

LCRA Transmission Services Corporation

Facility Interconnection Requirements

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1.0 INTRODUCTION

LCRA Transmission Services Corporation (“LCRA TSC”) is a Transmission Service Provider in the Electric Reliability Council of Texas (“ERCOT”) region. LCRA TSC tariffs for the provision of wholesale electric service are filed at the Public Utility Commission of Texas (“PUC”) and consist of Wholesale Transmission Service, Wholesale Transformation Service, and Wholesale Metering Service. LCRA TSC provides service on a non-discriminatory basis to any eligible Transmission Service Customer, as that term is defined in the PUC Substantive Rules.

LCRA TSC is not a retail electric utility and does not directly serve retail customers. The PUC substantive rules characterize a retail customer as the separately metered end-use customer who purchases and ultimately consumes electricity.

Wholesale transmission and/or transformation customers directly connecting to LCRA TSC’s facilities are required to have an Interconnection Agreement, in accordance with LCRA TSC’s Wholesale Transmission Service and Wholesale Transformation Service tariffs. Transmission Service Requirements for generation and transmission interconnections, under the tariffs mentioned above, are addressed in PUC Substantive Rules § § 25.191, 25.195 and 25.198.

Entities requesting interconnection should contact LCRA TSC at interconnection_request@lcra.org.

2.0 GLOSSARY OF TERMS

Brownfield Site – previously developed and currently in-service LCRA TSC substation facility.

Customer – an entity receiving wholesale electric service (transmission, transformation, or metering) from LCRA TSC, including transmission service providers, distribution service providers, river authorities, municipally owned utilities, electric cooperatives, power generation companies, retail electric providers, federal power marketing agencies, exempt wholesale generators, qualifying facilities, power marketers, or other persons.

ERCOT – the Electric Reliability Council of Texas, Inc.

ERCOT Requirements – the ERCOT Nodal Protocols and Operating Guides and ERCOT Generation Interconnection Procedures, as well as any other binding documents or procedures adopted by ERCOT or otherwise made applicable by reference, including NERC Reliability Standards, relating to the interconnection and operation of generation or energy storage facilities and transmission systems in ERCOT as amended from time to time, and any successors thereto.

Interconnection Agreement – the contractual conditions under which LCRA TSC and a Customer agree that one or more facilities may be interconnected to LCRA TSC’s system.

Interconnection Request – a request for a new Point of Interconnection or a Material Modification to facilities supporting an existing Point of Interconnection including requests for new or changes to wholesale electric transmission, transformation, or metering service from LCRA TSC.

Interconnection Facilities – all the facilities installed, or to be installed, for the purpose of interconnecting systems at the Point of Interconnection, including Transmission, Generation, Transformation, Distribution, and/or Metering Facilities.

Good Utility Practice – any of the practices, methods, and acts engaged in, or approved by, a significant portion of the electric utility industry during the relevant time period, or any of the practices, methods, and acts that, in the exercise of reasonable judgment in light of the facts known at the time the decision was made, could have been expected to accomplish the desired result at a reasonable cost consistent with good business practices, reliability, safety, and expedition. Good Utility Practice is not intended to be limited to the optimum practice, method, or act, to the exclusion of all others, but rather is intended to include acceptable practices, methods, and acts generally accepted in the region.

Greenfield Site – new undeveloped and yet to be constructed LCRA TSC substation facility.

Material Modification – in addition to the modification and change requirements defined in ERCOT Planning Guide Section 5 (for Generation Interconnections), a Customer's facilities are considered materially modified if:

For purposes of coordinated studies:

- bulk electric system contingencies are altered as a result of the modification;
- the rating of the Customer's Interconnection Facilities changes; or
- there is a significant change in the forecasted peak load or maximum generation capacity served at the Point of Interconnection.

For purposes of the Interconnection Facilities:

- the Point of Interconnection will be relocated or connections physically re-arranged;
- the metering point will be relocated or connections physically re-arranged;
- the function and operation of the relay protection scheme (including communications) will change;
- the Customer will add new equipment on LCRA TSC-owned property;
- the Customer will attach or install new equipment inside or attached to LCRA TSC structures (control enclosures or towers);
- the Customer will discontinue service from a Point of Interconnection or meter point; or
- where LCRA TSC is the transmission operator, Customer will add facilities that require modification to LCRA TSC's SCADA system.

Metering Facilities – facilities planned, designed, constructed and/or operated necessary to meter the amount of energy delivered.

NERC – the North American Electric Reliability Corporation.

NERC Reliability Standards – the mandatory electric reliability standards enforced by NERC and the Texas Reliability Entity ("TRE").

Point(s) of Interconnection ("POI") – the physical location where the electrical systems of LCRA TSC and a Customer are connected or may, by the closure of normally open switches, be connected.

POIB – as the term is defined in the ERCOT Nodal Protocols.

Transformation Facilities – facilities planned, designed, constructed and/or operated at voltage levels below 60 kilovolts necessary to deliver wholesale power to distribution voltages.

Transmission Facilities – facilities planned, designed, constructed and/or operated at voltage levels at or above 60 kilovolts necessary to allow economical and efficient use of generation resources to reliably serve loads.

3.0 REQUIREMENTS FOR ALL INTERCONNECTIONS

All interconnecting facilities, new or existing, for Interconnection Requests to the LCRA TSC transmission system shall be planned, designed, and operated in accordance with the Facility Connection Requirements, and any applicable requirements of ERCOT, the North American Electric Reliability Corporation (“NERC”), National Electric Code (“NEC”), the National Electric Safety Code (“NESC”), the Occupational Safety and Health Administration (“OSHA”) and PUC Substantive Rules.

LCRA TSC will provide an Interconnection Agreement to transmission and transformation Customers requesting a Point of Interconnection to LCRA TSC’s facilities. Generators are required to begin an Interconnection Request at ERCOT, where the request is processed in accordance with the ERCOT Generation Interconnection or Change Request Procedure.

Facility-specific ownership, design, maintenance, and operational requirements shall be documented in an Interconnection Agreement. An Interconnection Agreement or related agreement will address any necessary financial security, contribution in aid of construction, or cost reimbursement requirements related to the Interconnection Request.

3.1 Interconnection Service Voltages and System Operating Limits

Transmission Service Voltages (nominal): 69-kV, 138-kV, or 345-kV

Transformation Service Voltages (nominal): 12.5-kV or 24.9-kV

Operations Steady State System Voltage Limits:

- Normal Conditions 95-105%
- Post-Contingency Conditions 90-110%

Any power delivered onto or received from LCRA TSC’s transmission system must be three-phase, 60-hertz alternating current.

3.2 Planning Studies for the Interconnection

The appropriate voltage level for interconnection is determined during the planning phase.

LCRA TSC performs transmission planning assessments on an annual cycle to analyze and evaluate the impact on system performance of all existing interconnected facilities and for Interconnection Requests. Regional power flow cases developed by the ERCOT Steady State Working Group (“SSWG”) provide the base case system conditions (generation and load) for the steady state portion of the assessment. Stability studies for the assessment are conducted using cases and dynamics data developed by the ERCOT Dynamics Working Group (“DWG”). Short

circuit studies are conducted using the short circuit cases developed by the ERCOT System Protection Working Group (“SPWG”).

Using the SSWG, DWG, and SPWG cases, LCRA TSC determines if the existing transmission system is capable of meeting the performance requirements established in the LCRA TSC Transmission Planning Criteria, ERCOT Planning Guides, and NERC Transmission Planning (“TPL”) Reliability Standards with the proposed load or generation interconnection.

When system assessments demonstrate the need for improvements to the existing transmission system, LCRA TSC coordinates with the owners of generation, transmission, or load-serving facilities in the impacted area to develop the scope and technical requirements for the new or materially modified facilities. The project is then submitted for review in accordance with the requirements outlined in the ERCOT Protocol Section 3.11.4.

Substation bus arrangements shall be provided by LCRA TSC in accordance with project requirements or as specified by the LCRA TSC Transmission System Planning Criteria.

Customers should submit Interconnection Requests to LCRA TSC as early as possible to begin the interconnection study process and allow sufficient time for project implementation in response to the Interconnection Request. Below are the typical project timelines from design start:

Table 1: Typical Project Timelines for Interconnection Requests from Design Start

Scope of LCRA TSC Interconnection Facilities	Project Duration
New Substation Addition	36 Months
Substation Upgrade or Circuit Breaker Addition	30 Months
Transmission Line Extension	48 Months
Power Transformer Addition	36 Months
Metering or SCADA Addition	12 Months

3.3 Breaker Duty and Surge Protection

LCRA TSC shall determine the maximum available short-circuit current at the POI and communicate that fault data to the Customer. LCRA TSC-owned circuit breakers and circuit switchers (interrupting devices) at the POI shall have ratings that meet or exceed the following requirements:

- Gas circuit breakers shall have an interrupting rating of at least 110% of the maximum available close-in fault capacity at the electrically closest bus.
- Oil circuit breakers shall have an interrupting rating of at least 120% of the maximum available close-in fault capacity at the electrically closest bus.
- Circuit switchers shall have an interrupting rating of at least 110% of the maximum available close-in fault at the electrically closest bus.

Customer-owned circuit breakers and circuit switchers (interrupting devices) at the POI shall have ratings that allow for safe and reliable operation at all times under all fault conditions.

The Customer shall provide LCRA TSC with nameplate data for interrupting devices on an as-needed basis. LCRA TSC shall notify the Customer when anticipated available short circuit

current exceeds the requirements stated above. The Customer is responsible for planning replacement or upgrade of customer-owned interrupting devices.

The Customer shall be required to install over voltage protection for its equipment.

The surge arrester must be coordinated with the basic insulation level (BIL) of the protected equipment to be effective. The recommended BIL for power system equipment is shown in the table below:

Table 2: BIL for Power System Equipment

Nominal System Voltage (kV)	12.5	24.9	69	138	345
Basic Insulation Level (kV)	110	150	350	650	1300

Surge arresters must be placed at the transformer terminals and additional arresters must be applied to protect other equipment in the station.

3.4 System Protection and Coordination

Project-specific requirements for system protection and coordination are determined during the conceptual design phase and the detailed design phase, and documented in the engineering prints and relay coordination files. These requirements are necessary to address system performance and power quality requirements are met by LCRA TSC and the Customer (and end-use customer).

General requirements for system protection and coordination are found in the ERCOT Nodal Operating Guides, see Section 6.2.

For new Points of Interconnection:

- The Customer shall utilize high-speed dual pilot-assisted relaying schemes (primary and back-up) for transmission lines above 100-kV with a maximum clearing time of 5 cycles; and,
- The Customer shall establish relaying schemes for power transformers, autotransformers, shunt capacitors, or shunt reactors, with a maximum clearing time of 5 cycles for faults 100-kV and above.

The Customer protection system equipment shall be provided to LCRA TSC to allow for overlapping zones of protection. Examples include, but are not limited to, Customer's provision of transformer CTs for bus differential protection, Customer's provision of breaker CTs for bus differential protection, etc.

3.5 Metering

Project specific requirements for metering are determined during the design phase and documented in the Interconnection Agreement. General requirements are listed below.

ERCOT requirements for metering and telecommunications are found in the documents referenced below:

- ERCOT Settlement Metering Operating Guide
- ERCOT Nodal Operating Guides; Section 7; Telemetry and Communication
- ERCOT Nodal Protocols; Section 10: Metering

3.5.1 Current Transformers

All metering CTs must conform to 0.3% accuracy or better. Each CT shall be provided with factory test reports stipulating the ratios, accuracy class and burden. CTs should have a burden rating of at least 1.8 ohm but may have lower burden ratings in special circumstances depending on physical, electrical and/or economical restraints.

3.5.2 Voltage Transformers

All voltage transformers shall conform to 0.3% accuracy class or better and shall be provided with factory test reports stipulating ratio, accuracy class and burden. Voltage transformers should have a burden rating of at least Z (200 VA), but may have lower burden ratings in special circumstances depending on physical, electrical, or economical restraints.

3.5.3 Metering Equipment

LCRA TSC shall design, construct, operate and maintain wholesale meter packages that utilize metering accuracy instrument transformers, whether supplied by LCRA TSC or the Customer, as shown on LCRA TSC prints, and interval data recorder (“IDR”) meters that meet all requirements of the ERCOT Nodal Protocol Section 10, the Settlement Metering Operating Guide (“SMOG”) and the ERCOT Nodal Operating Guides. LCRA TSC shall have the right to install on Customer’s premises, metering equipment, communications equipment, and related appurtenances as required by LCRA TSC to provide a Wholesale Metering Service Point. The Customer shall allow LCRA TSC to utilize Customer’s available communications infrastructure, as determined by the Customer, to the extent necessary for carrying out the Agreement and without cost to LCRA TSC.

Any equipment installed by LCRA TSC is and shall remain the property of LCRA TSC and LCRA TSC shall be entitled to remove such equipment at the termination of the Agreement unless equipment is otherwise purchased by the Customer. LCRA TSC shall be entitled to abandon in place certain current transformers, switches, cables, conduits, etc. if the Customer and LCRA TSC agree in writing that removal of LCRA TSC’s equipment would place a significant burden on the Customer’s distribution delivery service (outages); and under such conditions the Customer would take responsibility for future removal and salvage without accounting of those items at its discretion and expense.

The Customer hereby grants LCRA TSC license and permission to enter upon the premises and easements of the Customer for the sole purpose of performing the work or any other activities associated with or contemplated by the Agreement, subject to the Customer’s physical security access practices and procedures. The Customer shall have the right to review test reports and to witness an audit or test carried out by the LCRA TSC for Wholesale Metering Service Points on the list.

3.6 Supervisory Control and Data Acquisition (“SCADA”)

This section defines LCRA TSC’s SCADA policy and responsibilities for connecting Transmission and Generation Facilities to the LCRA TSC transmission system.

3.6.1 SCADA Policy

The LCRA TSC SCADA policy is to install a Remote Terminal Unit (“RTU”) at substations connected to the LCRA TSC transmission system. The RTU shall monitor the status and/or control transmission system switching devices, Customer load, transmission bus voltage and select alarms and indication. LCRA TSC does not monitor or control distribution equipment below 60-kV. The RTU shall be operated by the System Operations Control Center (“SOCC”) through an LCRA TSC provided communications system using LCRA TSC’s preferred RTU protocol: DNP.

3.6.2 RTU Specification

The RTU shall be installed in a climate-controlled environment (control house) and will require 125 VDC power and 120 VAC power. LCRA TSC will install a 24”x30”x84” RTU in a cabinet and a 24” wide Supervisory Interface Panel (“SIP”). For locations with a small point count, such as a single transformer non-breakered substation, LCRA TSC will not require a Supervisory Interface Panel. All installations require access to the front and back of the panel. RTUs shall be capable of control (DO), status (DI), analog telemetering (AI) or interrogating select IEDs with a RS-232 connection by DNP protocol.

LCRA TSC will provide:

- An LCRA TSC RTU with associated cable and conduit to LCRA TSC’s equipment;
- Communication system between LCRA TSC SOCC and the RTU; and
- If necessary, terminations between the LCRA TSC RTU and Customer SCADA cables.

3.6.3 Telemetry Requirements

Each entity shall provide, at its own expense, the necessary facilities needed for the control, operation, and real-time monitoring of its generation facility or transmission and/or distribution system as specified in accordance with the Interconnection Agreement.

