UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

FERC TIER Assessment) Docket No. RM06-16-000

COMMENTS OF NERC STANDARDS REVIEW SUBCOMMITTEE OF THE MIDWEST RELIABILITY ORGANIZATION

The Midwest Reliability Organization's ("MRO") NERC Standards Review Subcommittee ("NSRS") has developed the following comments relating to the Federal Electric Regulatory Commission's ("Commission" or "FERC") Topological and Impedance Element Ranking ("TIER") report. On September 10, 2009, the Commission issued a Notice of Public Meeting, and announced that it would accept comments relating to the TIER report, which was posted on the Commission's website on September 11, 2009 and was the subject of a public meeting on September 22, 2009.[1] In response to the Commission's September 10 notice, the MRO NSRS respectfully submits these comments, and provides reasons for how the TIER report could significantly impact the basis and scope of Section 215 of the Federal Power Act's, mandatory Reliability Standards.[2]

I. INTRODUCTION

The role of the MRO NSRS, which reports to the MRO Standards Committee, a stakeholder standing committee of the MRO, is to provide comments on key matters, including standards, policies and procedures that impact the diverse stakeholders within the MRO region. MRO is one of eight Regional Entities that operates under delegated authorities from the North

[1] *See Mandatory Reliability Standards for the Bulk-Power System*, Notice of Public Meeting, Docket No. RM06-16-000 (Sep. 10, 2009) ("TIER Notice").
[2] *See* 16 U.S.C. § 824o (2006).

American Electric Reliability Corporation ("NERC") under Section 215 of the Federal Power Act in the United States and through agreements in applicable Canadian provinces.

II. COMMENTS

The MRO NSRS provides the following comments:

A. Summary

Generally, the MRO NSRS supports industry comments summarized by the Edison Electrical Institute ("EEI"), but offers the following specific comments regarding the proposed TIER method. As explained below, MRO NSRS is particularly concerned that the TIER method does not give due consideration to reliability concerns related to voltage, reactive power, transient stability, and small-signal stability. As such, the TIER method may not correctly identify the elements required to operate each of the interconnections in a secure state, and could also incorrectly rank the security importance of Bulk Power System ("BPS") elements.

MRO NSRS notes that the industry has already developed security tools such as steady-state AC analyses, transient-stability analyses, and small-signal analyses. For this reason, MRO NSRS recommends that the Commission analyze the existing tools developed by the industry. The MRO NSRS believes that these tools, combined with NERC and regional oversight, already identify and correct developing security issues such as Interconnected Reliability Operating Limits ("IROLs").

MRO NSRS is also concerned that a BPS definition using the TIER method will not provide the objectivity that the TIER report seeks to create. Instead, employing the TIER method to create a BPS definition could result in the creation of a "floating" registry of facilities and Registered Entities deemed to be within the BPS. The existence of such a floating registry would cause confusion as to which entities are subject to reliability standards from one day to the next, which may lead to a dramatic expansion of the scope of Section 215 of the Federal Power Act. Because Section 215 of the Federal Power Act is intended to apply only to the BPS, the inclusion of facilities and Registered Entities within the BPS as a result of the creation of a floating registry expands Section 215 of the Federal Power Act beyond that envisioned by Congress when enacting the Energy Policy Act of 2005. For example, the TIER method could easily classify facilities that are traditionally considered distribution facilities as within the BPS. In such a circumstance, those distribution facilities would then be subject to reliability standards. Therefore, the MRO NSRS recommends that the Commission use the existing industry transmission planning process and regional oversight already mandated through the existing NERC Reliability Standards and rules to determine the entities and facilities within the BPS. Such an action by the Commission will ensure certainty in determining the entities subject to the Commission-approved reliability standards.

B. The MRO NSRS Supports EEI Comments

The MRO NSRS supports many of the industry comments summarized by EEI.[3] A few of the more notable EEI comments include: (1) the report does not adequately describe specifically what FERC believes is “broken” and needs to be “fixed;” (2) the model does not establish a direct correlation between network congestion and instability; and (3) the Commission should engage NERC and industry stakeholders to work collaboratively in defining practical solutions. If the objective of the TIER report was to define an algorithm that found and ranked reliability issues to avoid instability, cascading, and uncontrolled separation, the algorithm appears to be insufficient at this time. In this regard, the TIER report should not be the

[3] *See* Comments of the Edison Electric Institute, Docket No. RM06-16-000. (Oct. 22, 2009)

sole basis for a methodology that could be utilized to determine what constitutes the BPS.[4] Instead, the TIER report should serve as one consideration in a joint effort between the Commission, NERC and industry in addressing the BPS and elements needed to operate electric interconnections while attempting to do so with minimal risk of a significant change in approach.

C. The TIER Method Has Significant Gaps as a Reliability Tool

The TIER method has significant gaps as a proper reliability tool because the method, in present form, does not give due consideration to voltage instability, transient instability, and small signal instability.

