Agenda Item 1 - Administrative

The meeting was called to order at 1:04 p.m. The following Model Development Working Group (MDWG) members were in attendance:

- Joe Fultz, Chair – Grand River Dam Authority
- Nate Morris, Vice Chair – Empire District Electric
- Scott Rainbolt – American Electric Power
- Nathan McNeil – Midwest Energy
- Reené Miranda – Southwestern Public Service
- Brian Wilson – Kansas City Power & Light
- Mike Clifton – Oklahoma Gas & Electric
- Derek Brown – Westar Energy
- Scott Schichtl – Arkansas Electric Cooperative
- Dustin Betz – Public Power District
- Jason Shook – GDS Associates

SPP Staff in attendance included Anthony Cook (Secretary), John Mills, Chris Haley, Mitch Jackson, Scott Jordan, and Billy Songer.

The following guests were also in attendance:
- Jason Bentz – American Electric Power
- Dona Parks – Grand River Dam Authority
- Mark Reinart – Golden Spread Electric Cooperative
- Gimod Olapurayil – ITC Great Plains
- David Sargent – Southwestern Power Administration
- John Shipman – Omaha Public Power District
- Liam Stringham – Sunflower Electric Power Corporation
- Peter Howard – Kansas City Power & Light
- Jerad Ethridge – Oklahoma Gas & Electric
- Alex Mucha – Oklahoma Municipal Power Authority
- John Payne – Kansas Electric Power Cooperative
- Peter Belkin – American Electric Power
- Dave Macey – City of Independence
- Perry Brown – American Electric Power
Meeting Agenda
The agenda was reviewed by the group. Scott Rainbolt asked to add a discussion topic for the Short Circuit models. The addition was made to Item 9. Scott Rainbolt motioned to approve the agenda with the edit; Derek Brown seconded the motion. The motion passed unopposed. (Attachment 1 - MDWG Meeting Agenda 20131111.doc)

Meeting Minutes
The July 26, 2013 and September 20, 2013 minutes were open for review. Nate Morris asked to add Kelsey Allen’s name to #71 under Review of Action Items. Mike Clifton motioned to approve the previous meeting minutes with edit; Brian Wilson seconded the motion. The motion passed unopposed. (Attachment 2 - MDWG Minutes 20130726.doc, Attachment 3 - Finalization of Dynamic Cases Email Vote 20130920.doc)

Review of Action Items
Anthony Cook reviewed the action items. He mentioned the items that had been completed were marked complete and would be removed for the next meeting. (Attachment 4 - SPP MDWG Action Items 20131111.xls)

Agenda Item 2 – 2014 Series:

Powerflow Update
Anthony Cook gave a status report of the 2014 Series MDWG powerflow model building effort. He stated that the 2013 Series MMWG models are not finalized due to issues trying to solve the models. He stated that the remaining MDWG models would be built using the latest trial of the MMWG models until they are finalized.

Dynamics Schedule
Scott Jordan discussed the proposed schedule for the 2014 Series build. Reené Miranda asked if items 94 and 95 could be made permanently into the powerflow models. Scott stated that these changes should be made in MOD by the members. He asked if the group thought that these two steps should be added into the powerflow schedule instead. Reené agreed that doing so would reduce time in the dynamics schedule. Scott will send out a request email to the MDWG members to review and make comments on the proposed schedule. (Attachment 5 - MDWG 2014 Series Schedule_Dynamics_REV1_10292013.pdf)

Action Item: Scott to send email requesting members to review and comment on proposed dynamic schedule.

Agenda Item 3 – Proposed NERC Standards:

MOD B (MOD-032, MOD-033)
Reené Miranda discussed the current MOD B effort. He stated that this is the second posting and that the ballot window and comment period closes November 20. He covered the changes of the requirements and attachments of the proposed MOD 32 and 33 standards.
**Agenda Item 4 – MDWG Pmax Presentation:**

Anthony Cook referred to the presentation that was posted for the meeting. He started the discussion rehashing data presented in previous MDWG meetings. Scott Jordan continued with the MOD standards both current and proposed. Anthony added the recommendations of the RTO and RE.

*(Attachment 6 - MDWG Pmax Presentation 2013.pptx)*

John Payne asked what happens with the aux load if the unit is turned off. Anthony answered that the load would need to be made zero. Derek Brown stated that modeling the Pmax based off of a test performed on one day isn’t fair if conditions are not just right for that season. Nathan McNeil asked for a size of the unit to be formally identified. Reené Miranda stated that all MOD standards are subject to the BES definition, meaning if the unit is not considered BES, than it would not fall under the requirement. Nate Morris expressed concerns keeping up with Aux load values and Pgen output. Scott Jordan discussed the use of automation programs for checks of Pgen levels versus Aux load values. Nate brought up Action Item #72 and asked Staff to work on this item.

John Mills stated that Staff will formally identify units that will be subject to the standard and send to the group for approval.

**Action Item:** Staff to formally identify units that will be subject to the Pmax modeling standard and send to group for approval.

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**Agenda Item 5 – Wind Generation Dispatch**

*Criteria 12.1.5.3.g – Renewable Resource Accreditation*

Nathan McNeil stated that Criteria 12.1.5.3.g does not allow for wind to be accurately represented in the off-peak models. He stated that the wind levels in the planning models are inconsistent with those in real time operations. He asked if all of the members are being consistent with the criteria. Scott Jordan mentioned that Chris Haley and himself are working on rewording Criteria 12.1. Nathan asked for a powerflow manual change to make the modeling of wind consistent by all members. He asked for Staff to discuss the Criteria and bring recommendations to the group for more discussion.

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**Agenda Item 6 – TPL-001-4:**

Anthony Cook discussed the gap analysis that SPP Staff had created. He stated that the main change for modeling is the inclusion of known outages spanning six months or longer. He also stated the NERC definition of year 1 and that currently the standard is being met, but more discussion may be needed if a request is made to change which models are studied. He stated that the most current gap analysis can be obtained in the background material for the November 18, 2013, TWG meeting.
Agenda Item 7 – Member Ratings Email List:

Reené Miranda discussed that FAC-08 requires coordination of ratings for ties. He stated that SPS has created an email distribution list specifically for ratings coordination. He asked if other companies have a specific distribution list, and if so, could the Modeling Contacts list be updated.

Action Item: Post updated contacts list and notify members.

Agenda Item 8 – LSE Involvement:

Communication between SPP/TO/LSE, Topology Changes, Profile Data (Generation, Load)

Anthony Cook discussed having all Load Serving Entities (LSE) begin participating in the annual model build. He stated that it is not cost effective to purchase MOD licenses for every LSE and therefore would need to rely on TOs to help submit data. Anthony stated that there is a concern of the TO to be responsible for compliance of the LSE data being modeled correctly. Anthony stated that a template has been made to make it easy on the LSE and host TO to get profile data updated. The LSE can fill out the data fields and resubmit to SPP and/or the host TO. The host TO can use formulas in the template to create a raw file for submission to MOD. This will reduce the concerns of human error. Anthony will contact each TO to establish an agreement for LSE data submission.

Action Item: Contact individual TOs and establish agreement for LSE data submission.

Agenda Item 9 – Other:

Short Circuit Model Discussion

Scott Rainbolt brought up the short circuit model discussion at the System Protection and Controls Working Group (SPCWG) meeting last week. He stated that it was stated in the meeting that most members are keeping a more detailed system in house than what is in the MDWG cases. He stated that the SPCWG discussed creating a taskforce to handle short circuit model improvements.

Peter Belkin stated the needs for short circuit versus the needs for powerflow models pertaining to the modeling horizon. He stated the need for short circuit models to be built more often than planning models. Peter talked about the difference with PSS/e and Aspen, using a tool that is built to deal with short circuit, and having the models built by people who focus on short circuit.

Anthony discussed how the MDWG short circuit models are built creating both PSS/e and Aspen user models. John Mills suggested having a joint meeting with the SPCWG to discuss the concerns with the short circuit models.

Action Item: Anthony to get with Doug Bowman to set up a joint meeting with the SPCWG.
Agenda Item 10 - Closing Administrative Duties:

Review of Action Items:
1. Scott to send email requesting members to review and comment on proposed dynamic schedule.
2. Staff to formally identify units that will be subject to the Pmax modeling standard and send to group for approval.
3. Post updated contacts list and notify members.
4. Contact individual TOs and establish agreement for LSE data submission.
5. Anthony to get with Doug Bowman to set up a joint meeting with the SPCWG.

Next Meetings Place and Date:
TBD

Next Meeting Topics:
TBD

Adjourn Meeting
Scott Rainbolt motioned to adjourn the meeting, Reené Miranda seconded the motion. With no further business to discuss, the MDWG adjourned at 5:17 p.m.

Respectfully submitted,
Anthony Cook
SPP Staff Secretary
Southwest Power Pool, Inc.
MODEL DEVELOPMENT WORKING GROUP MEETING
November 11, 2013
SPP Corporate Offices – Little Rock, AR

**ATTENDANCE LIST**

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<thead>
<tr>
<th>Name</th>
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<tbody>
<tr>
<td>Anthony Cook</td>
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<td>Mitch Jackson</td>
<td>SPP</td>
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<td>Dustin Bice</td>
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<td>Miller Clifton</td>
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<td>Joe Fultz</td>
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<td>EDE</td>
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<td>David Sargent</td>
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<td>John Payne</td>
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<td>Derek Brown</td>
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<td>Peter Belkin</td>
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<td>Scott Schichtl</td>
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Southwest Power Pool, Inc.
MODEL DEVELOPMENT WORKING GROUP MEETING
November 11, 2013
SPP Corporate Offices – Little Rock, AR

**ATTENDANCE LIST**

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<tr>
<th>Name</th>
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<tr>
<td>Scott Jordan</td>
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<td>Chris Haley</td>
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<td>John Mills</td>
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<tr>
<td>Billy Songer</td>
<td>SPP</td>
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11/12/13 Model Update Meeting

Sign up Sheet

1. Nate Morris
2. John Payne
3. Derek Brown
4. Dashi Betz
5. Mike Clifton
6. Jerad Ethridge
7. Dona Parks
8. Joe Fultz
9. Jason Bent
10. Scott Rainbolt
11. Brian Wilson
12. Peter Howard
13. David Sargent

14.
15.
16.
17.
18.
19.
20.
1. Administrative .............................................................................................................. Joe Fultz (15 min)
   a. Call to order
   b. Proxies
   c. Introductions
   d. Approve agenda
   e. Approve minutes of previous meetings
      i. July 26, 2013
      ii. September 20, 2013
   f. Review of Past Action Items (Anthony Cook)

2. 2014 Series ................................................................................................................... (20 min)
   a. Powerflow Update (Anthony Cook)
   b. Dynamics Schedule (Scott Jordan)

3. Proposed NERC Standards ................................................................................ Reené Miranda (45 min)
   a. MOD B (MOD-0 32, MOD-033)

4. MDWG Pmax Presentation ......................................................................................... All (1 hr)

5. Wind Generation Dispatch ...................................................................................... Nathan McNeil (15 min)
   a. Criteria 12.1.5.3.g – Renewable Resource Accreditation

6. TPL-001-4 ................................................................................................................ All (15 min)

7. Member Ratings Email List ..................................................................................... Reené Miranda (10 min)

8. LSE Involvement ....................................................................................................... All (20 min)
   a. Communication between SPP/TO/LSE
   b. Topology Changes
   c. Profile Data (Generation, Load)

9. Other ......................................................................................................................... (15 min)
   a. Short Circuit Model Discussion

10. Closing Administrative Duties ............................................................................... Joe Fultz (10 min)
    a. Review Action Items
    b. Next meeting place and date
    c. Next meeting topics
    d. Adjourn meeting
Southwest Power Pool
MODEL DEVELOPMENT WORKING GROUP
July 26, 2013
Conference Call
8:00 A.M. – 12:00 P.M.

• M I N U T E S •

Agenda Item 1 - Administrative

The meeting was called to order at 8:10 a.m. The following Model Development Working Group (MDWG) members were in attendance:

Joe Fultz, Chair – Grand River Dam Authority
Nate Morris, Vice Chair – Empire District Electric
Nathan McNeil – Midwest Energy
Reené Miranda – Southwestern Public Service
Brian Wilson – Kansas City Power & Light
John Boshears – City Utilities of Springfield
Mike Clifton – Oklahoma Gas & Electric
Derek Brown – Westar Energy
Dustin Betz - Public Power District
Jason Shook – GDS Associates

SPP Staff in attendance included:
Anthony Cook (Secretary), Chris Haley, Mitch Jackson, Scott Jordan, Billy Songer, Mike Hughes (RE), and James Bailey.

The following guests were also in attendance:
Jason Bentz (Proxy for Scott Rainbolt) – American Electric Power
Tim Smith – Western Farmers Electric Cooperative
John Shipman – Omaha Public Power District
Dave Macey – City of Independence
Daniel Benedict – City of Independence
Peter Howard - Kansas City Power & Light
James Okenfuss - Kansas City Power & Light

Meeting Agenda
The agenda was reviewed by the group. Jason Shook motioned to approve the agenda as presented; Derek Brown seconded the motion. The motion passed unopposed. (Attachment 1 - MDWG Meeting Agenda 20130726.doc)

Meeting Minutes
The May 16, 2013 minutes were open for review. Brian Wilson motioned to approve the previous meeting minutes; Jason Shook seconded the motion. The motion passed unopposed. (Attachment 2 - MDWG Minutes 20130516.doc)
Review of Action Items

Anthony Cook reviewed the action items. Most updates can be found in the notes column of the spreadsheet. (Attachment 3 - SPP MDWG Action Items 20130726.xls)

#71) Nate Morris stated that this task should be reassigned to another Staff since Kelsey Allen changed positions. Anthony Cook assigned it to himself.

Agenda Item 2 – 2014 Series MDWG Schedule:

The Modeling Staff sent the MDWG three options to choose from based on comments received since the May meeting. Nate Morris went over the main differences between the three options. The group leaned toward version 2.4. Reené Miranda asked for one week to be added to the Pass 5 member review period. He also asked if the ITP model building schedule could be added to the MDWG schedule so that members can plan for data/review requests. Joe Fultz called for a motion to be made. Nate Morris motioned to approve version 2.4 with the adjustments to add one week to the member review period thus shifting all remaining steps by one week in Pass 5. Reené seconded the motion. The motion passed unopposed.

Anthony stated that Staff would make the updates and send the schedule out to the group before posting. He also stated that Staff will work to include the ITP model building schedule into the MDWG model building schedule.

Action Item – Staff to include ITP model building schedule into the MDWG model building schedule.

Agenda Item 3 – Modeling Practice:

Pmax Standardization/Modeling

Anthony Cook, Chris Haley, and Scott Jordan explained the need for an SPP standard for modeling Pmax. They reviewed the power point presentation posted in the background material and discussed the direction of the proposed NERC standards. Reené stated that exceptions should be documented for units where information can’t be obtained. The group discussed the poll comments provided by the members. The group is not ready to make a decision at this time and tables the topic for future discussion.

Mothballed/Retired/Decommissioned Units

The group continued the discussion from the previous meeting to create a standard practice for modeling mothballed/retired/decommissioned units for the MDWG and ITP models. The group discussed that it would be best if it can be taken care of through MOD profiles and not projects. This would reduce the amount of unnecessary MOD projects. The current method of choice is to model the unit pmax as zero. This would prevent the unit from being dispatched. This discussion was tabled for future discussion.

Individual Units

The group continued the discussion from the previous meeting. Many of the members think that individual units should be modeled and not aggregated, but asked what the
size criterion is for a unit before it has to be model as an individual unit. This discussion was tabled for future discussion.

**Agenda Item 4 – EMS State Estimator Comparison:**

Derek Brown stated that Westar is working with SPP Ops to compare the SPP EMS models against Westar’s EMS models in an effort to validate the SPP models. He wanted everyone to know that SPP Ops is willing to work with the members to make sure member systems are up-to-date. Reené stated that the proposed MOD 33 standard will require this to be performed.

**Agenda Item 5 – Transformer Zero Sequence Data:**

Derek Brown wanted to inform the group that in PSS/E version 30-32 positive sequence transformer impedance data is entered based on a delta configuration where you can specify the impedance data in per unit (system base, winding kV), per unit (transformer base, winding kV), or real measured values pulled directly from the test report (load loss, no load loss, excitation current, etc.). However, the zero-sequence transformer impedance data is entered based on a star-equivalent configuration and can only be entered in per unit (system base, winding kV). For most people this means per unit on a 100 MVA base. In PSS/E version 33, you can specify to enter your zero sequence transformer impedance data on the transformer base or the system base.

**Agenda Item 6 – MDWG Charter Updates:**

Anthony discussed the proposed updates submitted by some of the members. He stated that he will update the Charter to include these updates and send to the members for review.

**Action Item** – Anthony to update Charter based on suggestions from members and send to group.

**Agenda Item 7 - Closing Administrative Duties:**

Review of Action Items:
1. Staff to include ITP model building schedule into the MDWG model building schedule.
2. Anthony to update Charter based on suggestions from members and send to group

*Next Meetings Place and Date:*
Face-to-Face November 11, 2013

*Next Meeting Topics:*
TBD

*Adjourn Meeting*
Reené Miranda motioned to adjourn the meeting, Nate Morris seconded the motion.
With no further business to discuss, the MDWG adjourned.
Respectfully submitted,
Anthony Cook
SPP Staff Secretary
The 2013 Series MDWG Dynamic Final Cases were posted for comments on August 19 & 21, 2013 requesting comments by August 30, 2013. Outstanding concerns were submitted by MDWG Members and addressed by SPP Staff. The 2013 Series MDWG Dynamic Final Cases were posted on September 6, 2013, and the MDWG motioned and seconded the posted dynamic cases. However, there was a minor situation with dyre information that needed to be addressed and voting was suspended due to this new information. SPP Staff revised the dynamic cases and re-posted the revised 2013 Series MDWG Dynamic Final Cases on September 12, 2013 and solicited for a motion and second to finalize the dynamic cases. Derek Brown made a motion on September 16, 2012 to finalize the 2013 Series MDWG Dynamic Cases Revision based on the September 12, 2012 posting. Dustin Betz seconded the motion on September 12, 2013. Joe Fultz asked the members in an e-mail on September 17, 2013 to cast their votes by September 20, 2013.

MDWG members submitted their votes by September 20, 2013. Scott Jordan sent an email to the group with the vote tally. There were 8 votes to approve and 4 MDWG Members that did not vote. The models were approved to be finalized and SPP staff sent an e-mail to the members to let them know the dynamic cases and supplemental data were posted.

Respectfully submitted,

Anthony Cook
SPP Staff Secretary
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<th>Action Item</th>
<th>Responsible Parties</th>
<th>Date Originated</th>
<th>Date Updated</th>
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<td>42</td>
<td>SPP Staff</td>
<td>3/1/2010</td>
<td>5/16/2013</td>
<td>In Progress</td>
<td>Further review with the new NERC MOD standards being developed.</td>
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<td>Scott to give update of TSTF discussion at May 8, 2012 meeting. Being discussed at the MMWG.</td>
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<td>Anthony Cook</td>
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<td>72</td>
<td>Staff</td>
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<td>Mon 12/13/13</td>
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<tr>
<td>103</td>
<td>1.12.3.5</td>
<td>MDWG/GENS RTG Check</td>
<td>4 days</td>
<td>Wed 3/4/14</td>
<td>Thu 3/6/14</td>
</tr>
<tr>
<td>103</td>
<td>1.12.3.6</td>
<td>COSL &amp; G&amp;I File Updates</td>
<td>4 days</td>
<td>Wed 3/4/14</td>
<td>Thu 3/6/14</td>
</tr>
<tr>
<td>103</td>
<td>1.12.3.7</td>
<td>Post Member Feedback for Dynamic Data &amp; Case Issues</td>
<td>1 day</td>
<td>Wed 3/4/14</td>
<td>Wed 3/5/14</td>
</tr>
<tr>
<td>103</td>
<td>1.12.3.8</td>
<td>Members Submit Data Updates</td>
<td>5 days</td>
<td>Wed 3/4/14</td>
<td>Wed 3/5/14</td>
</tr>
<tr>
<td>103</td>
<td>1.12.3.9</td>
<td>Member Data Due</td>
<td>1 day</td>
<td>Thu 3/6/14</td>
<td>Thu 3/6/14</td>
</tr>
<tr>
<td>103</td>
<td>1.12.3.10</td>
<td>Process SPP Member Updates</td>
<td>5 days</td>
<td>Fri 3/6/14</td>
<td>Fri 3/6/14</td>
</tr>
<tr>
<td>107</td>
<td>1.12.4</td>
<td>Dynamic Case Initialization</td>
<td>10 days</td>
<td>Fri 3/6/14</td>
<td>Thu 3/19/14</td>
</tr>
<tr>
<td>107</td>
<td>1.12.4.1</td>
<td>Duplicate &amp; Dyn File Corrections based on Initialization Messages</td>
<td>15 days</td>
<td>Fri 3/6/14</td>
<td>Thu 3/19/14</td>
</tr>
<tr>
<td>107</td>
<td>1.12.4.2</td>
<td>Build Initial Models</td>
<td>30 days</td>
<td>Fri 3/6/14</td>
<td>Thu 3/19/14</td>
</tr>
<tr>
<td>110</td>
<td>1.12.5</td>
<td>20 Second No Fault Test &amp; Case Adjustment</td>
<td>5 days</td>
<td>Fri 3/6/14</td>
<td>Thu 3/19/14</td>
</tr>
<tr>
<td>110</td>
<td>1.12.5.1</td>
<td>60 Second Ring Down Test &amp; Case Adjustment</td>
<td>5 days</td>
<td>Fri 3/6/14</td>
<td>Fri 3/6/14</td>
</tr>
<tr>
<td>110</td>
<td>1.12.5.2</td>
<td>NERC FBC Fault Test &amp; Case Adjustment</td>
<td>5 days</td>
<td>Fri 3/6/14</td>
<td>Fri 3/6/14</td>
</tr>
<tr>
<td>110</td>
<td>1.12.5.3</td>
<td>708 Dynamic Case Reduction</td>
<td>5 days</td>
<td>Fri 3/6/14</td>
<td>Fri 3/6/14</td>
</tr>
<tr>
<td>115</td>
<td>1.12.6</td>
<td>Dynamic Case Review and Finalization</td>
<td>31 days</td>
<td>Mon 6/16/14</td>
<td>Tue 7/29/14</td>
</tr>
<tr>
<td>115</td>
<td>1.12.6.1</td>
<td>Post Initial Models</td>
<td>10 days</td>
<td>Mon 6/16/14</td>
<td>Mon 7/14/14</td>
</tr>
<tr>
<td>115</td>
<td>1.12.6.2</td>
<td>Member Review of Initial Models</td>
<td>10 days</td>
<td>Mon 6/16/14</td>
<td>Mon 7/14/14</td>
</tr>
<tr>
<td>115</td>
<td>1.12.6.3</td>
<td>Member Data Due</td>
<td>5 days</td>
<td>Tue 6/16/14</td>
<td>Mon 7/14/14</td>
</tr>
<tr>
<td>115</td>
<td>1.12.6.4</td>
<td>Final Data Update - Build Initial Models</td>
<td>5 days</td>
<td>Tue 7/14/14</td>
<td>Mon 7/14/14</td>
</tr>
<tr>
<td>115</td>
<td>1.12.6.5</td>
<td>Final Data Update - Initial Models</td>
<td>1 day</td>
<td>Tue 7/14/14</td>
<td>Tue 7/14/14</td>
</tr>
<tr>
<td>115</td>
<td>1.12.6.6</td>
<td>Member Review for Finalization of Dynamic Models and MDWG Vote</td>
<td>1 day</td>
<td>Tue 7/14/14</td>
<td>Tue 7/14/14</td>
</tr>
</tbody>
</table>
Helping our members work together to keep the lights on... today and in the future
Generation Modeling

SPP MDWG Meeting
November 11, 2013

Anthony Cook and Scott Jordan
acook@spp.org · 501.688.1670
sjordan@spp.org · 501.614.3985
# Table of Contents

- MITF Uniform Generation Modeling
- Generation Reporting Differences
- Existing Modeling Standards - MOD-010-00 & MOD-012-00
- NERC MOD “B” Initiative
  - Project Objective
  - Reason for the Paradigm Shift
  - MOD-032-01
  - MOD-033-01
- NERC MOD-025-02
- SPP RTO and SPP RE Agreement
- Staff Recommendation
- SPP Recommended MDWG Manual Changes
A. Uniform Generation Modeling

Issue: No uniform requirements exist to model generation.
- Seasonal maximum and minimum capabilities and forecasted capabilities are often not accounted for.
- Some members model station service or auxiliary load and others do not.
- Municipal Generation listed in EIA reports is often netted with load.

Solution:
- Any distributive or otherwise generation registered with the SPP market shall be represented appropriately in the base model set such that generation is not netted with customer load.
- Net capability of units as listed in data reporting vehicles, such as EIA reports or SPP NITS applications, should be reflected in the base model set.
- Generator auxiliary load should be included in net capability of units. If an individual member company prefers to model gross generator capability, reports shall be provided detailing the bus number and ID for auxiliary load associated with each generator or plant.
- Ownership assignments shall be modeled with each machine.

Benefit: More effort spent to accurately model generator data will help to improve efficiency and accuracy of study processes and results.
Generation Reporting Differences

Method 1: Based on MITF Solution

- $P_{\text{max}}$ is Gross Maximum Seasonal Capability
- Station (Aux) Load is modeled explicitly
- $P_{\text{max}} - \text{Aux Load} = \text{Net Capability}$

Method 2: Based on MITF Solution

- $P_{\text{max}}$ is Net Maximum Seasonal Capability
- Station (Aux) Load is not modeled
- $P_{\text{max}} = \text{Net Capability}$
# Generation Reporting Differences

## 2013 Series MDWG: 2013 Summer

<table>
<thead>
<tr>
<th>Pmax (Coal)</th>
<th>364 MW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pgen</td>
<td>333 MW</td>
</tr>
<tr>
<td>Aux Load</td>
<td>N/A</td>
</tr>
</tbody>
</table>

**Model Assumption 1:** Pmax is Net

## 2011 EIA 860

<table>
<thead>
<tr>
<th>Name Plate</th>
<th>419 MW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summer Capability</td>
<td>364 MW</td>
</tr>
</tbody>
</table>

**Note:** Pmax = Summer Capability

**New Assumption 1:** Pmax is Net
#### Generation Reporting Differences

<table>
<thead>
<tr>
<th></th>
<th>2013 Series MDWG: 2013 Summer</th>
<th>2011 EIA 860</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pmax (Coal)</td>
<td>108.4 MW</td>
<td>Name Plate</td>
</tr>
<tr>
<td>Pgen</td>
<td>108.1 MW</td>
<td>109.8 MW</td>
</tr>
<tr>
<td>Aux Load</td>
<td>8.4 MW</td>
<td>Summer Capability</td>
</tr>
<tr>
<td></td>
<td></td>
<td>100 MW</td>
</tr>
</tbody>
</table>

**Model Assumption 1:** Pmax is Gross

**Model Assumption 2:** Pmax – Aux Load = 100 MW

**Note:** Pmax – Aux Load = Summer Capability
## Generation Reporting Differences

### 2013 Series MDWG: 2013 Summer

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pmax (Gas – CT1)</td>
<td>165 MW</td>
</tr>
<tr>
<td>Pgen</td>
<td>125 MW</td>
</tr>
<tr>
<td>Aux Load</td>
<td>N/A</td>
</tr>
</tbody>
</table>

**Model Assumption 1: Pmax is Net**

**GADS:** Pmax = 209, Dependable = 202

### 2011 EIA 860

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name Plate</td>
<td>206 MW</td>
</tr>
<tr>
<td>Summer Capability</td>
<td>191.8 MW</td>
</tr>
</tbody>
</table>

**Warning:** Pmax < Summer Capability

**Issue:** What is Pmax?

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pmax (Gas – CT2)</td>
<td>165 MW</td>
</tr>
<tr>
<td>Pgen</td>
<td>125 MW</td>
</tr>
<tr>
<td>Aux Load</td>
<td>N/A</td>
</tr>
</tbody>
</table>

**Model Assumption 1: Pmax is Net**

**GADS:** Pmax = 197, Dependable = 168

**Warning:** Pmax < Summer Capability

**Issue:** What is Pmax?
## Generation Reporting Differences

<table>
<thead>
<tr>
<th>2013 Series MDWG: 2013 Summer</th>
<th>2011 EIA 860</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pmax (Gas-Steam)</strong></td>
<td><strong>Name Plate</strong></td>
</tr>
<tr>
<td>265 MW</td>
<td>265 MW</td>
</tr>
<tr>
<td><strong>Pgen</strong></td>
<td><strong>Summer Capability</strong></td>
</tr>
<tr>
<td>175 MW</td>
<td>248 MW</td>
</tr>
<tr>
<td><strong>Aux Load</strong></td>
<td></td>
</tr>
<tr>
<td>N/A</td>
<td></td>
</tr>
</tbody>
</table>

**Model Assumption 1:** Pmax is Net

**GADS:** Pmax = 251

**Issue 1:** Pmax ≠ Summer Capability

**New Assumption 1:** Pmax is Gross

**New Assumption 2:** Aux Load = 17 MW
# Generation Reporting Differences

## 2013 Series MDWG: 2013 Summer

<table>
<thead>
<tr>
<th>Pmax (Coal)</th>
<th>540 MW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pgen</td>
<td>515 MW</td>
</tr>
<tr>
<td>Aux Load</td>
<td>N/A</td>
</tr>
</tbody>
</table>

**Model Assumption 1:** Pmax is Net

## 2011 EIA 860

<table>
<thead>
<tr>
<th>Name Plate</th>
<th>569 MW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summer Capacity</td>
<td>515 MW</td>
</tr>
</tbody>
</table>

**Issue 1:** Pmax ≠ Summer Capacity

**New Assumption 1:** Pmax is Gross

**New Assumption 2:** Aux Load = 25 MW

<table>
<thead>
<tr>
<th>Pmax (Coal)</th>
<th>540 MW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pgen</td>
<td>500 MW</td>
</tr>
<tr>
<td>Aux Load</td>
<td>N/A</td>
</tr>
</tbody>
</table>

**Assumption 1:** Pmax is Net

<table>
<thead>
<tr>
<th>Name Plate</th>
<th>569 MW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summer Capacity</td>
<td>523 MW</td>
</tr>
</tbody>
</table>

**New Assumption 1:** Pmax is Gross

**New Assumption 2:** Aux Load = 17 MW
Existing Modeling Standards

NERC MOD-10-00 and MOD-012-00 Current Requirements

• Both Standards are similar in nature.
• Apply to the Transmission Owners, Transmission Planners, Generator Owners, and Resource Planners.
• Ambiguous modeling requirements - really none at all.
• Report modeling and simulation data to the respective RRO
  – Interconnection Regional – SPP MDWG (Model Development Working Group) Models
  – Eastern Interconnect - ERAG (Eastern Reliability Working Group) MMWG (Multiregional Modeling Working Group)
NERC MOD-B Initiative

Project Objectives

• Reduce the Quantity of MOD Standards but....
  – Add specific data requirements
  – Address the need for Short Circuit data

• Reduce Ambiguity of Data Submission
  – Identify responsibility to provide and receive data (who provides what data to whom)
  – Provision for acceptability of data
  – Require specification and use of standard format
  – Consider how to deal with new technology
  – Share-ability of Data
NERC MOD-B Initiative

Reason for Paradigm Shift

• August 14, 2003 Blackout Recommendations
  – Establish requirements for collection and reporting of data needed for post-blackout analyses.
  – Improve quality of system modeling data and data exchange practices.
  – NERC should re-evaluate its existing reliability standards development process and accelerate the adoption of enforceable standards.

• FERC Order 890
  – “incorporate periodic review and modification of models, with certain criteria”

• FERC Order 693
  – “require models be validated against actual system responses”
  – “actual system events be simulated and if model output is not within the accuracy required, the model shall be modified to achieve the necessary accuracy”
NERC MOD-B Initiative

Reason for Paradigm Shift

• NERC “Standards Independent Experts review Project
  – Risks to BPS (Bulk Power System)
    • Review of the Construct of the NERC Reliability Standards
      – Retirements
      – Improvements
      – Address Gaps
    • Governor Frequency Response
    • Verification of Accuracy of Planning Models
    • Short Circuit/Fault Duty Models

• White Papers
  – NERC MWG (Model Working Group) & SAMS (Systems Analysis and Modeling Subcommittee)
    • Validation of EMS and Planning Models
    • Standardization of functional requirements for power flow and dynamics programs, including data exchange formats
    • The NERC MOD standards on power flow and dynamics data (MOD-010 through MOD-015) should be improved and strengthened.
NERC MOD-B Initiative

Proposed NERC Standard MOD-032-01

- Specific Data Requirements
  - Steady-State Power Flow
    - Bus, Load, Generation, AC and DC Transmission, Transformers, Reactive Compensation, and Static VAR Systems
  - Dynamics
    - Synchronous Machines, Other Technologies, Excitation, Governor, Power System Stabilizer, Composite Load Models, Wind Turbines Data, Photovoltaic, Static VAR Compensators/FACTS Devices, and DC System Models
  - Short Circuit
    - Positive, Negative, and Zero Sequence Data, and Mutual Line Impedance Data

- Planning Coordinator established as Entity for data collection and assembling the power flow, dynamic, and short circuit cases
  - Listed in a detailed table in “Attachment 1”
# NERC MOD-B Initiative

## Proposed NERC Standard MOD-032-01

Excerpt from Attachment 1

<table>
<thead>
<tr>
<th>steady-state</th>
<th>dynamics</th>
<th>short-circuit</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>(Items marked with an asterisk indicate data that vary with system operating state or conditions. Those items may have different data provided for different modeling scenarios)</em></td>
<td><strong>1. Generator [GO]</strong>&lt;br&gt; a. Synchronous machines, including, as appropriate to the model:&lt;br&gt; i. inertia constant&lt;br&gt; ii. damping coefficient&lt;br&gt; iii. saturation parameters&lt;br&gt; iv. direct and quadrature axes reactances and time constants</td>
<td><strong>1. Positive Sequence Data</strong> – provide for all applicable elements in column “steady-state” [GO, TO]</td>
</tr>
<tr>
<td>1. Each Bus [TO]&lt;br&gt; a. nominal voltage&lt;br&gt; b. area, zone and owner</td>
<td><strong>1. Generator [GO]</strong>&lt;br&gt; a. Synchronous machines, including, as appropriate to the model:&lt;br&gt; i. inertia constant&lt;br&gt; ii. damping coefficient&lt;br&gt; iii. saturation parameters&lt;br&gt; iv. direct and quadrature axes reactances and time constants</td>
<td><strong>1. Negative Sequence Data</strong> – provide for all applicable elements in column “steady-state” [GO, TO]</td>
</tr>
<tr>
<td>2. Aggregate Demand at each bus [LSE]&lt;br&gt; a. real and reactive power*&lt;br&gt; b. in-service status*&lt;br&gt; c. load type (e.g., firm, interruptible, scalable, etc.)</td>
<td><strong>1. Generator [GO]</strong>&lt;br&gt; a. Synchronous machines, including, as appropriate to the model:&lt;br&gt; i. inertia constant&lt;br&gt; ii. damping coefficient&lt;br&gt; iii. saturation parameters&lt;br&gt; iv. direct and quadrature axes reactances and time constants</td>
<td><strong>1. Zero Sequence Data</strong> – provide for all applicable elements in column “steady-state” [GO,TO]</td>
</tr>
<tr>
<td>3. Generating Units* [GO, RP (for future planned resources only)]&lt;br&gt; a. real power capabilities - gross and minimum values&lt;br&gt; b. reactive power capabilities - maximum and minimum values at real power capabilities in 3a above&lt;br&gt; c. station service auxiliary load (provide data in the same manner as that required for aggregate Demand under item 2, above).&lt;br&gt; d. regulated bus*&lt;br&gt; e. voltage set point* (as provided to the GO by the TOP)&lt;br&gt; f. owner(s) information (including percentage of ownership if jointly owned)&lt;br&gt; g. machine MVA base</td>
<td><strong>1. Generator [GO]</strong>&lt;br&gt; a. Synchronous machines, including, as appropriate to the model:&lt;br&gt; i. inertia constant&lt;br&gt; ii. damping coefficient&lt;br&gt; iii. saturation parameters&lt;br&gt; iv. direct and quadrature axes reactances and time constants</td>
<td><strong>1. Mutual Line Impedance Data</strong> [TO]</td>
</tr>
<tr>
<td><strong>1. Generator [GO]</strong>&lt;br&gt; a. Synchronous machines, including, as appropriate to the model:&lt;br&gt; i. inertia constant&lt;br&gt; ii. damping coefficient&lt;br&gt; iii. saturation parameters&lt;br&gt; iv. direct and quadrature axes reactances and time constants</td>
<td><strong>1. Generator [GO]</strong>&lt;br&gt; a. Synchronous machines, including, as appropriate to the model:&lt;br&gt; i. inertia constant&lt;br&gt; ii. damping coefficient&lt;br&gt; iii. saturation parameters&lt;br&gt; iv. direct and quadrature axes reactances and time constants</td>
<td><strong>1. Positive Sequence Data</strong> – provide for all applicable elements in column “steady-state” [GO, TO]</td>
</tr>
<tr>
<td><strong>1. Generator [GO]</strong>&lt;br&gt; a. Synchronous machines, including, as appropriate to the model:&lt;br&gt; i. inertia constant&lt;br&gt; ii. damping coefficient&lt;br&gt; iii. saturation parameters&lt;br&gt; iv. direct and quadrature axes reactances and time constants</td>
<td><strong>1. Generator [GO]</strong>&lt;br&gt; a. Synchronous machines, including, as appropriate to the model:&lt;br&gt; i. inertia constant&lt;br&gt; ii. damping coefficient&lt;br&gt; iii. saturation parameters&lt;br&gt; iv. direct and quadrature axes reactances and time constants</td>
<td><strong>1. Negative Sequence Data</strong> – provide for all applicable elements in column “steady-state” [GO, TO]</td>
</tr>
<tr>
<td><strong>1. Generator [GO]</strong>&lt;br&gt; a. Synchronous machines, including, as appropriate to the model:&lt;br&gt; i. inertia constant&lt;br&gt; ii. damping coefficient&lt;br&gt; iii. saturation parameters&lt;br&gt; iv. direct and quadrature axes reactances and time constants</td>
<td><strong>1. Generator [GO]</strong>&lt;br&gt; a. Synchronous machines, including, as appropriate to the model:&lt;br&gt; i. inertia constant&lt;br&gt; ii. damping coefficient&lt;br&gt; iii. saturation parameters&lt;br&gt; iv. direct and quadrature axes reactances and time constants</td>
<td><strong>1. Zero Sequence Data</strong> – provide for all applicable elements in column “steady-state” [GO,TO]</td>
</tr>
<tr>
<td><strong>1. Generator [GO]</strong>&lt;br&gt; a. Synchronous machines, including, as appropriate to the model:&lt;br&gt; i. inertia constant&lt;br&gt; ii. damping coefficient&lt;br&gt; iii. saturation parameters&lt;br&gt; iv. direct and quadrature axes reactances and time constants</td>
<td><strong>1. Generator [GO]</strong>&lt;br&gt; a. Synchronous machines, including, as appropriate to the model:&lt;br&gt; i. inertia constant&lt;br&gt; ii. damping coefficient&lt;br&gt; iii. saturation parameters&lt;br&gt; iv. direct and quadrature axes reactances and time constants</td>
<td><strong>1. Mutual Line Impedance Data</strong> [TO]</td>
</tr>
</tbody>
</table>
NERC MOD-B Initiative

Proposed NERC Standard MOD-032-01

• Data Reporting Requirements
  – Consistency of Data being Reported
  – Additional Reporting Requirements
    • Station Service Auxiliary Load
    • Dynamic Load Modeling
  – Establishes obligation of BAs, GOs, LSEs, RPs, TOs, TPs, TSPs, and PCs
  – Confirmation of No-Change to data
  – Establishes methodology to vet questionable data
  – Sets expectation of how the PC will report this data
NERC MOD-B Initiative

Proposed NERC Standard MOD-033-01

• Steady-State and Dynamic System Model Validation
  – Requires each PC implement a documented process to validate the data from MOD-032-01 from actual system response
    • Establishes timeframe for validation
  – Data Reporting Requirements
    • Establishes obligation of RCs and TOs to provide actual real time system data to the PC
  – The task of EMS/Real-time situations to Planning Validation has a lot of complications
    • Data Format
    • Time Stamp Issues
    • Sampling Rates
    • Topology Differences
NERC MOD-B Initiative

Proposed NERC Standard MOD-032-01 & MOD-033-01

• Approval Status
  – Did not pass the first industry balloting
  – Has come back out for Comments
NERC MOD-025-02

Proposed NERC Standard MOD-025-02

- Combined MOD-024-01 & MOD-025-01 into one concise Standard to cover Real and Reactive Capability Testing

- Applicable Entities
  - GOs
  - TOs owning synchronous condensers

- Impacted facilities connected to BES (Bulk Electric System)
  - Individual units greater than 20 MVA (gross nameplate rating)
  - Synchronous Condensers greater than 20MVA (gross nameplate rating)
  - Generating plant/facilities greater than 75MVA (gross aggregate nameplate rating)
NERC MOD-025-02

Proposed NERC Standard MOD-025-02

- Capability Testing requirements for Real and Reactive Power
  - “Attachment 1” outlines the periodicity for conducting a new verification
  - “Attachment 2” outlines what testing has been performed along with the data to be reported functional diagram of the plant
  - Add specificity and uniformity of the testing data

- Approval Status
  - Adopted by NERC Board of Trustees on February 7, 2013
  - The Standard has been filed with FERC for its’ approval
Simplified one-line diagram showing plant auxiliary Load connections and verification data:

- **Point of interconnection**
- **Generator Step Up**
- **Auxiliary or Station Service Transformer(s)**
- **Unit Auxiliary Transformer(s)**
- **Generator(s)**
- **Aux bus**

* Positive numbers indicate power flow in direction of arrow; negative numbers indicate power flow in opposite direction of arrow.
### Excerpt from Attachment 2

<table>
<thead>
<tr>
<th>Point</th>
<th>Voltage</th>
<th>Real Power</th>
<th>Reactive Power</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>kV</td>
<td>MW</td>
<td>Mvar</td>
<td>Sum multiple generators that are verified together or are part of the same unit. Report individual unit values separately whenever the verification measurements were taken at the individual unit. Individual values are required for units or synchronous condensers &gt; 20 MVA.</td>
</tr>
<tr>
<td>B</td>
<td>kV</td>
<td>MW</td>
<td>Mvar</td>
<td>Sum multiple unit auxiliary transformers.</td>
</tr>
<tr>
<td>C</td>
<td>kV</td>
<td>MW</td>
<td>Mvar</td>
<td>Sum multiple tertiary Loads, if any.</td>
</tr>
<tr>
<td>D</td>
<td>kV</td>
<td>MW</td>
<td>Mvar</td>
<td>Sum multiple auxiliary and station service transformers.</td>
</tr>
<tr>
<td>E</td>
<td>kV</td>
<td>MW</td>
<td>Mvar</td>
<td>If multiple points of Interconnection, describe these for accurate modeling; report points individually (sum multiple auxiliary transformers).</td>
</tr>
<tr>
<td>F</td>
<td>kV</td>
<td>MW</td>
<td>Mvar</td>
<td>Net unit capability</td>
</tr>
</tbody>
</table>

Identify calculated values, if any:
### Verification Data

Provide data by unit or Facility, as appropriate

<table>
<thead>
<tr>
<th>Data Type</th>
<th>Data Recorded</th>
<th>Last Verification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gross Reactive Power Capability (*Mvar)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aux Reactive Power (*Mvar)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Net Reactive Power Capability (*Mvar) equals Gross Reactive Power Capability (*Mvar) minus Aux Reactive Power connected at the same bus (*Mvar) minus tertiary Reactive Power connected at the same bus(*Mvar)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gross Real Power Capability (*MW)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aux Real Power (*MW)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Net Real Power Capability (*MW) equals Gross Real Power Capability (*MW) minus Aux Real Power connected at the same bus (*MW) minus tertiary Real Power connected at the same bus(*MW)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>* Note: Enter values at the end of the verification period.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GSU losses (only required if verification measurements are taken on the high side of the GSU - Mvar)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
SPP RTO and SPP RE Agreement

- SPP Regional Transmission Organization and SPP Regional Entity have discussed this modeling issue and are in agreement with the SPP recommendation.
- SPP RTO and RE agree modeling improvements per the NERC should be incorporated sooner rather than later.
  - Reasons to change modeling methodology from MITF
    - MOD-32-01 requires station service auxiliary load to be modeled
    - MOD-25-02 requires testing of complete system to determine both gross and net real and reactive power as shown per Attachment 2
Staff Recommends the MDWG adopt Gross modeling Method 1 and shall be based on unit test data in accordance with MOD-25-02

- $P_{\text{max}}$ is Gross Maximum Seasonal Capability
- Station (Aux) Load is modeled explicitly
- $P_{\text{max}} - \text{Aux Load} = \text{Net Capability}$

Staff Recommends $Q_{\text{max}}$ and $Q_{\text{min}}$ values in the models shall match this methodology and shall be based on unit test data in accordance with MOD-25-02

Staff Recommends $P_{\text{min}}$ shall match this methodology and shall be based on unit test data in accordance with MOD-25-02
SPP Recommended MDWG Manual Changes

Section 3 – Power Flow Model Development (page 8)

Generators should model the net output of the generating facility while taking auxiliary load into account. The net generator output is usually to be modeled with an explicit auxiliary load (fans, motors, etc.) at the generator bus and the generator PMAX & PGEN set to a gross output level. — OR — the generator PMAX & PGEN is simply set to the net power output (i.e., gross output — motor load — fan load, etc.) with the auxiliary load already accounted for.
Section 3 – Power Flow Model Development (page 10)

6. Generator Data

Check Generator MW and Mvar output to ensure the unit is within the PMAX, PMIN, QMAX, QMIN and Mbase limits and that the output of the generator accounts for auxiliary load. Generator MW should be set to “gross” level if with auxiliary load modeled explicitly. – OR – “net” level if auxiliary loads are not modeled. Qmax and Qmin values in the models shall be based on unit test data.
Section 13 – MDWG Appendices for Reference

15. Generator MW Limits – The generation capability limits specified for generators (PMIN and PMAX) should represent realistic seasonal unit output capability for the generator in that given base case. PMAX should always be greater than or equal to PMIN. Net-Gross maximum and minimum unit output capabilities shall be used unless requiring the generator terminal bus is to be explicitly modeled, the generator step up transformer is modeled as a branch, and unit load modeled at the bus or buses from which it is supplied.
Section 13 – MDWG Appendices for Reference

16. Generator MVAR Limits – The MVAR limits specified for generators (QMIN and QMAX) should represent realistic net-seasonal unit output capability of the generator modeled. QMAX should always be greater than or equal to QMIN. Net-Gross maximum and minimum unit output capabilities should be given unless requiring the generator terminal bus is to be explicitly modeled, the generator step up transformer is modeled as a branch, and unit load is modeled at the bus or buses from which it is supplied.