar performs an independent study to capture impacts local to the KCP&L/Westar system and to establish an initial data collection from the Customer. KCP&L/Westar will make an initial data request to the Customer for the purposes of studying the proposed interconnection. A subsequent data request will be made inside of 180 days prior to the initial synchronization listed in Appendix B of the SPP Generator Interconnection Agreement. Once the facility is built and in service KCP&L/Westar may submit additional data requests. The Customer is required by NERC standard MOD-032 Requirement R3 to provide data within 90 days. Per NERC Standard MOD-032, Requirement R2, the Customer is required to provide power flow, short circuit, and dynamic model data.

All data provided to KCP&L/Westar is owned by the Customer and, therefore, cannot be modified by KCP&L/Westar (unless KCP&L/Westar is also the Customer) for MOD-032 compliance. This means that the Customer is required to provide sufficient plant models. This includes generating unit models, corresponding generator step-up transformer (GSU) models, and models for any transformers and transmission lines owned by the Customer for the interconnecting facility.

The Customer shall provide as much detail as possible. Some data may not be available due to incomplete records or because a facility is not yet built.

### **Frequency of Data Updates**

When connecting to the Bulk Electric System (BES), the Customer is required by NERC to provide data and data updates to the TP. Some NERC Standards have data reporting frequencies and those must be reviewed and provided by the Customer as required. However, in accordance with NERC Standard MOD-032, the Customer must provide steady-state, short circuit, and dynamic modeling information to the TP per the modeling schedule set forth by the Planning Coordinator (PC), SPP. SPP builds cases on annual basis and requests data updates annually.

### **Deliverables**

This section summarizes what information is expected to be communicated from one entity to another.

### Transmission Planner and Planning Coordinator

The Transmission Planner (Company) and Planning Coordinator (SPP) will collaborate to provide the Customer with:

- System impedance data and available fault current at the Point of Interconnect (POI)
- A list of dynamics models acceptable to the TP (Company), including:
  - o Parameter sheet(s)
  - o Block diagram(s)

### Generator Owner (Customer)

The Customer should provide the following data to both the Planning Coordinator (SPP) and the Transmission Planner (Company):

- Load flow model in PSSE v33 RAW format, including all:
  - o Transmission lines owned by the Customer
  - o Primary station transformers owned by the Customer (i.e., 345/69 kV transformers)
  - o Generator step-up transformers owned by the Customer
  - o Generators
- Short circuit model for all load flow facilities (previously noted) in PSSE v33 SEQ format
- Dynamic models from the list of approved models provided by the TP in PSSE v33 DYR format for each generator:
  - o Generator model (e.g., GENTPJU1)
  - o Compensator model, if applicable (e.g., IEEEVC)
  - o Stabilizer model, if applicable (e.g., PSS2B)
  - o UEL, if applicable (e.g., UEL1)
  - o OEL, if applicable (e.g., MAXEX1)
  - o Excitation control system model, if applicable (e.g., AC7B)
  - o Turbine/Governor control system model (e.g., GCustomerV1DU)
  - o Turbine load controller, if applicable (i.e., LCFB1)
  - o Generator protection models (e.g., VTGDCAT, FRQDCAT, LOEXR1T, VPERHZU1)
- Dynamic models in PSSE v33 DYR format for each GSU:
  - o Generator saturation model, if available (e.g., SAT2T)

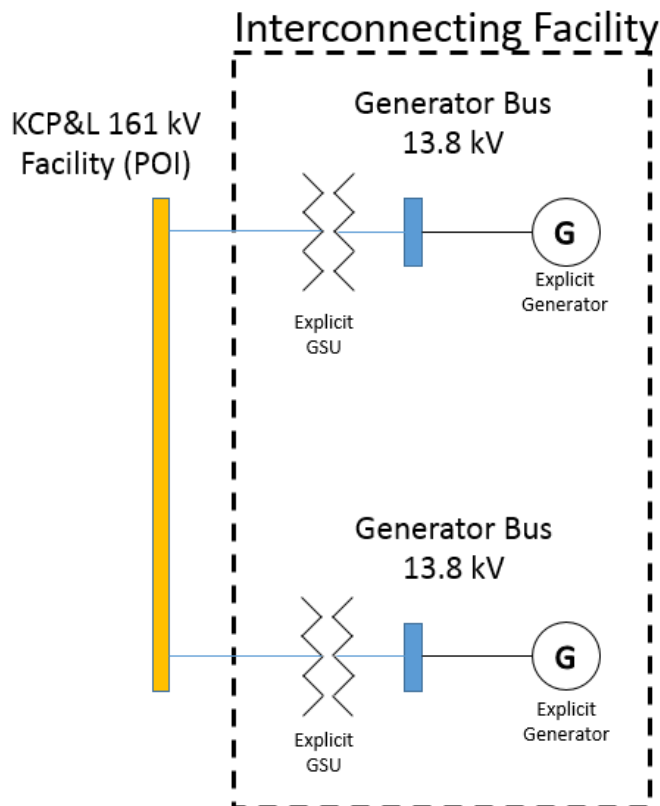
### Steady-State, Short Circuit, and Dynamic Data Requirements

Company as the TP requires a great deal of data to accurately model the plant in the Siemens PTI Power System Simulator for Engineers (PSSE) software package. Since Company does not own the plant, the Customer is responsible for and must provide enough data to create an accurate model in PSSE. The complete data requirements are listed in the following sections. Not all data is required.

### Example Plant Model

For most synchronous machines, Company requires an explicit model of each unit and its corresponding GSU for interconnection-wide studies.

Figure 1 provides an example of a one-line diagram of the interconnecting facility. Besides bus numbers, data for all elements shown in the Interconnecting Facility should be provided. In the given example, the connecting facility is located at an existing Company transmission facility.



**Figure 1: One-Line Representation of Example Interconnecting Facility Model**

**Load Flow**

Load Flow refers to the plant’s electrical topology and operating limits. This includes things like transformer impedance, generator capability, and equipment ratings. These data help establish the location of the plant in relation to the Company transmission system as well as inform Company of the operating limits of the plant. The information in Table 1 through Table 6 is requested to help create the load flow model of the plant. If some information is not available, the Customer should note what information is not available and discuss with the TP to determine if proxy data can be used.

**Table 1: Requested Substation Power Flow Data**

Data Requested	Desired Units	Data Value
<b>Station Ground-Grid DC Resistance (e.g., value from Fall-of-Potential Test)</b>	Ohms	

**Table 2: Requested Generator Power Flow Data**

Data Requested	Desired Units	Data Value
<b>EIA Plant Code</b>		
<b>Original design parameter sheet</b>		
<b>D-Curves</b>		
<b>Fuel Type 1 (e.g., Coal, Hydro, Gas, etc.)</b>		
<b>Fuel Type 2 (e.g., Coal, Hydro, Gas, etc.)</b>		
<b>Is part of combined-cycle plant?</b>	Yes or No	
<b>Is steam unit of combined-cycle plant?</b>	Yes or No	
<b>Inertia Constant</b>	ratio	
<b>Overspeed Droop Setting</b>	Hz	
<b>Underspeed Droop Setting</b>	Hz	
<b>Droop Deadband Setting</b>		
<b>Generator Bus Number (PSSE/PSLF/PowerWorld/TSAT)</b>	long integer	
<b>Real output (over-excited, Min; Pmax)</b>	MW	
<b>Real output (under-excited, Max; Pmin)</b>	MW	
<b>Reactive output (over-excited, Max)</b>	MVAR	
<b>Reactive output (over-excited, Min)</b>	MVAR	
<b>Reactive output (under-excited, Max)</b>	MVAR	
<b>Reactive output (under-excited, Min)</b>	MVAR	
<b>Rated Power Factor</b>		
<b>Rated RPM</b>	RPM	
<b>Rated Frequency</b>	Hz	
<b>Power Base</b>	MVA	
<b>Armature Resistance</b>	Ohms	
<b>D-Axis Unsaturated Sub-Transient</b>	PU on MVA Base	
<b>Reactance</b>		
<b>Owner #1</b>		
<b>Owner #2</b>		
<b>Owner #3</b>		
<b>Owner #4</b>		
<b>Owner #1 Fraction</b>	%	
<b>Owner #2 Fraction</b>	%	
<b>Owner #3 Fraction</b>	%	
<b>Owner #4 Fraction</b>	%	

Data Requested	Desired Units	Data Value
Real Auxiliary Load (over-excited, Max)	MW	
Real Auxiliary Load (over-excited, Min)	MW	
Real Auxiliary Load (under-excited, Max)	MW	
Real Auxiliary Load (under-excited, Min)	MW	
Reactive Auxiliary Load (over-excited, Max)	MVAR	
Reactive Auxiliary Load (over-excited, Min)	MVAR	
Reactive Auxiliary Load (under-excited, Max)	MVAR	
Reactive Auxiliary Load (under-excited, Min)	MVAR	
Typical voltage set point (voltage schedule)	PU on generator kV base e.g., "Low-Side of GSU", "High-Side of GSU", etc.	
Regulated Bus		

