AES Utilities
IPL d/b/a AES Indiana
DPL d/b/a AES Ohio

FERC Form 715 Part 4
Transmission Planning Criteria

Prepared by:
AES Transmission Planning

Revision History			
Revision #	Date	Notes	Author
R0	14-March-2023	Original, Superceed previous versions	J. Spalding, J. Melvin
R1	13-March-2024	Formatting Adjustments	J. Spalding, H. Fikes, J. Melvin
R2	24-February-2025	Unified Document for both AESI and AESO; FERC 881 updates; strengthen voltage criteria for large sinks	J. Spalding, J. Melvin, M. Jacob, S. Gogineni, J. Braun

Contents

1) Overview

AES US Utilities have two transmission owners, Indianapolis Power & Light Company d/b/a AES Indiana (AES Indiana) and Dayton Power and Light Company d/b/a AES Ohio (AES Ohio). The transmission portfolio consists of 345 kV, 138 kV, and 69 kV networks. These transmission facilities are designed to provide safe and reliable service to AES customers.

AES Indiana is part of the MISO Regional Transmission Organization (RTO), and as such, MISO is jointly responsible for planning the regional Bulk Electric System (BES), generally 100 kV and above. MISO-wide transmission planning includes the evaluation of BES interconnection requests of generation, transmission, or electricity end-user Facilities. AES Indiana's BES Facilities include its 345 kV and 138 kV networks.

AES Ohio joined the PJM Regional Transmission Organization (RTO) in October 2004, and as such, PJM is responsible for planning the regional bulk electric system (BES - generally 100 kV and above, per North American Electric Reliability Corporation (NERC) definition), including evaluating transmission interconnection requests. AES Ohio's BES facilities include its 345 kV and 138 kV networks.

AES Indiana and AES Ohio transmission plans are based on transmission planning criteria and other considerations. Other considerations include load growth, equipment retirement/additions, decreasing the impact of major system events and disturbances, and long-lead time equipment failure strategy. Additionally, AES Indiana and AES Ohio Transmission Facilities are planned in conjunction with the reliability standards of NERC including but not limited to the Transmission Planning (TPL) standards. The NERC Reliability Standards state the fundamental requirements for planning reliable interconnected BES and the required actions or system performance necessary to comply. MISO, PJM, AES Indiana, and AES Ohio ensure the NERC reliability standards are met in designing the transmission system.

Additionally, AES Indiana and AES Ohio plans its Transmission Facilities to coordinate the development of the greater regional transmission system with neighboring Interconnections, other member companies of MISO and PJM, and other coordinated RTOs. MISO and PJM conduct a comprehensive system-wide assessment to ensure it meets all applicable reliability planning criteria. MISO annually performs comprehensive steady-state, short circuit, and stability analyses as part of its MISO Transmission Expansion Plan (MTEP) process. Likewise, PJM annually comprehensive steady-state, short circuit, and stability analyses as part of its Regional Transmission Expansion Plan (RTEP) process. Both MISO and PJM processes allows local transmission planning criteria in conjunction with default criteria set by the RTO. The prevailing planning criteria is the most conservative.

AES Indiana and AES Ohio will coordinate with MISO and PJM as appropriate for the generation interconnection processes. Generator interconnection requests are fielded by the RTO.

2) Seasonal Planning Methodology

In coordination with MISO and PJM, AES Indiana and AES Ohio have adopted a seasonal planning methodology in accordance with FERC 881. MISO and PJM, as Transmission Providers, require no less than four seasons and directed the Transmission Owners to define the seasons to meet the requirements in FERC 881.

Planning Seasons

AES Indiana and AES Ohio define four planning seasons: Winter, Spring, Summer, and Fall. The months that are considered for each planning season are listed in Table 1 below.

Table 1: Planning Seasons

Season	Months in Planning Season
Winter	December, January, February
Spring	March, April
Summer	May, June, July, August, September
Fall	October, November

A longer five month summer was selected based on historical weather data. May and September months had more similarities to June and August respectively than April and October.

Selected Uniquely Determined Variables for Planning Seasons

Per AES Indiana and AES Ohio's NERC FAC-008 Facility Rating's Facility Rating Methodology, AES Indiana and AES Ohio uses a number of variables are used to calculate the ambient adjusted rating of equipment. In order to uniquely determine ratings for each season, AES Indiana and AES Ohio elected to uniquely determine the ambient air temperature and day of the year as appropriate for each season. The selected parameters for the planning seasons are listed in Table 2 below.

