



Proposed IEEE GIC Guide and Upcoming NERC Documents on Geomagnetic Disturbance Mitigation

— Technical Presentation —
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1. Abstract

Geomagnetically induced currents (GIC) can cause partial-cycle core saturation, depending on the magnitude of the GIC and the design of the transformer. This core saturation leads to additional VAR demand and injects current harmonics into the grid. When large enough, a geomagnetic disturbance (GMD) can result in voltage instabilities and subsequent blackouts. Another consequence of partial cycle saturation of a core is additional heating of transformer windings and structural parts.

In May 2013, FERC issued Order 779 which directs NERC to submit Reliability Standards which address the impact of GMD on the reliable operation of the bulk power system. Also, the IEEE Transformers Committee formed a working group to develop a guide associate with the subject.

This presentation has three parts. Frank Koza, who is the chairman of the drafting team of the NERC documents, will provide an overview of the content of these documents. Jane Verner, who is chairman of the IEEE GDM working group, will give an overview of the content of the proposed IEEE GIC Guide. Finally, Ramsis Girgis will present some of the main technical differences between the content of the NERC documents and the IEEE GIC Guide.

2. Learning Objectives

This presentation plans to

- Explain how the different NERC documents help in mitigating the effects of strong GMD storms on the power grid and power transformers.
- Describe how the proposed IEEE GIC Guide helps in proper evaluation and specification of the GIC capability of new and existing power transformers.
- Identify the factors used in appropriate evaluation of the GIC capability of power transformers.

3. Learning Outcomes

As a result of attending this session, members will gain an understanding of the following:

- Means of evaluating and mitigating the GMD vulnerability of power systems as proposed by the NERC GMD Task Force.
- Appropriate means of evaluating and confirming the GIC withstand capability of power transformers, as proposed by the proposed IEEE GIC Guide.
- Technical differences between the content of the IEEE GIC Guide and the content of some of the NERC documents.

4. Presenters' Biographies

Dr. Ramsis Girgis (IEEE Life Member) is presently the leader of ABB's global R&D activities in the areas of Transformer Core Performance and Low Noise Transformers. He has led Westinghouse's and now ABB's investigations in the area of GIC effect on power transformers since the 1989 GMD event. Over the past three years, he has contributed to the activities of the NERC GMD TF and is presently a contributor to the IEEE WG developing the IEEE GIC Guide. Ramsis received his PhD degree in Electrical Power Engineering from the University of Saskatchewan, Canada in 1978. In 2013, he was awarded the IEEE Standards Medallion for Significant Contributions to the Transformer Industry and Transformer Standards. In the mid-eighties, Dr. Girgis was the Technical Advisor, representing the US National Committee in the IEC Power Transformers Technical Committee 14.

Mr. Frank J. Koza is Executive Director of Infrastructure Planning at PJM Interconnection, where he is responsible for the technical staff supporting transmission and generation interconnection projects. He is Vice Chair of the NERC Geomagnetic Disturbance Task Force, and was formerly Chair of the NERC Operating Reliability Subcommittee. He received a BSME degree from the University of Pennsylvania and a MEng degree from Widener University. Prior to being employed at PJM, he was employed by Exelon for 29 years in a variety of positions in transmission maintenance, construction, system operations, and system planning.

Ms. Jane Ann Verner is the Manager of Pepco's Grid Operations Center. She formerly managed Substation Engineering and Substation Standards Teams for Pepco Holdings Inc. (Atlantic City Electric, Delmarva and Pepco). Jane is a licensed Professional Electrical Engineer in Maryland, PA and the District of Columbia. She is a member of IEEE and the IEEE PES. She recently chaired the working group of the newly published IEEE Power Transformer Field Test Guide, C57.152. She is presently chairing the IEEE working group, developing the IEEE GIC Guide for Power Transformers. Jane has a Bachelor of Science Degree in Electrical Engineering from the University of Pittsburgh.