**Table 3: Requested Two-Winding Transformer Power Flow Data**

Data Requested	Desired Units	Data Value
Serial Number		
Test Report		
Date No-Load Tap Changer Setting was Verified	MM/DD/YYYY	
Core Construction	"Single-Phase", "Core-Type, 3-Legs", "Core-Type, 5-Legs", "Core-Type, 7 Legs", or "Shell-Type"	
H-Winding has GIC Blocking Device?	Yes/No	
X-Winding has GIC Blocking Device?	Yes/No	
H-Winding DC Resistance	Ohms	
X-Winding DC Resistance	Ohms	
DC Winding Resistance Temperature	degrees	
Transformer Number	two-character identifier	
H-Winding Nominal Voltage	kV	
X-Winding Nominal Voltage	kV	
No-Load Tap Changer exists?	Yes/No	
No-Load Tap Changer winding	H or X	
Number of No-Load Tap Changer Steps	Integer or Letter (e.g., 3 or C)	
No-Load Tap Changer Step %	%	
Present No-Load Tap Changer Setting	Integer or Letter (e.g., 2 or B)	
Load Tap Changer exists?	Yes/No	
Load Tap Changer winding	H or X	
Number of Load Tap Changer Steps	Integer or Letter (e.g., 3 or C)	
Load Tap Changer Step %	%	
No-Load Losses	W	
Exciting Current	% at 100% rated voltage	
Vector Group	Characters	
Phase shift angle	degrees	
Load Loss (corrected to 85C)	W	
Impedance (corrected to 85C)	%	

Data Requested	Desired Units	Data Value
<b>Load Loss and Impedance S Base</b>	MVA	
<b>H-Winding Oil Normal, Air Normal (ONAN) Rating</b>	MVA	
<b>H-Winding Oil Normal, Air Forced (ONAF) Rating</b>	MVA	
<b>H-Winding Oil Forced, Air Normal (OFAN) Rating</b>	MVA	
<b>H-Winding Oil Forced, Air Forced (OFAF) Rating</b>	MVA	
<b>H-Winding Switch Gear Rating</b>	MVA	
<b>H-Winding Switch Gear Impedance</b>	Ohms	
<b>H-Winding Jumper Conductor</b>	Conductor Call sign (e.g., Tern, Drake, etc.)	
<b>H-Winding Number of Jumper Conductors</b>		Integer
<b>H-Winding Current-Transformer (CT) Tap Settings</b>	Ratio (e.g., 1000:5)	
<b>H-Winding CT Rating Factor</b>	Float (e.g., 1.0, 1.5, 2.0, etc.)	
<b>H-Winding Present Minimum CT Tap Setting</b>	Ratio (e.g., 1000:5)	
<b>H-Winding Series Reactor Impedance</b>	Ohms	
<b>H-Winding Series Reactor Type</b>	Type (e.g., air-core, epoxy, etc.)	
<b>H-Winding Series Reactor Rating</b>		MVA
<b>X-Winding Oil Normal, Air Normal (ONAN) Rating</b>	MVA	
<b>X-Winding Oil Normal, Air Forced (ONAF) Rating</b>	MVA	
<b>X-Winding Oil Forced, Air Normal (OFAN) Rating</b>	MVA	
<b>X-Winding Oil Forced, Air Forced (OFAF) Rating</b>	MVA	
<b>X-Winding Switch Gear Rating</b>	MVA	
<b>X-Winding Switch Gear Impedance</b>	Ohms	
<b>X-Winding Jumper Conductor</b>	Conductor Call sign (e.g., Tern, Drake, etc.)	
<b>X-Winding Number of Jumper Conductors</b>		Integer
<b>X-Winding Current-Transformer (CT) Tap Settings</b>	Ratio (e.g., 1000:5)	
<b>X-Winding CT Rating Factor</b>	Float (e.g., 1.0, 1.5, 2.0, etc.)	
<b>X-Winding Present Minimum CT Tap Setting</b>	Ratio (e.g., 1000:5)	
<b>X-Winding Series Reactor Impedance</b>	Ohms	
<b>X-Winding Series Reactor Type</b>	Type (e.g., air-core, epoxy, etc.)	
<b>X-Winding Series Reactor Rating</b>		MVA



**Table 4: Requested Three-Winding Transformer Power Flow Data**

Data Requested	Desired Units	Data Value
<b>Serial Number</b>	--	
<b>Test Report</b>		
<b>Date No-Load Tap Changer Setting was Verified</b>	MM/DD/YYYY	
<b>Core Construction</b>	--	
<b>H-Winding has GIC Blocking Device?</b>	Yes/No	
<b>X-Winding has GIC Blocking Device?</b>	Yes/No	
<b>Y-Winding has GIC Blocking Device?</b>	Yes/No	
<b>H-Winding DC Resistance</b>	Ohms	
<b>X-Winding DC Resistance</b>	Ohms	
<b>Y-Winding DC Resistance</b>	Ohms	
<b>DC Winding Resistance Temperature</b>	degrees	
<b>Transformer Number</b>	two-character identifier	
<b>H-Winding Nominal Voltage</b>	kV	
<b>X-Winding Nominal Voltage</b>	kV	
<b>Y-Winding Nominal Voltage</b>	kV	
<b>No-Load Tap Changer exists?</b>	Yes/No	
<b>No-Load Tap Changer winding</b>	H, X, or Y	
<b>Number of No-Load Tap Changer Steps</b>	Integer or Letter (e.g., 3 or C)	
<b>No-Load Tap Changer Step %</b>	%	
<b>Present No-Load Tap Changer Setting</b>	Integer or Letter (e.g., 2 or B)	
<b>Load Tap Changer exists?</b>	Yes/No	
<b>Load Tap Changer winding</b>	H, X, or Y	
<b>Number of Load Tap Changer Steps</b>	Integer or Letter (e.g., 3 or C)	
<b>Load Tap Changer Step %</b>	%	
<b>No-Load Losses</b>	W	
<b>Exciting Current</b>	% at 100% rated voltage	
<b>Vector Group</b>	Characters	
<b>Phase shift angle</b>	degrees	
<b>Load Loss (corrected to 85C)</b>	W	
<b>Impedance (corrected to 85C)</b>	%	
<b>Load Loss and Impedance S Base</b>	MVA	
<b>H-Winding Oil Normal, Air Normal (ONAN) Rating</b>	MVA	
<b>H-Winding Oil Normal, Air Forced (ONAF) Rating</b>	MVA	
<b>H-Winding Oil Forced, Air Normal (OFAN) Rating</b>	MVA	
<b>H-Winding Oil Forced, Air Forced (OFAF) Rating</b>	MVA	
<b>H-Winding Switch Gear Rating</b>	MVA	
<b>H-Winding Switch Gear Impedance</b>	Ohms	
<b>H-Winding Jumper Conductor</b>	Conductor Callsign (e.g., Tern, Drake, etc.)	
<b>H-Winding Number of Jumper Conductors</b>	Integer	
<b>H-Winding Current-Transformer (CT) Tap Settings</b>	Ratio (e.g., 1000:5)	
<b>H-Winding CT Rating Factor</b>	Float (e.g., 1.0, 1.5, 2.0, etc.)	
<b>H-Winding Present Minimum CT Tap Setting</b>	Ratio (e.g., 1000:5)	

Data Requested	Desired Units	Data Value
<b>H-Winding Series Reactor Impedance</b>	Ohms	
<b>H-Winding Series Reactor Type</b>	Type (e.g., air-core, epoxy, etc.)	
<b>H-Winding Series Reactor Rating</b>	MVA	
<b>X-Winding Oil Normal, Air Normal (ONAN) Rating</b>	MVA	
<b>X-Winding Oil Normal, Air Forced (ONAF) Rating</b>	MVA	
<b>X-Winding Oil Forced, Air Normal (OFAN) Rating</b>	MVA	
<b>X-Winding Oil Forced, Air Forced (OFAF) Rating</b>	MVA	
<b>X-Winding Switch Gear Rating</b>	MVA	
<b>X-Winding Switch Gear Impedance</b>	Ohms	
<b>X-Winding Jumper Conductor</b>	Conductor Callsign (e.g., Tern, Drake, etc.)	
<b>X-Winding Number of Jumper Conductors</b>	Integer	
<b>X-Winding Current-Transformer (CT) Tap Settings</b>	Ratio (e.g., 1000:5)	
<b>X-Winding CT Rating Factor</b>	Float (e.g., 1.0, 1.5, 2.0, etc.)	
<b>X-Winding Present Minimum CT Tap Setting</b>	Ratio (e.g., 1000:5)	
<b>X-Winding Series Reactor Impedance</b>	Ohms	
<b>X-Winding Series Reactor Type</b>	Type (e.g., air-core, epoxy, etc.)	
<b>X-Winding Series Reactor Rating</b>	MVA	
<b>Y-Winding Oil Normal, Air Normal (ONAN) Rating</b>	MVA	
<b>Y-Winding Oil Normal, Air Forced (ONAF) Rating</b>	MVA	
<b>Y-Winding Oil Forced, Air Normal (OFAN) Rating</b>	MVA	
<b>Y-Winding Oil Forced, Air Forced (OFAF) Rating</b>	MVA	
<b>Y-Winding Switch Gear Rating</b>	MVA	
<b>Y-Winding Switch Gear Impedance</b>	Ohms	
<b>Y-Winding Jumper Conductor</b>	Conductor Callsign (e.g., Tern, Drake, etc.)	
<b>Y-Winding Number of Jumper Conductors</b>	Integer	
<b>Y-Winding Current-Transformer (CT) Tap Settings</b>	Ratio (e.g., 1000:5)	
<b>Y-Winding CT Rating Factor</b>	Float (e.g., 1.0, 1.5, 2.0, etc.)	
<b>Y-Winding Present Minimum CT Tap Setting</b>	Ratio (e.g., 1000:5)	
<b>Y-Winding Series Reactor Impedance</b>	Ohms	
<b>Y-Winding Series Reactor Type</b>	Type (e.g., air-core, epoxy, etc.)	
<b>Y-Winding Series Reactor Rating</b>	MVA	