Customer will provide telemetry in accordance with LCRA TSC’s Operational Data Specification. Should additional data be required, LCRA TSC will request any additional data points via written notice in accordance with LCRA TSC’s Operational Data Specification (Appendix 9). Each entity shall provide all data necessary for real-time monitoring 60 days prior to new facility energization.

All communication and telemetry facilities required herein shall be selected, installed, tested, operated, and maintained by the entity owning such equipment in accordance with Good Utility Practice and the applicable ERCOT Requirements.

3.6.4 Phasor Measurement Unit (“PMU”)

LCRA TSC may provide, install, and maintain, as required by ERCOT Market Rules, the following equipment:

- PMU;
- Communication system between LCRA TSC SOCC and the PMU; and,
- Cable and conduit between LCRA TSC equipment and the PMU.

3.7 Telecommunications

Each entity shall provide, at its own expense, the necessary telecommunication facilities needed for the control, operation, and real-time monitoring of its transmission and/or distribution System.

In cases where LCRA TSC is requested to share telecommunications facilities, but at LCRA TSC's sole discretion, telecommunications facilities shall be designed, installed, tested, operated, and maintained by LCRA TSC in accordance with LCRA TSC Criteria, Good Utility Practice and the applicable ERCOT Requirements.

3.7.1 Transport Network Capacity Requirements

The appropriate capacity of the telecommunications transport system(s) for specific project requirements shall be determined during the design phase and documented in the Interconnection Agreement. General requirements shall refer to the guidelines below:

- ERCOT Nodal Operating Guides; Section 7; Telemetry and Communication.
- LCRA TSC Telecommunications Systems Performance and Expansion Criteria.

3.7.2 Transport Network Reliability Requirements

The main telecommunications transport system(s) shall provide appropriate levels of service reliability. Specific project requirements are determined during the design phase and documented in the Interconnection Agreement. General requirements shall refer to the guidelines below:

- ERCOT Nodal Operating Guides; Section 7; Telemetry and Communication.
- LCRA TSC Telecommunications Systems Performance and Expansion Criteria.

3.7.3 Transport Medium

The selection of transport medium for project requirements are listed below in order of preference, unless as prescribed in the requirements below specific to each type of interconnection or in the Interconnection Agreement:

- 1) Fiber
 - OPGW (single or dual).
 - All-Dielectric Self Supporting (ADSS).

- 2) Microwave
 - o Licensed.
 - o Unlicensed.

General requirements shall refer to the guidelines below:

- ERCOT Nodal Operating Guides; Section 7; Telemetry and Communication.
- LCRA TSC Telecommunications Systems Performance and Expansion Criteria.

3.7.4 Telecommunications Equipment Space and Power Requirement

Adequate shelter, tower space, and power, including back-up power, for planned equipment shall be determined for specific project requirements during the design phase and documented in the Interconnection Agreement.

Access to LCRA TSC telecommunications shelters and towers shall follow existing LCRA TSC Physical Security and Safety Rules and Guidelines.

General requirements shall refer to the guidelines below:

- ERCOT Nodal Operating Guides; Section 7; Telemetry and Communication.
- LCRA TSC Telecommunications Systems Performance and Expansion Criteria.
- LCRA TSC Physical Security Access Authorization.
- LCRA TSC Safety Rules and Guidelines.

3.8 Grounding and Safety Issues

Project specific requirements for grounding and safety issues are determined during the detailed design phase and documented in the engineering prints. Although the below information guides the user with certain design criteria, every grid is unique and must be designed as such.

LCRA TSC substations are designed to meet the following grounding requirements:

- Ground Potential Rise shall be less than 5,000 Volts.
- Ground Grid Resistance shall be less than 1 ohm.
- Step Potential within limits as specified by most current IEEE Std 80.
- Touch Potential within limits as specified by most current IEEE Std 80.
- All structures and equipment in the substation shall be properly grounded to the ground grid per IEEE Std 80 and IEEE Std 142.

The grounding conductor size is specified by the following table:

Table 3: Structure/Equipment Ground Conductor (Copper)

kAI	Grid Conductor	Tail Conductor
80kA	500MCM CU	750 MCM CU

63kA	4/0 CU	500 MCM CU
40kA	4/0 CU	4/0 CU

Table 4: Structure/Equipment Ground Conductor (Copper Clad)

kAI (kV)	Tail Conductor
80 kA (345-kV)	Bundle 19 No. 7 AWG
63 kA (138/345-kV)	19 No. 5 AWG
40 kA (138-kV)	19 No. 7 AWG

LCRA TSC shall be notified by Customer of any new or modified structures and/or equipment to be installed in or adjacent to an LCRA TSC substation.

If LCRA TSC adds equipment in the facility owner’s substation/facility, LCRA TSC shall coordinate with the facility owner or their agent on grounding and safety issues to ensure grounding meets industry standards.

Transmission and Generation Facility connections to the LCRA TSC transmission system shall meet the most current version of the following industry standard:

- National Electric Code (“NEC”)
- National Electric Safety Code (“NESC”)
- IEEE Std 80 – IEEE Guide for Safety in AC Substation Grounding
- IEEE Std 142 – IEEE Recommended Practice for Grounding of Industrial and Commercial Power Systems

Transmission lines connecting to an LCRA TSC facility are required to have proper overhead shields and adequate structure grounding for at least 1 mile out of the substation. Transmission line structure grounding, as stated in the Transmission Line Engineering Standards Design document, is defined below:

- 10 ohms maximum grounding resistance at each structure is optimum.
- Where 10 ohms is not practical, attempt to obtain 20 ohms maximum grounding resistance.
- Where 20 ohms is not practical, perform an adequate analysis of the grounding systems and lightning performance for the entire transmission line and determine grounding resistance requirements for individual structures or groups of structures along the entire length of line.

3.9 Insulation and Insulation Coordination

All structures and equipment in the substation shall be properly designed to meet clearances per ANSI C37.32. The minimum substation Basic Insulation Levels (BIL) required within a LCRA TSC substation are shown below per the National Electrical Safety Code C2-2017, Table 110-1 & Figures 110-1 and 110-2:

Where an impenetrable fence is used, the safety zone clearance can be modified to account for the protection offered by the barrier. The sum of the height of the impenetrable barrier (H) and the distance from that point to the closest energized part (R1) must be greater than or equal to the sum of the dimension R and 1.5 m (5 ft.): $R1 + H \geq R + 1.5m$ (5 ft.), where:

- H = Height of impenetrable barrier
- R1 = Distance between point at height H and the closest energized part
- R = Dimension from table 110-1

Figure 1: BIL Values for kV Classes

Nominal voltage between phases	Typical BIL	Dimension "R"	
		m	ft
151-7200	95	3.0	10.0
13 800	110	3.1	10.1
23 000	150	3.1	10.3
34 500	200	3.2	10.6
46 000	250	3.3	10.9
69 000	350	3.5	11.6
115 000	550	4.0	13.0
138 000	650	4.2	13.7
161 000	750	4.4	14.3
230 000	825	4.5	14.9
230 000	900	4.7	15.4
345 000	1050	5.0	16.4
345 000	1175	5.3	17.3
345 000	1300	5.5	18.3
500 000	1550	6.0	19.8
500 000	1800	6.6	21.5
765 000	2050	7.1	23.4

Note: The values are for altitudes of 1,000 m (3,300 ft) or less. For higher altitudes, refer to Rule 124A1 in the NESC. For current industry recommended values, refer to the latest revision of the National Electric Safety Code.

Figure 2: Safety Clearance to Electric Supply Station Fence

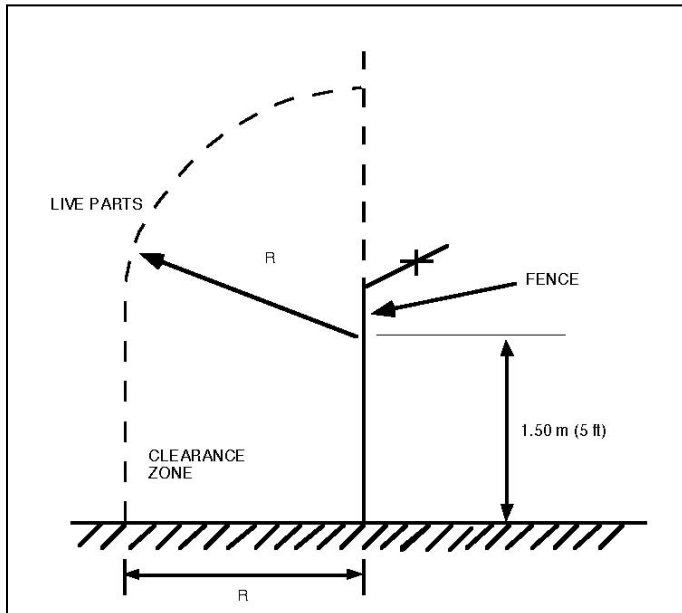
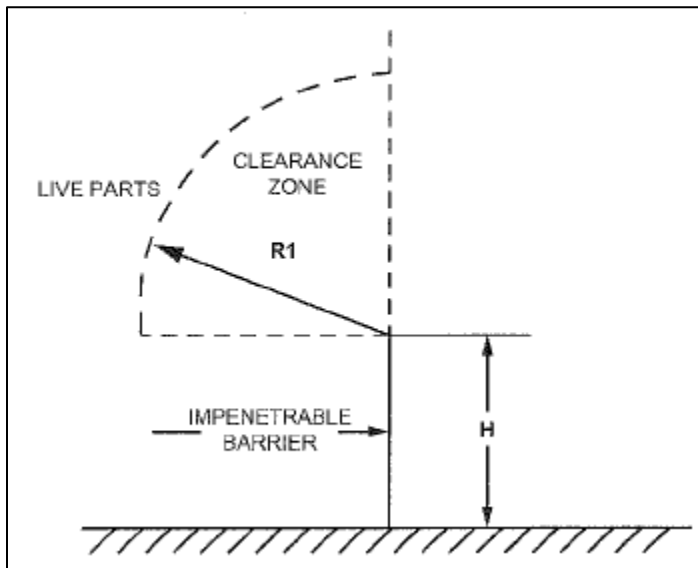


Figure 3: Safety Clearance to Electric Supply Station Impenetrable Fence



3.9.1 Surge Arrester and BIL Coordination

The arrester rating must be selected such that the maximum continuous power system voltage applied to the arrester is less or equal to the arrester’s maximum continuous operating voltage. An arrester of the minimum practical rating is preferred for its greatest margin of protection of the equipment. The Basic Surge Level (“BSL”) of the insulators should be 83% of the Basic Insulation Level (“BIL”). A minimum of 15% margin between arrester protective level and the Basic Surge Level is recommended.

3.10 Power Quality Impacts

The requirements on power quality for interconnection with LCRA TSC facilities comply with PUCT rules (Chapter 25 Substantive Rules Applicable to Electric Service Providers, Subchapter 1 Transmission and Distribution, Division 2 Transmission and Distribution Applicable to All Electric Utilities, 25.212 Technical Requirements for Interconnection and Parallel Operations of On-Site Distributed Generation). Customers are required to meet applicable NERC Reliability Standards, IEEE standards and ERCOT, and in accordance with Good Utility Practice. LCRA TSC may require detailed studies and/or permanent power quality monitoring for performance testing, troubleshooting, post-event analysis and determining the responsibility for mitigating power quality issues. Customer (or Customer's end-use customer) is responsible for installing necessary equipment to protect its facilities in the event of abnormal voltage or frequency due to disturbance events on the transmission system.

3.10.1 Voltage Fluctuations and Flicker

Voltage fluctuations may be noticeable as visual lighting variations (flicker) and can damage or disrupt the operations of electronic equipment. IEEE Standard 1453 provides definitions on limits on acceptable levels of voltage fluctuation. Load or system connections to the LCRA TSC system shall comply with the limits set by IEEE 1453. If it is determined that the new connection is the source of the fluctuations, the necessary equipment to control the fluctuations to the limits identified in IEEE 1453 is the responsibility of the Customer.

3.10.2 Harmonics

Harmonics can cause telecommunications interference, increase thermal heating in transformers, disable solid state equipment and create resonant overvoltage. In order to protect equipment from damage, harmonics must be managed and mitigated. The new connection shall not cause voltage and current harmonics on the LCRA TSC system that exceed the limits specified in IEEE Standard 519. Harmonic distortion is defined as the ratio of the root mean square (rms) value of the harmonic to the rms value of the fundamental voltage or current. Single frequency and total harmonic distortion measurements may be conducted at the connection point or other locations in the LCRA TSC system to determine whether the new connection is the source of excessive harmonics. If it is determined the new connection is the source of the harmonic voltage and currents, the necessary equipment to control the harmonics to the limits identified in IEEE 519 is the responsibility of the Customer.

3.10.3 Voltage Transients

Measures shall be taken to mitigate switching transients and their impact on surrounding systems.

3.10.4 Phase Unbalance

Load unbalance can affect protective relay coordination and cause high neutral currents and thermal overloading of transformers. To protect LCRA TSC and Customer equipment, the contribution from facilities at the connection point shall not cause an unbalance greater than 15%. Phase unbalance is the percent deviation of one phase from the average of all three phases.

System problems, such as a blown transformer fuse or open conductor on a transmission system, can result in extended periods of phase unbalance. It is the Customer's responsibility to protect any of their connected equipment from damage that could result from such an unbalanced condition.

3.10.5 Power Factor

Generation entity reactive power must meet the requirements of the ERCOT Generation Interconnection or Change Request Procedure and ERCOT requirements.

3.11 Equipment Ratings

Customer will rate terminal equipment at the interconnecting station such that the terminal equipment will not be the Most Limiting Series Element (MLSE) throughout the entire ambient temperature range for the transmission line.

Customers shall make the ratings of their equipment or lines known to LCRA TSC for each POI. The owner of facilities shall make known their Facility Ratings to the operator of their Facilities. Reference NERC FAC-008.

The interconnection is preceded by an assessment of the capability of the existing transmission system to support the interconnection. This assessment will be used to determine the required minimum ratings for transmission facilities impacted by the proposed interconnection. Consideration of the life of equipment and long-term planning needs may result in equipment ratings above what is required to serve the requested interconnection.

The criteria for determining the required ratings for station equipment is provided below.

- During any new transmission line project, all station equipment related to that line shall be designed such that the continuous rating of all station equipment is greater than or equal to the continuous rating of the new line throughout the entire ambient temperature range. During any transmission line upgrade project, station equipment related to that line shall be upgraded as necessary such that the continuous rating of all station equipment allows for operating conditions described in the second bullet in this section.
- Station equipment (circuit breakers, circuit switches, wave traps, jumpers, connectors, current transformers, relays, relay settings, etc.) connected in series with the conductor shall be upgraded (independent of a conductor upgrade) if either of the following two conditions are met: the continuous rating of the station equipment is less than or equal to 50% of the continuous rating of the conductor; or the loading through the station equipment during normal or single-contingency conditions is greater than or equal to 80% of the continuous rating of the station equipment.

Planned loading on autotransformers during normal, single, or multiple contingency conditions shall be limited to 100% of the auto-transformer's maximum megavolt-ampere (MVA) nameplate rating as specified by the manufacturer.

