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NERC Lessons Learned and Alerts

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Link: Lessons Learned (nerc.com)

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NERC Lessons Learned

Distributed Energy Resource performance characteristics during a disturbance

Initial Distribution: April 13, 2022

Interest Groups:	GO, GOP, TO, TOP
Problem Statement:	A three-phase-to-ground fault with incorrect switching and incorrect distance protection resulted in two 500 kV circuits being removed from service. This led to a net loss of approximately 1,300 MW of voltage-sensitive loads as well as at least 300 MW of supply from distributed energy resources (DER) also occurred.
Lessons Learned :	Switching procedure at high risk facilities should be designed to mitigate the risk of human error.
	DERS without smart inverters do not have adequate ride though capability and can exacerbate the impact of a voltage or frequency transient event. TOP should update performance requirements o ensure that future DERs are better able to remain connected during system events and support voltage.
	BAs and RCs will need to understand the generation and load connected to the distribution system and how they behave so that it can be modeled accurately and assessed for contingency event. The number of DERs connected to the distribution system, their capabilities, and location should be reported to BAs and RCs for accurate modelling.

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NERC Lessons Learned

Islanding and insufficient primary frequency response resulted in unintended Under Frequency Load Shedding, Initial Distribution: April 13, 2022

Interest Groups:	BA, GO, GOP, TO, TOP
Problem Statement:	An entity separated from the interconnection and experienced an under frequency event for various reasons including generator control system settings and operating mode; low system inertia due to high penetration of renewable; and inadequate pre-arranged load-shedding.
Lessons Learned :	RCs and BAs should provide clarity and details to GOs and GOPs on the desired frequency response from generating assets during system frequency events. Consider using frequency bias in plant level turbine level load controller.
	Consider operating inverter-based renewable generation resources with droop and dead band characteristics where possible and dispatching these resources with headroom to allow for fast frequency response.
	Collect and analyze generators actual performance during frequency events on a periodic basis (or following a major frequency event) and update frequency response estimates and modeling accordingly.
	Test results from field testing performed for MOD-027 governor model verifications can be used to indicate plant/unit responsiveness to frequency disturbances. Simulating off-nominal frequency conditions during testing can reveal a plant/unit's ability to provide frequency response.
	Modify control systems to cause governors/load controllers to provide adequate primary frequency response.

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NERC Lessons Learned

Model data error impacts state estimator and real-time contingency analysis results

Initial Distribution: April 13, 2022

Interest Groups:	BA, TOP, TO, RC
Problem Statement:	Telemetry data format was not programmed properly during a model update. This resulted in State Estimator(SE) and Real Time Contingency Analysis (RTCA) using stale data to produce solutions that seemed to be correct. It was hard to detect this error as there were no major topology and dispatch changes to indicate that something was wrong.
Lessons Learned :	Entities should collaborate with vendors to implement proper solutions for modelling changes in test environment before introducing them to production.
	Stale data monitoring and error trapping routines should be with the help of historical data for future events. Operators should be alerted which will trigger the next steps for monitoring and analysis.
	The use of off-line/non production testing (sandbox/test QA environment) is paramount for catching model change related problem before they can cause an issue in the live system.

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NERC Lessons Learned

Substation flooding events highlight potential design defecinecies

Initial Distribution: April 13, 2022

Interest Groups:	GO, GOP, TO, TOP
Problem Statement:	Heavy rainfall led to flooding of a basement relay room in a 230 kV transformer station resulting in unexpected equipment and protection operation during the event, removing two 230 kV and six generation units (a total of 435 MW). The main cause of flooding was found to be due to a sump pump not able to keep up with the volume of water as a result to heavy rainfall, and the drainage system of the sump pump being too close to the building
Lessons Learned :	TO should consider an extent of condition review for transmission station that have been identified to be susceptible for flooding to ensure that precautions are taken.
	TO should ensure that there are no design deficiencies, such as site drainage systems.
	Ensure that all critical power system equipment at the transmission stations are located above grade where possible.
	Past design criteria may no longer be sufficient. TOs and TOPs should review their criteria and ensure it meets what is need for today and tomorrow.

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NERC Lessons Learned

Unintended consequences of altering protection system wiring to accommodate failing equipment

Initial Distribution: April 13, 2022

Interest Groups:	TO, TOP
Problem Statement:	A failing capacitor coupled voltage transformer (CCVT) had its voltage sensing element jumped to a CCVT of a nearby line position, to accommodate repairs. This is a standard practice utilities employ for failing equipment, but the jumper provided false good sync voltage across the open breaker which caused the sync check relays in the reclosing system to close the breakers into a permanent fault multiple times in rapid succession.
Lessons Learned :	The practise of using jumpers from a good CCVT to a failing CCVT has been a standard practise for many entities. When CCVT gets to this point, significant voltage error is noticed, the time to failure may be very short.
	Line outage scheduling to replace failing equipment may require a long-term temporary accommodation, this needs thorough consideration. It is difficult to predict the implications of altering protection system wiring in an ad hoc fashion. Taking time to review the design and properly engineer the modification could have avoided some of the problems.
	Equipment that is known to be failing should be removed from service as soon as practicable.