**Table 5: Requested Transmission Line Power Flow Data**

Data Requested	Desired Units	Data Value
<b>Line Length</b>	Miles	
<b>Conductor Type</b>	Call Sign, Size in kcmil, strands, and class (e.g., "Rail 954 45/7 ACSR")	
<b>Static Wire #1 type</b>	Wire type and stranding (e.g., "3/8 EHS")	
<b>Static Wire #2 type</b>	Wire type and stranding (e.g., "24 OPGW, 5")	

Data Requested	Desired Units	Data Value
<b>Line construction</b>	e.g., "H-Frame, Single Circuit", "Single-Pole, Double Circuit", etc.	
<b>DC Line Resistance</b>	Ohms / Phase @ 50°C	
<b>AC Line Resistance</b>	PU on 100 MVA Base	
<b>AC Line Reactance</b>	PU on 100 MVA Base	
<b>Line Charging</b>	PU on 100 MVA Base	
<b>Conductor Rating (50°C)</b>	MVA	
<b>Conductor Rating (40°C)</b>	MVA	
<b>Conductor Rating (30°C)</b>	MVA	
<b>Conductor Rating (20°C)</b>	MVA	
<b>Conductor Rating (10°C)</b>	MVA	
<b>Conductor Rating (0°C)</b>	MVA	
<b>Line Switch Rating (normal)</b>	MVA	
<b>Line Switch Rating (emergency)</b>	MVA	
<b>Line Breaker Rating (normal)</b>	MVA	
<b>Line Breaker Rating (emergency)</b>	MVA	
<b>Line CT Current Tap Setting</b>	ratio (e.g., "2000:5")	
<b>Line CT Rating Factor</b>		
<b>Line CT Maximum Tap Setting</b>	ratio (e.g., "2000:5")	
<b>Wave-Trap Rating (normal)</b>	MVA	
<b>Wave Trap Rating (emergency)</b>	MVA	
<b>Series Shunt Rating (normal)</b>	MVA	
<b>Series Shunt Rating (emergency)</b>	MVA	
<b>Number of Jumpers per Phase</b>		
<b>Jumper Type</b>	Call Sign, Size in kcmil, strands, and class (e.g., "Rail 954 45/7 ACSR")	
<b>Jumper Rating (normal)</b>	MVA	
<b>Jumper Rating (emergency)</b>	MVA	
<b>Has Metal-Oxide Varistor (MOV) Protection?</b>	"Yes" or "No"	
	0 = No MOV	
	1 = MOV Protection Enabled	
	2 = MOV Protection Disabled	
	3 = MOV Spark-Gap Protection	
<b>MOV Protection Type</b>		
<b>MOV Voltage Rating (continuous)</b>	kV	
<b>MOV Current Rating (continuous)</b>	kA	
<b>Owner #1</b>		
<b>Owner #2</b>		
<b>Owner #3</b>		
<b>Owner #4</b>		
<b>Owner #1 Fraction</b>	%	
<b>Owner #2 Fraction</b>	%	
<b>Owner #3 Fraction</b>	%	
<b>Owner #4 Fraction</b>	%	

**Table 6: Requested Shunt Capacitor/Reactor Data**

Data Requested	Desired Units	Data Value
<b>Is Static Var Compensator (SVC)?</b>	Yes or No	
<b>Total amount of capacitance</b>	MVAR	

Data Requested	Desired Units	Data Value
<b>Number of capacitive blocks</b>		
<b>Number of steps per capacitive block</b>		
<b>Amount of capacitance per step</b>	MVAR	
<b>Total amount of reactance</b>	MVAR	
<b>Number of reactive blocks</b>		
<b>Number of steps per reactive block</b>		
<b>Amount of reactance per step</b>	MVAR	
<b>DC Resistance</b>	Ohms/Phase	
<b>Grounding Resistance</b>	Ohms	
<b>Grounding Connection</b>	Grounded Wye, Wye, Delta	

**Short Circuit**

Short circuit data allows Company to assess the ability of the transmission system to interrupt fault current provided by the plant. It will aid in determination of the ability of existing breakers and circuit switchers to handle fault current provided by the new plant. In addition, this data helps size breakers, circuit switchers, and or switches at the new point of interconnect (POI). Data requested is listed in is requested to help create a short circuit model of the plant.

**Table 77: Requested Generator Short Circuit Data**

Data Requested	Desired Units	Data Value
<b>Positive Sequence Armature Resistance</b>	PU on MVA Base	
<b>D-Axis Saturated Sub-Transient Reactance</b>	PU on MVA Base	
<b>D-Axis Saturated Transient Reactance</b>	PU on MVA Base	
<b>D-Axis Saturated Synchronous Reactance</b>	PU on MVA Base	
<b>Negative Sequence Armature Resistance</b>	PU on MVA Base	
<b>Negative Sequence Reactance</b>	PU on MVA Base	
<b>Zero Sequence Armature Resistance</b>	PU on MVA Base	
<b>Zero Sequence Reactance</b>	PU on MVA Base	
<b>Grounding Transformer high-side kV</b>	kV	
<b>Grounding Transformer low-side kV</b>	kV	
<b>Grounding resistance</b>	ohms	
<b>Grounding reactance</b>	ohms	

**Table 8: Requested Two-Winding Transformer Short Circuit Data**

Data Requested	Desired Units	Data Value
<b>Is Autotransformer?</b>	Yes/No	
<b>Zero-Sequence Resistance</b>	% on test MVA base	
<b>Zero-Sequence Reactance</b>	% on test MVA base	
<b>Test MVA</b>	MVA	
<b>H-Winding Grounding Resistance</b>	Ohms	
<b>H-Winding Grounding Reactance</b>	Ohms	
<b>X-Winding Grounding Resistance</b>	Ohms	
<b>X-Winding Grounding Reactance</b>	Ohms	
<b>Neutral Resistance</b>	Ohms	
<b>Neutral Reactance</b>	Ohms	

**Table 9: Requested Three-Winding Transformer Short Circuit Data**

Data Requested	Desired Units	Data Value
<b>Is Autotransformer?</b>	Yes/No	
<b>Which windings are auto?</b>	H-X, X-Y, or H-Y	
<b>Zero-Sequence Resistance 1</b>	% on test MVA base; Z1No, H, or H-X	
<b>Zero-Sequence Reactance 1</b>	% on test MVA base; Z1No, H, or H-X	
<b>Zero-Sequence Resistance 2</b>	% on test MVA base; Z2No, X, or X-Y	
<b>Zero-Sequence Reactance 2</b>	% on test MVA base; Z2No, X, or X-Y	
<b>Zero-Sequence Resistance 3</b>	% on test MVA base; Z1Ns, Y, or H-Y	
<b>Zero-Sequence Reactance 3</b>	% on test MVA base; Z1Ns, Y, or H-Y	
<b>Test MVA</b>	MVA	
<b>H-Winding Grounding Resistance</b>	Ohms	
<b>H-Winding Grounding Reactance</b>	Ohms	
<b>X-Winding Grounding Resistance</b>	Ohms	
<b>X-Winding Grounding Reactance</b>	Ohms	
<b>Y-Winding Grounding Resistance</b>	Ohms	
<b>Y-Winding Grounding Reactance</b>	Ohms	
<b>Neutral Resistance</b>	Ohms	
<b>Neutral Reactance</b>	Ohms	

**Table 108: Requested Transmission Line Short Circuit Data**

Data Requested	Desired Units	Data Value
<b>AC Zero-Sequence Line Resistance</b>	PU on 100 MVA Base	
<b>AC Zero-Sequence Line Reactance</b>	PU on 100 MVA Base	
<b>Zero-Sequence Line Charging</b>	PU on 100 MVA Base	
<b>MOV Rated Current</b>	kA	

## Dynamics Models

Dynamics models are relatively precise device models that help Company understand how a plant operates in real time. These models help establish the stability of the Company system as well as determine voltage recovery issues that may arise. Depending on the type of plant, Company requires several individual dynamic models be created for each unit. These models should be appropriate for the specific unit(s) and be developed by the Customer per Company's list of acceptable dynamics models. Company's list of acceptable dynamics models contains parameter worksheets, software syntax, and block diagrams and a PDF may be requested from Company Transmission Planning ([LongTermPlanning@kcpl.com](mailto:LongTermPlanning@kcpl.com)).