Planned transmission line loading shall be such that NESC line-to-ground clearances will be maintained for all anticipated normal and contingency conditions. Transmission system power flow shall not exceed 100% of the conductor thermal rating.

3.12 Operational issues (abnormal frequency and voltages)

Each entity shall, at each POI and at its own risk and expense, design, install, or cause the design and installation, (including all apparatus and necessary protective devices) on its side of the POI, so as to reasonably minimize the likelihood of voltage and frequency abnormalities, originating in the system of one entity, from affecting or impairing the system of the other entity, or other systems to which the system of such entity is interconnected.

Under-frequency load shedding relay settings must be maintained for prospective transfers consistent with ERCOT Nodal Operating Guides (Section 2.6) in order to maintain the dynamic stability of the interconnected system.

LCRA TSC shall periodically review its system to determine if under-voltage load shedding is necessary and shall coordinate with affected Parties, as necessary.

System operating conditions may dictate limits outside of normal and contingency ratings.

3.13 Inspection Requirements for Existing or New Facilities

To maintain the reliability of the LCRA TSC transmission system, LCRA TSC reserves the right, upon request, to review the Customer's design schemes, equipment placement and ratings.

To maintain the reliability of the LCRA TSC transmission system, LCRA TSC reserves the right to conduct facility inspections of Generation and Transmission Facilities. The inspection of Interconnection Facilities is to observe and not to be construed as a formal engineering review of the Customer's compliance with, ERCOT Nodal Operating Guides, Section 6.2.5 and 6.2.6, Requirements and Recommendations for ERCOT System Facilities.

Facility inspections shall be coordinated between the respective Project Managers and shall consist of, but not limited to, the following substation design categories:

- Substation/Switchyard
- Fence
- Steel Structures
- Concrete Foundations
- Grounding
- Bus & Fitting
- Control House
- Substation Equipment
- Telecommunications Equipment

3.14 Communications and procedures during normal and emergency operating conditions

Notices regarding outage coordination should be sent to SOCCOUTAGECoordination@lcra.org. LCRA TSC's 24x7 SOCC telephone number is (800) 223-7622.

3.14.1 Normal Operations

The Transmission System Operator shall assist neighboring utilities and generation interconnects in implementing all transmission switching functions as necessary, according to associated interconnect agreements, good utility practice, regulator, and statutory requirements, and to operate the bulk transmission system safely and efficiently.

The Transmission System Operator shall notify ERCOT and appropriate neighboring utility of any abnormal relaying configuration that may affect reliability.

The Customer's operation center is expected to fully cooperate with the LCRA TSC Transmission System Operators.

3.14.2 Emergency Operations

The Transmission System Operator shall render available emergency assistance to neighboring utilities and generators provided the neighboring utility or generator has completed implementation of its own emergency procedures. These actions by Transmission System Operator shall not, however, violate safety, equipment or regulatory or statutory requirements.

The Transmission System Operator shall not remove any facilities from service that would burden a neighboring utility or generator. If removal is necessary, the Transmission System Operator shall contact ERCOT and the affected neighboring utility or generator at the earliest possible time and explain the impact of removing such facilities.

The Transmission System Operator shall notify ERCOT and appropriate neighboring utility of any abnormal relaying configuration at LCRA TSC owned or operated facilities that may affect reliability. The Customer's operation center is expected to fully cooperate with the LCRA TSC Transmission System Operators.

3.14.3 Load Shed

Load-serving Customers connected to the LCRA TSC system participate in the ERCOT Energy Emergency Alert ("EEA"). When ERCOT declares an EEA3 event, LCRA TSC's share of the load shed will be allocated to the Customers proportionately based on their summer peak load ratio share.

The Customer will provide and maintain a list of all critical loads connected to the POI to LCRA TSC SOCC Operations. Customers shall communicate their ability to meet load shed requirements and report back to LCRA TSC SOCC Operations within 20 minutes, in accordance with the ERCOT Nodal Operating Guides.

During an ERCOT declared EEA3 event, LCRA TSC SOCC Operators will shed load for Customers who do not maintain a 24x7 operations control center or are unable to shed their own load at all times (“Criteria 2 Owners”). Customers responsible for shedding their load (“Criteria 1 Owners”) will provide an analog value of the total load shed to LCRA TSC SOCC.

3.15 Wildlife Mitigation

The application of wildlife mitigation utilizes specially designed apparatus that is designed to reduce or eliminate wildlife contact to energized equipment. These wildlife mitigation measures may be included at the following substation equipment:

- Transformers – Includes the use of bushing covers on the low voltage transformer bushings, polymeric surge arrestors that offer larger metal-metal distance, split hose covering or specialized wrapping on the energized low voltage conductors and connectors.
- Low Voltage Breakers – The use of bushing covers will be applied to the breaker bushings and split hose covering will be applied to the conductors.
- Low Voltage Switches – Protective discs will be applied to switch insulators and split hose covering will be applied to the conductors.
- Bus Insulators – Protective discs will be applied to the insulator sheds.
- Instrument Transformers – Protective discs will be applied to insulators and split hose covering will be applied to exposed conductors.

4.0 GENERATION INTERCONNECTION SPECIFIC REQUIREMENTS

The following requirements apply to Generation Resources and Energy Storage Resources (“ESRs”) requesting interconnection for transmission service at nominal voltage levels of 345-kV, 138-kV, and 69-kV. LCRA TSC requires the execution of an ERCOT Standard Generation Interconnection Agreement (“SGIA”), notice to proceed (“NTP”), and posting of financial security prior to commencing the design, procurement, and construction of the Interconnection Facilities for the POI and provision of transmission service to the Generator.

4.1 Planning Studies for the Generation Interconnection

LCRA TSC follows the Generation Interconnection or Modification process outlined in section 5 of the ERCOT Planning Guide to facilitate new or modified generation interconnections. New or modified generation interconnections with an aggregate nameplate capacity of one MW or greater will follow the requirements in section 5 of the ERCOT Planning Guide. Interconnections less than 10 MW will go through interconnection procedures for small generators while interconnections 10 MW or greater will go through study procedures for large generators as laid out in Section 5 of the ERCOT Planning Guide. LCRA TSC evaluates existing generation interconnections through the annual transmission assessments.

4.2 Voltage, Reactive Power and Power Factor Control

All Generation Resources and ESR that are connected to Transmission Facilities and that have a gross unit rating greater than 20 MVA or those units connected at the same POI that have gross unit ratings aggregating to greater than 20 MVA, that supply power to the ERCOT Transmission

Grid, shall provide Voltage Support Services (“VSS”) as required under ERCOT Nodal Protocol 3.15, Voltage Support.

Each Generation Resource and ESRs required to provide VSS shall be capable of providing an over-excited (lagging or producing) power factor capability of 0.95 or less and an under-excited (leading or absorbing) power factor capability of 0.95 or less as required in ERCOT Nodal Protocol 3.15, Voltage Support.

ERCOT and/or LCRA TSC will establish a voltage profile at the POIB for new and existing generators. The voltage profile is reviewed two times each year by ERCOT and LCRA TSC for interconnected generation and updated based on changing system needs. LCRA TSC in coordination with ERCOT may work with Generators to change the voltage set point in real time based on system conditions. The voltage set point at the POIB for generating facilities shall be established per guidelines outlined in ERCOT Nodal Protocol 3.15 – *Voltage Support* and ERCOT Operating Guide 3.15.3 – *Generation Resource Requirements Related to Voltage Support*. Generator Operators shall maintain the voltage at the POI within the bandwidth of the voltage set point in conformance with ERCOT Nodal Protocols and Operating Guides.

4.3 System Protection and Coordination

The Generator will provide a line protection panel for Generator’s interconnecting line at the Generator’s facilities, which will coordinate with the LCRA TSC line panel(s) at the LCRA TSC Substation.

The Plant and the Generator Interconnection Facilities shall be designed to isolate any fault, or to disconnect from or isolate any abnormality that would negatively affect the ERCOT system. The Generator shall be responsible for protection of its facilities. In particular, Generator shall provide relays, circuit breakers, and all other devices necessary to promptly remove any fault contribution of the generation equipment to any short circuit occurring on the LCRA TSC system. Such protective equipment shall include, without limitation, a disconnect device or switch with the appropriate interrupting capability to be located within the Generator Interconnection Facilities. In addition to faults within the Plant and the Generator Interconnection Facilities, Generator shall be responsible for protection of such facilities from such conditions as negative sequence currents, over or under frequency, sudden load rejection, over or under voltage, generator loss of field, inadvertent energization (reverse power), uncleared transmission system faults and other special requirements as specified by ERCOT (SSO, SSCI, etc.).

The Plant and the Generator Interconnection Facilities shall have protective relaying that is consistent with the protective relaying criteria described in the ERCOT Nodal Operating Guide Section 6 and NERC Reliability Standards. If requested by LCRA TSC, Generator shall, at its expense, provide timely corrections, upgrades, or additions to existing control and protective equipment required to protect the ERCOT system or to comply with government, industry regulations, or standard changes.

The Generator’s protective relay design shall incorporate the necessary test switches to enable complete functional testing. The required test switches will be placed such that they allow operation of lockout relays while preventing breaker failure schemes from operating and causing unnecessary breaker operations and tripping generator units.

Generator under-frequency and over-frequency relay settings must be maintained for prospective transfers consistent with ERCOT Nodal Operating Guides (Section 2.6) in order to maintain the dynamic stability of the interconnected system. Generators shall be able to remain online and delivering power during voltage disturbances up to the time periods and associated voltage levels set forth in NERC Reliability Standards (PRC-024) and ERCOT Requirements for voltage ride-through capability.

Generator shall install sufficient disturbance and fault monitoring equipment to thoroughly analyze all system disturbances of the generation system. This equipment shall monitor the voltages at major nodes of the system, current at major branches, breaker, and switch positions, and provide sequence of event reporting and relay event reporting to analyze a system disturbance. LCRA TSC shall provide for disturbance and fault monitoring equipment in the LCRA TSC Substation. The disturbance and fault monitoring for both Generator and LCRA TSC shall be consistent with the disturbance monitoring requirements described in the ERCOT Requirements and NERC Reliability Standards.

Prior to modifying any relay protection system design or relay setting involving the connecting facilities between the two Parties, Generator shall submit the proposed changes to LCRA TSC for review and approval. LCRA TSC's review and approval shall be for the limited purpose of determining whether such proposed changes are compatible with the ERCOT transmission system.

In accordance with Good Utility Practice, ERCOT, and NERC Reliability Standards, LCRA TSC shall determine requirements for protection of the POI and the zone of protection around the POI and shall specify and implement protection and control schemes as necessary to meet such requirements. Generator shall have the right to review and comment on the necessary protection requirements, and such comments shall not be unreasonably refused by LCRA TSC when determining such requirements. LCRA TSC shall coordinate the relay system protection between Generator and the ERCOT system.

The Generator shall provide the short circuit model (in Aspen One-Liner format) for the Generator Interconnection Facilities, the generator units, and collector system prior to the protective relays settings being calculated no later than 60 days prior to the initial actual in-service date.

4.4 Metering and Telecommunications

Metering and telemetry of data shall be accomplished in accordance with ERCOT Requirements. The specific ERCOT-pollled settlement ("EPS") Meter Facilities, telemetry, and communications equipment to be installed, and the data to be telemetered, are described in Exhibit "C" of the SGIA.

At the POIB, the EPS Metering Facilities shall be owned by LCRA TSC. However, the EPS metering interval data (kWH and kVARH) may be accessed, if requested, by the Generator or its Qualified Scheduling Entity via LCRA TSC's Third Party Metering Network. Requests for access to the Third-Party Metering Network shall be submitted to LCRA TSC.

LCRA TSC shall notify the Generator at least five (5) working days in advance of any planned maintenance, inspection, testing or calibration of the EPS Metering Facilities, unless otherwise agreed to in writing. The Generator, or its designated representative, shall have the right to be

present for these activities and to receive copies of any documents related to the procedures and results.

Prior to the connection of the GIF to the TIF, acceptance tests shall be performed by the owning entity to ensure the proper functioning of the EPS Metering Facilities, telemetry and communications equipment associated with the POI and both entities' Interconnection Facilities, and to verify the accuracy of data being received by LCRA TSC, ERCOT and the Generator. All acceptance tests shall be performed consistent with ERCOT Requirements.

Each entity shall promptly advise the other entity if it detects or otherwise learns of any metering, telemetry or communications equipment errors or malfunctions that require the attention and/or correction by the other entity. The entity owning such equipment shall correct such error or malfunction as soon as reasonably feasible in accordance with ERCOT Requirements.

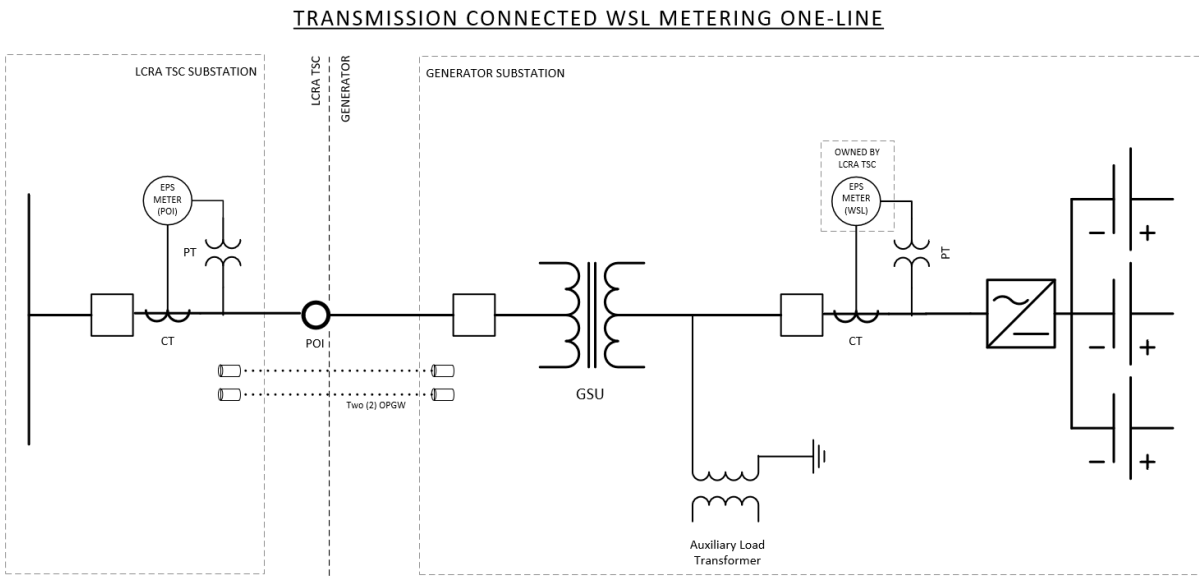
4.4.1 **ERCOT Polled Settlement (“EPS”) Meters**

In accordance with ERCOT requirements, EPS Metering Facilities shall be installed at LCRA TSC substations where generation over 10 MW is interconnected to the ERCOT Transmission Grid. The EPS metering point shall have primary and backup meters that can provide power and energy values for billing purposes. If the metering point is bidirectional, extended range current transformers (CTs) shall be installed to measure the large amount of generation into the substation under normal conditions and the small amount of back-feed (auxiliary power or station service) to the Generator when the generation facilities are not online. All EPS Metering Facilities shall be certified pursuant to, and in compliance with, ERCOT protocols and metering guidelines.

