NERC
NORTH AMERICAN ELECTRIC
RELIABILITY CORPORATION

Technical Rationale for Reliability Standard

MOD-026-2 – Verification of Models and Data for BES Connected Facilities

Introduction

This document is the technical rationale and justification for Reliability Standard MOD-026-2 and includes the rationale for changes in the current proposed version, as well as previous versions of the standard.

It is intended to provide stakeholders and the ERO Enterprise with an understanding of the revisions, technology and technical concepts of Reliability Standard MOD-026-2. This is not a Reliability Standard and should not be considered mandatory and enforceable.

Background

The NERC Inverter-based Resource (IBR) Performance Task Force (IRPTF) performed a comprehensive review of all NERC Reliability Standards to identify any potential gaps and/or improvements. The IRPTF discovered several issues as part of this effort and documented its findings and recommendations in the *IRPTF Review of NERC Reliability Standards White Paper*, which was approved in March 2020 by the Operating Committee and the Planning Committee (PC)-now part of the Reliability and Security Technical Committee (RSTC)). Among the findings noted in the white paper, the IRPTF identified issues with MOD-026-1 and MOD-027-1 that should be addressed. The RSTC endorsed the standard authorization request (SAR) on June 10, 2020.

Consistent with the IRPTF recommendations, the scope of the proposed SAR includes revisions to NERC Reliability Standards MOD-026-1 and MOD-027-1. These standards require, among other things, Generator Owners to provide verified dynamic models to their Transmission Planner for the purposes of power system planning studies. The project proposed revisions to MOD-026-1 and MOD-027-1 to clarify requirements related to IBRs, and to require sufficient model verification to ensure accurate generator representation in dynamic simulations. The IRPTF recommended revisions to clarify the applicable requirements for synchronous generators and IBRs.

Additionally, the potential risk of increasing amounts of reactive power being supplied by nonsynchronous sources was identified in *NERC's 2017 Long-term Reliability Assessment*. In response to the concern, the PC assigned the System Analysis and Modeling Subcommittee (SAMS) to study the issue. The SAMS developed the *Applicability of Transmission-Connected Reactive Devices* white paper, which was approved by the PC at its December 2019 meeting. The PC Executive Committee approved the SAR on February 11, 2020. Recommended revisions to MOD-026-1 and MOD-027-1 outlined in the SAR were undertaken within the scope of this project.

Rationale for Applicability Section - Functional Entities

The purpose of the MOD-026-2 standard is to ensure models used in planning and interconnection analyses are verified and validated, and that these models accurately represent in-service equipment. There are four functional entities that play a role in MOD-026-2 requirements and have an obligation to comply with them. These are:

- Generator Owner
- Transmission Owner that owns a Facility per Section 4.2.4 and 4.2.5
- Transmission Planner
- Planning Coordinator

The Generator Owner and Transmission Owner are responsible for providing validated and verified models to the Transmission Planner that reflect in-service equipment and power plant performance. These validated and verified models must reflect the dynamic performance of equipment being installed or already installed in the grid under various expected grid conditions and disturbances, so that Transmission Planners may assess the impact of power plants and transmission-connected devices on grid stability and resiliency.

The Transmission Planner and its Planning Coordinator are responsible for jointly developing and maintaining model requirements and processes and making them available to the Generator Owner or Transmission Owner. These requirements and processes outline the type and acceptance criteria of required validated and verified models as well as the process to submit and review them for acceptance. The Transmission Planner, jointly with its Planning Coordinator, will also specify processes for provision of models to Planning Coordinators as well as how Generation Owners and Transmission Owners may obtain models from the Transmission Planner’s database. These requirements and processes are needed to clearly articulate validated model acceptance, provision and dissemination by and to all necessary entities.

The Transmission Planner is also responsible for reviewing submitted verified models and accompanying information, updated verified models, and written responses from Generator Owners and Transmission Owners. Transmission Planners are responsible for communicating model acceptance and denial to the Generator Owner or Transmission Owner.