### *Machine Models*

Depending on the type of unit, what data is available, and what models make sense to the Customer, the TP needs the following:

- Rotor model
- Exciter System model (if applicable)
- Power System Stabilizer model (if applicable)
- Turbine/Governor System model (if applicable)
- Turbine Load Controller model (if applicable)
- Voltage Compensator model (if applicable)
- Under-Excitation Limiter system model (if applicable)
- Over-Excitation Limiter system model (if applicable)
- Over-Frequency trip models
- Under-Frequency trip models
- Over-Voltage trip models
- Under-Voltage trip models
- Loss of Excitation Distance Relay model (if applicable)
- Volts per Hertz Relay model (if applicable)

### *Transformers*

It is possible that both Generator Step-Up Units (GSUs) and station transformers have a magnetic saturation curve supplied with the test report. As such, it is appropriate to create a transformer saturation model for use with dynamic studies.

## **Attachment E - Generator Interconnection Data Requirements for A-Synchronous Machines**

### **Data Request Background**

By interconnecting to the KCP&L/Westar transmission system, KCP&L/Westar is designated as the interconnection facility and Customer's Transmission Planner (TP). A TP is an entity defined by the North American Electric Reliability Corporation (NERC) that has certain requirements and obligations (requirements) to meet Electric Utility Industry Standards (Standards). Among other things, these requirements involve developing a model of the interconnecting facility for use in transmission studies.

To adequately assess the transmission system for the proposed facility interconnect (plant), a Generator Interconnection (GI) study must be performed. While the Customer must make a formal data submission to the Southwest Power Pool (SPP) and participate in an SPP regional GI study, KCP&L/Westar performs an independent study to capture impacts local to the KCP&L/Westar system and to establish an initial data collection from the Customer.

KCP&L/Westar will make an initial data request to the Customer for the purposes of studying the proposed interconnection. A subsequent data request will be made once the facility is built and in service. Once KCP&L has submitted an official data request, the Customer is required by NERC standard MOD-032 Requirement R3 to provide data within 90 days unless a longer time period is agreed upon, back to KCP&L/Westar. Per NERC Standard MOD-032, Requirement R2, the Customer is required to provide power flow, short circuit, and dynamic model data. All data provided to KCP&L/Westar is owned by the Customer and, therefore, cannot be modified by KCP&L/Westar (unless KCP&L/Westar is also the Customer) for MOD-032 compliance. This means that the Customer is required to provide sufficient equivalent models for plants where four or more machines feed into one or more collector circuit(s). This includes equivalent generating unit models, corresponding equivalent generator step-up transformer (GSU) models, and models for any transformers and transmission lines owned by the Customer for the interconnecting facility.

The Customer shall provide as much detail as possible. Some data may not be available due to incomplete records or because a facility is not yet built. In this case the TP requires general information so a generic model may be produced. Once a facility is in-service a supplementary data request will be made and the Customer must provide complete models within 90 days unless a longer time period is agreed upon, per NERC standard MOD-032.

### **Frequency of Data Updates**

When connecting to the Bulk Electric System (BES), the Customer is required by NERC to provide data and data updates to the TP. Some NERC Standards have data reporting frequencies and those must be reviewed and provided by the Customer as required. However, in accordance with NERC Standard MOD-032, the Customer must provide steady-state, short circuit, and dynamic modeling information to the TP per the modeling schedule set forth by the Planning Coordinator (PC, SPP). SPP builds cases on annual basis and requests data updates annually.



## **Transmission Planner (TP) and Planning Coordinator (PC)**

The TP and PC (SPP) will collaborate to provide the Customer with:

- System impedance data and available fault current at the Point of Interconnect (POI)
- A list of dynamics models acceptable to the TP, including:
  - o Parameter sheet(s)
  - o Block diagram(s)

## **Generator Owner (Customer) Deliverables**

The Customer should provide the following data to both the PC and the TP for all applicable facilities owned by the Customer:

- Load flow model in PSSE v33 RAW format, including all:
  - o Transmission lines owned by the Customer
  - o Primary station transformers owned by the Customer (e.g., 345/34.5 kV transformers)
  - o Equivalent collector circuit(s) owned by the Customer
  - o Equivalent GSU(s) owned by the Customer
  - o Equivalent generator(s)
- Short circuit model for all load flow facilities previously noted in PSSE v33 SEQ format
- Approved dynamic models in PSSE v33 DYR format for each equivalent generator:
  - o Generic models (i.e., PSSE library models) are preferred
  - o Equivalent generator model (e.g., REGCAU1)
  - o Equivalent electrical control model (e.g., REECAU1)
  - o Wind mechanical control model, if applicable (e.g., WTDTAU1)
  - o PV panel model, if applicable (e.g., PANELU1)
  - o Wind pitch control model, if applicable (e.g., WTPTAU1)
  - o PV irradiance profile model, if applicable (e.g., IRRADU1)
  - o Wind aerodynamics control model, if applicable (e.g., WTARAU1)
  - o Generator protection models (e.g., VTGDCAT, FRQDCAT, LOEXR1T)
- Approved dynamic model in PSSE v33 DYR format for each plant:
  - o Plant controller model (e.g., REPCAU1)
- While it is not preferred, if black-box, vendor-supplied dynamics models are to be used, the following shall be included:
  - o Data sheets for all models to be used at the facility:
    - PDF format
    - Including a description of each ICON/CON value
  - o LIB files for all models to be used at the facility (needed for SPP compilation)
  - o DLL files for all models to be used at the facility (needed for MOD studies)

## **Steady-State, Short Circuit, and Dynamic Data Requirements**

A great deal of data is required to accurately represent a plant in the Siemens PTI Power System Simulator for Engineers (PSSE) software package. The Customer is responsible for and must provide enough data to create an accurate model in PSSE. The complete data requirements are

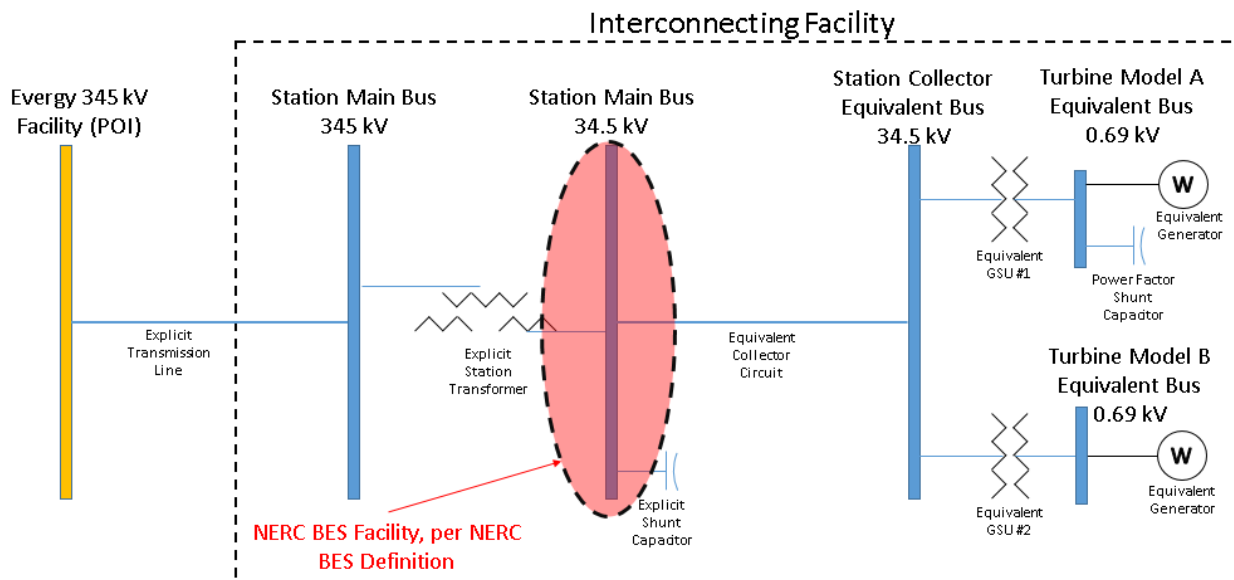
listed in the following sections. Depending on plant configuration and construction, not all data may be required. The plant model should adhere to the NERC BES Definition.