4.4.2 **Wholesale Storage Load (“WSL”) EPS Meters**

In accordance with ERCOT requirements, WSL EPS meters shall be installed by LCRA TSC at substations where WSL facilities are located in order to accurately measure the WSL. The WSL EPS metering point shall be located such that the WSL EPS meters only measure the charging power and energy for the WSL and do not also measure any of the auxiliary or non-WSL power to the Generator, except as otherwise permitted under applicable regulations. LCRA TSC's WSL EPS metering will be located in a suitable space allocated by Generator in the control building of the Generator's interconnection substation. The Generator shall install, for TSP's use, adequately rated instrument transformers to accurately meter the WSL. The Generator shall provide the cable and suitable conduit paths between the Generator's WSL instrument transformers and the Generator's control building for TSP's use in metering the WSL. TSP will terminate any control cable to the WSL EPS meters. The WSL EPS meters shall be “netted” with the POI EPS meters to derive the Generator's auxiliary load usage for settlement purposes. Any of the Generator's auxiliary load measured by the net of the WSL and POI EPS meters shall be assigned to the Generator's chosen Retail Electric Provider per ERCOT protocols and metering guidelines.

Figure 4: WSL One-Line Diagram



4.4.3 Telecommunications

Generator shall, in accordance with Good Utility Practice and ERCOT Requirements, provide communications facilities that are, or may in the future be, necessary for the effective interconnected operation of the Plant and the GIF with the LCRA TSC System. Such communication facilities shall be included in Exhibit “C” of the SGIA. The Generator shall make arrangements to procure and bear the cost of such facilities. The Generator shall own and be responsible for the installation, operation, and maintenance of fiber optic communication facilities between the Generator’s transmission voltage substations and the POI Structure at the POI. Generator will complete its OPGW termination and dress out in a manner acceptable to LCRA TSC inside the LCRA TSC-provided fiber splice boxes on the POI Structure. LCRA TSC will provide the splicing of fibers within the splice boxes at the POI. The Generator shall provide the dedicated channels or fiber pairs for necessary items including Generator’s radial circuit protective relaying, LCRA TSC’s WSL EPS metering (if applicable), and Remedial Action Scheme communications. Generator shall provide any necessary fiber optic jumpers and termination equipment (if applicable) from Generator’s fiber patch panel(s) to LCRA TSC’s WSL EPS meters. LCRA TSC will provide fiber transceivers at the WSL EPS meters and terminate the fiber. Voice communications provided by the Generator shall at a minimum include one POTS (plain old telephone service) or equivalent wired voice circuit in the Generator’s substation control buildings.

4.5 Maintenance Coordination

The Parties agree to operate and maintain their systems in accordance with Good Utility Practice, National Electric Safety Code, ERCOT Requirements, PUCT Rules and all applicable laws and regulations. Subject to any necessary ERCOT approval, each entity shall provide necessary equipment outages to allow the other entity to perform periodic maintenance, repair, or replacement of the Transmission Interconnection Facilities (“TIF”) or Generation Interconnection

Facilities (“GIF”) as the case may be. Such outages shall be scheduled at mutually agreeable times, unless conditions exist which an entity believes, in accordance with Good Utility Practice, may endanger persons or property. No changes shall be made in the normal operation of the POI without the mutual agreement of the Parties except as otherwise provided herein. All testing of the Plant that affects the operation of the POI shall be coordinated between LCRA TSC, ERCOT, and the Generator, and shall be conducted in accordance with regulatory and statutory requirements, including NERC and ERCOT Requirements.

Any outages needed at the Substation POI for the Generator shall be coordinated with the SOCC Outage Coordinator as soon as possible for completion of outage studies and submission to ERCOT.

Notices regarding outage coordination should be sent to SOCCOUTAGECoordination@lcra.org. LCRA TSC’s 24x7 SOCC telephone number is (800) 223-7622.

4.6 Synchronizing of Facilities

The Generator will be responsible for the proper synchronization of its facilities with the LCRA TSC transmission system, in accordance with the ERCOT Resource Integration Handbook and associated ERCOT Requirements. LCRA TSC is not responsible for the design of the Facilities’ synchronization relaying. It is highly recommended that the Generator consult with the equipment manufacturers when setting relays associated with the protection of their equipment.

4.7 Black Start

The Generator will notify LCRA TSC upon the establishment or termination of a Black Start Service Agreement with ERCOT for classification as a Black Start Resource. The Generator will provide all necessary information to LCRA TSC in accordance with Nodal Operating Guides. At minimum, the Generator will provide MW, MVAR, frequency, voltage, and GIF breaker status to LCRA TSC via ICCP or other approved method. The Generator will provide the D-curve for the Generator’s plant. If the Generator will provide Black Start Service, then Generator shall provide and maintain an emergency communication system with LCRA TSC’s SOCC to support coordination during a black start condition.

4.8 Provision of Interconnection Facilities

LCRA TSC will perform a facility study to determine the scope of the Interconnection Facilities, including estimated costs and preliminary project schedule, which will be required to provide Points of Interconnection to the Customer. The facility study will follow the technical requirements detailed below for the POI and generally follow the Interconnection Facilities diagram for each of the following types of interconnections:

- Appendix 1: Generation Interconnections for Greenfield Sites.
- Appendix 2: Generation Interconnections for Brownfield Sites.

4.8.1 LCRA TSC will provide:

- LCRA TSC will own the necessary Interconnection Facilities inside the LCRA TSC Substation.

LCRA Transmission Services Corporation Facility Interconnection Requirements

- The LCRA TSC Substation will be located in accordance with LCRA TSC's substation siting criteria.
- LCRA TSC will own the Interconnection Facilities to, and including, a POI dead-end structure ("POI Structure") located outside of the LCRA TSC Substation.
- LCRA TSC will own two (2) OPGW splice boxes on the LCRA TSC-owned POI Structure and make splices at the splice box(es) with the Generator's OPGW.
- LCRA TSC will review and approve the Generator's conductor and static wire tensions connecting to the LCRA TSC-owned POI Structure to ensure tensions meet the structure requirements.
- LCRA TSC will own conductor (including jumpers) and OPGW between the LCRA TSC-owned POI structure and the LCRA TSC-owned A-frame at the LCRA TSC Substation.
- Subject to LCRA TSC review, acceptance, and approval, LCRA TSC will acquire the necessary real property rights and/or easement(s) from the Generator for construction of the LCRA TSC Interconnection Facilities.

4.8.2 Generator will provide:

- One radial circuit with necessary material to dead-end and connect to the LCRA TSC-owned POI Structure outside the LCRA TSC Substation;
- A full tension, dead-end, structure located near the LCRA TSC-owned POI Structure (Generator shall coordinate the height of this structure, the arrangement of the phases, and the exact location of the structure with LCRA TSC);
- Two (2) Fiber optic cables (Corning SMF-28e+ or equivalent minimum 12-fiber, single-mode, fiber optic OPGW) from Generator's interconnection substation control building to the LCRA TSC OPGW cable splice boxes on the LCRA TSC POI Structure at the POI; Generator shall coordinate with LCRA TSC on the type of OPGW being selected and shall provide a diverse fiber-optic routing paths within the Generator's substation. Any Generator owned splice boxes used for communication with the LCRA TSC interconnecting facilities shall be located in a fenced area within the Generator's substation or other appropriately secured facility.
- The Generator will terminate conductor and OPGW at the LCRA TSC-owned POI structure.
- Generator's interconnection substation(s) including control building(s), step-up transformer(s), transformer protection package(s), circuit breaker(s), disconnect switch(es), and protective relaying panels for the Generator's line protection that will coordinate with the LCRA TSC line panels at the LCRA TSC Substation;
- The Generator will configure the transmission voltage side winding of the Plant's Generation Step-Up Unit (GSU) to have a grounded wye configuration.
- One or more RTUs and panels to provide breaker status, telemetry, and energy data from the Generator's interconnection substation(s) to the Plant, Generator and ERCOT;
- Associated structures, bus-work, conductor, connectors, grounding, conduit, control cable, foundation work, perimeter fencing, grading/dirt work and any appurtenances necessary for construction and operation of the Generation Interconnection Facilities;

For Interconnection Requests at existing LCRA TSC Substations (Brownfield Sites), the Generator will acquire and convey easement(s) for the LCRA TSC Interconnection Facilities located outside the LCRA TSC Substation property, including the POI structure. If direct access from the existing LCRA TSC Substation property is not feasible, the Generator will acquire and convey an access easement to the LCRA TSC Interconnection Facilities. The acquisition by LCRA TSC of the above easement(s) are subject to LCRA TSC review, acceptance, and approval.

For Interconnection Requests at new LCRA TSC Substations (Greenfield Sites), the Generator will acquire and convey to LCRA TSC the suitable real property rights for the new LCRA TSC Substation and related Interconnection Facilities, including all rights-of-way and written consent from directly affected landowners necessary for the modification, construction, or extension of a transmission. If required, the Generator will construct the access road to the LCRA TSC Substation and convey an access easement to LCRA TSC. The Generator will acquire and convey any easements required for the for the LCRA TSC Interconnection Facilities, subject to LCRA TSC review and approval. The acquisition by LCRA TSC of the above real property rights and easements are subject to LCRA TSC review, acceptance, and approval.

- Surveys including the boundary survey plat(s) and legal description(s); topographic survey with one-foot contours; and Sub-surface Utility Engineering (SUE) survey, per LCRA TSC-provided surveying specifications and LCRA TSC engineering review, of the relevant real property being conveyed to LCRA TSC.
- Title commitment and title insurance policy exclusively for the real property rights being conveyed to LCRA TSC.

5.0 TRANSMISSION INTERCONNECTION SPECIFIC REQUIREMENTS

The following requirements apply to Transmission Service Provider (TSP) or Distribution Service Provider (DSP) interconnection requests for transmission service at nominal voltage levels of 345-kV, 138-kV, and 69-kV.

5.1 Planning Studies for the Load Interconnection

LCRA TSC evaluates load interconnections through annual transmission assessments and individual load Interconnection Requests. LCRA TSC performs the annual transmission assessments by applying load forecasts provided annually by load-serving entities through the ERCOT Annual Load Data Request (“ALDR”) process to the SSWG and DWG planning cases. Through annual assessments, LCRA TSC is able to evaluate transmission system performance when the load Interconnection Request is provided through the ERCOT ALDR process. For load Interconnection Requests received outside of the ERCOT ALDR process, LCRA TSC applies load data obtained from the entity requesting the interconnection to the SSWG and DWG cases to evaluate the impact of the interconnection on transmission system performance. Prior to seeking load service via the LCRA TSC transmission system, the interconnecting DSP must confirm and provide data that the distribution system cannot serve the load. Once need for transmission system load service is confirmed, LCRA TSC will conduct system impact studies to determine transmission system improvements needed to reliably serve the load. Load impact studies are coordinated with impacted TSP(s) and ERCOT and are required by NERC Reliability Standards.

When transmission system improvements are needed to integrate the load interconnection into the transmission system, LCRA TSC coordinates with the owners of impacted facilities to develop the project scope and cost. LCRA TSC follows the requirements provided in ERCOT Protocol Section 3.11.4 for seeking ERCOT review of the project. Smaller transmission improvements (generally those less than \$25 million, not requiring modifications to the 345-kV system, and not requiring an amendment to LCRA TSC’s Certificate of Convenience and Necessity) do not require ERCOT review. Larger transmission improvements may require an ERCOT endorsement. Upon

completing the ERCOT review process, including obtaining ERCOT endorsement when required, LCRA TSC presents the project to its Board of Directors for approval and funding.

LCRA TSC communicates the plan for new or modified facilities to ERCOT through the SSWG and DWG case-building process upon approval of the project by the LCRA TSC Board of Directors.

5.2 Planning Studies for the Transmission Facility Interconnection

LCRA TSC will coordinate with the Customer regarding LCRA TSC scope to support a Transmission Facility Interconnection. LCRA TSC will assess the impact of a Transmission Facility Interconnection on the LCRA TSC System. The entity proposing the interconnection is responsible for conducting ERCOT and NERC required Facility Interconnection Studies.

5.3 Voltage Level and MW and MVAR Capacity or Demand at the POI

Anticipated MW and MVAR demand are determined by the Customer at a POI and must be communicated to LCRA TSC for planning purposes. Annual updates are accepted through the ERCOT ALDR process. ERCOT power factor requirements must be followed for all connected loads.

5.4 Voltage, Reactive Power, and Power Factor Control

Each load-serving Customer is required to maintain at least a 0.97 power factor on its distribution system as required in ERCOT Nodal Protocol 3.15, Voltage Support.

LCRA TSC reviews voltage performance at substations with interconnected loads during the initial interconnection study and through subsequent annual assessments.

5.5 System Protection and Coordination

LCRA TSC and Customer shall design, provide, and coordinate their respective protection system equipment so that adjacent zones of protection overlap.

For interconnections of power transformers with capacity of 10 megavolt ampere (MVA) and below, fuse protection is allowed if the utilization of the fuse protections does not compromise reliability. However, for interconnection of power transformers above 10 MVA, a fully relayed circuit switcher or circuit breaker installation is required.

Distribution protection schemes shall be coordinated with the transformer owner.

5.6 Maintenance Coordination

The Parties shall, consistent with maintaining good operating practices, coordinate their operations to maintain continuity of services to their respective customers to the extent practicable. Planned facility maintenance by either entity that will cause a deviation from the normal power and energy flow at a POI shall be scheduled at a mutually agreeable time. No changes shall be made in the normal operation of a POI without the mutual agreement of the Parties. The Parties shall, to the extent necessary to support continuity of operations, coordinate

the operation of protective devices on the facilities they operate in the proximity of the Points of Interconnection which might reasonably be expected to affect the operation of facilities on the other entity's system. All testing of the facilities that affects the operation of the POI shall be coordinated between LCRA TSC, the TSP and ERCOT and shall be conducted in accordance with regulatory and statutory requirements, including NERC and ERCOT Requirements. Where a main-and-transfer bus configuration is installed, the installation may include a back-up protection device (e.g., fuse) during planned maintenance periods when the transfer bus is utilized for providing the service temporarily. Outage requests for transmission facilities shall be submitted to LCRA SOCC via iTOA (integrated Tools for Operations Application) for review and submission to ERCOT as per ERCOT requirements.

5.7 Synchronizing of Facilities

Synchronizing at transmission tie points shall be determined on a site-specific basis as consideration for ERCOT-approved Black Start plans. If applicable, synchronizing requirements shall be stated in the appropriate Interconnection Agreement.

5.8 Provision of Interconnection Facilities

The provision of facilities by LCRA TSC described below are for typical Interconnection Requests, other interconnection options may be evaluated on a case-by-case basis. For interconnection of load-serving facilities (power transformers) or transmission facilities (transmission lines, autotransformers, capacitor banks, reactors, dynamic reactive devices) to an existing LCRA TSC-owned transmission line or substation bus(es), LCRA TSC shall provide all series elements on LCRA TSC transmission lines and the termination equipment for all interconnecting facilities. LCRA TSC shall provide static reactive and dynamic reactive devices connecting directly to LCRA TSC owned substation buses.