Table 2: Selected Variables and Parameters for Seasonal Ratings

	Variables	
Season	Ambient Air Temperature	Day of the Year
Winter	30 Degree Fahrenheit	355
Spring	50 Degree Fahrenheit	80
Summer	95 Degree Fahrenheit	172
Fall	50 Degree Fahrenheit	264

Ambient air temperature was selected based on historical weather data collected for the area. Statistical analysis was performed to then inform the selection based reasonable expectations for the planning season. The day of the year was selected at the season's representative day of the year. For summer and winter, the solstices were picked. For spring and fall, the equinoxes were selected.

3) Transmission Performance Criteria

AES Indiana and AES Ohio's Annual Planning Assessment evaluates existing, new, and modified Transmission Facilities against the prevailing planning criteria. Any planned system changes are added to the next MTEP/RTEP cycle. AES Indiana uses MTEP profiles for internal assessments. AES Ohio may use PJM RTEP cases, MMWG, or PJM base cases for internal assessments.

Steady-State Performance Criteria

AES Indiana and AES Ohio's Annual Planning Assessment evaluates the steady-state nature of Transmission Facilities.

Thermal Limits

AES Indiana and AES Ohio's Annual Planning Assessment evaluates the thermal loading of transmission Facilities. For general planning purposes, normal and emergency Facility Ratings in Table 2 below are based on AES Indiana and AES Ohio's FAC-008 Facility Rating Methodology. New transmission and/or upgrades to transmission may be proposed at 90% of normal Facility Rating. New transmission and/or upgrades to transmission shall be proposed per the following evaluation:

- No Facility shall exceed its normal rating in the system normal state.
- No Facility shall exceed its emergency rating in the post-contingency state.

Table 3: System Performance Criteria – Thermal Magnitude Limits

Nominal Voltage (kV)	Rating		
	P0	P1	P2-P7
345	Normal	Emergency	Emergency
138	Normal	Emergency	Emergency
69	Normal	Emergency	N/a

Voltage Magnitude Limits

AES Indiana and AES Ohio's Annual Planning Assessment evaluates the voltage magnitude of Transmission Facilities. The voltage magnitude limits are listed in Table 1 below.

Table 4: System Performance Criteria – Voltage Magnitude Limits

Nominal Voltage (kV)	Nominal Voltage Limits		Emergency Voltage Limits	
	Minimum (%)	Maximum (%)	Minimum (%)	Maximum (%)
345	95%	105%	92%	105%
138	95%	105%	92%	105%
69	95%	105%	90%	105%

The transmission bus voltages will be between 0.95 per unit and 1.05 per unit in the system normal. In the contingent state for 138 kV and 345 kV, the transmission bus voltages for the systems will be between 0.92 per unit and 1.05 per unit. In the contingent state for 69 kV, the transmission bus voltages for the systems will be between 0.90 per unit and 1.05 per unit.

Voltage Deviation Limits

AES Indiana and AES Ohio's Annual Planning Assessment evaluates the voltage deviation of Transmission Facilities. The transmission bus post-contingent bus voltages shall not be less than 6% of the pre-contingency bus voltages.

Stability Performance Criteria

AES Indiana and AES Ohio's Annual Planning Assessment evaluates the stability of Transmission Facilities.

Transient Voltage Recovery

AES Indiana and AES Ohio will maintain bus transient voltage recovery limits after fault clearing, as shown in Table 6.

Table 5: System Performance Criteria – Transient Voltage Recovery

Nominal Voltage (kV)	Rating		
	0.0 s – 2.0 s	2.0 s – 20.0 s	> 20.0 s
345	None	< 0.7 p.u.	< 0.9 p.u.
138	None	< 0.7 p.u.	< 0.9 p.u.
69	None	None	None

Damping Ratio

AES Indiana and AES Ohio will maintain a minimum damping ratio after fault clearing, as shown in Table 5.

Table 6: System Performance Criteria – Damping Ratio

Nominal Voltage (kV)	Damping Ratio
345	0.03
138	0.03
69	None

Critical Switching Times

AES Indiana and AES Ohio will maintain stability limits including critical switching times to within acceptable limits for generators, conductors, terminal equipment, loads, and protection equipment for all credible contingencies including three-phase faults, phase-to-ground faults, and the effect of slow fault clearing associated with undesired relay operation or failure of a circuit breaker to open.

PRC-024

The performance of voltage and frequency relays for each generator will be evaluated during system contingent conditions if a generator exceeds voltage and/or frequency limits as defined in PRC-024. Generator performance will be evaluated for Cascading, voltage instability, or uncontrolled islanding.

Fault Duty

AES Indiana and AES Ohio's Annual Planning Assessment evaluates the fault duty of transmission breakers. AES Indiana and AES Ohio shall maintain facilities such that three-phase and phase-to-ground fault currents are within equipment interruption rating limits established by the equipment manufacturer.

5) Annual Baseline Analysis

AES Indiana and AES Ohio performs an annual baseline analysis subject to TPL-001 and other criteria herein.

AES Indiana and AES Ohio will maintain sufficient reactive capacity to support transmission voltages under contingent scenarios, outages, or other abnormal operating conditions.

Redispatch Methodology

The AES Indiana and AES Ohio transmission system shall be planned to handle a variety of generation dispatch scenarios and generally; depending on load levels, AES Indiana and AES Ohio may not be dependent on peaking plants or intermittent resources to mitigate thermal overloads or low voltage conditions.
As a system sensitivity, an outage of the entirety of each peaking plant or intermittent plant will be evaluated for normal and TPL-001 P1 and TPL-001 P2 system performance.

Transmission Facilities Design

AES Indiana and AES Ohio will design transmission substations such that the operation of substation switching involved with the outage or restoration of a transmission line does not also require the switched outage of a second transmission line.

AES Indiana and AES Ohio will design 345 kV transmission substations connecting to generating stations such that maintenance and outage of Facilities associated with the generation does not cause an outage of any other transmission Facilities connected to the substation.

Extreme Event Contingencies

NERC Reliability Standard TPL-001-5 includes a table that describes extreme events that shall be simulated. In addition to the prevailing planning criteria, AES Indiana and AES Ohio will consider other factors, such as the likelihood of an event and the magnitude of its impact. The performance of extreme events will be considered when evaluating transmission projects.

Consequential Load Loss

AES Indiana will avoid the excessive loss of distribution transformer capacity resulting from a double transmission Facility contingency. AES Indiana will coordinate planning studies and analysis with customers to provide reliable service as well as adequate voltage and delivery service capacity for known load additions.

Appendix A – IPL Planning Criteria

Indianapolis Power & Light Company d/b/a AES Indiana Planning Criteria

The criterion for IPL d/b/a AES Indiana stated herein is summarized below in table A-1.

Table A-1 – IPL d/b/a AES Indiana Planning Criteria for 138 kV & 345 kV Networks

Steady-State Thermal	
TPL-001-5 Planning Event P0	Normal
TPL-001-5 Planning Events P1-P7	Emergency
Steady-State Voltage (Pursuant to TPL-001-5 Requirement R5)	
Normal Low Voltage Limit (p.u.)	0.95
Normal High Voltage Limit (p.u.)	1.05
Emergency Low Voltage Limit (p.u.)	0.92
Emergency High Voltage Limit (p.u.)	1.05
Post Contingency Maximum Voltage Deviation (p.u.)	0.06
Transient Voltage: Load low Voltage Recovery Limits (Pursuant to TPL-001-5 Requirement R5)	
0.00 to 2.00 seconds (p.u.)	0.0
2.00 to 20.00 seconds (p.u.)	0.7
Beyond 20.00 seconds (p.u.)	0.9
Stability Criteria (Pursuant to TPL-001-5 Requirement R6)	
Angular Transient Stability Minimum Damping Ratio (ζ)	0.03

Appendix B – DPL Planning Criteria

Dayton Power & Light Company d/b/a AES Ohio Planning Criteria

The criterion for Dayton Power & Light Company d/b/a AES Ohio stated herein is summarized below in tables B-1 and B-2.

Table B-1 – DPL d/b/a AES Ohio Planning Criteria for 138 kV & 345 kV Networks

Steady-State Thermal	
TPL-001-5 Planning Event P0	Normal
TPL-001-5 Planning Events P1-P7	Emergency
Steady-State Voltage (Pursuant to TPL-001-5 Requirement R5)	
Normal Low Voltage Limit (p.u.)	0.95
Normal High Voltage Limit (p.u.)	1.05
Emergency Low Voltage Limit (p.u.)	0.92
Emergency High Voltage Limit (p.u.)	1.05
Post Contingency Maximum Voltage Deviation (p.u.)	0.06
Transient Voltage: Load low Voltage Recovery Limits (Pursuant to TPL-001-5 Requirement R5)	
0.00 to 2.00 seconds (p.u.)	0.0
2.00 to 20.00 seconds (p.u.)	0.7
Beyond 20.00 seconds (p.u.)	0.9
Stability Criteria (Pursuant to TPL-001-5 Requirement R6)	
Angular Transient Stability Minimum Damping Ratio (ζ)	0.03

Table B-2 – DPL d/b/a AES Ohio Planning Criteria for 69 kV Networks

Steady-State Thermal	
TPL-001-5 Planning Event P0	Normal
TPL-001-5 Planning Event P1	Emergency
Steady-State Voltage (Pursuant to TPL-001-5 Requirement R5)	
Normal Low Voltage Limit (p.u.)	0.95
Normal High Voltage Limit (p.u.)	1.05
Emergency Low Voltage Limit (p.u.)	0.90
Emergency High Voltage Limit (p.u.)	1.05
Post Contingency Maximum Voltage Deviation (p.u.)	0.06