GR-23-05 – Investigating the Reliability and Resiliency Benefits of Smart Monitoring for Renewables-rich Transmission & Distribution Systems

1. Company or University Name, as well as partnering organizations

University of Wisconsin-Milwaukee partnering with SPP, EPRI, and WE Energies.

2. Project Title

GR-23-05: Investigating the Reliability and Resiliency Benefits of Smart Monitoring for Renewables-rich Transmission & Distribution Systems

3. Project PI/Contact

Dr. Lingfeng Wang (email: wang289@uwm.edu)

4. Technology Roadmap Target Area

Power System Reliability; Power Electronics Reliability; Distributed Energy Resources.

5. Project Summary

In this project, we will explore and quantify the potential technical and economic advantages resulting from the widespread implementation of smart monitoring (SM) technologies in the evolving energy infrastructure. We will assess the effects of adopting SM technologies on various power system components, including transformers and substations, measuring their impacts at both the individual component and system-wide levels in terms of reliability and resilience. Additionally, we will conduct cost-benefit analyses to determine the reliability and resilience value of SM technologies, aiding in the identification of optimal investment strategies for their implementation.

6. Technology Gap/Market Need

This project is a crucial endeavor aimed at enhancing power system planning and operations while refining decision-making processes with the integration of emerging situational-awareness-enhancing technologies through uncertainty quantification.

7. Target Application (where does it fit in?)

Power Transmission Systems.

8. Accomplishments/Deliverables

Key accomplishments: 1) Developed an efficient and high-confidence reliability model by integrating both power systems and SM technologies. 2) Quantified the reliability implications of SM technologies on overall power system reliability. 3) Conducted case studies at the transmission grid level considering wind power penetration.

Specific deliverables: Probabilistic reliability modeling and evaluation methods.

9. Impact/Benefits

Quantifying the impact of SM on the power grid facilitates the risk-aware integration of higher amounts of power electronics-based renewable energy resources.

10. Images

The figure below illustrates that condition monitoring is expected to be implemented across various segments of a power grid.