1. Voltage Instability

With regard to voltage instability, the TIER method in its present form cannot properly identify potential voltage and reactive power issues. The DC steady-state power flow algorithm used by the TIER method is a simplified version of a full AC power flow, and neglects voltage support and reactive power management. Industry members have recognized as much, and have explained that DC power flow algorithms neglect to consider voltage support, reactive power management, and transmission losses.[5]

Because the TIER method is DC-based and neglects voltage support and reactive power management, it would not correctly rank and would potentially ignore important semi-radial high-voltage transmission facilities that supply critical voltage support to large lower voltage networks. This possibility presents reliability concerns, and exposes reliability oversights that exist in the TIER method. An example discussed below demonstrates that transmission topologies exist that are susceptible to potential voltage collapse, and that the TIER method

[4] *See* TIER Notice (explaining that the project resulting in the TIER report could lead to a methodology that the Commission employs to "aid in refining the scope of what constitutes the [BPS]").

[5] *See* Konrad Purchala, Leonardo Meeus, Daniel Von Dommelen & Ronnie Belmans, *Usefulness of DC Power Flow for Active Power Flow Analysis*, Proc. IEEE Power Eng. Soc. Annu. Meeting 2005 at 454-59 (Jun. 2005).

could potentially miss the risk, or at a minimum, wrongly rank an important voltage-support element because the TIER method is based on the DC power flow approximation.

A short 345 kV line feeding a 345/161 kV transformer without any other 345 kV support, for a large area, might be missed altogether as a potential voltage instability problem or at least ranked improperly. It is likely that a radial high-voltage line or transformer connected to a lower-voltage network would not react to changes in generation. Instead, the configuration could respond more to changes in load than in generation. This same configuration would likely contain higher network impedances due to the lower voltage of network branches. Because of the configuration, the TIER method would not highlight such an element as a risk because there would be relatively low flow change on the element. Further, because of the same low flow change, the element would rank relatively low in the TIER method even though the facility was critical to preserving voltage stability. Such a possibility illustrates just one drawback of the TIER method.

2. Transient Instability

Similarly, the TIER method in its present form cannot properly identify transient stability issues. The steady-state power flow algorithm used by the TIER method does not contain the time-based differential equations of a full dynamic simulation. Such an omission ultimately means that the power flow algorithm is unable to predict transient stability issues, and therefore cannot properly detect transient instability.[6]

[6] *See* Paul M. Anderson & A.A. Fouad, Power System Control and Stability, 150 (IEEE Press Power Engineering 2002) ("When the machine operates in a steady state condition, differential equations are not necessary. This means that steady state power flow algorithms do not contain the time differential equations that can predict transient stability issues.").

This concept is illustrated by the IEEE. In *Definition and Classification of Power System Stability from the IEEE / CIGRE Joint Task Force on Stability, Terms and Definitions*,[7] the authors describe the two aspects of system security analysis: (1) static security analysis; and (2) dynamic security analysis. Static security analysis is used "to verify no equipment ratings and voltage constraints are violated." Dynamic security analysis "involves examining different categories of system stability…" The stability group joint task force recognized the need for full dynamic simulations beyond steady-state analyses to ensure system security, which supports the proposition that full dynamic stability analyses remain the benchmark for verifying power flow simulation results and detecting potential instability.[8] In the absence of full dynamic stability analyses, transient stability issues simply cannot be identified.

Many transient stability issues result from too much generation behind a high-impedance path under contingencies. For example, a reasonable transient or oscillatory stability example is the loss of one or more extra-high-voltage outlet paths near a generation complex. Under this condition, the loss could force too much generation onto a lower-voltage network, and result in transient instability. One possible TIER method outcome could be that the steady-state power-flow based algorithm would accept all of the total generation power without diverging, and thus miss the transient-stability issue altogether. Another possibility would be the incorrect ranking

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[7] This characterization of system security highlights two aspects of its analysis, as follows:

> **Static security analysis –** This involves steady-state analysis of post-disturbance system conditions to verify that no equipment ratings and voltage constraints are violated
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> **Dynamic security analysis –** This involves examining different categories of system stability described in Section III.

See Kundar, P. et. al., *Definition and Classification of Power System Stability IEEE/CIGRE Joint Task Force on Stability Terms and Definitions*, 19 IEEE Transactions on Power Systems No. 3 (Aug. 2004).
IEEE / CIGRE Joint Task Force on Stability and Terms and Definitions titled Definition and Classification of Power System Stability, IEEE Transactions on Power Systems, Vol. 19, No 2, May 2004

[8] *See, e.g.*, Craig Anthony Aumuller & Tapan Kumar Saha, *Investigating the Impact of Powerformer on Voltage Stability by Dynamic Simulation*¸18 IEEE Transactions on Power Systems No. 3 (Aug. 2003) (stating that dynamic simulation is the benchmark for verifying power flow based simulation results, and that dynamic simulation accurately includes the time dependent actions of control and protection).

of the problem based on the higher impedance of the lower-voltage network, which would likely rank poorly in a power-flow based method. In either case, a critical transient security issue is not identified.