5.8.1 Load Interconnections

LCRA TSC will perform a facility study to determine the scope of the Interconnection Facilities, including estimated costs and preliminary project schedule, which will be required to provide Points of Interconnection to the Customer. The facility study will follow the technical requirements detailed below for the POI and generally follow the Interconnection Facilities diagram for each of the following types of interconnections:

- Appendix 3: Load Interconnections for Greenfield Sites.
- Appendix 4: Load Interconnections for Brownfield Sites.

1) LCRA TSC will provide:

- The necessary modifications to the LCRA TSC-owned transmission line.
- Transmission Facilities including, without limitation, transmission bus(es), transmission line connections, and termination equipment (circuit breakers, switches, buswork, structures, instrument transformers) for connecting transmission elements with the associated protective relaying (including transmission bus differential and transmission line schemes).

LCRA Transmission Services Corporation Facility Interconnection Requirements

- If requested by the Customer under an existing Wholesale Metering Service Agreement (WMSA), LCRA TSC may provide meter panels, cables, and instrument transformers (if necessary).

For Interconnection Requests at new LCRA TSC Substations (Greenfield Sites):

- The LCRA TSC Yard ground grid, gravel, perimeter fence, the partition fence, and other appurtenances.
- LCRA TSC Yard ground grid will be installed independently and LCRA TSC will connect to the Customer ground grid at the partition fence. LCRA TSC will perform ground potential rise analysis considering connected ground grids for the Customer Yard and LCRA TSC Yard.
- Control enclosure(s) with batteries, battery charger and appurtenances.
- Power Voltage Transformers for station service to LCRA TSC's Transmission Facilities.
- The junction box interfacing with the Customer's relay, control, and metering systems located in the LCRA TSC Yard ("Interface Box").
- Four (4) 2-inch conduits from the Interface Box to three (3) feet inside the Customer Yard.

2) Customer will provide:

- Distribution facilities including distribution lines, circuit breakers, insulators, foundations, switches, and associated protective relaying.
- Power transformer with associated surge arresters, foundations, jumpers, and associated protective relaying.
- Fault interrupting device (circuit switcher or breaker) on the transmission source-side of the Customer-owned power transformer with associated disconnect switches.
- Two (2) sets of current transformers located inside the high voltage power transformer bushings for LCRA TSC's bus differential relaying and breaker failure scheme.
- Breaker failure initiate and close inhibit contacts from its fault interrupting device relaying panel to LCRA TSC's 138-kV transformer bus differential and breaker failure relaying panel.
- For access to shared yards, hardened locks and chains on all gates are required.
- LCRA TSC recommends the Customer add wildlife mitigation to the Customer-owned transformation facilities.
- Install underfrequency relaying ("UFLS Facilities"). Upon request by the Customer, LCRA TSC may install and own the UFLS Facilities.
- If LCRA TSC is providing Metering Facilities, the Customer must provide:
 - Distribution voltage bus potential transformers for LCRA TSC metering.
 - Distribution voltage metering class current transformers located inside the power transformer bushings for LCRA TSC metering.

For Interconnection Requests at new LCRA TSC Substations (Greenfield Sites), the Customer must:

- Acquire the load serving substation property and convey the LCRA TSC portion fee simple to LCRA TSC. Prior to acquisition of the load serving substation property, Customer will provide LCRA TSC with a boundary survey, title commitment, environmental site assessment for the property and LCRA TSC will perform a site feasibility assessment and accept (if appropriate) the proposed load-serving substation site. Customer may elect to defer substation property acquisition upon mutual agreement by LCRA TSC.
- Perform or cause to be performed the site grading for the Customer Yard and the LCRA TSC Yard. LCRA TSC will review the grading plan and reimburse Customer for LCRA TSC's proportionate share of the site grading costs.

- Provide any required flood mitigation for the load-serving substation and will design, construct, and maintain any required detention pond(s).
- Acquire any necessary permits required for development of the load-serving substation.
- If the Customer requires a perimeter wall (concrete or decorative), the Customer will be solely responsible for the design, installation, and maintenance of the perimeter wall.
- Convey fee simple title to the portion of the real property underlying LCRA TSC Yard including the provision of good and adequate rights of vehicular ingress and egress to and from a public road contingent on approval by the LCRA TSC Board of Directors.
- Install and maintain its separate access to the Customer Yard.
- Install the Customer Yard ground grid and provide to LCRA TSC grounding system model data.
- Independently design and install shield wires for static protection of the Customer's facilities.
- Provide its own station service within the Customer Yard for power to its facilities.
- Provide its own telecommunication facilities for the Customer Yard including towers, fiber, etc.

5.8.2 Transmission Facilities

LCRA TSC will perform a facility study to determine the scope of the Interconnection Facilities, including estimated costs and preliminary project schedule, which will be required to provide Points of Interconnection to the Customer. The facility study will follow the technical requirements detailed below for the POI and generally follow the Interconnection Facilities diagram for each of the following types of interconnections:

- Appendix 6: Transmission Interconnections for Greenfield Sites.
- Appendix 7: Transmission Interconnections for Brownfield Sites.
- Appendix 8: Transmission Interconnections driven by ERCOT and NERC reliability requirements between separate substation bus owners.

1) LCRA TSC will provide:

- The interconnecting substation and all the transmission facilities contained within, including, without limitation, transmission line terminal equipment and protective relaying in LCRA TSC's substation for the Customer's interconnecting transmission line.
- The POI Structure with fiber splice box located outside LCRA TSC's Substation.
- The LCRA TSC substation property, ground grid, gravel, perimeter fencing, and other appurtenances.

2) Customer will provide:

- The interconnecting transmission line comprised of conductors, connecting hardware, insulators, fiber splice cans, Optical Ground Wire ("OPGW"), and structures to the POI Structure.
- The dead-end assembly for Customer's conductor connecting to LCRA TSC's POI Structure.
- Where the Customer provides the POI Structure, the POI Structure will be designed as a full tension dead-end structure meeting all of NESC requirements for Grade-B. The design of POI Structure is subject to review and acceptance by LCRA TSC.

5.9 Transmission Operations

Upon mutual agreement, the Customer may designate LCRA TSC as its Transmission Operator. The Customer will operate its facilities in accordance with LCRA TSC's Transmission Operations Handbook.

5.9.1 Facility and Equipment Numbering

When a Customer with whom LCRA TSC has an operating agreement adds a new facility or makes modifications to an existing facility, the Customer must request LCRA TSC to assign facility and equipment numbers for the transmission lines, substations, circuit breakers, circuit switchers, and disconnect switches at the transmission voltage. The request should be submitted at least 90 days prior to the Network Operations Model Change Request ("NOMCR") due date in accordance with ERCOT Nodal Protocols Section 3.10, to allow for adequate time to model the equipment in the ERCOT system.

5.9.2 Load Shed

For Criteria 2 Owners, LCRA TSC will install and own the UFLS Facilities. Customer will allow LCRA TSC to install facilities connected to the Customer's distribution system feeder breakers and instrument transformers for the purposes of tripping and closing during EEA3 or an under-frequency event.

6.0 TRANSFORMATION INTERCONNECTION SPECIFIC REQUIREMENTS

The following requirements apply to Distribution Service Provider ("DSP") Interconnection Requests for transformation service at nominal voltage levels of 24.9-kV or 12.5-kV.

LCRA TSC reserves the right to provide Transformation Service where it owns the substation property. Prior to seeking load service via the LCRA TSC transmission system, the interconnecting DSP must confirm and provide data that the distribution system cannot serve the load.

6.1 Planning Studies for Transformation Service

After the DSP confirms and provides evidence that the distribution system cannot serve the load, and that there is a need to build a new substation, upgrade an existing PWT, or add a new PWT to an existing LCRA TSC-owned substation, LCRA TSC will request written justification which shall include the following:

- 1) The data used to calculate any load-growth projections in native format.
- 2) A written description and map of the need study area used to support need for the proposed transmission facilities. This map should include and identify the location of all existing transmission facilities within and around the study area, the location of any

proposed substations or switching stations, and the boundaries of the routing study area and the need study area.

- 3) A thorough explanation of the assumptions made and relied upon to create any load growth projections, including, but not limited to:
 - Rates of load growth.
 - Factors applied to calculate forecasted loads for new developments in the need study area, and.
 - Adjustments made to forecasted loads to account for utility service provided by other utilities also certificated within the need study area.
- 4) If the Customer used new development loads to calculate any load growth projections, a map showing the following:
 - The locations of current consumers of the utility whose distribution facilities are evaluated in the purpose and need study.
 - The locations of new development projects relied on to create any load growth projections.
 - The locations of the existing load and new load centers.
 - The boundaries of the need study area and routing study area.
- 5) A written justification by the customer if a new substation is needed; this justification could be written request or in a form of a distribution study.
- 6) A written justification by the customer if a PWT upgrade or a PWT addition is needed; this justification could be written request or in a form of a distribution study.

6.2 Transformation Service

- LCRA TSC provides Transformation Service to eligible Customers in accordance with LCRA TSC's wholesale transformation service tariff.
- LCRA TSC will provide Metering Service to all Customers where it provides Transformation Service in accordance with LCRA TSC's wholesale metering service tariff.
- A Transformation Service Agreement ("TSA") shall be developed, or an existing TSA shall be amended and executed for the inclusion of new Transformation Service Points.
- Prior to or concurrent with the execution of the TSA, the Interconnection Agreement will be amended to include the POI required as part of an Interconnection Request.
- Prior to or concurrent with the execution of the TSA, the Wholesale Metering Service Agreement ("WMSA") shall be developed and executed.
- Upon request by the Customer, at substations where LCRA TSC does not own or will not own the property, LCRA TSC may provide the transformation facilities if it elects to do so.

6.3 Voltage Level and MW and MVAR Capacity or Demand at the POI

LCRA TSC provides Transformation Service at nominal voltage levels of 24.9-kV or 12.5-kV.

6.4 System Protection and Coordination

LCRA TSC and Customer shall design, provide, and coordinate their respective protection system equipment so that adjacent zones of protection overlap.

6.5 Maintenance Coordination

The Parties shall, consistent with maintaining good operating practices, coordinate their operations to maintain continuity of services to their respective customers to the extent practicable. Planned facility maintenance by either entity that will cause a deviation from the normal power and energy flow at a POI shall be scheduled at a mutually agreeable time. No changes shall be made in the normal operation of a POI without the mutual agreement of the Parties. The Parties shall, to the extent necessary to support continuity of operations, coordinate the operation of protective devices on the facilities they operate in the proximity of the Points of Interconnection which might reasonably be expected to affect the operation of facilities on the other entity's system. All testing of the facilities that affects the operation of the POI shall be coordinated between LCRA TSC, the DSP and ERCOT and shall be conducted in accordance with regulatory and statutory requirements, including NERC and ERCOT Requirements.

6.6 Wildlife Mitigation

LCRA TSC will apply measures to mitigate outages caused by wildlife contact, particularly at concentrated areas that have higher risk of contact, such as distribution equipment. LCRA TSC will only apply these measures to equipment owned by LCRA TSC, therefore the DSP will need to apply wildlife mitigation measures to its own equipment. All new substation and retrofit projects with distribution facilities will be evaluated for the use of wildlife mitigation measures; therefore, coordination between the DSP and LCRA TSC should take place during the project planning phase.

6.7 Provision of Interconnection Facilities

LCRA TSC will perform a facility study to determine the scope of the Interconnection Facilities, including estimated costs and preliminary project schedule, which will be required to provide Points of Interconnection to the Customer. The facility study will follow the technical requirements detailed below for the POI and generally follow the Interconnection Facilities diagram in Appendix 5: Transformation Interconnections.

6.7.1 LCRA TSC will provide:

- The substation property and construct the substation yard (including fence, control house, ground grid, battery bank, HVAC system, and yard lights) and perform vegetation management within the substation.
- Physical security for the substation in accordance with LCRA TSC standards.
- Transformation facilities including, but not limited to, equipment such as power transformers, voltage regulating equipment, circuit breakers, system protection and control devices, panels, control enclosures, surge arrestors, insulators, buswork, switches, real property rights, site work, structures, station service, foundations, grounding equipment, cables, fences, telecommunication facilities, and miscellaneous substation equipment necessary for the provision of Transformation Service.

LCRA Transmission Services Corporation Facility Interconnection Requirements

- Wildlife mitigation to the LCRA TSC transformation facilities.
- Metering Facilities (including CTs, PTs and meter panel(s)) where LCRA TSC provides transformation facilities.
- Primary and back-up station service.
- 125 VDC and 120 VAC power to Customer's devices located in the LCRA TSC Yard or within a separate control enclosure.

6.7.2 Customer will provide:

- Distribution circuits including feeder breakers, feeder protective relaying, foundations, dead-end insulators, distribution poles, conductor, static wire, hardware.
- Surge arrestors to protect the Customer's distribution feeder breakers and associated facilities.
- For Criteria 1 Owners, install underfrequency relaying ("UFLS Facilities").
- Any necessary telecommunications and SCADA facilities to operate Customer's facilities.
- A separate control enclosure within the LCRA TSC Yard or locate at feeder breaker the Customer's protective relaying, telecommunication, and telecom panels.
-

6.8 Transmission Operations

If LCRA TSC is the designated Transmission Operator for the Customer, the Customer must operate its facilities in accordance with LCRA TSC's Transmission Operations Handbook.

6.8.1 Load Shed

For Criteria 2 Owners, LCRA TSC will install and own the UFLS Facilities. Customer will allow LCRA TSC to install facilities connected to the Customer's distribution system feeder breakers and instrument transformers for the purposes of tripping and closing during EEA3 or an under-frequency event.

7.0 DISTRIBUTION CONNECTED GENERATION REQUIREMENTS

Generation with a nameplate capacity greater than or equal to 10 MW and connected to the distribution system must follow the large generator process in Section 5 of ERCOT's Planning Guide.

Distributed Generation ("DG") is an electrical generating facility located at a Customer's Point of Common Coupling ("PCC") that has a nameplate capacity of less than 10 MW and is connected at a voltage less than or equal to 60-kV, which may be connected in parallel operation to the utility system (regardless of fuel type or technology). DG with installed capacity greater than 1 MW capable of providing a net export of energy into a Distribution Service Provider's ("DSP") distribution system is required to be registered with ERCOT and follow the small generator process in Section 5 of ERCOT's Planning Guide.

LCRA TSC is not a DSP and does not provide service at distribution voltages (below 60-kV) other than by those facilities that are associated with LCRA TSC transformation facilities. LCRA TSC does not connect directly to the DG requesting interconnection at distribution voltages. LCRA

TSC will refer Interconnection Requests by DG developers for a POI to LCRA TSC transformation facilities (regardless of the capacity level) to the local DSP.

Upon receipt of Interconnection Request by the DSP, LCRA TSC will perform a study to define the necessary Interconnection Facilities, including financial security requirements, for LCRA TSC's interconnection to the DSP. At minimum, the DSP will own and install a distribution feeder circuit breaker between LCRA TSC and the DG.

7.1 Transformation Service

Where LCRA TSC provides transformation service, the DSP may submit an Interconnection Request to LCRA TSC for Transformation Service to support the DSP's interconnection of a DG, but such provision of service is contingent upon review and approval by LCRA TSC. Transformation Service charges to the DSP for demand through LCRA TSC's Transformation Facilities, in accordance with LCRA TSC's PUC-approved wholesale transformation service tariff, remain applicable. Metering Service charges to the DSP are applicable for Metering Facilities required to support the Interconnection Request.

