EL PASO ELECTRIC COMPANY

ORIGINAL RULE NO. 25

TECHNICAL INTERCONNECTION AND INTEROPERABILITY REQUIREMENTS

X

(SEE ATTACHMENT)

Advice Notice No. *290*

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El Paso Electric Company's

Technical Interconnection and Interoperability Requirements (TIIR)

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1. Introduction

1.1 Technical Interconnection and Interoperability Requirements (TIIR)

The technical requirements for interconnecting Distributed Energy Resources (DER) to El Paso Electric's (EPE) distribution system in the New Mexico service territory.

1.2 General

The scope of this document, referred to as the Technical Interconnection and Interoperability Requirements (TIIR), is to provide the requirements for the interconnection of DER systems to EPE's distribution system in New Mexico as a part of 17.9.568.11 NMAC. The TIIR is based on IEEE Std 1547-2018 and other applicable standards. The intent of this document is to provide clear guidance on the technical requirements, specific to the topics listed in this document, for interconnecting DERs with a nameplate rating up to 10MW in a safe, reliable, and economical manner.

2. Definitions, Abbreviations, and Common Terms

2.1 Definitions

Abnormal Operating Performance Categories: The grouping for a set of requirements that specify technical capabilities and settings for a DER under abnormal operating conditions, i.e., outside the continuous operation region.

Normal Operating Performance Categories: The grouping for a set of requirements that specify technical capabilities and settings for DER under normal operating conditions, i.e., inside the continuous operation region

2.2 Acronyms

BPS -	Bulk Power System
DER -	Distributed Energy Resource
EPS -	Electric Power System
TPS -	Transmission Power System

3. Performance Categories

The IEEE 1547 standard provides a technology-neutral approach to performance categories that are dependent on application considerations. Performance categories are assigned to specify required capability for reactive power

performance, voltage regulation performance, and response to abnormal conditions. Requirements associated with performance categories could be driven by Area EPS, TPS, or BPS needs. The requirements listed in this document have been determined to apply to New Mexico applications.

3.1 Abnormal Operating Performance Categories

Categories I, II, and III differentiate performance requirements for DER response to abnormal conditions.

I. Category I – Based on essential bulk power system (BPS) stability needs and reasonably attainable by all DER technologies that are in use today.

II. Category II – Covers all BPS stability/reliability needs and is coordinated with existing reliability standards to avoid tripping for a wider range of disturbances of concern to BPS stability.

III. Category III – is based on both BPS stability/reliability and distribution system reliability/power quality needs and is coordinated with existing interconnection requirements for very high DER penetration.

3.2 Normal Operating Performance Categories

Categories related to reactive power capability and voltage regulation performance requirements.

- Category A – Covers minimum performance capabilities needed for voltage regulation and are reasonably attainable by all DER technologies as of the publication of IEEE 1547-2018. This level of performance is deemed adequate for applications where the DER penetration in the distribution system is lower, and where the overall DER power output is not subject to frequent large variations.

- Category B – Covers all requirements within Category A and specifies supplemental capabilities needed to adequately integrate DERs where the aggregated DER penetration is higher or where the overall DER power output is subject to frequent large variations.

3.3 Performance Category Assignments

Synchronous machine-based DER shall comply with normal performance Category A and abnormal performance Category I. Inverter based DER shall comply with normal

performance Category B and abnormal performance Category III. Table 1 lists the technology based normal and abnormal performance categories.

Table 1: Normal and Abnormal Performance Categories

Technology	Normal Performance Category	Abnormal Performance Category
Inverter Based DER	Category B	Category III
Synchronous Machine Generation	Category A	Category I

4. Reactive Power Capability and Voltage/Power Control Performance

Voltage impacts to the Area EPS, caused by DER performance, that extend beyond the acceptable ANSI C84.1 Range A levels must be mitigated. Reactive and active power control functions shall be used to assist in mitigating these voltage impacts.

4.1 Reactive Power Capability

Reactive power capability shall be available for use by the Area EPS Operator and compliant with IEEE 1547.

4.2 Constant Power Factor

The Constant Power Factor mode will be deactivated unless explicitly stated by the Area EPS operator. The desired power factor will be specified by the Area EPS operator and should not necessitate reactive power beyond the reactive capability requirements as specified in 5.2 of the IEEE 1547-2018. The power factor configurations can be adjusted either locally or remotely as directed by the Area EPS operator. The DER must respond within 10 seconds or less to ensure a constant power factor.

4.3 Voltage-Reactive Power Control

The DER shall enable the voltage-reactive power control and apply the default settings listed in Table 2, unless otherwise specified by the Area EPS operator.

Table 2: Voltage-Reactive Power Default Setting

Voltage-Reactive Power Parameters	Default Settings	
	Synchronous Machine-Based DER	Inverter-Based DER
V_{Ref}	V_N*	V_N*
V_1	0.9 V_N	V_{Ref} – 0.08 V_N
V_2	V_N	V_{Ref} – 0.02 V_N
V_3	V_N	V_{Ref} + 0.02 V_N
V_4	1.1 V_N	V_{Ref} + 0.08 V_N
Q_1[a]	25% of nameplate apparent power rating, injection	44% of nameplate apparent power rating, injection
Q_2	0	0
Q_3	0	0
Q_4	25% of nameplate apparent power rating, absorption	44% of nameplate apparent power rating, absorption
Open Loop Response Time	10 s	5 s

*V_N is assumed to be set at DER nominal operating voltage
[a]The DER reactive power capability may be reduced at a lower voltage.

All DER shall use a fixed V_{ref} volt-var.

4.4 Voltage active power (volt-watt) mode activation and default settings

The DER shall enable the voltage-active power function with the default settings listed in Table 3, unless otherwise specified by the Area EPS.