Facilities

A facility that would need to meet the requirements in this standard and be considered an “applicable Facility” fall under the characteristics defined by the NERC Bulk Electric System (BES) Definition Inclusion I2 and I4 for generating facilities, Inclusion I5 for dynamic reactive resources (synchronous condenser and FACTS devices), or for high voltage direct current (HVDC) facilities. That is, any unit, plant or resource connected to the BES and meeting the unit rating criteria set by the BES definition is applicable. This Facilities applicability is consistent with most other NERC reliability standards being tied to BES-qualified units. The proposed standard links applicability to the BES definition (as opposed to defined rating or other thresholds) to be sure that now and in the future, should the BES definition be modified, the standard is consistent with applicable BES facilities. This avoids the need to modify the standard if definitive thresholds are specified and the BES definition is modified.

Rationale for Requirement R1 - Part 1.1

MOD-026-2 R1 Part 1.1 expands MOD-026-1 R1 bullet 1 to not only require the Transmission Planner to list the acceptable models, but also requires the Transmission Planner to specify the required format and level of detail. The 90-day response time in MOD-026-1 R1 is removed and instead MOD-026-2 R1 requires a document to be maintained for distribution. The intent of Part 1.1 is to require the Transmission Planner to specify the type of positive sequence models compatible with their planning process. The Transmission Planner should specify the software tools and version numbers that the model must be compatible with and describe the format and submission requirements. The Transmission Planner must specify which models are acceptable and may decide to adopt the NERC Acceptable Models List. Regarding format, the Transmission Planner may specify compatible file types, may request completion of forms or templates, and may require example cases where the model is set up to run. The Transmission Planner should consider requiring complete documentation / user manuals describing other required model parameters, control block topology, tuning, etc. For other model required parameters, it is common to describe the appropriate apparent power (MVA) base, equivalent reactance (Rsource and Xsource), reactive limits (Qmin and Qmax), and impedances of any generator step-up transformers not explicitly modeled in powerflow cases. In addition, the Transmission Planner may have requirements to ensure model compatibility, accuracy, or performance and may have specific policies regarding user-defined models versus standard library or generic models.

Part 1.2

MOD-026-2 Requirement R1, Part 1.2 expands requirements of MOD-026-1 R1 bullet 1 to cover electro-magnetic transient (EMT) models in addition to positive sequence dynamic models. EMT models are not required of all types of generators or devices; only IBRs, FACTS, and HVDC. The applicable Facilities listed in MOD-026-2 Requirement R6 and the exception to Requirement R6 in Attachment 1, Row 11 limit the facilities for which verified EMT models need to be submitted by a Generator Owner or Transmission Owner. Requirement R1 Part 1.2 merely requires the Transmission Planner to document acceptable models, format, and level of detail for generation facilities where EMT models are required. The intent of Part 1.2 is to require the Transmission Planner to specify the type of EMT models compatible with their planning process. The Transmission Planner should specify the type of software used and version (including compiler version). To ensure the model is compatible with nearby models for larger studies, the Transmission Planner may define the range of simulation time-step sizes the model must be capable of operating over. Regarding level of detail, the Transmission Planner may require full detailed modeling of phase-locked-loops (PLL) and fast current controls, power electronic switches or equivalent switching models (as opposed to average source models). For accuracy, the Transmission Planner may require usage of actual code or require hardware validations / benchmarks or may prohibit models from using certain off-the-shelf library blocks (such as using a generic phase-locked-loop (PLL) control block rather than modeling the actual PLL control block). It is recommended that the Transmission Planner describe the planned use for the EMT model (such as weak-grid studies, sub-synchronous resonance, unbalanced faults, or special islanding or over-voltage protection studies), so that the vendor can ensure an appropriate level of detail. The Transmission Planner should also indicate if balance-of-plant equipment shall also be included in the model including the Power

Plant Controller (PPC). For ease-of-use, the Transmission Planner may require that certain controls or outputs be easily accessible (such as real or reactive power dispatch controls), require description of trip codes for debugging, or the ability to adjust or disable protection models.

Part 1.3

Part 1.3 incorporates the usability criteria of MOD-026-1 R6 (Parts 6.1-6.3) and MOD-027-1 R5 (Parts 5.1-5.3). The intent of Part 1.3 is to allow the Transmission Planner to define acceptance criteria to determine whether the model is usable and other necessary criteria and to make the acceptance criteria clear to the Generator Owner/Transmission Owner upfront. Having defined and known criteria creates efficiency in the review process, reducing review times and submission overheads, and increases the likelihood that models will be accepted by the Transmission Planner without multiple revisions from Generator Owners/Transmission Owners.

The Transmission Planner should ensure that appropriate dynamic models are being used and perform a data review before any simulations are performed. It is recommended that the Transmission Planner is familiar with the most recent industry guidance to inform their acceptance criteria. For example *NERC BPS-Connected IBR Modeling and Studies Technical Report (Chapter 1)* provides a list of recommended questions to ask when receiving dynamic models, which provide a basis for the Transmission Planner when receiving a model. For example, for PV plants using the WECC generic models, Transmission Planners can follow the steps in Sections 4.2 and 4.3 *WECC's Solar Photovoltaic Power Plant Modeling and Validation Guideline* to verify that model control flags are set appropriately. For parameterization checks, Transmission Planners may also choose to identify parameters that are technically acceptable, but violate interconnection requirements; such as inappropriate droops, deadbands, protection settings, or control modes. The Transmission Planner may also identify the specific large disturbance tests that must be simulated by a Generation Owner/Transmission Owner on both EMT and positive sequence IBR models for benchmarking comparisons.

Usability refers to the ability of a Transmission Planner and Planning Coordinator to utilize a model with their existing tools and processes. It is possible for a model to be usable when connected only to an infinite bus and then it fails when simulated as part of larger power system. *Interoperability* refers to the ability of a model to be used in conjunction with other existing models. The two terms are closely related and typically they both describe the acceptable formats and levels of detail specified by the Transmission Planner and Planning Coordinator in R1.1. Some items that may be specified to ensure usability and interoperability include:

- Documentation or instructions
- Time steps the model should be capable of running at
- Pertinent controls and/or options accessible to the user such that they can manipulate the model
- Reporting or diagnostics to enable a user to identify performance issues
- Ability to accept external reference values
- Ability to be scaled
- Ability to be interconnected with other models

- Specifications for software and its version
- The Fortran version that is required for it to run
- Initialization time
- Support simulation tool features such as “snapshots” or “multiple runs”
- Does not rely on global variables

To meet the acceptance criteria for *initialization*, models should be able to initialize without errors and flat run in no-disturbance simulations.

Part 1.4

Part 1.4 was not directly included in MOD-026-1 or MOD-027-1. Part 1.4 requires that a process for submitting models to the Transmission Planner is developed jointly by the Transmission Planner and Planning Coordinator and is made available to submittal parties. This part is an addition to the previous MOD-026-1 standard and is intended to aid in model submittal efficiency by providing clear submittal processes for the Generator Owner and Transmission Owner to follow.

Part 1.5

Part 1.5 was not directly included in MOD-026-1 or MOD-027-1. Part 1.5 requires that a process be developed by which verified models are submitted to the Planning Coordinator, which could be done by the Transmission Planner or a designee, after meeting acceptance criteria of the Transmission Planner. This part is an addition to the previous MOD-026-1 standard and is added to ensure there is a clear process for the Planning Coordinator to receive acceptable models for their studies. This also allows the Planning Coordinator to make verified models available for use in Interconnection-wide cases.

Part 1.6

Part 1.6 incorporates MOD-026-1/MOD-027-1 R1 bullet 3. Part 1.6 allows the ability for Generator Owners and Transmission Owners to obtain their existing models from the Transmission Planner via a process defined by the Transmission Planner. This request is essential to Generator Owners and Transmission Owners when there is a change in ownership, the model is not on file, or there are discrepancies between model records.

Rationale for Requirement R2

MOD-026-2 R2 incorporates only the synchronous generation aspects of MOD-026-1 R2. This requirement adds more detail about what must be modeled for synchronous generation, such as certain limiters and protection systems, and that the model represents in-service equipment at the Facility. The representation of the voltage regulation and dynamic reactive response of synchronous generating units to transmission system voltage disturbances is necessary for accurate evaluation of system stability and reliability in dynamic simulations. Therefore, verified dynamic models and associated parameters representing generators, their excitation systems, and certain limiters and protective functions associated with the voltage regulation and reactive performance are requested.

Rationale for Requirement R3

MOD-026-2 R3 incorporates only the synchronous generation aspects of MOD-027-1 R2. This requirement adds more detail about what must be modeled for synchronous generation, including certain protection systems, and that the model represents in-service equipment at the Facility. The representation of the speed governing and active power response of synchronous generating units to transmission system frequency events is necessary for accurate evaluation of system stability and reliability in dynamic simulations. Therefore, verified dynamic models and associated parameters representing prime movers, governors, load controllers, and certain protective functions associated with frequency response and active power performance are requested. Additionally, the term “turbine” was replaced with prime mover, which can include a turbine, reciprocating engine, or other mechanical sources of power.

Protection systems modeling in MOD-026-2 R2 and R3: Modeling of generator Protection Systems is critical because large disturbance phenomena can cause protection systems to disconnect generating resources from the grid. This can exacerbate grid disturbances, potentially causing cascading failures, islanding scenarios, etc. Additionally, transient behavior can result in the disconnection of units if protection system elements are set with minimal time delays. The Transmission Planner must be able to study this behavior to assess and mitigate the reliability risk. Even though relays on synchronous generators and synchronous condensers may have settings compliant with the NERC PRC standards, system disturbances may cause these elements to trip regardless, affecting system response. Protection Systems that shall be modeled are specified in MOD-026-2 R2 and R3, and are understood to be relay elements applied on Bulk Electric System assets that cause the generator breaker to open and disconnect the asset, whether by directly tripping the breaker, tripping the breaker through an auxiliary relay (such as a lockout relay), or causing the prime mover to be quickly shutdown resulting in the breaker opening (sometimes called “sequential tripping”). Protection functions specified in part 2.3 are potentially sensitive to large disturbance events and, with the exception of out-of-step, operate on quantities directly or indirectly regulated by the excitation system. The elements and functions listed in part 3.3, frequency (and speed) elements, are of concern due to many entities setting these based on PRC-024 requirements rather than equipment capability. Similarly, many large steam turbines are set with tight frequency/speed protection settings due to the nature of steam turbine design and capability and system events may cause these machines to trip offline, which will affect overall system performance during disturbances.

Rationale for Requirement R4

MOD-026-2 R4 incorporates the IBR generation aspects of MOD-026-1 R2. This requirement adds information that must be provided and additional details on required models for IBR generation. MOD-026-2 R4 has been drafted with the intent of providing clear modeling requirements for dispersed power producing resources outlined in BES Inclusion I4 (essentially IBR Facilitiess), power based electronics (FACTS devices), and HVDC terminal equipment, so that models represent in-service equipment at each Facility. R4 is specific to positive sequence modeling of volt/var control. This requirement has both verification and validation activities including documentation of manufacturer, equipment information, modeling of hardware and control systems, requirement for validation (staged testing or disturbance monitoring), and protection system modeling.

Rationale for Requirement R5

MOD-026-2 R5 incorporates the IBR generation aspects of MOD-027-1 R2. This requirement adds information that must be provided and additional details on required models for IBR generation. The technical rationale for MOD-026-2 R5 is similar to R4, described above. The intent of this requirement is to ensure active power/frequency response of the model reflects in-service equipment at the Facility.

Rationale for Requirement R6

MOD-026-2 R6 has been drafted with the intent of providing clear requirements to verify that EMT models represent in-service equipment at each IBR Facility. As inverter-based resources continue to interconnect to the bulk power system (BPS) across North America, Transmission Planners and Planning Authorities are faced with challenges relying solely on positive sequence dynamic models to ensure reliable operation of the BPS. The following challenges have been identified in an increasing number of networks across North America and around the world:

- The RMS positive sequence simulation platforms, by design, are generally not suitable for capturing the dynamic response of inverter-based resources for unbalanced fault conditions.
- Due to the aforementioned point, any individual phase-based controls or protection cannot generally be modeled to complete accuracy in an RMS positive sequence simulation platform. For this reason, the RMS positive sequence dynamic models have limitations in precisely assessing ride-through performance during unbalanced faults often performed during interconnection studies.
- In areas of high penetrations of inverter-based resources or low short-circuit strength networks, the existing state-of-the-art generic RMS positive sequence dynamic models may encounter numerical issues that pose challenges for Transmission Planners.
- The RMS positive sequence dynamics models do not include the real-code behavior of inverter-based resources and often involve engineering judgment based on controller block diagrams used in representing the actual performance of these complex power electronic resources.
- Due to the numerical issues and simplified modeling assumptions described above, the existing state-of-the art generic RMS positive sequence dynamic models are often unable to identify controls instability or controls interactions with neighboring facilities or sub-cycle inverter tripping.
- As recommended in the *NERC Odessa Disturbance Report*, most of the causes of solar PV reduction identified in this event and past events analyzed by NERC cannot be properly represented in positive sequence dynamic models. High quality, vendor-specific EMT models are required to identify these causes of tripping.

A combination of modeling challenges drives the growing need for EMT modeling and studies for inverter based resources, particularly in areas of growing penetration of inverter-based resources or low short-circuit strength. These areas may be wider areas of the BPS or may be local pockets of inverter-based resources that often do not include any nearby synchronous generation or loads. The *NERC Reliability Guideline: Improvements to Interconnection Requirements for BPS-Connected Inverter-Based Resources* recommends including real-code EMT modeling requirements for all newly interconnecting inverter-based resources to the BPS and also recommends benchmarking the RMS positive sequence dynamic models with those EMT models. All the issues described above are dependent on accurate parameterization of the models to match the installed equipment in the field. Inaccurate parameterization of any model (RMS positive sequence or EMT) can lead to misidentification of potential BPS reliability issues via studies.

Large signal disturbances - In the context of MOD-026-2, a large signal disturbance is typically the result of a fault on the transmission system, the loss of generation, the loss of a large load, or the switching of a heavily loaded transmission line. References *IEEE Standard for Interconnection and Interoperability of Inverter-Based Resources (IBRs) Interconnecting with Associated Transmission Electric Power Systems*, 2022; and *BPS-Connected Inverter-Based Resource Performance*, *NERC, September 2018* characterize large disturbances in the context of IBRs as disturbances that result in the IBR unit terminal voltage going outside of the continuous operating range. Such disturbances may result in activating nonlinearities in the control, such as limits (amplitude and/or rate of change), control mode switching (e.g., switching to FRT control mode), and/or actions to protect the equipment. Since these nonlinearities depend on non-standardized and potentially proprietary control design, this will vary among the equipment manufacturers. Therefore, it is not possible to identify a voltage magnitude, frequency, or phase angle change that describes when such nonlinearities occur that is consistent across all IBRs.

Large-signal response of IBRs is dependent on programmable control and protection functions and therefore cannot confidently be extrapolated from small-signal staged testing. Additionally, large-signal validation by staged testing is not feasible and events of a large-signal nature are unlikely to occur at convenient intervals or at all. An alternate means of large-signal positive sequence model validation is necessary. The use of EMT modeling and simulation as a substitute for large-signal staged testing or actual large disturbance events comprises such alternate means. In Requirement R6, EMT modeling of individual inverter units is first to be attested by the OEM and verified against factory type tests. In the case of the IBR unit, the R6.1 attestation is that the EMT model(s) contains the control modes, control blocks, and protective functions that may be active in disturbance performance. R6.2 device testing then ensures that the IBR unit model response is consistent with or emulates the response of the supplied equipment. Although the standard intentionally does not specify device test procedures or methods related to R6.2, device tests should be hardware specific and may include factory type tests, hardware in the loop tests, or other manufacturer tests to ensure the EMT model's large signal response emulates the supplied equipment. Aggregate EMT plant or Facility models are then formed by adding other plant element models, including the similarly OEM attested power plant controller model and any auxiliary dynamic device models such as statcoms, to the validated equivalent(s) of the individual inverter units into an overall plant model per R6.3. The aggregate EMT plant or Facility model is also subject to staged test or system disturbance validation under R6.4 and R6.5.

The verified/validated EMT plant model then becomes the platform against which the positive sequence plant model may be validated in R6.6. The specific large-signal simulation tests that must be run on both EMT and positive sequence models for benchmarking comparisons should include balanced and unbalanced faults, delayed clearing phase-ground point of interconnection faults, temporary or transient over-voltages, rates of change of frequency (ROCOF), varying short circuit levels (or ratios), and phase angle jumps as may be specified by the Transmission Planner under R1.3.

Large disturbance tests on individual IBR projects may be run on both EMT and positive sequence test systems that consist of the project model connected to a controllable bus representing the point of interconnection (POI) and a Thevenin equivalent representing the transmission grid. It is not necessary to model the interconnected transmission system in detail to run these tests. The voltage, voltage phase angle, frequency, and short circuit level at the POI bus may then be varied to simulate various large-signal disturbances under various system conditions.

If positive sequence model verification were to exclude the IBR EMT model and associated steps in R6.2-6.6, the positive sequence plant model large-disturbance behavior would need to be validated directly from the unit level device tests alone. OEM unit tests may be limited in their ability to characterize system conditions and events that cause IBR instability, runback, cessation, and tripping, which behaviors must be represented accurately in transmission planning and operational studies. Positive sequence IBR models are also limited in their ability to represent protection and controls that affect instability, runback, cessation, and tripping as well. In contrast, EMT plant models validated by unit level device tests are not theoretically limited in their ability to representing these behaviors and therefore are more apt to represent the operating boundaries of IBR plants accurately. The chief advantage of applying EMT simulations to validate positive sequence models is that simulations may be pushed to those operating boundaries and beyond whereas OEM unit tests would not do that. It is only in this pushing to boundaries that enables the Transmission Planner to assess the ability of the positive sequence plant models to represent the large-disturbance behavior.

Rationale for Requirement R7

MOD-026-2 R7 incorporates the intent and aspects of MOD-026-1 R4 and MOD-027-1 R4. This requirement is intended to ensure that updated verified and validated models are provided to the transmission planner within a reasonable timeframe after any modification to an existing facility that changes the dynamic performance of that facility. This would cover a change in facility ratings or characteristics such as, nameplate rating, control software or parameter adjustments, hardware alterations such as exciter or governor changes, etc. If changes to dynamic performance result from these equipment or facility modifications, the dynamic models used to assess their impact to the grid also need to be revalidated and resubmitted so Transmission Planners may study the reliability impact of the new as-built facility on the grid.

Rationale for Requirement R8

MOD-026-2 R8 incorporates the intent and aspects of MOD-026-1 R3 & R6 and MOD-027-1 R3 & R5. This requirement is intended to ensure that the Transmission Planner reviews the model and accompanying information and provides feedback to the Generator Owner/Transmission Owner within a reasonable time. If the Transmission Planner determines that the verified model and accompanying information does not meet the acceptance criteria or processes established in Requirement R1 they must provide sufficient information for the Generator Owner or Transmission Owner to understand and correct the deficiency. This requirement is similar to R6 of MOD-026-1 and R5 of MOD-027-1, but with more comprehensive acceptance criteria.

Rationale for Requirement R9

MOD-026-2 R9 incorporates the aspects of MOD-026-1 R3 and R5, and MOD-027-1 R3. This requirement is intended to ensure that the Generator Owner/Transmission Owner responds to the Transmission Planner's notification of denial or a request for model review within a reasonable time. If the Generator Owner/Transmission Owner determines that a model update is warranted to address the deficiencies, the Generator Owner/Transmission Owner should respond by either providing an updated model or providing a plan to verifiy the model in accordance with the requirements. Otherwise, if the Generator Owner/Transmission Owner determines that the current model should be maintained, the Generator Owner/Transmission Owner must provide technical justification and evidence that addresses the model deficiencies or concern identified by the Transmission Planners. This requirement ensures the Generator Owner/Transmission Owner resolves modeling issues identified by the Transmission Planner, whether as part of the initial model review or sometime thereafter, by using one of the disposition options.

Rationale for Attachment 1

Attachment 1, Row 11 (R3 and R5 exemption)
Industry practice for generator and turbine modeling has recognized that some prime-mover control schemes do not vary the prime mover output significantly due to speed or frequency changes and have not been modelled in stability cases, although there has been some uncertainly and disagreement on which prime-move controls should be considered unresponsive. *NERC Reliability Guideline – Application Guide for Turbine-Governor Modeling* provides guidance to the industry on the best practices of modeling various types of control schemes that affect frequency response, including control schemes that should not be modeled. The recommendations are summarized in Table 1.2 of the guideline. The language provided in Attachment 1, Row 11 in MOD-026-2 is intended to concisely capture the recommendations of the Application Guide on which prime movers do not need to modeled, and thus if an applicable facility is modeled following the recommendations in Table 1.2 of the *Application Guide for Turbine-Governor Modeling*, it is following the intent of Attachment 1, Row 11.

Rationale for Removal of MOD-026-1 R6

Portions of MOD-026-1 R6 are covered under two requirements in MOD-026-2. MOD-026-2 R8 covers the response the Transmission Planner is obligated to send to the Generator Owner/Transmission Owner. MOD-026-2 R1 covers the obligation for the Transmission Planner the define acceptance criteria which includes usability, as described in MOD-026-1 Part 6.1-6.3.

Rationale for Retirement of MOD-027-1

MOD-027-1 R1 content is covered in MOD-026-2 R1.

MOD-027-1 R2 content is covered in MOD-026-2 R3 for synchronous generation and MOD-026-2 R5 for inverter based resources or aggregated distributed generation.

MOD-027-1 R3 content is covered in a number of requirements in MOD-026-2. MOD-026-2 R1 Part 1.3 outlines the acceptance criteria define by Transmission Planner, MOD-026-2 R8 gives options for the Transmission Owner to provide a notification of denial, and MOD-026-2 R9 defines the written response options by the Generator Owner after receiving a notification of denial or technical justification for model review.

MOD-027-1 R4 content is covered in MOD-026-2 R7.

MOD-027-1 R5 content is covered in a number of requirements in MOD-026-2. MOD-026-2 R1 Part 1.3 outlines the acceptance criteria define by Transmission Planner, and MOD-026-2 R8 gives options for the Transmission Owner to provide a notification of acceptance of notification of denial based on the acceptance criteria define in Part 1.3. Usability requirements outlined in MOD-027-1 R5 Part 5.1-5.2, would be defined in the acceptance criteria under MOD-026-2 R1 Part 1.3.