3. Small-Signal Instability

For the same reasons stated above, the TIER method in its present form cannot properly identify oscillatory or small-signal instability because the steady-state power-flow algorithm used by the TIER method does not contain the time-based differential equations of a full dynamic simulation. The known Mid-Continent Area Power Pool (MAPP) quarter hertz mode within the MRO region provides an example of this concept. This documented phenomenon first appeared with the addition of a 230 kV interconnection between Manitoba and North Dakota in 1970. Low-frequency oscillations were detected in the Dakotas and Canada, resulting in the isolation of North Dakota on several occasions through 1972.

The contributing factor underlying this oscillatory problem is insufficient strength of the connecting transmission system. As additional transmission was constructed, DC controls tuned, load developed, and power system stabilizers were installed, the quarter hertz mode was controlled. Similar to transient stability, a similar occurrence in the future would not be properly identified under the TIER method. If a circumstance similar to MAPP quarter hertz mode occurred under the TIER method, one possible outcome is that the steady-state power-flow based TIER method would not diverge, and miss the oscillatory instability altogether. Another possibility would be the incorrect ranking of the problem as there would be no unusual impedance ranking indicators pointing to insufficient transmission strength in a power-flow based TIER method. It is likely that those elements near or within the insufficient transmission area would rank lower than normal in the TIER ranking method as the contributing condition would be of weaker-than-normal transmission.

Due to the weaknesses identified above, the TIER method will not correctly identify the elements required to operate each of the interconnections in a secure state, nor will it correctly rank the security importance of potential BPS elements. As such, it is improperly suited to determine what should and should not be included in the BPS, which defines the scope of applicable facilities for NERC standards.

D. The Commission Should Use Existing Transmission Planning Processes

The existing NERC transmission planning process already requires that steady-state, transient-stability, and small-signal studies be performed, that potential instabilities be identified, that critical facilities be communicated to the regional authorities, and that potential instabilities be corrected. Further, the existing NERC standards[9] and methods are already superior to the TIER method since they already incorporate industry knowledge, industry methods, and proven technology to identify voltage instability, transient instability, and small-signal instability. In short, the existing NERC transmission planning process addresses the very issues that the TIER method neglects.

The industry has been developing regional expertise pertaining to various regional instabilities for decades. Within the MRO region, an example is the previously mentioned MAPP quarter hertz mode where very few persons beyond local experts understand the complex nature of the controls used to enhance area damping. Proven transient and small-signal analyses using known stability algorithms have been refined over time to ensure that model results match reality. Planning Coordinators, Transmission Planners, Reliability Coordinators, and

[9] TPL-001, TPL-002, TPL-003, TPL-004, and FAC-014

Transmission Operators already exchange information on potential critical stability elements and conditions.

For these reasons, the Commission should consider using existing regional practices and the NERC transmission planning standards combined with existing regional oversight as a viable and potentially superior method to the TIER method. Since the Commission has not clearly identified any final or ultimate objective there is no reason to disqualify existing regional practices, NERC transmission planning standards, and existing regional criteria as viable alternatives.

E. The Commission Should Allow Regional Flexibility

The existing NERC transmission planning process and regional oversight already provide a vehicle for FERC to determine, at a minimum, what should and should not be included in the BPS. Further, the NERC transmission planning process and regional oversight also allow for appropriate regional flexibility. NERC and the Regional Entities, through the existing criteria, should retain the existing procedures and authority to add or exclude facilities to best meet region-specific conditions and needs, subject to Commission approval.

Clearly, the electric grid differs among the eight Regional Entities, especially when it comes to system stability. Examples include: the aforementioned MAPP quarter hertz mode; the DC control schemes to damp oscillations; and the western part of the MRO region, which is characterized by long transmission lines that transport power from remote generation to load centers. Through NERC, Regional Entities have been developing methods to classify facilities to meet regional needs and the Commission should provide due consideration to the existing methods before a change is instituted across the United States, Canada, and Mexico.

III. CONCLUSION

The MRO NSRS respectfully requests that Commission provide due consideration to these comments.

Respectfully submitted,

NSRS of Midwest Reliability Organization

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CERTIFICATE OF SERVICE

I hereby certify that I have served a copy of the foregoing document upon all parties listed on the official service list compiled by the Secretary in this proceeding.

Dated at Roseville, MN. this 28th day of October, 2009.

/s/ Sara E. Patrick
Sara E. Patrick

Director of Regulatory Affairs and Enforcement, and Counsel for Midwest Reliability Organization