Proposed Improvements for NERC MOD Standards
July 10, 2012

Background

This paper outlines proposed improvements for NERC Reliability Standards MOD-010 through MOD-015, listed in the table below.

<table>
<thead>
<tr>
<th>MOD Standards for Improvement</th>
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</thead>
<tbody>
<tr>
<td>MOD-010-0 — Steady-State Data for Transmission System Modeling and Simulation - TO, GO, RP</td>
</tr>
<tr>
<td>MOD-011-0 — Regional Steady-State Data Requirements and Reporting Procedures - RRO</td>
</tr>
<tr>
<td>MOD-012-0 — Dynamics Data for Transmission System Modeling and Simulation - TO, GO, RP</td>
</tr>
<tr>
<td>MOD-013-1 — RRO Dynamics Data Requirements and Reporting Procedures - RRO</td>
</tr>
<tr>
<td>MOD-014-0 — Development of Interconnection-Specific Steady State System Models - RRO</td>
</tr>
<tr>
<td>MOD-015-0.1 — Development of Interconnection-Specific Dynamics System Models – RRO</td>
</tr>
</tbody>
</table>

Standards MOD-010-0 and MOD-011-0 address steady state data, while MOD-014-0 addresses steady-state models. Standards MOD-012-0 and MOD-013-0 address dynamics data, while MOD-015-0 addresses dynamics models.

The following recommendation is taken from the NERC white paper on Power System Model Validation Draft May 28, 2010 by the NERC Model Validation Task Force of the Transmission Issues Subcommittee:

**Recommendation** – The NERC MOD standards on powerflow and dynamics data (MOD-010 through MOD-015) should be improved and strengthened. The Planning Committee should assign the TIS or MVTF to develop a list of suggested improvements for a Standards Authorization Request (SAR).

The current standards lack specificity in many areas; examples include who is responsible for providing and receiving data and models, and shareability of the data and models. All devices and equipment attached to the electric grid must be modeled to accurately capture how that equipment performs under static and dynamic conditions.

There have been issues with propriety of models and the ability to share across sectors. Many generator manufacturers, notably wind turbine manufacturers, wish to keep dynamics models of their equipment
confidential. As most areas are experiencing a surge in wind penetration, obtaining accurate dynamics model data for wind farms is becoming increasingly difficult if not impossible.

The generator owners provide accurate model data of their systems during the generator interconnection process. This information is critical as it ensures that their power generating systems can be safely integrated into the electric grid. However, many of these accurate model datasets which are submitted for use in the generator interconnection process cannot be used for any other modeling endeavors due to non-disclosure agreements or pro forma tariff language concerning use of confidential information. These generator owners state that industry sensitive data is contained in their datasets and therefore cannot be divulged to anyone outside the interconnecting utility, for use in interconnection-wide powerflow and dynamic models.

Suggested Improvements

1. **Reduce the quantity of MOD Standards**

The team recommends combining MOD-010 through MOD-015 into a fewer number of standards such as one standard for steady state and one for dynamics. However, the team also recognizes the usefulness of developing separate standards for equipment data collection and construction of solved cases.

MOD-012 provides requirements that responsible entities including Transmission Owners, Transmission Planners, Generator Owners, and Resource Planners shall provide appropriate equipment characteristics, system data, and dynamics system modeling and simulation data in compliance with the respective Interconnection-wide Regional requirements and reporting procedures. Further the standard requires that the responsible entities must have evidence that they so complied with the Interconnection-wide Regional requirements and reporting procedures.

The current MOD-012 clearly provides that the responsible entities including the Generator Owners must provide the needed data and models in accordance with requirements that are provided in MOD-013. If MOD-013 is eliminated then the specifics provided in R1.1, R1.2, R1.3, R1.4, and R1.5 must be included in MOD-012. Further MOD-012 must provide for the Interconnection Modeling Coordinator (IMC) to develop interconnection-wide data gathering and model building procedures and to coordinate the development of interconnection-wide models.

The new MOD-012 must deal with the current MOD-013 provision that that interconnection-wide data procedures allow for responsible entities to provide estimated or typical manufacturer’s dynamics data based upon criteria provided in the Interconnection-wide Regional procedures. The MOD-012 with MOD-013 provisions should be strengthened by modifying the provision by specifying in the standard the instances when generic manufacturers’ data may be provided. In this way, a FERC-approved
standard would ultimately control the use of generic manufacturers’ data for units including wind turbines.

The current MOD-010 clearly provides that responsible entities must provide the needed steady state data and models in accordance with requirements that are provided in MOD-011. MOD-011 should be eliminated and the MOD-011 specifics provided in R1.1 through R1.7 must be included in MOD-010. Further MOD-010 must provide for the IMC to develop comprehensive steady-state data requirements and for the IMC to develop coordinated interconnection-wide steady state models.

Recommend removing standards MOD-011 and MOD-013; placing details from these standards into MOD-010 and MOD-012 respectively (as well as adding additional details).

2. **Add Short Circuit Data to MOD Standards**

Short circuit analysis is required in the latest draft of the TPL standard – see page 209 in Project 2010-03 Modeling Data.

3. **Add to the Requirement to Supply Data and Models**
   
   a. **Identify responsibility to provide and identify who is responsible to receive**

   A model of the power system requires data concerning loads, transmission lines, transformers, shunt devices, generators, stacking order for dispatching generators, and interchanges of power. This data must be supplied by various functional entities as shown in the table below. This data must be supplied to Planning Coordinators, Transmission Planners, Transmission Operators, and Reliability Coordinators as applicable. The Planning Coordinator or Transmission Planner should be responsible for putting all of the data together in a power flow case with associated dynamics data. These cases should then be supplied to the Interconnection Modeling Coordinator who will combine cases to develop an interconnection-wide model of the power system.
Table 2: Data Responsibilities

<table>
<thead>
<tr>
<th>Data</th>
<th>Responsible for Providing Data &amp; Models</th>
<th>Delivers To</th>
</tr>
</thead>
<tbody>
<tr>
<td>Load Forecast</td>
<td>LSE</td>
<td>PC, TP, TOP, RC</td>
</tr>
<tr>
<td>Transmission Data</td>
<td>TOs</td>
<td>PC, TP, TOP, RC</td>
</tr>
<tr>
<td>Generator Data</td>
<td>GOs</td>
<td>PC, TP, TOP, RC</td>
</tr>
<tr>
<td>a. Resource Projections</td>
<td>Resource Planners</td>
<td>PC, TP, TOP, RC</td>
</tr>
<tr>
<td>b. Generation stacking order</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interchange</td>
<td>TSP, BA</td>
<td>Interconnection Modeling Coordinator (IMC) for each of the Interconnections</td>
</tr>
<tr>
<td>Complete cases/models</td>
<td>PC, TP</td>
<td></td>
</tr>
</tbody>
</table>

b. **Identify acceptability**

The present MOD standards provide little to no specification on whether a particular set of model data meets the requirements of the standards. The group recommends the following changes to the standards to provide specificity:

- For powerflow models, the standards should specifically list all of the parameters which must be provided. For some parameters, it may be desirable to include established norms (for example, a typical range for transmission line impedance per mile at a given voltage). For these parameters, the data should either conform to established norms or a statement attesting to unusual values should be provided. Data for new equipment should be tested in a standard library powerflow case by performing a solution to test convergence and reasonableness. Model data for a particular piece of equipment should be consistent across all applications that use that data. When available, the model data for the equipment should be from vendor certified test reports or field tests. If a novel device is required to be represented by a user-written model, the standards should mandate that all of the equations describing the characteristics and logic of the model must be provided, along with any other descriptive information. Additionally, the data provided by asset owners needs to meet model validation standards such as MOD-026 and MOD-027 and any additional standards that arise from the work of the NERC Model Validation Working Group (NERC MVWG).

- For dynamics models, a standard, industry-recognized model name and a set of parameter values must be provided. If a standard, industry-recognized model is not available, the standards should specify that the asset owner must provide, at a minimum, a block diagram, equations describing the characteristics of the model, values and names for all model parameters, and a
list of all state variables. The standards also need to specify that this information will be shared on an interconnection-wide basis. Proprietary models with details hidden from the user ("black box" models) or those models that cannot be shared across the interconnection are not acceptable. Engineers performing power system studies need access to all of the model information in order to properly analyze the reliability and operating characteristics of the power system. To the extent practical, the drafting team should develop a list of specific data that is required and include that list in the MOD standards. Preference should be given to IEEE standard models where such models are suitable representations of the equipment being modeled. Additionally, the data provided by asset owners needs to meet model validation standards such as MOD-026 and MOD-027 and any additional standards that arise from the work of the NERC Model Validation Working Group (NERC MVWG).

- The standards must also specify that the asset owner will provide models with additional detail and specificity to any PA upon request for its own internal studies.

c. **Standard format**

The specification and use of a standard format or set of formats enables data to be exchanged easily between PCs, TPs, TOP, RC, TOs, GOs, LSEs, & RPs and help support the accurate development of steady state, short circuit, and dynamic base cases. Having a standard format allows the development and aggregation of base cases which cover many control areas such as the three interconnections in North America. Each vendor has their own data format some of which are translatable between vendors. However, some translations are only good for steady state analysis. Dynamic data does not translate well between vendors.

The Task team recommends that the MOD standards incorporate standard formats for all steady state, short circuit, and dynamic data and the standard formats should be approved via the NERC process. A translation of a specific vendor’s format to the common format is acceptable provided the resulting data has been validated.

NERC should lead the development of test cases to validate the translation of the vendor format to the common format. If a specific vendor’s format is not translatable to the approved common format then it does not comply with the standard. Coding for generic block diagrams should be included. Provisions should be made for private extensions (addition of program-specific data for particular users that is being used outside the realm of the standard). The NERC Model Validation Task Force (MVTF) that was approved in December 2010 recommends standardizing data exchange formats.
d. **How to deal with new technology (require a user written model if no standard model exists)**

Presently, models for new technology are introduced in a non-uniform manner. Equipment manufacturers and other outside interests have internally created a proliferation of equipment models. These models thus lack sufficient input from the individuals who study reliability and operating characteristics of the power system. These models were inserted into production studies without vetting from recognized technical authorities such as IEEE. Many of these models are proprietary and distributed as “black box” object code modules for specific simulation programs.

The Task team recommends that the models for new technology need to include information comparable to existing models in common use. For dynamics, a block diagram is essential. Powerflow models need to include the equations describing the characteristics of the model. Ideally, the industry should collaboratively develop model structures which include those elements that are of importance in power system studies. Such an effort would enable consistent development of useful models while simultaneously protecting manufacturer interests regarding confidential trade secrets of implementation details that are not relevant to power system studies. Equipment should not be allowed to connect to the grid if the models lack the information needed for performing appropriate reliability and operating characteristics assessments. All responsible entities including TOs and GOs must be held accountable for providing the information needed to maintain power system reliability.

e. **Shareability (an issue tangential to the MOD standards)**

One of the problems identified in the Power System Model Validation report is that there are legal and procedural issues that inhibit the gathering and distribution of model data among stakeholders. The report cites FERC CEII (critical energy infrastructure information) requirements and proprietary issues that result in claims of the need for confidentially.

The report noted that in particular, Generator Owners of wind turbines are unable to provide unit specific data due to wind turbine manufacturer statements that the dynamics models of their equipment must be held confidential. This is particularly problematic in areas that are experiencing a surge in wind penetration.

One possible approach to addressing proprietary model issues is for the GO to work with the vendor to develop a generic model that can be shared across the interconnection. The standard should specify the simulations that must be performed by the vendor to demonstrate and certify that the generic model will accurately simulate the generator (or any other device in question) for system level studies. The GO must also arrange to give the proprietary model to the PC for its sole use, using an NDA, if necessary. Another approach is for NERC and/or FERC to hold a technical conference where wind turbine manufacturers will be asked to give explanations for keeping their models proprietary while NERC staff
and members of the SAMS describe why the detailed models are required. Subsequent to the technical conference NERC and FERC could consider subsequent steps that could result in a FERC NOI and/or NOPR on the subject.