7.2 Notifications

LCRA TSC shall be notified by the Transmission Service Customer of planned DG systems rated greater than 50 kW intended for parallel operation that will be served off LCRA TSC transmission and transformation facilities.

DG facilities interconnected to Transmission Service Customer systems less than 60-kV shall be documented via the customer-submitted load forecast.

7.3 Planning Studies for Distributed Generation

A DG impact study may be performed at LCRA TSC's discretion for DG installations rated greater than 50 kW intended for parallel operation.

Generation that must follow the Large Generation process shall have steady state, short circuit and stability studies performed to assess the impacts of the transmission system as required in Section 5 of the ERCOT Planning Guide. Generation that must follow the Small Generation process and installations rated greater than 50 kW intended for parallel operation may require a small generator study to be performed by LCRA TSC. Prior to commencement of LCRA TSC studies, DSP will provide a distribution impact study for the DG interconnecting to the DSP system for LCRA TSC review. The DSP will execute a study agreement with LCRA TSC for the small generator interconnection study.

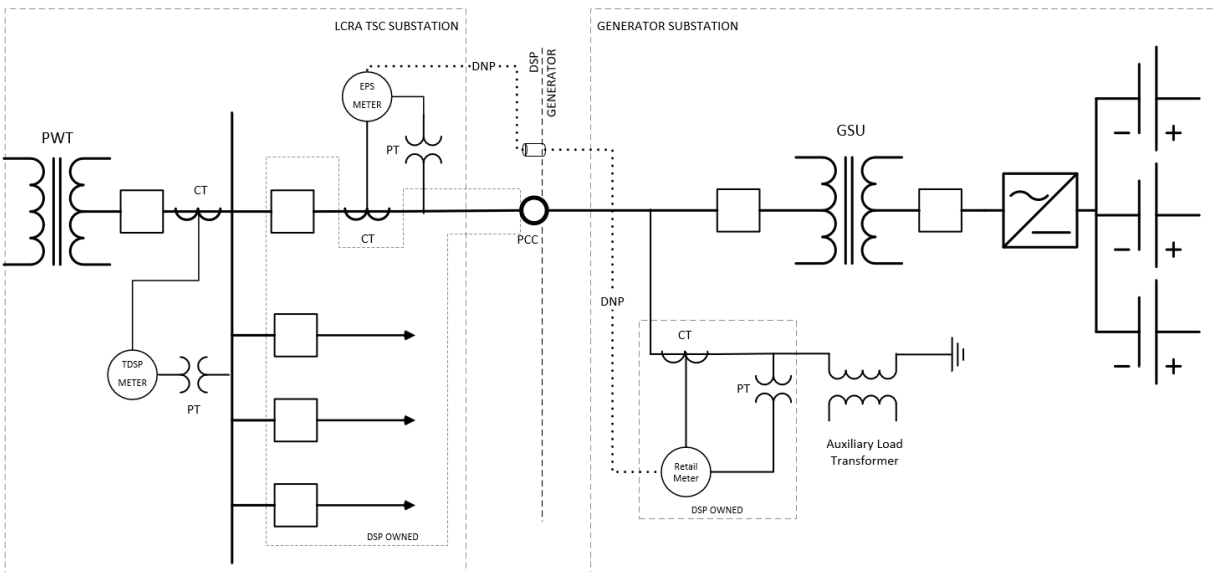
7.4 Metering Facilities

Upon request by the DSP, LCRA TSC may install any specialized revenue metering, instrument transformers, and communications required at the DG facility to account for bi-directional energy flows and for revenue settlement purposes. Requirements for such metering are determined by the DG capacity and resource registration as needed for the installation of ERCOT Polled Settlement Metering, Wholesale Storage Load ("WSL") classification, or Emergency Response Service ("ERS") classification.

Regarding Battery Energy Storage Systems (BESS), DSP will provide LCRA TSC a distributed network protocol (DNP) signal from its revenue grade meter measuring the auxiliary load for the BESS to LCRA TSC’s EPS meter at the Substation. The DSP will provide reasonable support for maintenance and testing of the EPS metering scheme.

Where required, the EPS metering point for the POI shall be located at the LCRA TSC Substation. For Wholesale Storage Loads (WSL) the EPS meters will be configured such that only the charging power and energy for the WSL is measured excluding auxiliary or non-WSL power to the DG, except as otherwise permitted under applicable regulations. The DSP will provide LCRA TSC a distributed network protocol (DNP) signal from its revenue grade meter measuring the auxiliary load for the WSL to LCRA TSC’s EPS meter at the LCRA TSC Substation. The DSP will provide reasonable support for maintenance and testing of the EPS metering scheme.

DISTRIBUTION CONNECTED WSL METERING ONE-LINE



7.5 System Protection and Coordination

Depending on the results of a DG impact study, specialized protective relaying may be required to provide reverse-power, under-frequency, under-voltage, over-voltage, communication-assisted transfer tripping, or other protection requirements. Requirements vary based on the DG size and technology.

For DG connecting to LCRA TSC transformation, DSP will establish a transfer trip scheme between the DSP’s feeder breaker and the DG. Prior to modifying any relay protection system design or relay setting involving the PCC, DSP shall submit the proposed changes to LCRA TSC for review and approval. LCRA TSC’s review and approval shall be for the limited purpose of determining whether such proposed changes are compatible with LCRA TSC’s system.

7.6 Voltage Control and Synchronization

DSP is responsible for the coordination of the proper synchronization of the DG facilities with the LCRA TSC system, in accordance with ERCOT Requirements.

For DG connecting to LCRA TSC transformation, DSP will require DG to control voltage to the distribution voltage bus at the LCRA TSC Substation in accordance with the voltage set point provided by LCRA TSC.

7.7 Energy Storage Charge and Discharge Limitations

The DG may designate any proposed DG as self-limiting. Charge and discharge limits may not be increased without reinitiating the interconnection process, as required in Section 5 of the ERCOT Planning Guide.

LCRA TSC and/or the DSP will specify any charge and discharge limitations as a result of the studies. Any limitations will be memorialized between LCRA TSC and DSP in the Interconnection Agreement, and DSP will ensure that the DG charge and discharge rate limits are not exceeded.

7.8 Provision of Interconnection Facilities

LCRA TSC will perform a facility study to determine the scope of the Interconnection Facilities, including estimated costs and preliminary project schedule, which will be required to provide Points of Interconnection to the Distribution Service Provider.

7.8.1 At LCRA TSC transformation sites:

The facility study will follow the technical requirements detailed below for the POI and generally follow the Interconnection Facilities diagram in Appendix 5: Transformation Interconnections.

1) LCRA TSC will provide:

- 12.5-kV or 24.9-kV breaker with associated protective relaying for power transformer protection.
- 12.5-kV or 24.9-kV bus, disconnect switches for DSP's feeder to DG.
- Potential transformers (PT) on the transmission voltage side of the power transformer.
- Load tap changer controller additions or modifications.
- Power transformer modifications or upgrade, if required.
- 12.5-kV or 24.9-kV bus-work expansion, A-Frame, and foundations.
- Feeder bay and disconnect switches.
- Where LCRA TSC provides metering service, EPS metering located at the LCRA TSC substation.
- For Criteria 2 Owners, protective relay and control equipment to remotely operate DSP's feeder breakers for manual load shed control.

2) DSP will provide:

- Distribution feeder breaker and protective relaying.
- Distribution line extension to the PCC with the DG.
- Fiber from the PCC to the POI with LCRA TSC.
- Revenue grade metering for auxiliary loads at the DG.

LCRA Transmission Services Corporation Facility Interconnection Requirements

- Protective relaying modifications for LCRA TSC's remote operation of feeder breakers as required per ERCOT Nodal Protocol 3.8.6.

3) DG will provide:

- Step-up and Plant facilities at the DG.
- Line extension to the PCC with the DSP.
- Fiber communications to the PCC.
- Protective relaying and fault interrupting devices at the DG.

7.8.2 At DSP transformation sites:

The facility study will follow the technical requirements detailed below for the POI and the Interconnection Facilities.

1) LCRA TSC will provide:

- Any necessary transmission facilities needed to support the DG interconnection.
- For Metering Service Customers, EPS meters at the Substation.
- For Criteria 2 Owners, protective relay and control equipment to remotely operate DSP's feeder breakers, as required per ERCOT Nodal Protocol 3.8.6.

2) DSP will provide:

- 12.5-kV or 24.9-kV breaker with associated protective relaying for power transformer protection.
- 12.5-kV or 24.9-kV bus, disconnect switches for DSP's feeder to DG.
- Distribution feeder breaker and protective relaying.
- 12.5-kV or 24.9-kV CTs and PTs for LCRA TSC's EPS metering at the Substation.
- For Criteria 2 Owners, protective relaying modifications for LCRA TSC's remote operation of feeder breakers for manual load shed control.

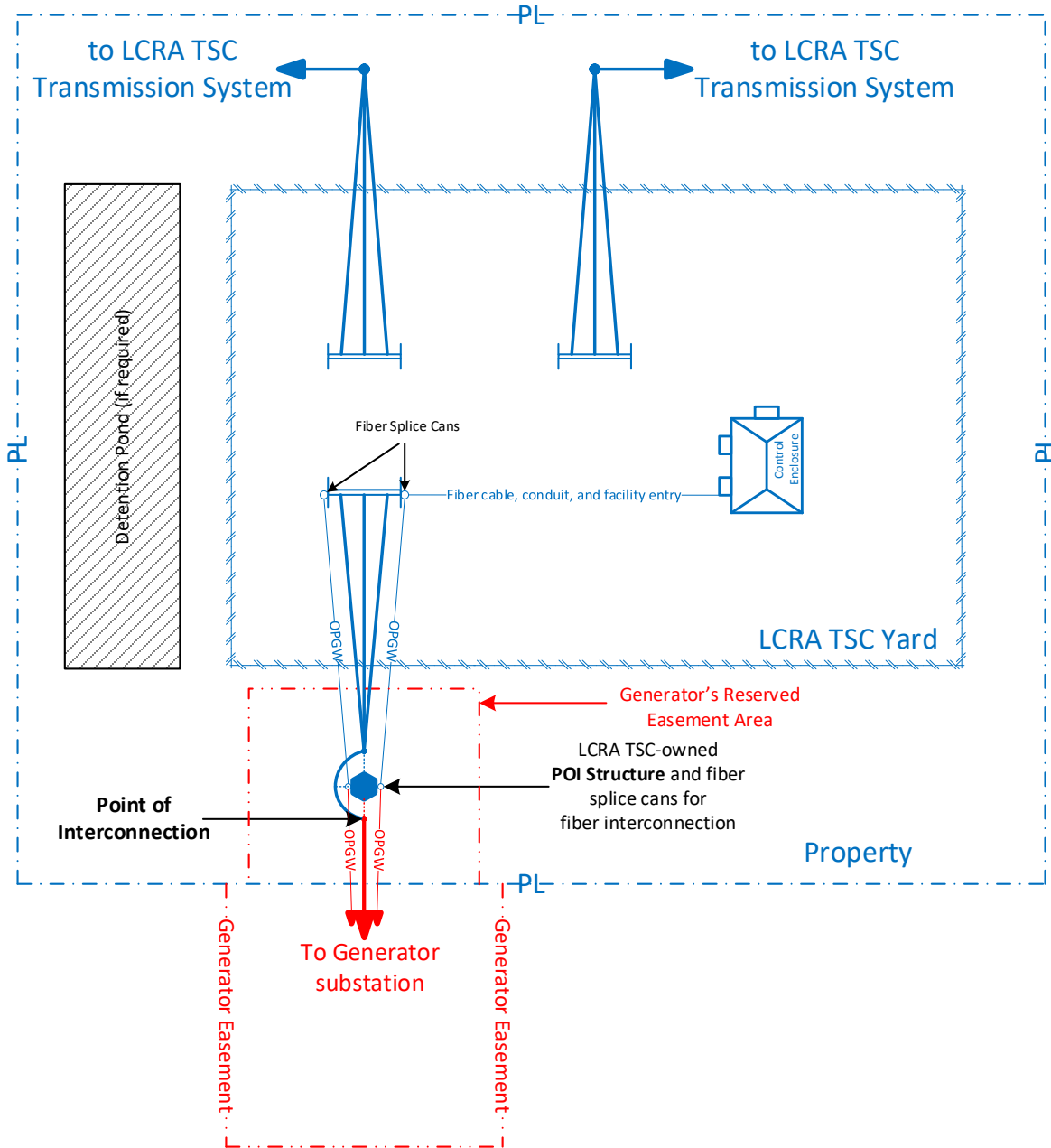
3) DG will provide:

- Step-up and Plant facilities at the DG.
- Line extension to the PCC with the DSP.
- Fiber communications to the PCC.
- Protective relaying and fault interrupting devices at the DG.

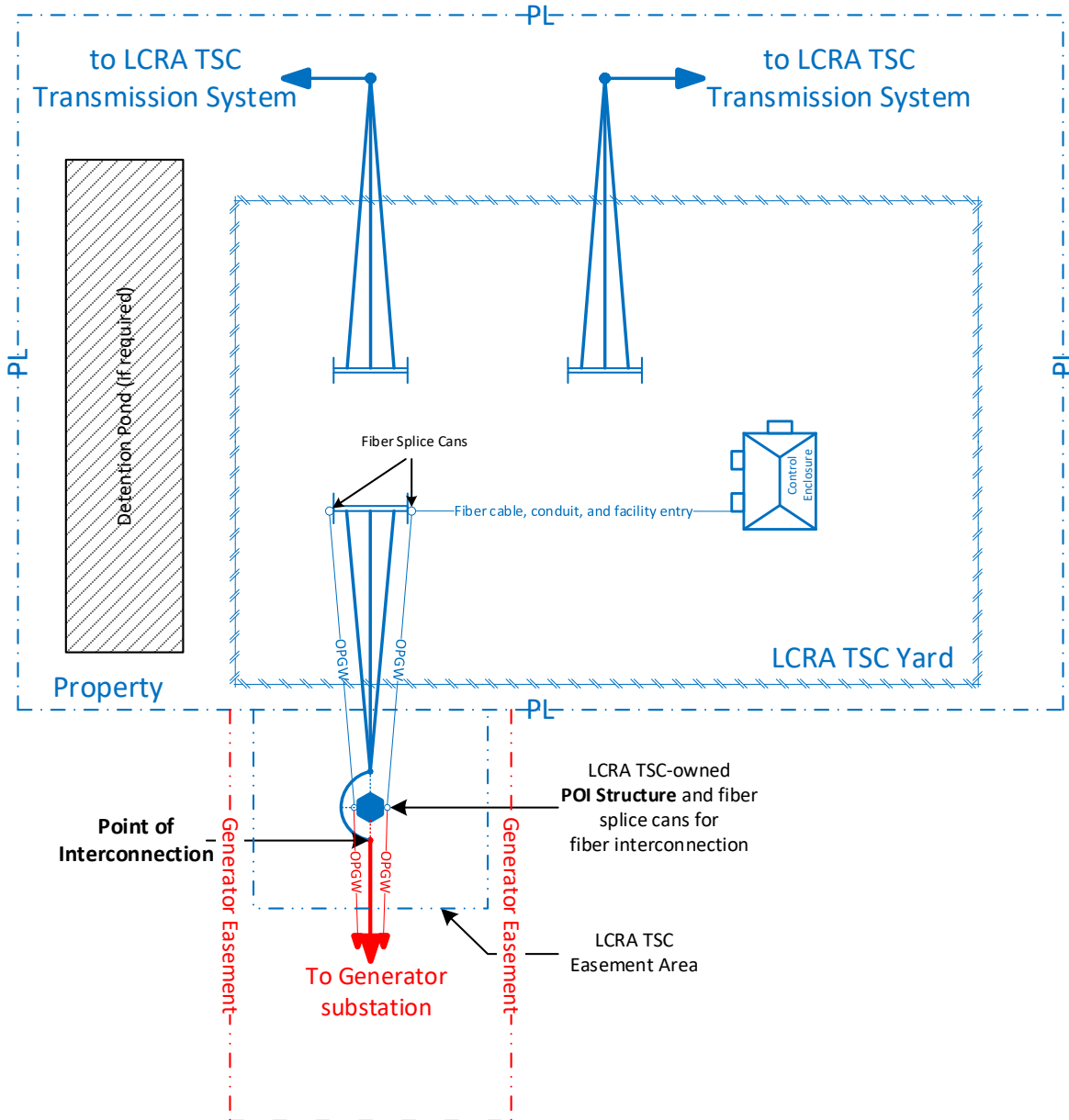
7.9 Other applicable requirements

- PUC §25.211. Interconnection of On-Site Distributed Generation.
- PUC §25.212. Technical Requirements for Interconnection and Parallel Operation of On-Site Distributed Generation.

