Draft IEEE P2800 Working Group Meeting Minutes, 4/06/20 – 4/09/20

IEEE P2800 Standard for Interconnection and Interoperability of Inverter-Based Resources Interconnecting with Associated Transmission Electric Power Systems

Chair: Jens Boemer
Vice Chairs: Mahesh Morjaria, Bob Cummings, Babak Enayati, Ross Guttromson, Chenhui Niu and Manish Patel
Secretary and Treasurer: Diwakar Tewari

Attendees

Please refer to the attachment with attendance report from iMAT.

Administrative Items

The meeting was called to order at approximately noon Eastern on April 6, 2020. Chair reviewed administrative items. This meeting was the eighth meeting of the IEEE P2800 Working Group. The meeting was held virtually due to COVID-19 concerns. Each of the SubGroups' Draft 2 content was discussed in detail and feedback was provided by the meeting participants.

The meeting slides and the revisions were uploaded after the meeting to iMeetCentral link as Draft 2.1.

Refer to Draft 2.1 for edits, pertinent notes, and key takeaways for each section based on the WG feedback. Link

Quorum was achieved early on during the first session. Meeting minutes from the February virtual WG meeting were approved. The meeting agenda was distributed prior to the meeting. The agenda was reviewed, and no objections were made to the agenda.

A member asked whether attendance is logged only via iMAT or also via iMeet. Chair clarified that from now on, only iMAT is used.

Chair Jens asked Malia Zaman from IEEE to present IEEE SA's 'Dominance Policy' slides. One OEM expressed concerns that there will always be more TEPS Owners in the WG and the ballot pool than OEM representatives due to the large number of TEPS. Malia clarified that WG members and balloters should vote as 'individual' SMEs and not 'by directive' of their employer. She further explained that IEEE can extend the ballot for a week if not enough representation of a certain stakeholder group. Any SA member can vote (not limited to WG members). No one stakeholder group is allowed to represent more than one-third of the votes. IEEE will not exclude any voting members to achieve balance.

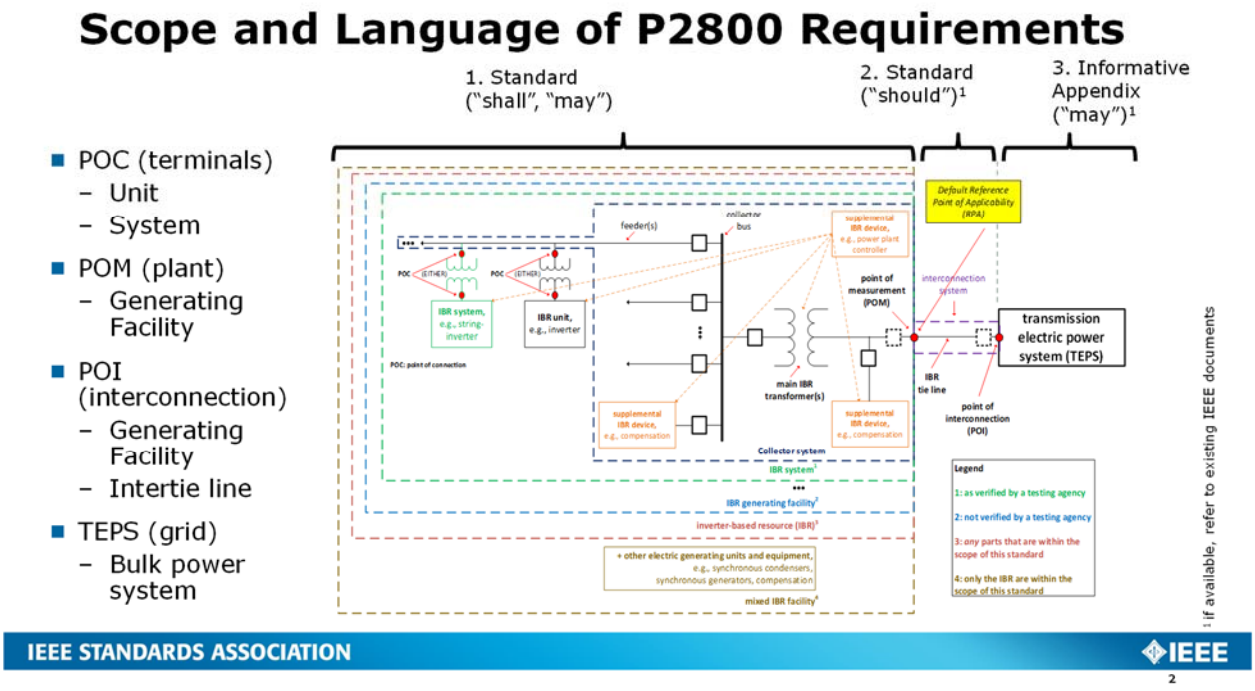
Jens took an action item to research this topic further and report back to the WG.

Additional Information based on further research:
IEEE has over 33 categories to ensure we have balance. Invitation can be extended to include more representation and the SA Program Manager is available to assist with that. Refer to 5.2.2.3 (Standards

Association balloting group) and 5.4.1 (Balloting group) of the IEEE SA Standards Board Bylaws: https://standards.ieee.org/about/policies/bylaws/sect5.html#5.2.2.3 [standards.ieee.org]

Summary of Sub-Group Level Discussion on Draft 2.0

SubGroup I (Overall Document) work includes Front Matter and Clauses 1 through 3 and was reviewed. It was clarified that although P2800 does not specify any explicit of requirements for HVDC, the P2800 requirements can be applied to HVDC-VSC connected resources, e.g., the onshore connection point of a HVDC-VSC tie line interconnecting an offshore resource. In that context a new WG Observer, Ewgenij (Eugen) Starschich of HVDC – VSC- Siemens Energy in Germany was welcomed; he is also involved in related CIGRE working groups. The updated Figure 1 was presented (see below and the post-meeting slide deck) along with a discussion of the anticipated scope and language used in P2800 for certain parts shown in the figure. The latest P2800 definitions are available on iMeet at https://ieee-sa.imeetcentral.com/p/aQAAAAAEA4tv.



What followed was a preliminary discussion of the important topic of test and verification requirements in P2800. While it was acknowledged that the IEEE 1547-2018 test and verification requirements may not be transferred to P2800 without modifications, that framework could be a starting point for the discussions. P2800 shall only specify capability and performance requirements that can actually be tested or verified otherwise. The test/verification method could vary depending on where a specific requirement would apply (POM, PoC, or POI) and whether it relates to small-signal or large-signal

disturbances; there may be multiple alternate means of verification. IBR unit type tests play a major role in the new IEEE 1547.x series of standards and, for information only, the following requirements for DER type tests have been reviewed:

IEEE 1547-2018 states: "The tests shall be performed on a representative DER unit or DER system, either in the factory, at a testing laboratory, or on equipment in the field."

IEEE 1547.1-2020 states: "*Type tests* are performed or overseen by a *testing agency* on one or more representative unit(s) and may be conducted in the factory, at a testing laboratory, or on equipment in the field."

SubGroup II (General Requirements) work includes Clause 4 and was reviewed. The Draft 2.0 language for Clause 4.2 (Reference points of applicability (RPA)) was reviewed and it was discussed whether the default RPA should be moved from the POM (IBR generating facility) to the POI (TEPS) in a future P2800 draft; in between could be a short or a long IBR tie line. This is a complicated and very contentious topic as it requires consideration of technical, design, organizational, and possibly some policy criteria. A challenging complication could be IBRs with multiple owners or that are developed in multiple phases. SubGroups I and II were tasked to host dedicated calls to continue this discussion and possibly define criteria for when the RPA be moved from the POM to the POI or vice versa.

What followed was a brief discussion of Table 1 (Minimum measurement and calculation accuracy requirements for IBR facilities, units, and supplementary devices) and it was suggested that the columns for "steady state" and "transient" measurements could be further clarified with the applicable purpose, e.g., "for controls" versus "for protection". One WG member suggested to add measurement accuracy requirements for electric current.

Clause 4.5 (Cease to energize performance requirement) was agreed to be non-applicable to P2800 and shall be struck in a future draft. Requirements in Clause 4.6 (Control capability requirements) shall be adequately coordinated with SubGroup X (Measurement and Modeling).

SubGroup III (Active Power – Frequency Control): The potential issue of V/Hz capability of transformers within the IBR in reference to the frequency ride-through capability requirements (Fig. 5) was discussed. Based on feedback from the WG, the SG will consider whether there are realistic scenarios in which frequency would be decreasing and voltage would be increasing. The SG will also continue to coordinate with the Electric Machinery Committee on this topic.

SubGroup IV (Reactive Power – Voltage Control): The changes to the voltage response requirement (Subclause 5.2.2 Table 3) based on feedback from the previous WG meeting was reviewed. In general, the WG tends to agree with the updated requirement. The SG will develop a diagram to illustrate the requirement as there was some confusion regarding the reaction time definition.

SubGroup V (Low Short-Circuit Power): Annex C, Inverter Stability and System Strength was reviewed. It was noted that the location within the plant for SCR calculations should be specified, as should the fault condition (e.g. min/max fault currents). A comment was made that Figure C.1 is generic in nature,

intended to present a class of controllers, not an instance of one. Suggestions were made to improve the diagrams, including the location of transformers, the names of subcomponents, etc. Regarding SCR, a comment was made that the draft should include more information regarding how SCR might change under changing system topologies. A reminder was made to ensure the team properly manages copyright issues for information in the draft that was adopted from other sources. Significant discussion was held regarding the many and various nuances of SCR calculations. It was mentioned multiple times that SCR is used as a screening tool to determine whether an EMT study needs to be conducted. However, no definite rules exist to make such a decision for an arbitrary system, rather SCR acts more as a measure of risk of instability if an EMT analysis is not conducted. In the area of control instability, it was suggested to describe ways to dampen out oscillations, including controller tuning. Figure C.6 needs more explanation along with some discussion regarding how the instability could be mitigated. A request was made to differentiate between the events in Figures C.5 and C.6. It was requested to break out section C3.2 into several paragraphs and edit it for improvements. Discussion on dynamic tuning of IBRs to manage variations in topology, days, or seasons could be helpful. More discussion on how to approach SSCI problems and mitigations would be useful. SSTI should not be associated with HVDC only.

SubGroup VI (Power Quality): Section 8, Power Quality was reviewed. The group was reminded that the entire Power Quality specification applies to steady state operation only, not transient or short-term operation. Minor discussion occurred on flicker, but no objection to specific requirements were presented. It was mentioned that existing flicker standards take the form of a recommended practice, not a requirement, although future specifications will be as requirements. The IEEE 519 working group has advised P2800 to take up the question of harmonic limits for IBR noting that IBRs were not considered in the creation of those limits. The harmonic limits shown in P2800 originated from 519 but have been revised to consider their application to IBR. The P2800 specifications have some similarity to IEEE 519, but also some important differences. It was also noted that operational issues (such as the selection of control modes for operation) are out of scope for P2800. It was also noted that any requirement that are established need to have a means of measurement, thus are enforceable. It was noted that IBR voltage phase imbalance withstand should be less than 2% (as measured by V2 at the IBR terminals), which is consistent with the draft specification. It was noted that some committee members favored current limits, while others favored voltage limits. This lack of firm consensus resulted in the draft including both current and voltage limits, although the SG6 committee continues to refine this approach. One member noted the possibility of establishing a harmonic amplification limit, which spurred further investigative discussion. An OEM noted a concern regarding requirements that could be used by a TEPS to justify preventing an IBR plant to interconnect, including pre/post connection TEPS harmonic levels (including those caused by resonances). It was also noted that the P2800 does not apply to the TEPS, and thus cannot make any requirements for them.

SubGroup VII and VIII (Ride-Through Capability and Performance Requirements): Manish Patel and Bob Cummings presented and discussed drafted requirements for ride-through capability and performance. Feedback received is noted below:

The proposed ride-through requirements takes into account challenges offered by wind turbine generator based resources. Hence, the proposed ride-through capability for WTG based resource is slightly different compared to same for PV, BESS, etc. based resources. However, in regards to performance in the ride-through mode, the type IV WTG based resource is included with PV & BESS (also referenced as other IBR resources). Reigh Walling raised a concern with including emerging technology, for example, fuel cell based IBRs with PV and BESS based resources. Jens Boemer brought to attention that some international grid codes are more ambitious in terms of HVRT capability compared to proposed here and encouraged sub-group to discuss further. There was a mixed feedback from few folks with background in transmission planning. Discussion also briefly focused on impact of RPA, i.e., POM or POI. Manish Patel noted that the sub-group is still working on ride-through requirements for consecutive voltage dips and that this is a complex topic.

The draft requirements for ride-through performance was well received. It was noted that K-factor based control is considered closed loop control. The draft requires IBRs to inject negative sequence current during unbalanced faults. There was no concern with this requirement, however, Reigh Walling pointed out that words used to write this requirement are not appropriate.

SubGroup IX (IBR Protection): Jason Espinosa presented Section 10 on IBR Protection. There was a concern from OEMs that the standard currently includes language that indicates “design requirements” It should not tell OEMs how to design their equipment. The language in this section needs to be updated to present the requirements as performance specifications. Jason commented that most of the language in this section aligns with the IRPTF report. There was also a discussion whether C32 WG is the right forum for some of these topics as it has over 40 members who are subject matter experts on system protection. It was clarified that the C32 report referenced in this discussion was written due to some protection system mis-operation events and some if these recommendations would not be valid in future. The report should be used as a reference rather than adopting the language from it. SubGroups 7, 8, and 9 were asked to host joint calls to draft language with a focus on coordination of IBR protection with ride-through performance requirements.

SubGroup X (Modeling & Validation, Measurement Data, and Performance Monitoring): Manish Patel presented drafted requirements for modelling data and measurement data for performance monitoring and validation. The draft requirements were well received with some recommendations to improve clarity. For example, the EMT model for supplemental devices may not be based on type test results and usually is based on HIL test results. Due to time restrictions, table 14 which includes measurement data for performance monitoring and validation was not discussed in detail. Manish Patel noted that there is broad agreement among subgroup members for details in Table 14 with few outstanding comments.

SubGroup XI (Tests and verification requirements) work includes Clause 14 (Tests and verification requirements) and was reviewed. It was noted that Chenhui Niu had sent a newer version but that was kept for a future draft and not reviewed. Instead, the purpose and structure of Table 15 (Interconnection test specifications and requirements for IBR that shall meet requirements at the POM) was reviewed and discussed. It became clear that there are still very different test and verification practices in North America and the WG members’ expectations towards requirements in this Clause

differ significantly. It was reaffirmed that the IEEE 1547-2018 test and verification requirements may not be transferred to P2800 without modifications, but that framework could be a starting point for the discussions. A combination of type testing, design evaluations including plant-level modeling, commissioning tests, and post-commissioning field measurements may be used to verify each capability and performance requirement in P2800. It was noted that Supplemental IBR Devices are often not type-tested. Small-signal response of an IBR generating facility could be tested during commissioning whereas large-signal response (e.g., during transmission faults) could only be verified through plant-level modeling. There may be multiple alternate means of verification. SubGroup XI was tasked to refine the framework, likely delete Table 16, and start working closely with the subject matter experts in the other SubGroups to fill the revised Table 15 as input to Draft 3.0 for discussion at the next WG meeting in July. One WG member suggested to develop an informative annex that would explain each verification method in further detail – would need to coordinate how such annex would differ from P2800.1.

Open Discussion, Timeline, Future Drafts and Wrap-up

Chair presented the summary of the meeting in the wrap up session:

- Many SGs are in a good shape with some minor revisions still needed
- Challenges to create consensus among interested parties for some SGs
- Be specific about the RPA and consider the differences between POM and POI
- SG11 relies on near-final requirements from all other groups
  - Maybe have other SGs draft applicable lines of the SG11 tables?
- Scope may still be too broad for SMEs to contribute effectively

Existing and proposed new timeline with stretch goals was presented.

Given the current status, Chair Jens proposed the following:

- 6-months delay due to COVID-19

- Merging of SubGroups to reduce the amount of individual SubGroup calls / work load
- Increasing frequency of remaining joint SubGroup calls to weekly schedule
- Possible adjustment of scope
    - Re-convene P2800 WG shortly after successful balloting to start working on the 1st revision to the standard that may address requirements that weren't addressed in the first version.

At this time, input to draft 3.0 is due from Sub-Groups on June 15, 202 and a consolidated draft 3.0 is scheduled to be posted on imeet on June 30th. The next WG meeting is scheduled from July 13-16 as a virtual meeting.

The meeting adjourned at approximately 5:00 PM Eastern.