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Compliance solutions for model validation of generating resources

NERC MOD-025, -026, and -027

At a glance

The goal of the North American Electric Reliability Corporation (NERC) Reliability Standards is to protect and maintain the reliability of the North American Bulk Electrical System (BES). NERC's Modeling, Data, and Analysis (MOD) reliability standards set forth requirements to validate generating resources steady-state and dynamic models used in the planning and operations of the bulk electric system. The steady state models are used in load flow calculations, while the dynamic models are used in power system stability analysis. The set of

standards dealing with the validation of generating resource are MOD-025, -026, and -027, which require:

- Generator Real and Reactive Power Capability Demonstration (MOD-025-2)
- Verification of Models for Generator Excitation Control Systems (MOD-026-1)
- Verification of Models for Turbine/Governor and Load Control Functions, including validation of turbine droop (MOD-027-1)

MOD standards

MOD-025-2, focuses on the determination of the generating unit reactive limits at both overexcited and underexcited operating modes. When documenting the values of active and reactive power (P and Q) for different operational conditions, it is possible to obtain the Reactive Capability (D) curve that characterizes the thermal limits of the armature winding, field winding and core end of the generator unit. In most cases, this curve has an operative area that is considerably lower than that used in planning studies. This is because the interconnection studies usually do not consider the limits that are imposed by operative conditions, such as those imposed by overexcitation, under-excitation, field current, or V/Hz limiters that act directly on reactive power production. This is in essence the main objective of the MOD-025-2, providing transmission regional operators (TROs) and independent system operators (ISOs)

with an updated model of the generating unit where the actual amount of reactive power under lagging and leading power factor operation is readily available.

MOD-026-1 requires the validation of the automatic voltage regulator (AVR), exciter, and power system stabilizer (PSS) models and data. The speed of the AVR response to reach ceiling voltage and the field forcing capability of the excitation system is of paramount importance when the stability of the power system may be at risk. The excitation system model validation and tuning is generally obtained with the unit rotating at synchronous speed and rated terminal voltage operating in open-circuit condition that is isolated from the network. However, it is also recommended to validate the excitation system with generating unit synchronized to grid and operating at rated power. If the generating unit has a power system stabilizer (PSS) in service, the MOD-026-1 report must also include the validation of the PSS model.

MOD-027-1 is the NERC standard for the validation of the model and data of the turbine/governor and load controls of a generating unit. The validation can be performed using historical data of transient system frequency events or using test data obtained by injecting a frequency bias signal to the frequency loop of the unit's speed governor. The importance of a good turbine/speed governor model is that it has direct impact on the accurate description of the frequency response of the unit and the aggregated power system frequency response.

Our solution

Validation of a generating unit active and reactive capability and excitation system and turbine/governor controls dynamic models is vital to the operations, planning, security and reliability of power systems. Compliance with NERC standards MOD-025-2, MOD-026-1 and MOD-027-1 will help achieve an accurate representation of the steady state and dynamic response of generating units in simulations of power systems. Siemens PTI is here to assist you to solve this challenging task.

Siemens PTI's experience spans the electric industry, from long-term system planning to facility design and system operation. We have an equal understanding of both generation and transmission, as well as the comprehension of how the two parts of the business augment each other. The experts at Siemens PTI are globally renowned for their in-depth knowledge built over decades of experience. By contributing actively to national and international committees and bodies, such as IEC, IEEE, CIGRE and CIRED, Siemens PTI consultants play an active role in shaping the future of technical developments and standards.

Given that we are the developers, consultants and trainers for the PSS[®]E software, Siemens PTI is intimately knowledgeable in even the smallest details of the program. While Siemens PTI may be the home of PSS[®]E, we still recognize that there are other software tools available, and we pride ourselves on delivering vendor neutral services based on the needs of the client.

With regards to compliance for NERC MOD-025-2, MOD-026-1 and MOD-027-1 standards, Siemens PTI provides:

- Data processing for field measurements and records of the trends that will be used in the report for validating the unit's performance according with NERC standards.

- Validation of the actual PSS[®]E dynamic models with simulations for the generator, voltage control, and governor and load control derived from the field tests.
- Documentation of the results of the tests and analyses and any other useful information related with the tested equipments.
- Customized add-on solutions that complement the compliance requirements, such as on-site Automatic Voltage Regulator (AVR) and/or Power System Stabilizer (PSS) tuning.

In collaboration with a team of partners, Siemens PTI is also able to provide an end-to-end generator testing and model validation solution. Our trusted partners offer on-site assistance for performing the necessary generator tests; the injection of testing signals or the connection of digital recorders.

How to get started

For further information, please contact Siemens PTI consulting sales at pti-consulting.ptd@siemens.com or +1 518 395 5000.

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