NERC Lessons Learned

Intermittent network connection causes EMS disruption

Initial Distribution: April 13, 2022

Interest Groups:	GO, GOP, TO, TOP
Problem Statement:	During nightshift at the backup control centre, an entity experienced intermittent client connection failure with the MCC EMS and VoIP Phone (BCC utilises MCC's EMS Server). The cause of the intermittent connection was a faulty optical card in the primary network path to the BCC.
Lessons Learned :	Ensure that the network path fail-over design for EMS redundant network paths is set to a graceful transition (i.e. transition the network from its initial state to a final state while minimizing the overall disruption).
	Ensure that there are controls in place to keep the primary path unused if it fails until its reliability has been verified.
	Ensure notification alarms are issued to network staff when a fail-over occurs so that stable redundancy can be verified and restored as soon as possible.

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Forecasted high wind speed

Initial Distribution: July 20, 2022

Interest Groups:	TO, TOP, GO, GOP, RC, BA
Problem Statement:	High-speed wind days can pose challenges to transmission, distribution, and wind-generation availability.1 This lesson learned focuses on the implementation of coping strategies by a specific utility developed from prior experience; it is largely a success story.
Lessons Learned :	RCs could initiate calls with various facility owners and operators in order to proactively posture the transmission system.
	The postponement of non-critical transmission planned outages could be employed to improve the resiliency of the transmission system.
	Scheduling additional staff and maintaining constant communication between the RCs and facility owners and operators could enable for quicker and proactive response to correct the events as they occur
	Position recovery staff and material for both transmission and distribution purposes in protected locations near the areas expecting damage. If the event is expected to create widespread damage, consider asking for other entities and contractors to help in the recovery and have them prepare as well.
	Secure loose, light weight material in or around substations and generation switchyards (this is often an issue where construction is on-going).

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Tower climber incident

Initial Distribution: July 20, 2022

Interest Groups:	TO, TOP, RC, BA
Problem Statement:	A civilian tower climber was reported to be on the top of a rower shared by three circuits (500kV, 230kV and 115kV) which resulted in all three circuits being manually removed from service to protect the safety of the climber taking into account system limitation that may be cause by their removal. Below are the lessons learned from this event.
Lessons Learned :	TOs/TOPs should consider having policies in place that provide direction on the installation of deterrents to prevent unauthorized climbing ensuring the safety of members of the public.
	TOs/TOPs should have policies in place that outline how to respond to public safety hazards to ensure safety for members of the public.
	Procedures on how to communicate with various stakeholders during such events need to be in place. Communication among the TOP, RC, first responders, Local Distribution Center, etc. was vital in identifying the incident, its exact location, and the resources available to control the situation. Such actions allowed the TOP to minimize the electrical hazard by working with the RC to emergently remove the circuits from service until the incident was resolved.
	TOs/TOPs should establish a minimum above grade height for tower climbing aids that discourages unauthorized climbing and consider additional deterrents within their policies.

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NERC Alert

Mitsubishi Transformer test data falsification

Initial Distribution: July 8, 2022

Entity Distribution:	TO, TOP, GO, GOP, DP
Problem Statement:	Transformers manufactured at Mitusbishi's Ako plant and Memphis plant were not fully complying with customer requested testing standards, internal design guidelines or agreements but were documented to have passed the required criteria. The subject transformers were rated 22kV 2MVA or above (upto 750kV, 1000MVA) and were manufactured between 1982 to March 2022. Affected tests include Dielectric Test, Partial discharge measurements, Temperature rise tests, Load loss measurements, and audible noise testing. 289 of these transformers were shipped to the united states and none to Canada.
Recommendations:	Consider increasing the frequency of Dissolved Gas Analysis (DGA) sampling and testing.
	Review previous and historical DGA test records, if available, and establish a trend line of the historical and current test data to assess the transformer condition over the service years.
	Monitor and maintain oil quality and moisture content within industry accepted guidelines.
	Use periodic furan testing to obtain additional insights into insulation thermal degradation.
	Consider installing electrical or acoustic partial discharge monitors, then periodically check and trend partial discharge.
	Confirm that relays used, Buchholz, fault protection, cooling fans etc., are maintained regularly, are in good operating condition and set correctly.

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