### Example Plant Model

A complete model of the a-synchronous plant must be developed to allow adequate assessment of the facility in interconnection-wide studies. The equivalent plant model must have an adequate electrical representation of the different classes of equipment implemented at the plant. For example, assume a wind farm with 150 turbines uses two different GE models:

- Model A has a 1.5 MW capability (100 turbines)
- Model B has a 2.0 MW capability (50 turbines)

The equivalent model provided to KCP&L/Westar should have only two generators, a single an equivalent GSU, and one equivalent collector circuit. One generator represents the 150 MW capability of the 100 Model A turbines. The second generator represents the 100 MW capability of the 50 Model B turbines. The Model A generating unit requires an equivalent GSU representative of the 100 GSUs for all 100 turbines. The Model B generating unit also requires an equivalent GSU representative of the 50 GSUs for all 50 turbines. The underground lines should be appropriately combined to produce a single transmission line equivalent. All station power transformers owned by the Customer (e.g., 345/34.5 kV transformers) should be modeled explicitly. All overhead transmission lines 60 kV or above should be modeled explicitly. Based on this example, Figure 1 shows a one-line diagram of the equivalent facility. Besides bus numbers, data for all elements shown in the Interconnecting Facility should be provided.



**Figure 2: One-Line Diagram of Example Interconnecting Facility Model**

If a normally-open bus tie exists at the interconnection, independent equivalents must be created representing all applicable generators, GSUs, and collector cables.

This situation is depicted in Figure 3 where breaker 52-BT is operated normally open. Figure 4 provides an example of how this situation must be represented for transmission models.

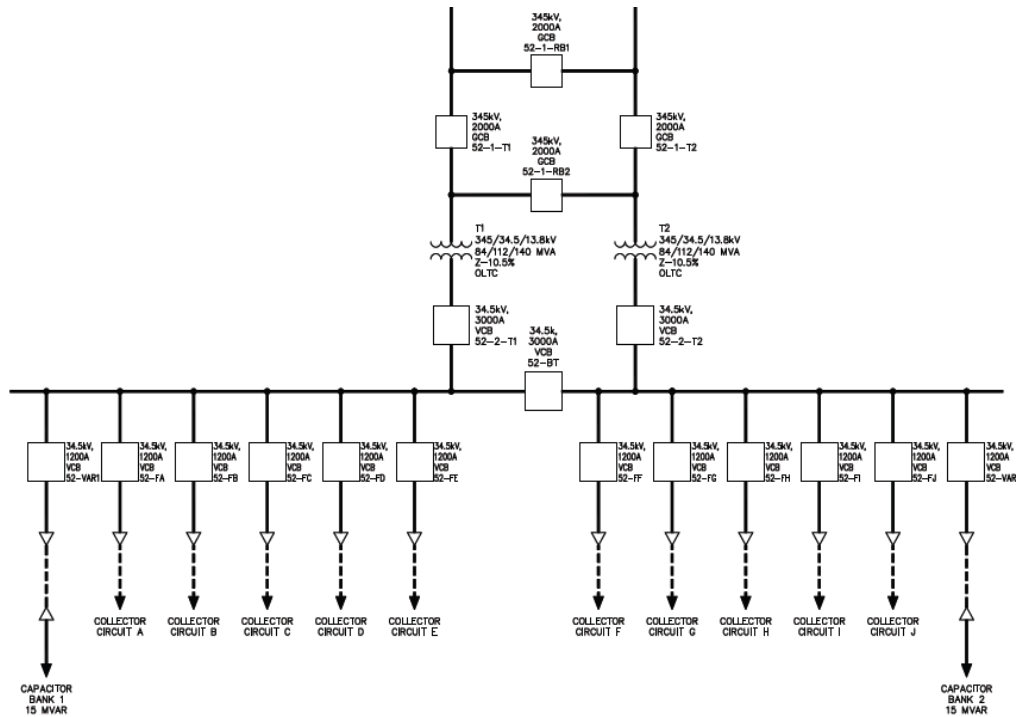


Figure 2: As-Built One-Line Diagram Showing Two Independent Collector Circuits

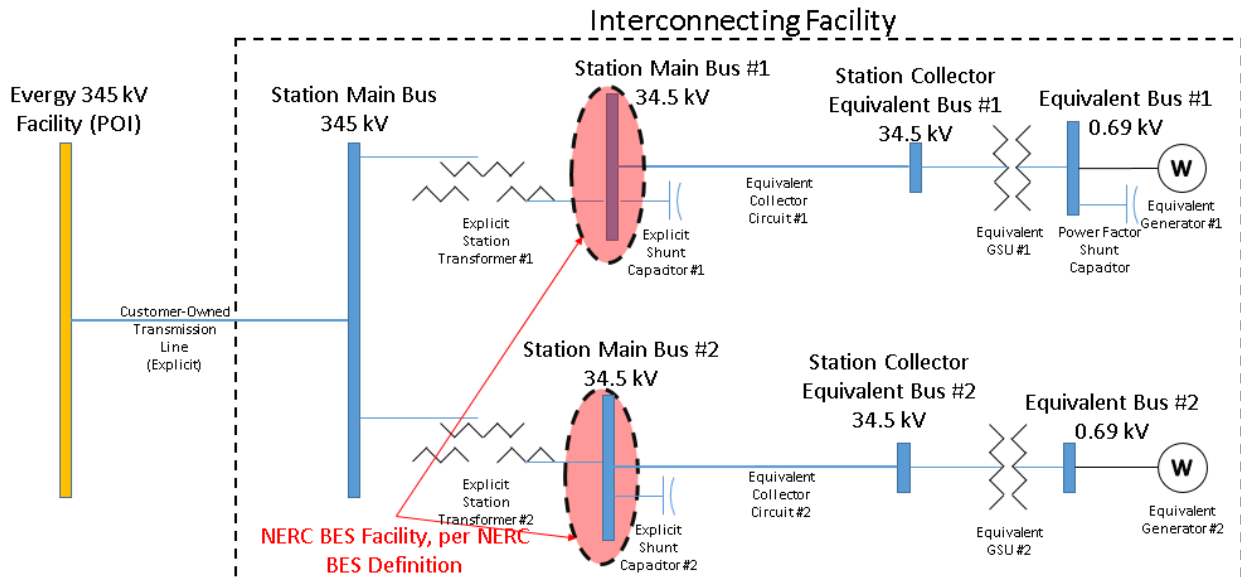


Figure 3: One-Line Diagram Depicting a Normally-Open 34.5 kV Bus Tie at the Customer Substation

### Facility Rating Data (NERC Standard FAC-008)

The Customer is also required to establish thermal ratings for all the plant’s facilities (i.e., series elements modeled in PSSE). KCP&L/Westair cannot rate these facilities and is not responsible for establishing ratings at the Customer’s facility. Typically, thermal ratings include, but are not limited to, the following: normal and emergency conductor ratings, normal and emergency jumper ratings, substation layout, bus normal and emergency ratings, breaker ratings, switch ratings, CT settings, CT thermal rating factor (TRF), and line relay limits. The most limiting

normal and emergency ratings are used to establish the final facility ratings. The Customer has the option of either filling out the appropriate data in the tables below or providing their own FAC-008 documentation that contains all required rating data. The facility must be able to operate at full output using the Normal Rating, this includes the equivalent GSU(s) and equivalent feeder circuit(s).

**Transmission Interconnection Substation Data**

KCP&L/Westar requires a proposed or as-built facility one-line diagram for both the Customer’s Interconnection Facility (illustrates transmission voltage to collection network voltage) and the collection network (illustrates the wind farm from the Customer’s Interconnection Facility to the individual wind generators with typical or intended collection feeder design).

In addition to these diagrams the TP requires data for Geo-Magnetic Disturbance (GMD) vulnerability assessments, per NERC Standard TPL-007. The information required for these studies is outlined in Table 11.

**Table 9: Required Transmission Interconnection Substation Data**

#	Parameter	Data	Units
1	Station ground-grid DC resistance (e.g., value from Fall-of-Potential Test)		Ohms
2	Substation Latitude		degrees
3	Substation Longitude		degrees
4	Interconnection Facility Substation Diagram	(please attach)	
5	Plant Collection Network Diagram	(please attach)	

### Power Plant Data

The steady state and dynamic response of the power plant depends upon the aggregate plant real and reactive capabilities as well as the plant control characteristics.

**Table 10: Required Generator Power Flow Data**

#	Parameter	Data	Units
1	EIA plant code		
2	Energy source (e.g., wind, solar, etc.)		
3	Total plant maximum real power capability (P <sub>MAX</sub> )		MW
4	Total plant maximum reactive power capability (Q <sub>MAX</sub> )		MVAR
5	Where will the plant regulate voltage (e.g., POI bus or low-side of Interconnection transformer)		
6	To what voltage will the regulated bus be controlled?		PU
7	Over-speed droop setting		Hz
8	Under-speed droop setting		Hz
9	Droop deadband setting		± Hz
10	Energy storage solution (e.g., battery, fly-wheel, etc.)		
11	Energy storage real power capability		MW
12	Energy storage rated power factor		
13	Energy storage manufacturer		
14	Energy storage data sheet	<b>(please attach)</b>	

**Table 11: Required Plant Dynamic Data**

#	Data Requested	Data	Units
1	PSSE Model Library Name		
2	Model Type (Standard or User-Written)		
3	Description		
4	Dynamic Model(s)	<b>(please attach)</b>	

**Table 12: Required Energy Storage Solution Data**

#	Data Requested	Data	Units
1	PSSE Model Library Name		
2	Model Type (Standard or User-Written)		
3	Description		
4	Dynamic Model(s)	<b>(please attach)</b>	

### Equivalent Generator Data

Individual turbine characteristics can impact the steady state and stability response of a unit. The data in Table 15 through Table 26 should be provided for each type of generator included at the Customer’s Interconnection Facility.