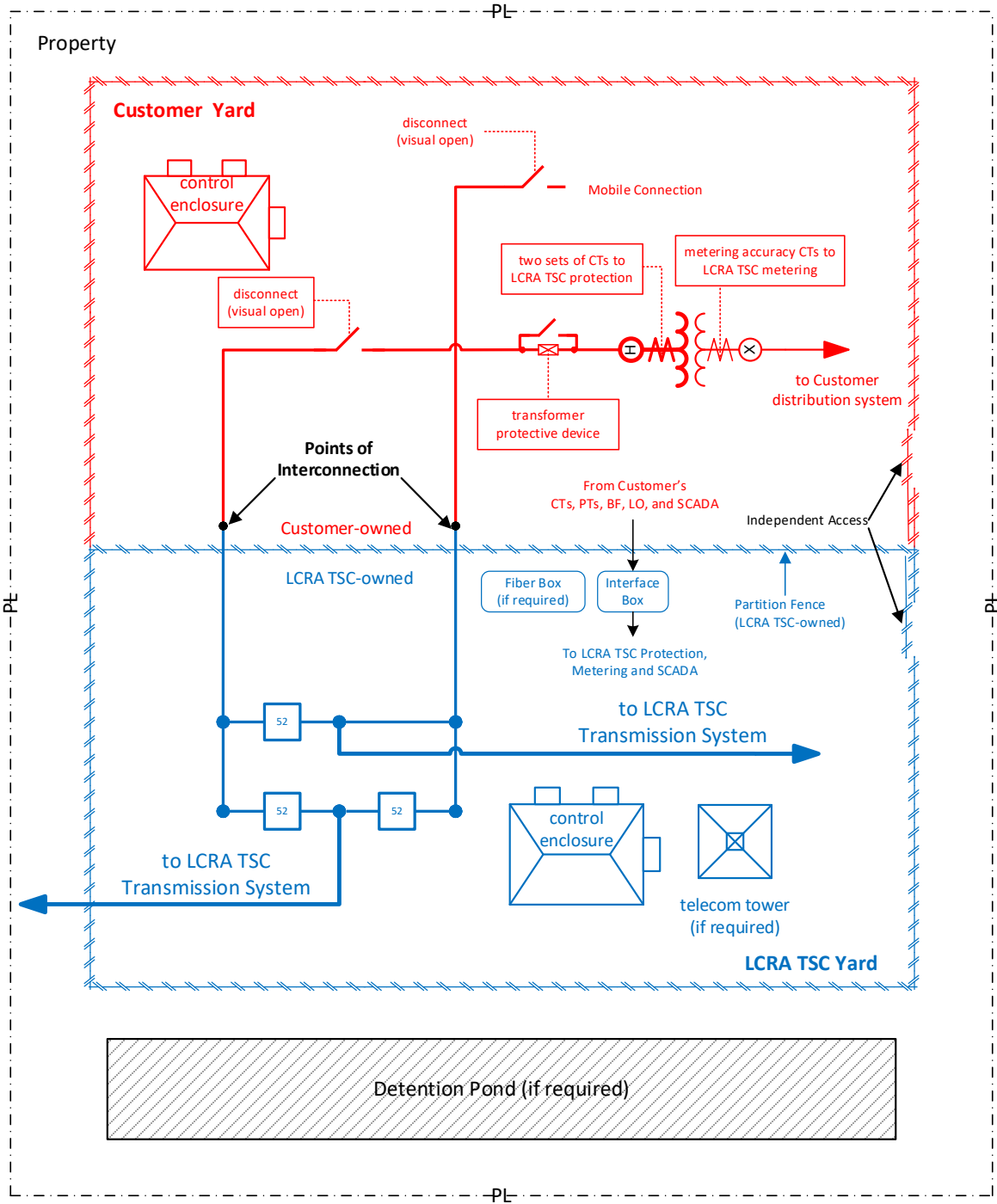
APPENDIX 1: GENERATION INTERCONNECTIONS FOR GREENFIELD SITES



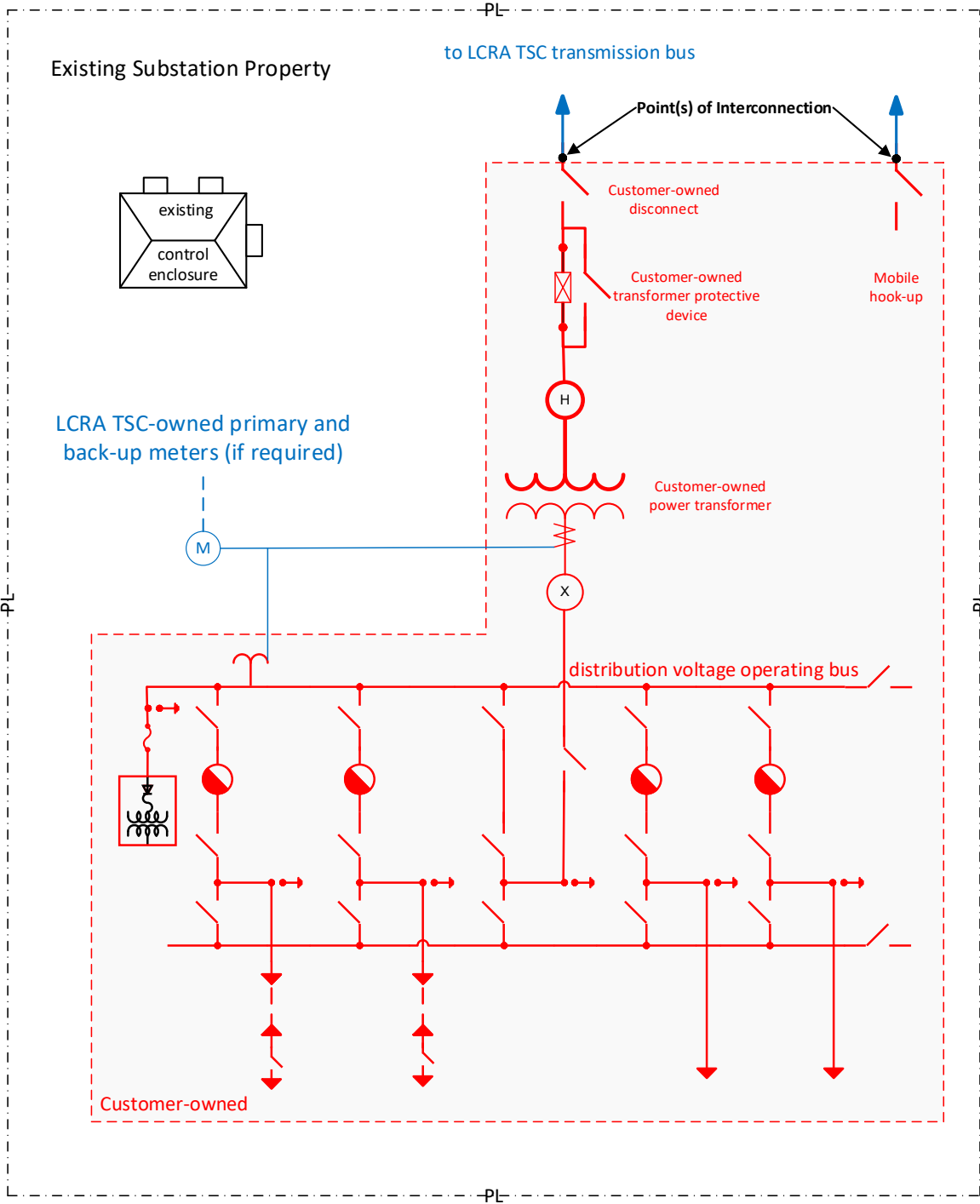
APPENDIX 2: GENERATION INTERCONNECTIONS FOR BROWNFIELD SITES



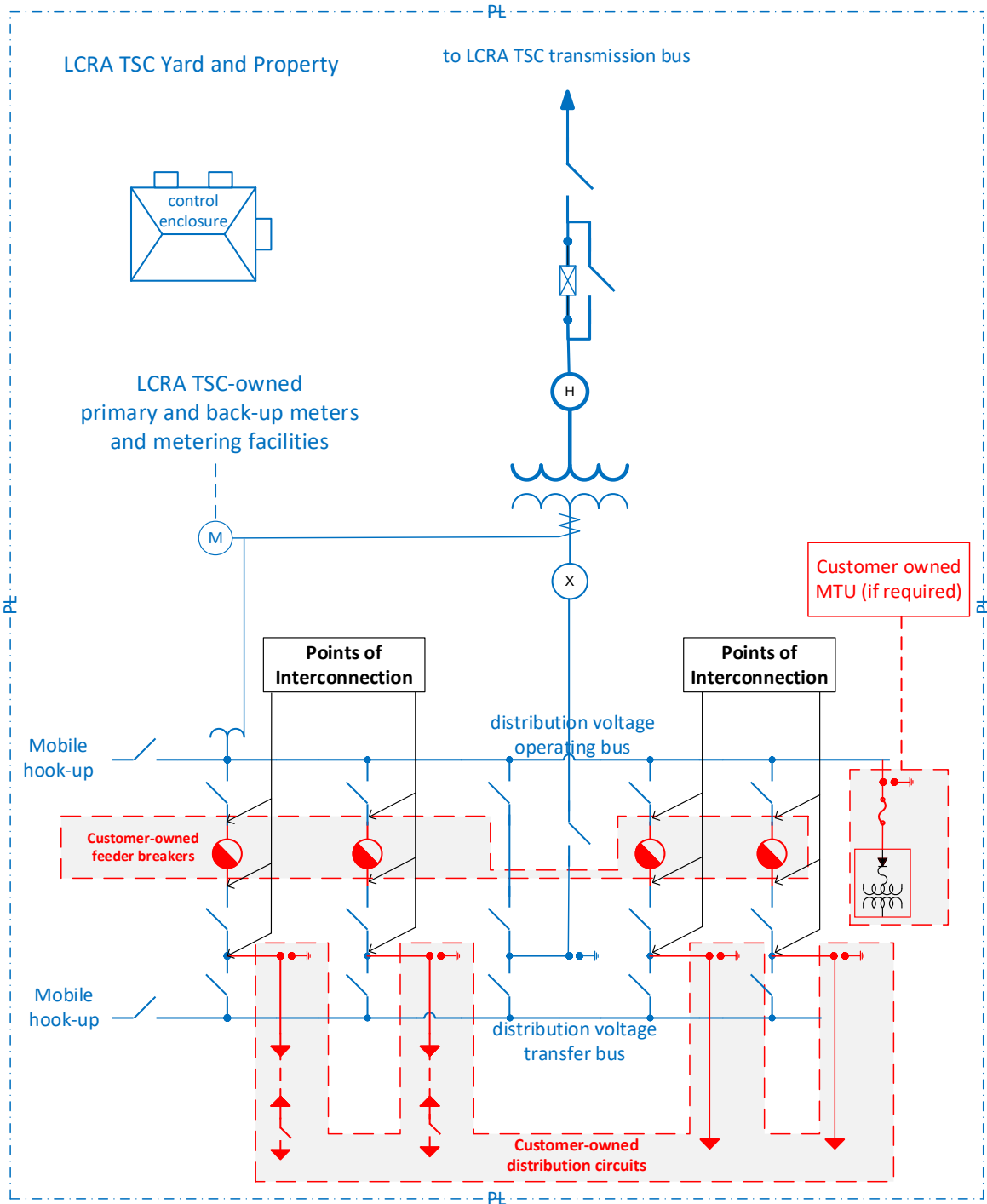
APPENDIX 3: LOAD INTERCONNECTIONS FOR GREENFIELD SITES



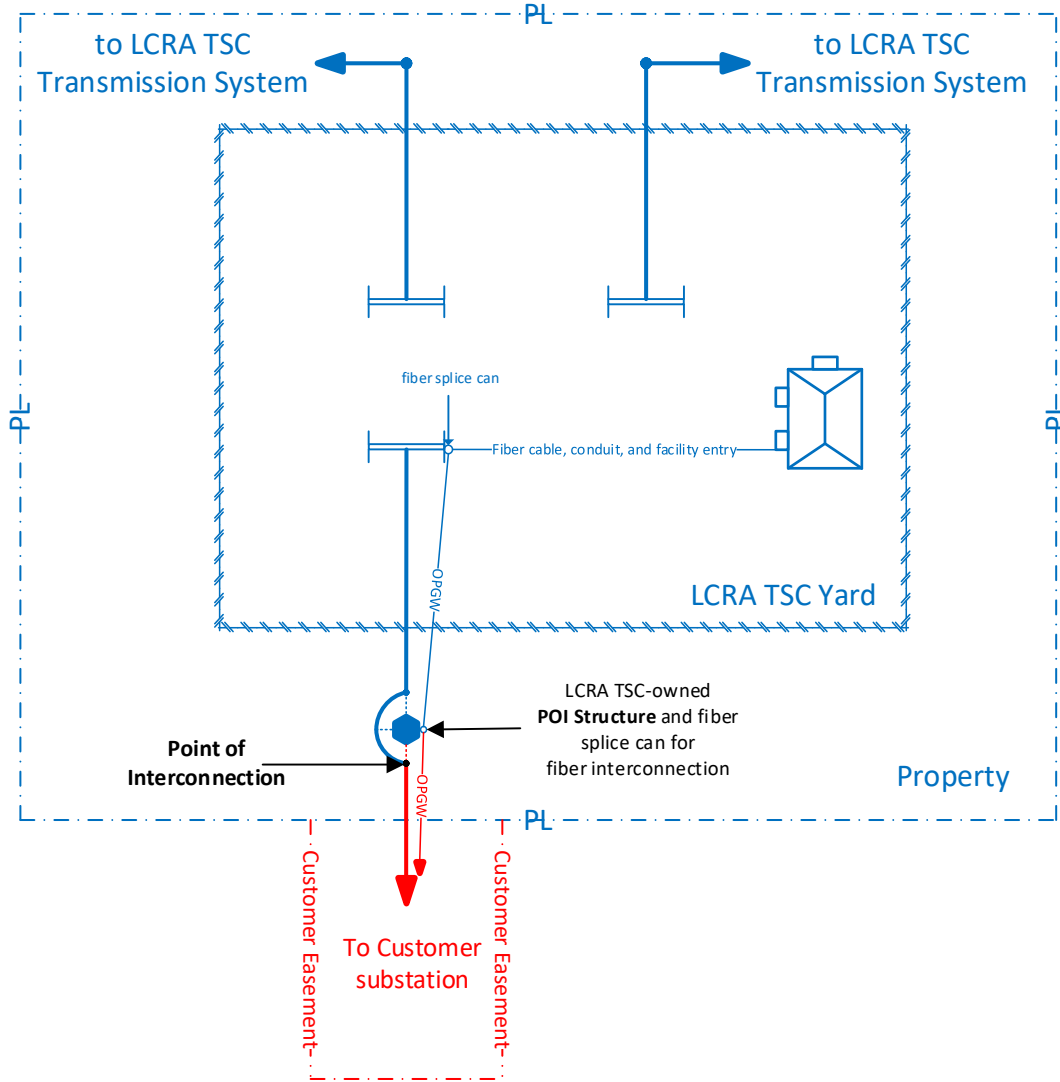
APPENDIX 4: LOAD INTERCONNECTIONS FOR BROWNFIELD SITES