Table 3: Voltage-Active Power Settings for Category B DER

Voltage-Active Power Parameters	Default Setting
V_1	1.06 V_N
P_1	P_{rated}
V_2	1.1 V_n
P_2	The lesser of 0.2 P_{rated} or P_{min}[a]
P'_2	0[b]
Open Loop Response Time	10 s[c]

[a]P_{min} is the minimum active power output in p.u. of the DER rating.

[b]P'_{rated} is the maximum amount of active power that can be absorbed by the DER. ESS operating in the negative real power half plane, through charging, shall follow this curve as long as available energy storage capacity permits this operation.
[c]Any settings for the open loop response time of less than 3 s shall be approved by EPE with due consideration of the system dynamic oscillatory behavior.

4.5 Active-Reactive Power Control

Unless otherwise specified by the Area EPS, the DER shall disable Active Power-Reactive Power control.

4.6 Constant Reactive Power Control

Unless otherwise specified by the Area EPS, the DER shall disable Constant Reactive Power control.

5. Response to Abnormal Conditions

5.1 Voltage and Frequency Trip Setting

The DER shall comply with voltage and frequency ride-through requirements for the applicable Abnormal Operating Performance Category. IEEE 1547 default settings should be implemented unless otherwise specified by the Area EPS. Tables 4 and 5 list the required default voltage settings and Table 6 lists the required default frequency settings.

Table 4: Synchronous Machine DER Response (shall trip) to Abnormal Voltages

Shall Trip – Synchronous Machine Based DER		
Shall Trip Function	Default Setting	
	Clearing Time (s)	Voltage (p.u. of nominal)
UV2	0.16	0.45
UV1	2	0.70
OV1	2	1.10
OV2	0.16	1.20

Table 5: Inverter DER Response (shall trip) to Abnormal Voltages

Shall Trip – Inverter Based DER		
Shall Trip Function	Default Setting	
	Clearing Time (s)	Voltage (p.u. of nominal)
UV2	2	0.50
UV1	21	0.88
OV1	13	1.10
OV2	0.16	1.20

Table 6: DER Response (shall trip) to Abnormal Frequencies

Shall Trip – Inverter and Synchronous Machine Based DER		
Shall Trip Function	Default Setting	
	Clearing Time (s)	Frequency (Hz)
UF2	0.16	56.5
UF1	300*	58.5
OF1	300	61.2
OF2	0.16	62.0

*The Area EPS may need to adjust this time to coordinate with typical regional under frequency loadshedding programs and expected frequency restoration time.

Inverter based DER shall comply with the Rate of Change of Frequency (ROCOF) ride-through performance requirements per IEEE 1547-2018 Section 6.5.2.5.

Inverter based DER shall comply with the voltage phase angle changes ride-through requirements per IEEE 1547-2018 Section 6.5.2.6.

5.2 Frequency Droop Settings

The DER shall comply with the frequency-droop requirements for the applicable Abnormal Operating Performance Categories. The IEEE 1547 settings shown in Table 7 shall be implemented unless otherwise specified by the Area EPS.

Table 7: Frequency Droop Operating Parameters

Parameter	Default Setting
db_{OF}, db_{UF} (Hz)	0.036
k_{OF}, k_{UF}	0.05
$T_{response\ (small\ signal)}$ (s)	5

db_{OF} – A single-sided deadband value for high frequency and low-frequency, respectively, in Hz

db_{UF} – A single-sided deadband value for high frequency and low-frequency, respectively, in Hz
k_{OF} – The p.u. frequency change corresponding to 1 per-unit output change (frequency droop), unitless
k_{UF} – The p.u. frequency change corresponding to 1 per-unit output change (frequency droop), unitless

6. Communication Protocols and Ports Requirements.

According to Section 10 of IEEE 1547 – 2018, the following is applicable to communications interoperability functions. The application of these requirements will be determined by EPE.

- A DER shall have provisions for a local DER interface capable of communicating (local DER communication interface) to support the information exchange requirements specified in the IEEE 1547 – 2018 standard for all applicable functions that are supported in the DER.
- Under mutual agreement between EPE and DER operator, additional communication capabilities are allowed.
- The decision to use the local DER communication interface or to deploy a communication system shall be determined by EPE.
- Emergency and standby DER are exempt as specified from the interoperability requirements specified in the IEEE 1547 – 2018 standard.

According to Table 8, the DER shall support at least one of the following protocols specified below. The protocol to be utilized may be allowed under mutual agreement between EPE and DER operator. Additional physical layers may be supported along with those specified in the table.

Table 8: Eligible protocols

Protocol	Transport	Physical Layer
IEEE Std 2030.5 (SEP2)	TCP/IP	Ethernet
IEEE Std 1815 (DNP3)	TCP/IP	Ethernet
SunSpec Modbus	TCP/IP	Ethernet
	N/A	RS-485

7. Enter Service Criteria and Ramp Rates.

The DER shall enable the permit service settings consistent with the default voltage and frequency settings listed in Table 9 below, unless otherwise specified by the Area EPS.

Table 9: DER Enter Service Criteria

DER Enter Service Criteria		
Voltage Within Range	Minimum Value	≥0.917 p.u.
	Maximum Value	≤1.05 p.u.
Frequency Within Range	Minimum Value	≥59.5 Hz
	Maximum Value	≤60.1 Hz

The DER shall delay entry into service by a default minimum of 300 seconds and this requirement shall apply for returning to service after a DER disconnects due to intentional or unintentional tripping.

The DER shall ramp the active power output with a linear ramp of 300 seconds or comply with Exception 1 listed IEEE 1547-2018 Section 4.10.3(c) with a default maximum time random interval of 300 seconds.

The DER shall parallel and synchronize with the Area EPS in accordance with IEEE 1547-2018 Section 4.10.4.