**Table 13: Required Equivalent Generator Data**

#	Parameter	Data	Units
1	Wind turbine or solar PV manufacturer		
2	Wind turbine or solar PV model		
3	Wind turbine type: 1. Not applicable 1. Directly connected to AC system (uncommon) 2. Induction generator with controlled external rotor resistor 3. Doubly-fed induction generator 4. Wind generator with power converter 5. Speed/Torque converter powering synchronous generator		
4	Individual turbine maximum real power capability		MW
5	Individual turbine minimum power capability (cut-in rating)		MW
6	Individual turbine rated power factor (leading)		
7	Individual turbine rated power factor (lagging)		
8	Individual turbine MVA rating		MVA
9	Rated turbine output frequency		Hz
10	Total number of wind turbines represented by equivalent		
11	Equivalent machine maximum real power capability (P <sub>MAX</sub> )		MW
12	Equivalent machine minimum real power capability (P <sub>MIN</sub> )		MW
13	Equivalent machine maximum reactive power capability (Q <sub>MAX</sub> )		MVAR
14	Equivalent machine minimum reactive power capability (Q <sub>MIN</sub> )		MVAR
15	Equivalent machine Power Factor		
16	Equivalent machine MVA base rating		MVA
17	Maximum machine voltage		per-unit
18	Maximum machine current (I <sub>max</sub> )		Per-unit on full-load current base
19	Equivalent machine impedance ( $X = 1.0 - (I_{max} - 1.0)$ )		per-unit
20	Generator manufacturer's technical datasheet summary	<b>(please attach)</b>	

**Table 14: Required Equivalent Generator Dynamic Generator/Converter Data**

#	Parameter	Data	Units
1	PSSE Model Library Name		
2	Model Type (Standard or User-Written)		
3	Description		
4	Dynamic Model(s)	<b>(please attach)</b>	

**Table 15: Required Equivalent Dynamic Electrical Control Data**

#	Parameter	Data	Units
1	PSSE Model Library Name		
2	Model Type (Standard or User-Written)		
3	Description		
4	Dynamic Model(s)	<b>(please attach)</b>	

**Table 16: Required Equivalent Dynamic Mechanical Control Model (Wind Plants Only)**

#	Parameter	Data	Units
1	PSSE Model Library Name		
2	Model Type (Standard or User-Written)		
3	Description		
4	Dynamic Model(s)	<b>(please attach)</b>	

**Table 17: Required Equivalent Dynamic Wind Pitch Control Model (Type 3 Wind Plants Only)**

#	Parameter	Data	Units
1	PSSE Model Library Name		
2	Model Type (Standard or User-Written)		
3	Description		
4	Dynamic Model(s)	<b>(please attach)</b>	

**Table 18: Required Equivalent Dynamic Wind Aerodynamic Model (Type 1, 2, and 3 Wind Plants Only)**

#	Parameter	Data	Units
1	PSSE Model Library Name		
2	Model Type (Standard or User-Written)		
3	Description		
4	Dynamic Model(s)	<b>(please attach)</b>	

**Table 19: Required Equivalent Dynamic Solar Panel Model (Solar Plants Only)**

#	Parameter	Data	Units
1	PSSE Model Library Name		
2	Model Type (Standard or User-Written)		
3	Description		
4	Dynamic Model(s)	<b>(please attach)</b>	

**Table 20: Required Equivalent Dynamic Irradiance Profile Model (Solar Plants Only)**

#	Parameter	Data	Units
1	PSSE Model Library Name		
2	Model Type (Standard or User-Written)		
3	Description		
4	Dynamic Model(s)	<b>(please attach)</b>	

**Table 21: Required Equivalent Dynamic Loss-of-Excitation Distance Relay Model (If Applicable)**

#	Parameter	Data	Units
1	PSSE Model Library Name		
2	Model Type (Standard or User-Written)		
3	Description		
4	Dynamic Model(s)	<b>(please attach)</b>	

**Table 22: Required Equivalent Generator Dynamic Low Voltage Ride Through Model (If Applicable)**

#	Parameter	Data	Units
1	PSSE Model Library Name		
2	Model Type (Standard or User-Written)		
3	Description		
4	Dynamic Model(s)	<b>(please attach)</b>	

**Table 23: Required Over-/Under-Voltage Protection Tripping Limits**

#	Parameter	Data	Units
1	Instantaneous high-voltage limit		%
2	Relay pickup time for instantaneous high-voltage trip		seconds
3	Timed trip high-voltage threshold		%
4	Timed high-voltage trip relay time delay setting		seconds
5	Instantaneous low-voltage limit		%
6	Relay pickup time for instantaneous low-voltage trip		seconds
7	Timed low-voltage threshold		%
8	Timed low-voltage trip relay time delay setting		seconds

**Table 24: Required Over-/Under-Frequency Protection Tripping Limits**

#	Parameter	Data	Units
1	Instantaneous high-frequency limit		Hz
2	Relay pickup time for instantaneous high-frequency trip		seconds
3	Timed trip high-frequency threshold		Hz
4	Timed high-frequency trip relay time delay setting		seconds
5	Instantaneous low-frequency limit		Hz
6	Relay pickup time for instantaneous low-frequency trip		seconds
7	Timed low-frequency threshold		Hz
8	Timed low-frequency trip relay time delay setting		seconds



### Equivalent GSU Data

If multiple equivalent GSUs are present, this data request should be populated for each applicable GSU.

**Table 25: Required Equivalent GSU Data**

#	Parameter	Data	Units
1	Is auto-transformer (yes or no)?		
2	Transformer core construction: 1. Single-phase bank 2. Three-phase, shell-type 3. Three-phase, core-type (3 legs) 4. Three-phase, core-type (5 legs) 5. Three-phase, core-type (7 legs)		
3	Nominal H-winding phase-to-phase voltage		kV
4	H-winding connection configuration		Grounded-Y, Y, or Δ
5	H-winding fixed tap setting, if present		kV
6	Nominal secondary X-winding phase-to-phase voltage		kV
7	X-winding connection configuration		Grounded-Y, Y, or Δ
8	X-winding Load Tap Changer (LTC) present (yes or no)?		
9	If applicable, number of LTC steps		
10	If applicable, LTC control method (e.g., voltage, real power flow, etc.)		
11	LTC regulation range (plus/minus of nominal)		±%
12	H-winding impedance base		MVA
13	Average no-load losses at 100% voltage and corrected to 85°C		W
14	Average no-load exciting current at 100% voltage and corrected to 85°C		%
15	Average no-load conductance (G)		per-unit on H-winding MVA base
16	Average no-load susceptance (B)		per-unit on H-winding MVA base
17	Average H-X load losses at nominal tap, corrected to 85°C		W
18	Average H-X load loss impedance at nominal tap, corrected to 85°C		%
19	Equivalent H-X winding positive sequence resistance		per-unit on H-winding MVA base
20	Equivalent H-X winding positive sequence reactance		per-unit on H-winding MVA base
21	Zero-sequence impedance base		MVA
22	Average zero-sequence resistance		%

#	Parameter	Data	Units
23	Average zero-sequence reactance		%
24	Equivalent zero-sequence resistance R01 (if applicable)		per-unit on H-winding MVA base
25	Equivalent zero-sequence reactance X01 (if applicable)		per-unit on H-winding MVA base
26	Equivalent zero-sequence grounding resistance Rg1 (if applicable)		per-unit on H-winding MVA base
27	Equivalent zero-sequence grounding reactance Xg1 (if applicable)		per-unit on H-winding MVA base
28	Equivalent zero-sequence resistance R02 (if applicable)		per-unit on H-winding MVA base
29	Equivalent zero-sequence reactance X02 (if applicable)		per-unit on H-winding MVA base
30	Equivalent zero-sequence grounding resistance Rg2 (if applicable)		per-unit on H-winding MVA base
31	Equivalent zero-sequence grounding reactance Xg2 (if applicable)		per-unit on H-winding MVA base
32	Equivalent neutral resistance (if applicable)		per-unit on H-winding MVA base
33	Equivalent neutral reactance (if applicable)		per-unit on H-winding MVA base
34	Transformer winding temperature rise (55°C, 65°C, or 55/65°C)		
35	Equivalent transformer continuous rating		MVA
36	Equivalent transformer eight-hour emergency rating		MVA
37	GSU nameplate(s)	<b>(please attach)</b>	
38	GSU test report(s)	<b>(please attach)</b>	

### Equivalent Collector Circuit Data

If multiple equivalent collector circuits are present, this data request should be populated for each applicable collector circuit.

**Table 26: Required Equivalent Collector Circuit Data**

#	Parameter	Data	Units
1	Nominal line phase-to-phase voltage		kV
2	Number of collection feeders per equivalent circuit		
3	Total length of feeder network		miles
4	Positive sequence resistance (R1)		per-unit on 100 MVA base
5	Positive sequence reactance (X1)		per-unit on 100 MVA base
6	Line charging (B)		per-unit on 100 MVA base
7	Zero sequence resistance (R0)		per-unit on 100 MVA base
8	Zero sequence reactance (X0)		per-unit on 100 MVA base
9	Zero sequence line charging (B0)		per-unit on 100 MVA base
10	Continuous rating of aggregate feeder network		MVA
11	Eight-hour emergency rating of aggregate feeder network		MVA
12	Line is protected by Metal-Oxide Varistor (MOV); yes or no		
13	MOV protection mode (choose one of the following): 1. MOV protection enabled 2. MOV protection disabled 3. Spark-gap protection		
14	MOV rated current		kA
15	MOV continuous rating		MVA
16	MOV eight-hour emergency rating		MVA

### Customer’s Interconnection Transmission Line Data

If the Customer owns multiple applicable interconnection transmission lines, this data request should be populated for all applicable lines.

**Table 27: Required Customer Interconnection Line Data**

#	Parameter	Data	Units
1	Nominal line phase-to-phase voltage		kV
2	Length of interconnection transmission line		miles
3	Phase conductor call-sign and type (e.g., Bunting ACSR)		
4	Number of conductors in bundle		
5	Static conductor type #1 (e.g., 24-fiber OPGW)		
6	Static conductor type #2 (e.g., 3/8 EHS)		
7	Average line pole height above ground		feet
8	Transmission structure construction (e.g., H-Frame)		
9	Phase A: average conductor distance from centerline		feet
10	Phase A: average conductor height above ground		feet
11	Phase B: average conductor distance from centerline		feet
12	Phase B: average conductor height above ground		feet
13	Phase C: average conductor distance from centerline		feet
14	Phase C: average conductor height above ground		feet
15	Static #1: average conductor distance from centerline		feet
16	Static #1: average conductor height above ground		feet
17	Static #2: average conductor distance from centerline		feet
18	Static #2: average conductor height above ground		feet
19	Phase conductor mid-span sag		feet
20	Static conductor mid-span sag		feet
21	DC line resistance at 50°C		ohms/phase
22	Positive sequence resistance (R1)		per-unit on 100 MVA base
23	Positive sequence reactance (X1)		per-unit on 100 MVA base
24	Line charging (B)		per-unit on 100 MVA base
25	Zero sequence resistance (R0)		per-unit on 100 MVA base
26	Zero sequence reactance (X0)		per-unit on 100 MVA base
27	Zero sequence line charging (B0)		per-unit on 100 MVA base
28	Continuous line rating in summer (ambient temperature of 37.7°C)		MVA
29	Eight-hour emergency line rating in summer (ambient temperature of 37.7°C)		MVA

#	Parameter	Data	Units
30	Continuous line rating in winter (ambient temperature of 0.0°C)		MVA
31	Eight-hour emergency line rating in winter (ambient temperature of 0.0°C)		MVA
32	Continuous line rating in spring/fall (ambient temperature of 20.0°C)		MVA
33	Eight-hour emergency line rating in spring/fall (ambient temperature of 20.0°C)		MVA
34	Buswork continuous rating		MVA
35	Buswork eight-hour emergency rating		MVA
36	Jumper continuous rating		MVA
37	Jumper eight-hour emergency rating		MVA
38	Disconnect switch continuous rating		MVA
39	Disconnect switch eight-hour emergency rating		MVA
40	CT set ratios		MVA
41	CT full ratios		MVA
42	CT Thermal Rating Factors		MVA
43	High relay limit		MVA
44	Low relay limit		MVA
45	Wave trap type (air core, epoxy, etc.)		
46	Wave trap continuous rating		MVA
47	Wave trap eight-hour emergency rating		MVA
48	Series shunt resistance		per-unit on 100 MVA base
49	Series shunt reactance		per-unit on 100 MVA base
50	Series shunt continuous rating		MVA
51	Series shunt eight-hour emergency rating		MVA
52	Line is protected by Metal-Oxide Varistor (MOV); yes or no		
53	MOV protection mode (choose one of the following): 1. MOV protection enabled 2. MOV protection disabled 3. Spark-gap protection		
54	MOV rated current		kA
55	MOV continuous rating		MVA
56	MOV eight-hour emergency rating		MVA
57	One-line diagram of the interconnection facility with the above information	<b>(please attach)</b>	

### Interconnection Transformer Data

If the Customer owns multiple applicable interconnection transformers, this data request should be populated for all applicable transformers.

**Table 28: Required Interconnection Two-Winding Transformer Data (If Applicable)**

#	Parameter	Data	Units
1	Primary (H) winding DC resistance corrected to 85°C		ohms/phase
2	Secondary (X) winding DC resistance corrected to 85°C		ohms/phase
3	H-winding has GIC blocking device (yes or no)?		
4	H-winding GIC blocking device is enabled (yes or no)?		
5	X-winding has GIC blocking device (yes or no)?		
6	X-winding GIC blocking device is enabled (yes or no)?		
7	Is auto-transformer (yes or no)?		
8	Transformer core construction: 1. Single-phase bank 2. Three-phase, shell-type 3. Three-phase, core-type (3 legs) 4. Three-phase, core-type (5 legs) 5. Three-phase, core-type (7 legs)		
9	Nominal H-winding phase-to-phase voltage		kV
10	H-winding connection configuration		Grounded-Y, Y, or Δ
11	H-winding fixed tap setting, if present		kV
12	Nominal secondary X-winding phase-to-phase voltage		kV
13	X-winding connection configuration		Grounded-Y, Y, or Δ
14	X-winding Load Tap Changer (LTC) present (yes or no)?		
15	If applicable, number of LTC steps		
16	If applicable, LTC control method (e.g., voltage, real power flow, etc.)		
17	LTC regulation range (plus/minus of nominal)		±%
18	H-winding impedance base		MVA
19	No-load losses at 100% voltage and corrected to 85°C		W
20	No-load exciting current at 100% voltage and corrected to 85°C		%
21	Transformer no-load conductance (G)		per-unit on H-winding MVA base
22	Transformer no-load susceptance (B)		per-unit on H-winding MVA base
23	H-X load losses at nominal tap, corrected to 85°C		W
24	H-X load loss impedance at nominal tap, corrected to 85°C		%

#	Parameter	Data	Units
25	H-X winding positive sequence resistance		per-unit on H-winding MVA base
26	H-X winding positive sequence reactance		per-unit on H-winding MVA base
27	Zero-sequence impedance base		MVA
28	Zero-sequence resistance		%
29	Zero-sequence reactance		%
30	Zero-sequence resistance R01 (if applicable)		per-unit on H-winding MVA base
31	Zero-sequence reactance X01 (if applicable)		per-unit on H-winding MVA base
32	Zero-sequence grounding resistance Rg1 (if applicable)		per-unit on H-winding MVA base
33	Zero-sequence grounding reactance Xg1 (if applicable)		per-unit on H-winding MVA base
34	Zero-sequence resistance R02 (if applicable)		per-unit on H-winding MVA base
35	Zero-sequence reactance X02 (if applicable)		per-unit on H-winding MVA base
36	Zero-sequence grounding resistance Rg2 (if applicable)		per-unit on H-winding MVA base
37	Zero-sequence grounding reactance Xg2 (if applicable)		per-unit on H-winding MVA base
38	Neutral resistance (if applicable)		per-unit on H-winding MVA base
39	Neutral reactance (if applicable)		per-unit on H-winding MVA base
40	Transformer winding temperature rise (55°C, 65°C, or 55/65°C)		
41	Maximum transformer continuous rating		MVA
42	Maximum transformer eight-hour emergency rating		MVA
43	Buswork continuous rating		MVA
44	Buswork eight-hour emergency rating		MVA
45	Jumper continuous rating		MVA
46	Jumper eight-hour emergency rating		MVA
47	Disconnect switch continuous rating		MVA
48	Disconnect switch eight-hour emergency rating		MVA
49	CT set ratios		MVA

#	Parameter	Data	Units
50	CT full ratios		MVA
51	CT Thermal Rating Factors		MVA
52	High relay limit		MVA
53	Low relay limit		MVA
54	Interconnection transformer nameplate(s)	<b>(please attach)</b>	
55	Interconnection transformer test report(s)	<b>(please attach)</b>	

**Table 29: Required Interconnection Three-Winding Transformer Data (If Applicable)**

#	Parameter	Data	Units
1	Primary (H) winding DC resistance corrected to 85°C		ohms/phase
2	Secondary (X) winding DC resistance corrected to 85°C		ohms/phase
3	Tertiary (Y) winding DC resistance corrected to 85°C		ohms/phase
4	H-winding has GIC blocking device (yes or no)?		
5	H-winding GIC blocking device is enabled (yes or no)?		
6	X-winding has GIC blocking device (yes or no)?		
7	X-winding GIC blocking device is enabled (yes or no)?		
8	Y-winding has GIC blocking device (yes or no)?		
9	Y-winding GIC blocking device is enabled (yes or no)?		
10	Is H-X auto-transformer (yes or no)?		
11	Is H-Y auto-transformer (yes or no)?		
12	Is X-Y auto-transformer (yes or no)?		
13	Transformer core construction: 1. Single-phase bank 2. Three-phase, shell-type 3. Three-phase, core-type (3 legs) 4. Three-phase, core-type (5 legs) 5. Three-phase, core-type (7 legs)		
14	Nominal primary H-winding phase-to-phase voltage		kV
15	H-winding connection configuration		Grounded-Y, Y, or Δ
16	H-winding fixed tap setting, if present		kV
17	Nominal secondary X-winding phase-to-phase voltage		kV
18	X-winding connection configuration		Grounded-Y, Y, or Δ
19	X-winding Load Tap Changer (LTC) present (yes or no)?		
20	If applicable, number of LTC steps		
21	If applicable, LTC control method (e.g., voltage, real power flow, etc.)		
22	LTC regulation range (plus or minus of nominal)		±%
23	Nominal tertiary Y-winding phase-to-phase voltage		kV
24	Y-winding connection configuration		Grounded-Y, Y, or Δ
25	H-winding impedance base		MVA
26	No-load losses at 100% voltage and corrected to 85°C		W
27	No-load exciting current at 100% voltage and corrected to 85°C		%



#	Parameter	Data	Units
28	No-load conductance (G)		per-unit on H-winding MVA base
29	No-load susceptance (B)		per-unit on H-winding MVA base
30	H-X winding impedance base rating		MVA
31	H-X load losses at nominal tap, corrected to 85°C		W
32	H-X load loss impedance at nominal tap, corrected to 85°C		%
33	X-Y winding impedance base rating		MVA
34	X-Y load losses at nominal tap, corrected to 85°C		W
35	X-Y load loss impedance at nominal tap, corrected to 85°C		%
36	H-Y winding impedance base rating		MVA
37	H-Y load losses at nominal tap, corrected to 85°C		W
38	H-Y load loss impedance at nominal tap, corrected to 85°C		%
39	H-X winding positive sequence resistance		per-unit on H-winding MVA base
40	H-X winding positive sequence reactance		per-unit on H-winding MVA base
41	H-Y winding positive sequence resistance		per-unit on H-winding MVA base
42	H-Y winding positive sequence reactance		per-unit on H-winding MVA base
43	X-Y winding positive sequence resistance		per-unit on H-winding MVA base
44	X-Y winding positive sequence reactance		per-unit on H-winding MVA base
45	Zero-sequence impedance base		MVA
46	Zero-Sequence winding 1 resistance (H, H-X, or Z1No)		%
47	Zero-Sequence winding 1 reactance (H, H-X, or Z1No)		%
48	Zero-Sequence winding 2 resistance (X, X-Y, or Z2No)		%
49	Zero-Sequence winding 2 reactance (X, X-Y, or Z2No)		%

#	Parameter	Data	Units
50	Zero-Sequence winding 3 resistance (Y, H-Y, or Z1Ns)		%
51	Zero-Sequence winding 3 reactance (Y, H-Y, or Z1Ns)		%
52	Zero sequence resistance R01 (if applicable)		per-unit on H-winding MVA base
53	Zero sequence reactance X01 (if applicable)		per-unit on H-winding MVA base
54	Zero sequence grounding resistance Rg1 (if applicable)		per-unit on H-winding MVA base
55	Zero sequence grounding reactance Xg1 (if applicable)		per-unit on H-winding MVA base
56	Zero sequence resistance R02 (if applicable)		per-unit on H-winding MVA base
57	Zero sequence reactance X02 (if applicable)		per-unit on H-winding MVA base
58	Zero sequence grounding resistance Rg2 (if applicable)		per-unit on H-winding MVA base
59	Zero sequence grounding reactance Xg2 (if applicable)		per-unit on H-winding MVA base
60	Zero sequence resistance R03 (if applicable)		per-unit on H-winding MVA base
61	Zero sequence reactance X03 (if applicable)		per-unit on H-winding MVA base
62	Zero sequence grounding resistance Rg3 (if applicable)		per-unit on H-winding MVA base
63	Zero sequence grounding reactance Xg3 (if applicable)		per-unit on H-winding MVA base
64	Neutral resistance		per-unit on H-winding MVA base
65	Neutral reactance		per-unit on H-winding MVA base
66	Transformer winding temperature rise (55°C, 65°C, or 55/65°C)		
67	H-winding maximum continuous rating		MVA
68	H-winding maximum eight-hour emergency rating		MVA
69	X-winding maximum continuous rating		
70	X-winding maximum eight-hour emergency rating		
71	Y-winding maximum continuous rating		

#	Parameter	Data	Units
72	Y-winding maximum eight-hour emergency rating		
73	Buswork continuous rating		MVA
74	Buswork eight-hour emergency rating		MVA
75	Jumper continuous rating		MVA
76	Jumper eight-hour emergency rating		MVA
77	Disconnect switch continuous rating		MVA
78	Disconnect switch eight-hour emergency rating		MVA
79	CT set ratios		MVA
80	CT full ratios		MVA
81	CT Thermal Rating Factors		MVA
82	High relay limit		MVA
83	Low relay limit		MVA
84	Interconnection transformer nameplate(s)	<b>(please attach)</b>	
85	Interconnection transformer test report(s)	<b>(please attach)</b>	

**Table 30: Required Interconnection Transformer Dynamic Saturation Model (If Applicable)**

#	Data Requested	Data	Units
1	PSSE Model Library Name		
2	Model Type (Standard or User-Written)		
3	Description		
4	Dynamic Model(s)	<b>(please attach)</b>	

### Shunt Reactive Compensation Device Data

If the Customer owns multiple applicable shunt reactive devices, this data request should be populated for all applicable devices.

**Table 31: Required Shunt Reactive Device Data**

#	Parameter	Data	Units
1	Is SVC (yes or no)?		
2	Is STATCOM (FACTS) device (yes or no)?		
3	Is non-SVC switched capacitor and/or reactor bank (yes or no)?		
4	Number of capacitive steps		
5	Size of each capacitive step		MVAR
6	Number of reactive steps		
7	Size of each reactive step		MVAR
8	Voltage control method (manual or automatic)		
9	Voltage switching levels		per-unit
10	Voltage switching time response for controls		seconds
	Voltage switching control loop		
11	If SVC, STATCOM, or D-SMES, provide: Manufacturer Manufacturer Contact Technical and Operating data	<b>(please attach)</b>	
	DC resistance		ohms
	Grounding resistance		ohms
	Grounding connection		Grounded-Y, Y, or Δ
12	Other reactive power compensation method (capacitive and inductive ratings)		
48	Other reactive power compensation control method	<b>(please attach)</b>	

#	Parameter	Data	Units
1	Is SVC (yes or no)?		
2	Is STATCOM (FACTS) device (yes or no)?		
3	Is non-SVC switched capacitor and/or reactor bank (yes or no)?		
4	Number of capacitive steps		
5	Size of each capacitive step		MVAR
6	Number of reactive steps		
7	Size of each reactive step		MVAR
8	Voltage control method (manual or automatic)		
9	Voltage switching levels		per-unit
10	Voltage switching time response for controls		seconds
11	Voltage switching control loop		
12	If SVC, STATCOM, or D-SMES, provide: Manufacturer Manufacturer Contact Technical and Operating data	<b>(please attach)</b>	
13	DC resistance		ohms

14	Grounding resistance		ohms
15	Grounding connection		Grounded-Y, Y, or Δ
16	Other reactive power compensation method (capacitive and inductive ratings)		
17	Other reactive power compensation control method	<b>(please attach)</b>	

**Table 32: Required Dynamic Switched Shunt Model (If Applicable)**

#	Data Requested	Data	Units
1	PSSE Model Library Name		
2	Model Type (Standard or User-Written)		
3	Description		
4	Dynamic Model(s)	<b>(please attach)</b>	

**Table 33: Required Dynamic SVC Model (If Applicable)**

#	Data Requested	Data	Units
1	PSSE Model Library Name		
2	Model Type (Standard or User-Written)		
3	Description		
4	Dynamic Model(s)	<b>(please attach)</b>	

**Table 34: Required Dynamic STATCOM Model (If Applicable)**

#	Data Requested	Data	Units
1	PSSE Model Library Name		
2	Model Type (Standard or User-Written)		
3	Description		
4	Dynamic Model(s)	<b>(please attach)</b>	