Emerging Issue #RAS-8: Assessment of Fault-Induced Delayed Voltage Recovery (FIDVR) Simulations

Emerging Issue	Item	Specifics
Horizon	**Number of years**	On-going and beyond
Status	**Emerging or Standing**	Standing
	Technical Group	System Analysis and Modeling Subcommittee
Background	**Description**	Fault-Induced Delayed Voltage Recovery (FIDVR) events are characterized by a depressed voltage for 5 to 30 seconds following a fault. These events are of concern because they show a temporary loss of voltage control in an area, and they pose a risk of cascading to a larger area, especially if another unexpected event occurs while the voltage is depressed. These events have been studied and are believed to be initiated by the stall of low-inertia induction motors during the fault. Motors at risk of stalling include compressor-driving loads such as air conditioners. The subject of FIDVR events, their causes and solutions is covered in a NERC white paper on this topic.[1] The following recurring issues need to be addressed: • The FIDVR phenomenon must be more universally broadcast and understood throughout the electric utility planning community. • Dynamic load models adequate for FIDVR studies should be developed, communicated, and appropriately customized for local use by grid planners. • Post Event Analysis has been vital in finding model deficiencies and implementing corresponding improvements and should be promoted. • Understanding and proper planning of power system protection and control action is important in preventing FIDVR events, which often are initiated by single-phase-to-ground faults that progress to multi-phase-to-ground faults because of protection inadequacy or failure. • The degree of urgency that should be assigned to FIDVR studies is directly related to the degree of air conditioning load penetration. Guidelines or standards should not be issued to require the same level of effort from Alaskan planners as from those in California, Texas, Arizona, or Florida. • Unit level protection should be standardized for residential air conditioners to remove them from service for under-voltage conditions and lower FIDVR risk.

[1] http://www.nerc.com/docs/pc/tis/FIDV_R_Tech_Ref_V1-1_PC_Approved.pdf

	What changes during the 10-year horizon?	Load characteristics (increasing low-inertia air conditioning loads without compressor under-voltage protection) that may increase FIDVR risk.
	What is the impact to regional reliability?	Insufficient dynamic planning models do not accurately assess FIDVR risk. Significant load loss due to motor protective device action can result, as can significant loss of generation, with a potential secondary effect of high system voltage due to load loss. A severe event can result in fast voltage collapse.
Assessment Factors	**Resource Adequacy Considerations** [Yes/No]?	No. This issue is more related to operational reliability and system security.
	Transmission Adequacy Considerations [Yes/No]?	Yes. FIDVR events expose transmission risks. New transmission can reduce FIDVR vulnerability. However, in some cases, new transmission can also allow a fault to reduce voltages over a wider area during the fault, so each situation needs to be carefully analyzed. This information can be used to install transmission based dynamic Mvars, or for targeting regions for potential new generation.
	Resource Siting Impacts [Yes/No]?	Yes. The effectiveness of dynamic support is very dependent on its location. Dynamic simulation studies should be conducted to determine sites where dynamic support will provide optimal FIDVR mitigation. This information can be used to install transmission based dynamic Mvars, or for targeting regions for potential new generation.
	Operations Impacts [Yes/No]?	Yes. Special Protection Schemes (SPS) may be used as a safety net to confine the area impacted by FIDVR. If a voltage collapse develops in a load center because of a multi-contingency event, an SPS can contain the disturbance from spreading to larger grid.
	Remaining Uncertainties	• Planning studies have not been able to replicate FIDVR events very accurately due to inaccurate modeling of loads. Uncorrected, this modeling deficiency has a two-fold detrimental effect. First, it can result in studies that do not adequately identify potential FIDVR events. Second, it can give false confidence in mitigation plans designed to prevent reoccurrence of events. • Synchrophasor use for operational preparations and FIDVR mitigation