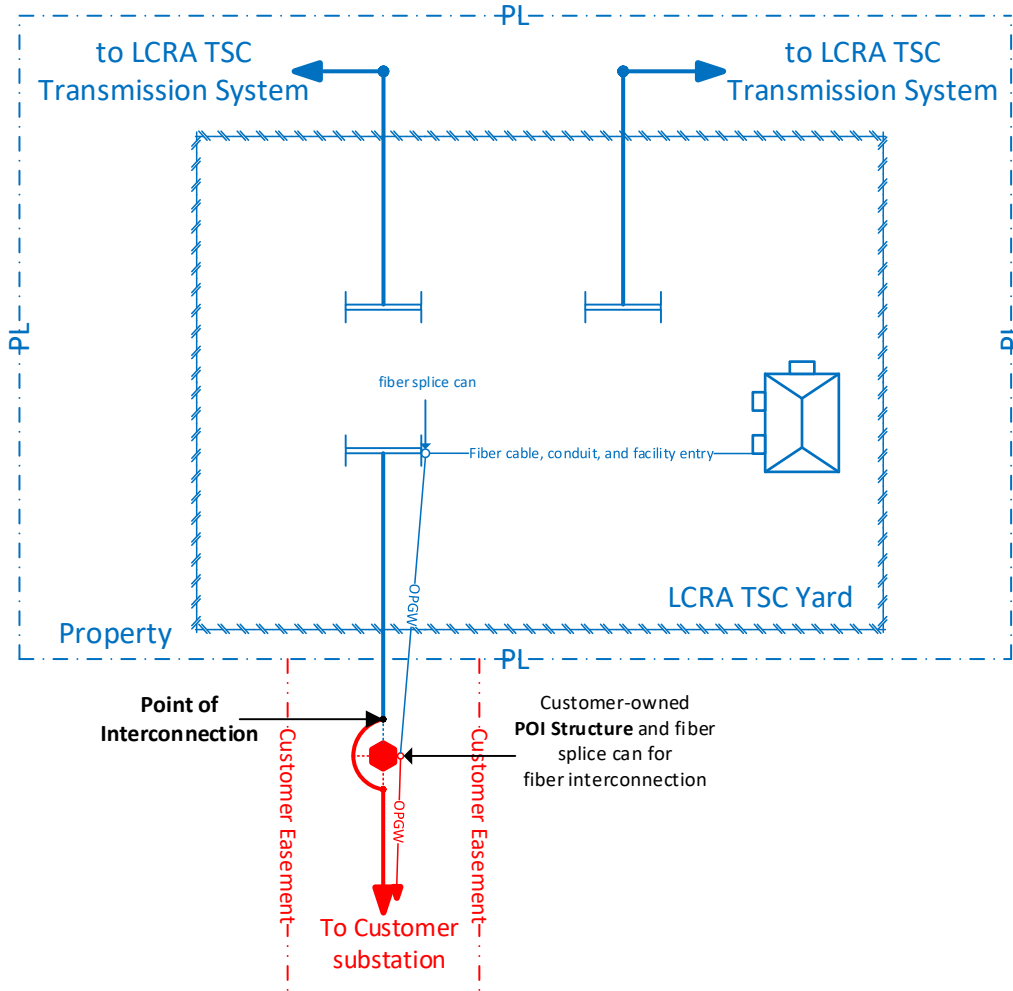
APPENDIX 5: TRANSFORMATION INTERCONNECTIONS



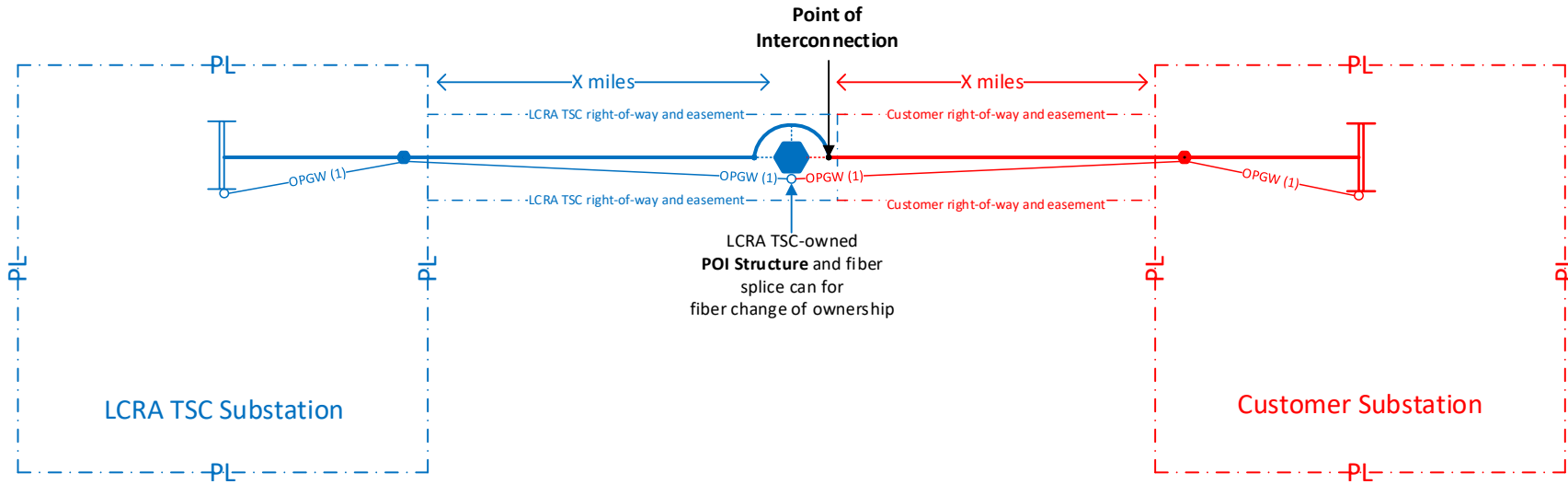
APPENDIX 6: TRANSMISSION INTERCONNECTIONS FOR GREENFIELD SITES



APPENDIX 7: TRANSMISSION INTERCONNECTIONS FOR BROWNFIELD SITES



APPENDIX 8: TRANSMISSION INTERCONNECTIONS WITHIN TRANSMISSION LINE RIGHTS-OF-WAY



APPENDIX 9: LCRA TSC OPERATIONAL DATA SPECIFICATION

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1.0 PURPOSE

The purpose of this data specification is to detail the data necessary for LCRA Transmission Services Corporation to perform its Real-time monitoring as required by NERC Standards, the ERCOT Coordinated Functional Registration (CFR), and ERCOT Protocols and Guides.

2.0 SCOPE

The scope of this procedure applies to all entities for which LCRA TSC is the Transmission Operator as well as any interconnected Generator Operators, Generator Owners, Transmission Operators, Distribution Providers, RAS-entity, or other entities.

3.0 DOCUMENT INFORMATION

To ensure that you have a current version of this document, go to the LCRA TSC SOCC Operations Procedures SharePoint site. The document will be made available as part of all executed Interconnection or Transmission Operator Agreements, as well as on the customer facing SharePoint site.

4.0 DEFINITIONS

BES – Bulk Electric System. Elements of the Transmission System as defined by the NERC Standards.

TOA – Transmission Operator Agreement.

ICCP – Inter-Control Center Communication Protocol (ICCP) Data. Data that is transmitted or exchanged over the ICCP link and the subject of any provisions of the ERCOT Nodal ICCP Communication Handbook.

RAS-entity – the Transmission Owner, Generator Owner, or Distribution Provider that owns all or part of a Remedial Action Scheme.

POIB – Point of Interconnection Bus.

5.0 DATA SPECIFICATIONS

The specifications within the following sections constitute the data and information needed by LCRA TSC to support its Real-time monitoring of all BES, non-BES, Remedial Action Scheme (RAS), and external network data deemed necessary for the safe and reliable operation of its transmission system. The requested data is in accordance with NERC TOP-003 and ERCOT Protocols and Operating Guides. Unless otherwise specified in an Interconnection Agreement (IA), Transmission Operations Agreement (TOA), or other binding document, all entities in this document must follow the data specification format, security protocol, and process for resolving data conflicts as described in the ERCOT Protocols and Operating Guides.

5.1 LCRA TSC Transmission Operator Entities

This section applies to all entities with which LCRA TSC has an executed Transmission Operations Agreement (TOA). Entities for which LCRA TSC is the **Transmission Operator shall:**

- 5.1.1 Provide LCRA TSC access to the required telemetry and status data (analog and status) by allowing LCRA TSC to install RTU's at Owner's substations or through a mutually agreed upon communications path.
- 5.1.2 Provide LCRA TSC with continuous access to the following required telemetry as appropriate:

Required Data	Measurement Unit (s)	Periodicity
Circuit Breaker Status	Open / Closed	10 seconds
Circuit Switcher Status	Open / Closed	10 seconds
Motor Operated Switches	Open / Closed	10 seconds
Line Flow	MW, MVAR	10 seconds
Transmission Facility Bus Voltages	kV	10 seconds
Transmission Facility Line Voltages	kV	10 seconds
Autotransformer Flow	MW, MVAR	10 seconds
Autotransformer Tap Position	Tap Position (Integer)	10 seconds
Power Transformer Flow	MW, MVAR	10 seconds

- 5.1.3 Shall use sufficient metering of suitable range, accuracy, and sampling rate to ensure accurate and timely monitoring of its operating conditions under both normal and emergency situations to meet all ERCOT Nodal Protocol and Operating Guide requirements

5.2 All Other Entities

This section applies to all other entities such as generator owners or operators, transmission owners or operators, or distribution owners or operators with a point of interconnection with LCRA TSC or is an entity for which LCRA TSC deems real time monitoring is necessary to maintain system reliability. LCRA TSC will either acquire continuous access to the following data from ERCOT or through an agreed upon communications path:

Required Data	Measurement Unit (s)	Periodicity
Circuit Breaker Status	Open / Closed	10 seconds
Circuit Switcher Status	Open / Closed	10 seconds
Motor Operated Switches	Open / Closed	10 seconds
Line Flow	MW, MVAR	10 seconds
Transmission Facility Bus Voltages	kV	10 seconds
Transmission Facility Line Voltages	kV	10 seconds
Transmission Facility POIB Voltage	kV	10 seconds
Autotransformer Flow	MW, MVAR	10 seconds
Autotransformer Tap Position	Tap Position (Integer)	10 seconds
Power Transformer Flow	MW, MVAR	10 seconds
Generator Output (Can be Aggregate)	MW, MVAR	10 seconds



5.3 RAS-Entity

This section applies to any RAS-entity that has implemented or plans to implement a Remedial Action Scheme (RAS) that may have impact on LCRA TSC’s system:

- 5.3.1 Provide all telemetry to ERCOT or LCRA TSC directly as required by the current Nodal Protocols and Operating Guides.
- 5.3.2 Provide any data requested by LCRA TSC to monitor the status of the RAS or degradation that impacts System Reliability.

6.0 DATA CONFLICT

- 6.1 All entities will promptly advise LCRA TSC if it detects or otherwise learns of any metering, telemetry, or communication equipment errors or malfunctions and shall correct such error or malfunction as soon as reasonably feasible in accordance with the ERCOT Protocols.
- 6.2 If LCRA TSC detects or otherwise learns of any metering, telemetry, or communication equipment errors by entities that have data required for LCRA TSC to perform Real-time monitoring, LCRA TSC will contact that entity as soon as practicable.

7.0 FORMALIZATION

Each of these data specifications are formalized within the Transmission Operator Agreement and Operations Handbook for all entities for which LCRA TSC is the Transmission Operator, and within the Interconnection Agreement for each other external entity.

8.0 ASSOCIATED DOCUMENTS

- 8.1 LCRA TSC Operations Handbook
- 8.2 NERC TOP-003
- 8.3 ERCOT Nodal Protocols
- 8.4 ERCOT Nodal Operating Guides
- 8.5 ERCOT Nodal ICCP Communication Handbook

9.0 DATA RETENTION

This data specification will be reviewed annually

10.0 CHANGE HISTORY

The table below reflects changes to the procedure.

Description of change	Date (header)
Initial version of the procedure	7/27/2022

11.0 APPROVALS

New Document

Existing Document

Stakeholder Review Team 1. Justin Gibson 2. Peter Lewis 3. Cris Ureña 4. Aniruddha Khedlekar 5. Wesley Maurer 6. Brian Kunz	Attachment Documentation Rules: New Documents: <ul style="list-style-type: none"> • Are to be in black text and indicated as a new document Additions to Existing Documents: <ul style="list-style-type: none"> • Are to be in color (such as red or blue) and indicated as an existing document • Deletions are to be striketrough or Microsoft Track Changes
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Management Approval (Supervisors/Managers responsible for managing the tasks are described in the document)

1. <u>Nayana Phadke</u>	Date: <u>8/12/22</u>
2. <u>Cris Ureña</u>	Date: <u>8/1/22</u>
3. <u>Wesley Maurer</u>	Date: <u>7/28/22</u>
4. _____	Date: _____
5. _____	Date: _____
6. _____	Date: _____
7. _____	Date: _____
8. _____	Date: _____

Final Approval (Signature and Date Required) by Manager

Manager

 _____ Date 8/17/22
 Daniel Marr

Responsible Person (may also be the Manager)

 _____ Date 8/17/22
 Daniel Marr

Effective Date of Change is the listed in the header of each document and with Manager approval, or if the header date is not available the date that the Manager approved the document in EDMS.

Communication /Change Plan:
