OHIO VALLEY ELECTRIC CORPORATION - 2024 FILING

FERC FORM 715 - ANNUAL TRANSMISSION PLANNING AND EVALUATION REPORT

PART 4 -- TRANSMISSION PLANNING RELIABILITY CRITERIA

The Ohio Valley Electric Corporation (OVEC) and its subsidiary, Indiana-Kentucky Electric Corporation (IKEC), were organized and their transmission systems initially constructed in the years 1952-1956. OVEC/IKEC was formed by investor-owned utilities furnishing electric service in the Ohio River Valley area and their parent holding companies (Sponsors) for the express purpose of supplying the electric power requirements of the U.S. Department of Energy's (DOE) uranium enrichment project (Project) then under construction near Portsmouth, Ohio. Due to the highly critical nature of the DOE load, stringent design criteria were adopted for planning and constructing the OVEC/IKEC System.

The OVEC/IKEC System is primarily an EHV network, and is entirely part of the Bulk Electric System (BES). The 138 kV facilities in the OVEC/IKEC System are all associated with interconnections to its Sponsors. In addition to those at the 138 kV class, OVEC/IKEC-Sponsor interconnections include EHV facilities. The DOE load was originally served from two 345 kV stations within the Project's boundaries -- owned, operated, and maintained by DOE. One of these stations remains. The OVEC/IKEC System has eleven generating units located at two plants with a total capacity of about 2200 MW net. All OVEC/IKEC generation, with the exception of required operating reserves, is committed to the Sponsors. In 2018, OVEC/IKEC joined PJM as a Transmission Owner, designating PJM as its Transmission Planner.

Introduction

This document provides the criteria to test and assess the strength of OVEC/IKEC's transmission system to meet its load serving responsibility and provides a description of transmission planning criteria for the OVEC/IKEC System. This material and the OVEC/IKEC criteria described herein supplements and is consistent with: 1) the North American Electric Reliability Council (NERC) Reliability Standards; 2) the ReliabilityFirst (RF) Standards and 3) PJM Planning and Operating Manuals: Manual 14B.

PERFORMANCE STANDARDS

Performance Standards establish the basis for determining whether system response to contingency analysis is acceptable. Depending on the nature of the study, one or more of the following performance standards will be assessed: thermal, voltage, relay, stability, and short circuit.

In general, system response to contingencies evolves over a period of several seconds or more. Steady state conditions can be simulated using a power flow computer program. A short circuit program can provide an estimate of the large magnitude currents, due to a disturbance, that must be detected by protective relays and interrupted by devices such as circuit breakers. A stability program simulates the power and voltage swings that occur as a result of a disturbance, which could lead to undesirable generator/relay tripping or cascading outages. Finally, a post-contingency power flow study can be used to determine the voltages and line loading conditions following the removal of faulted facilities and any other facilities that trip as a result of the initial disturbance. For the OVEC/IKEC System, thermal performance standards are usually the most constraining measure of reliable system performance. Each type of performance standard is described in the following discussion.

Thermal Limits

Thermal ratings define transmission facility loading limits. Normal ratings are generally based upon no abnormal loss of facility life or equipment damage. Emergency ratings accept some loss of life or strength, over a defined time limit for operation at the rated loading level. The thermal rating for a transmission line is defined by the most limiting condition, be it conductor capability, sag clearance, or terminal equipment rating.

Most thermal ratings are defined in amperes. However, transmission planning studies use ratings expressed in MVA, based on the ampere rating at nominal voltage. When voltages during testing deviate considerably from nominal, the MVA loading is adjusted for the voltage deviation from nominal to permit an appropriate comparison to the MVA rating. Maximum facility loading on transmission facilities should be below the applicable ratings listed in Table 1 below for each given contingency scenario.

Voltage Limits

Voltages at transmission stations should be above the values listed in Table 1 below to reduce the risk of system collapse and/or equipment problems. In addition, voltages at generating stations below minimum acceptable levels established for each station must be avoided to prevent tripping of the generating units. High voltage limits are specific to particular pieces of equipment, but are typically 105% of nominal. Post-contingency voltage drop limits are utilized to prevent voltage instability, which could result in system voltage collapse. OVEC will investigate any potential voltage drop that exceeds 6% for voltage instability. Voltage drops exceeding 8% are considered violations of OVEC's criteria.

Relay Trip Limits

BES facilities are designed to comply with NERC PRC Reliability Standard requirements.

Short Circuit Limits

Short circuit limits are also an important aspect of system performance, since the extremely high, short duration currents that accompany system faults will impose considerable stresses on network elements. Circuit breakers must be capable of interrupting the anticipated fault currents in the shortest possible time. Failure to interrupt these currents may lead to catastrophic equipment damage and endanger human life. Short circuit levels increase as network reinforcements are implemented or new generating units are added to the system. Therefore, short circuit levels must be reviewed periodically so that inadequate equipment can be replaced or upgraded, or a mitigation procedure developed.

TRANSMISSION TESTING CRITERIA

Steady State Testing Criteria

The planning process for OVEC/IKEC's transmission network embraces conditions with all facilities in service (NERC Category P0) as well as two major sets of contingency testing criteria to ensure reliability. The first set includes single and multiple contingencies contained in NERC Categories P1 through P7. The second set includes more severe multiple contingencies (NERC Extreme Events) and is primarily intended to test the potential for system cascading.

For OVEC/IKEC transmission planning, the testing criteria are deterministic in nature; these outages serve as surrogates for a broad range of possible operating conditions that the power system will have to withstand in a reliable fashion. In the OVEC/IKEC transmission system, thermal and voltage performance standards are usually the most constraining measures of reliable system performance. Each type of performance requirement is described in the following discussion. Table 1 below documents the performance criteria for all transmission facilities under normal and contingency conditions.

Table 1 OVEC/IKEC Transmission Planning Criteria (Steady State System Performance)			
Transmission System Condition	Maximum Facility Loading (Rating)	Minimum Bus Voltage (Delta V < 8%)	
		EHV	138 kV
All facilities in service (NERC Category P0)	Normal	95%	95%
Single Contingencies (NERC Categories P1 and P2)	Emergency	92%	92%
Multiple Contingencies (NERC Categories P3 through P7 & Extreme Events)**	Emergency	92%	92%

* Because the OVEC stations are primarily of "breaker and ½" configuration, steady state simulation of the more likely Extreme Events is identical to one or more Category P3 through P7 contingencies. Where simulation of Extreme Events differ from Categories P3 – P7 events, performance is reviewed for risks and consequences. Issues identified may not require mitigation, but may be considered when evaluating possible solutions to violations from Category P1 through P7 contingencies.

Planning Contingencies

Planning Contingencies include those defined in NERC Reliability Standard TPL-001-4. A single event is defined based on the arrangement of automatic protective devices.

Extreme Events

The more severe reliability assessment criteria required in NERC Reliability Standard TPL-001-4 are primarily intended to prevent uncontrolled area-wide cascading outages under adverse but credible conditions. OVEC/IKEC, as a member of ReliabilityFirst, plans and operates its transmission system to meet the criteria. However, new facilities would not be committed based on local overloads or voltage depressions following the more severe multiple contingencies unless those resultant conditions were expected to lead to widespread, uncontrolled outages.

In operational planning studies, the purpose of studying multiple contingencies and/or high levels of power transfers is to evaluate the strength of the system. Where conditions are identified that could result in significant equipment damage, uncontrolled area-wide power interruptions, or danger to human life, IROL operating procedures will be developed, if possible, to mitigate the adverse effects. It is accepted that the defined performance limits could be exceeded on a localized basis during the Extreme Events, and that there could be resultant minor equipment damage, increased loss of equipment life, or limited loss of customer load.

Stability Testing Criteria

OVEC/IKEC transmission system stability testing is performed in accordance with the contingency scenarios defined in NERC TPL-001-4. TPL-001-4 R4.1.3 acceptable damping and R5 transient voltage response criteria may be found in PJM Manual 14B Section G.2.2. An exception to the TPL-001-4 stability testing criteria is that P7 Planning Events are simulated with three-phase faults instead of phase-to-ground faults because three-phase is more conservative for common tower structure outages.

All transmission and sub-transmission connected generation, including wind and solar projects, are required to maintain stability and continuity of real and reactive power delivery through all TPL-001-4 planning events.