Prepared Statement of Frank J. Koza to the FERC Technical Conference on GMD March 1, 2016

Introduction

I am Frank J. Koza, Executive Director, Infrastructure Planning, at PJM. I have worked at PJM for over 14 years in a variety of assignments in operations and planning. Before working at PJM, I worked for 29 years at PECO/ Exelon in operations, planning, transmission maintenance, and construction. I hold a BSME from the University of Pennsylvania, and a Master of Engineering degree from Widener University. I am a registered Professional Engineer in Pennsylvania.

I am Chair of the NERC GMD Standard Drafting team and Vice-chair of the NERC GMD Task Force. I was formerly Chair of the NERC Operational Reliability Subcommittee. In this testimony, I am explaining PJM's experience with GMD response and GIC monitoring, but also providing a perspective from my experience with the NERC GMD response effort.

History of GMD Response in PJM

PJM's direct experience with GMD starts with the March 1989 Quebec storm, which blacked out the province of Quebec. During that storm, some facilities of PJM members were impacted, most notably the generator step up (GSU) transformer at the Salem nuclear plant, which catastrophically failed. PJM then embarked on an effort to explore what happened, and develop a plan to mitigate the impact of potential future GMD events. Part of that effort was to develop an operational procedure for implementation during a severe GMD event.

PJM's operational procedure for GMD (http://www.pjm.com/~/media/documents/manuals/m13.ashx, PJM Manual M-13, Emergency Operations, GMD Operating Plan, Section 3.7) relies on the use of geomagnetic induced current (GIC) detectors as an early warning system for operator action. A limit of 10 amperes (amps) was established as the threshold for taking operator action, as a response to the experience with the Salem transformer during the 1989 event. At that time, about 6 GIC detectors were installed at what were thought to be the most sensitive areas to GIC on the PJM system. Data from those detectors were telemetered to PJM and operator action was taken based on sustained exceedances of the 10 amp threshold.

The operator actions contained in the procedure focus on two issues: (1) operate to more conservative transfer limits across the PJM transmission system to minimize the impact of the potential loss of equipment due to voltage excursions, protection misoperation, or equipment failure; and (2) boost system voltage in order to counteract the increased reactive power consumption that occurs during GMD events. Operating to more conservative transfer limits is implemented by including additional, more severe contingency events (e.g. loss of the Phase 1 DC from Quebec to New England) in the transfer limit calculation versus normal operations. Boosting system voltage is implemented by bringing additional reactive supply sources into operation and increasing generator reactive output as the situation dictates.

GMD Response in PJM Today

The PJM operational procedure is still in place today. However, the state of the art in the industry has advanced since 1989. (Consequently, the 10 amp limit is presently being reviewed.) The work of the NERC GMD Task Force (GMDTF) has been instrumental in raising awareness in the industry on the potential impacts of GMD on the power system. In its interim report, issued in February 2012, and subsequent publications, the GMDTF provided the industry with a roadmap of how to identify and analyze the power system risks associated with GMD and the potential methods for mitigating those risks. Also, the power system analysis vendors picked up on the industry need and developed GIC calculation modules to go with their software. The result is that now there is pretty wide access to GIC calculation software in the industry where almost none existed a few years ago.

In PJM, a number of our transmission owners have taken the cues from the GMDTF and advanced the industry response to GMD in the area of monitoring. Where PJM used to have about 6 GIC monitors, we now have about 50 GIC monitors with the data being telemetered into the PJM control center. AEP is in the process of installing a number of magnetometers on their system and Dominion is installing magnetometers in conjunction with a pilot program with NASA. It must be noted that the PJM transmission owners installed additional monitoring without any regulatory or compliance obligation. The industry often gets criticized for not embracing new technology, but in the case of GMD response, the PJM experience is that the PJM transmission owners are being very proactive in addressing the potential risks.

On the analytical front, PJM led a GMD impact study of the PJM system working with all of the PJM transmission owners—a forerunner to the GMD Vulnerability Assessment that is included in the proposed NERC standard. Also, a number of the PJM transmission owners have conducted GMD impact studies of their respective transmission systems in advance of any requirement to do so. Again, the PJM experience is that the industry is being proactive.

With regard to the potentially vulnerable EHV transformers, PJM is aware of transformer tests that have been conducted in association with the manufacturers. Some PJM transmission owners are now including GIC withstand requirements in their transformer specifications. Some PJM transmission owners are installing additional instrumentation on transformers to be able to better anticipate operational problems in the future. It is now understood that the failure of the Salem transformer, while attributed to the 1989 GMD event, was the result of a flawed design on the low voltage winding. Those transformers have since been replaced by the owner. So, more work needs to be done to better understand the potential impact to transformers, but the industry is not standing still. The transformer manufacturers are engaged with the transformer owners to address the potential issues.

The issue of sharing the GIC data is one that probably needs to be addressed by entities other than PJM. PJM receives the telemetered data from the GIC detectors and use the data to address operational actions. The GIC data is fed to EPRI to support their research program on GMD. The widespread dissemination of the GIC data should be addressed outside of the NERC standards process.

Next Steps

PJM does not believe that a mandatory requirement to install additional monitoring is necessary or beneficial. Each operational entity needs to assess its needs for GIC monitoring to ensure that its operational procedures can be implemented. In PJM's case, sufficient monitoring exists for us to carry

out our operational responsibilities based on our procedure which is triggered by measured GIC values. PJM will be able to implement the requirements of the proposed proposed standard without the need for additional monitoring.

What is missing at this point is FERC approval of the proposed GMD standard. If there is reluctance in the industry, it is because of what was thought to be the imminent approval by the Commission of the proposed standard. The fact that the proposed standard is still pending at the Commission for over a year does not help in keeping up momentum in the industry to address the GMD issue. Lack of the standard is restraining further activity and investment in GMD mitigation. If there is to be a mandatory set of standards to address the modeling, analysis, and corrective action associated with GMD, the industry needs to know the details before committing additional resources that may result in lost effort.

As chair of the GMD standard drafting team and vice-chair of the NERC GMDTF, I've heard all of the criticisms of the proposed standard. I can only hope that the Commission is not seeking the four decimal place answer when a one decimal place answer will suffice. What I mean by that is the state of the art in GMD research will continue to evolve and there will likely be a day where the standard will need to be changed from what is contained in the present proposed standard. However, that day is likely years away and the present proposal is based on the best available set of data and analysis that exists. There will always be a need for more work to be done. With that said, the drafting team members that I have had the pleasure to work with constitute the leading experts in the industry on this topic. The proposed standard, as presently submitted, is a very solid starting point to address the issue of GMD in the industry.

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