

# Updating Minnesota’s Interconnection Standards

## Proposed Phase II Plan

### Scope

Update or replace the Minnesota’s existing interconnection technical requirements ([Attachment 2 Technical Requirements in the Commission’s September 28, 2004 Order in Docket No. E-999/CI-01-1023](#)) consistent with local and national standards, including the newly revised IEEE 1547, and best practices using the outline described below.

### Working Document

Red-lined version of [“Regulated Utilities” Technical Interconnection and Interoperability Requirements \(TIIR\)](#)

### Additional Materials

- i) [Xcel Energy NSPM Electric Energy Storage Interconnection Guidelines \(V1.0, 6 Nov 2017\)](#)
- ii) [Participants’ Materials and the Meeting Summary for DGWG Meeting #5 \(November 3, 2017\) related to storage and non-exporting \(Energy Freedom Coalition for America, Joint Movants, Xcel Energy\)](#)
- iii) [California Utilities’ energy storage interconnection guidelines](#)
- iv) [California Rule 21](#)
- v) [Hawaiian Electrics Rule 14](#)
- vi) [Massachusetts Technical Review Group](#)  
(1) [Massachusetts’ 2017 Common Technical Standards Manual](#)
- vii) [New York Interconnection Technical Working Group](#)

### Technical Subgroup Schedule

All Technical Subgroup Meetings are 9:30am – 12:30pm CST. Full DGWG Meetings are 9am – 2:30pm.

<u>Date</u>	<u>Topic</u>	<u>Outcome</u>	<u>Prep Work</u>
3/23/18	Meeting 1  Scope/Overview** (Walk-through with explanations: Red-lined TIIR; List of topics in scope of TSMs; Definitions	1) Red-lined TIIR 2) Details on utility TSMs 3) List of Definitions to address	Subgroup members provide proposals and citations to examples, where applicable, to staff by 3/16/18:  1) Red-lined/track changes draft of TIIR; 2) List of topics with summary/examples of content considered in scope of a utility TSM 3) Definitions that need to be discussed

4/13/18	Meeting 2 Performance Categories**; Response to abnormal conditions; MISO Bulk Power System Overview	1) Discuss Performance Categories	
5/18/18	Meeting 3 Reactive Power and Voltage/Power Control Performance**; Protection Requirements		
6/1/18	Full DGWG Meeting Technical Subgroup update; Phase I Update/Next Steps		
6/8/18	Meeting 4 Energy Storage; Non-Export and Inadvertent Export**		
7/20/18	Meeting 5 Interoperability** (Monitor and Control Criteria); Metering**; cyber security		
8/10/18	Meeting 6 Test and Verification**; Witness Test Protocol		
9/14/18	Meeting 7 References; Definitions*; 1-line diagram requirements; Agreements*		
9/21/18	Full DGWG Meeting 2		

<b>Sections in existing MN Technical Requirements</b>	<b>Sections in IEEE 1547 Revision</b>	<b>Technical Interconnection and Interoperability Requirements (Regulated Utilities' Proposal)</b>
1) Definitions	Clause 3. Definitions and Acronyms	Ch. 3: Definitions and Acronyms  Annex B: Clarifications on RPA, PCC, POC, Supplemental devices
2) References	Clause 2. Normative References  Annex A  Annex D.5, Related Standards	Ch 2: References  Annex A: links to utility TSMs
3) Types of Interconnections	Annex B. Guidelines for DER Performance Categories/ Attribute Groupings  Storage  Non-exporting  Parallel Operation	Ch 4: Performance Categories  Ch. 10: Energy Storage  Ch. 11: Non-exporting and Inadvertent Export
4) Interconnection Issues and Technical Requirements	Clause 4. General Interconnection Technical Specification and Performance Requirements  Clause 5. Reactive Power and Voltage Control  Clause 7. Power Quality	Ch. 5: Reactive Power Capability and Voltage/Power Control Performance
5) Metering, Monitoring and Control	Clause 10. Interoperability, Monitoring, Control  Annex D, DER Communication, Information Guidelines, Network and Cyber Security	Ch. 8: Metering  Ch. 9: Interoperability
6) Protective Devices and Systems	Clause 6. Response to Area EPS Abnormal Conditions  Clause 8. Islanding  Clause 9. DER on Distribution Secondary Grid/Area/Grid Networks and Spot Networks  Annex C, DER Intentional and Microgrid Island Configurations  Annex E, Ride-Through of Voltage Disturbances, Faults, Protection, Reclosing	Ch 6: Response to Abnormal Conditions  Ch. 7: Protection Requirements

7) Agreements	<i>Operating agreement</i> <i>Maintenance agreement</i>	Ch. 13: Agreements
8) Testing Requirements	Clause 11. Test and Verification Requirements  Annex F, Testing and Verification Requirements at PCC or PoC	Ch. 12: Test and Verification Requirements

The following standards and guidelines/guidance will also be considered:

[UL 1741 Inverters, Converters, Controllers and Interconnection System Equipment for Use in Distributed Energy Resources \(2010\)<sup>1</sup>](#) (Including UL 1741 Supplemental A (SA) Advanced Inverters)

[NFPA 70 \(2017\), National Electrical Code](#)

[National Electrical Safety Code \(ANSI C2-2017\)](#)

[ANSI C84.1-\(2016\) Electric Power Systems and Equipment – Voltage Ratings \(60 Hertz\)](#)

[NEMA MG 1-2016, Motors and Generators](#)

[IEEE 1547.1 – 2005 Standard Conformance Test Procedures for Equipment Interconnection Distributed Resources with Electric Power Systems \(including IEEE 1547.1a Amendment 1\)<sup>2</sup>](#)

[IEEE 1547.2-2008 Application Guide for IEEE 1547 Standard for Interconnecting Distributed Resources with Electric Power Systems](#)

[IEEE 1547.3-2007 Guide for Monitoring, Information Exchange, and Control of Distributed Resources Interconnected with Electric Power Systems](#)

[IEEE 1547.4-2011 Guide for Design, Operation, and Integration of Distributed Resource Island Systems with Electric Power Systems](#)

[IEEE 1547.6-2011 Recommended Practice for Interconnecting Distributed Resources with Electric Power Systems Distribution Secondary Networks](#)

[IEEE 1547.7-2013 Guide for Conducting Distribution Impact Studies for Distributed Resources Interconnections](#)

[IEEE P1547.8 Draft Recommended Practice for Establishing Methods and Procedures that Provide Supplemental Support for Implementation Strategies for Expanded Use of IEEE Standard 1547](#)

---

<sup>3,4</sup> Following the finalization of the IEEE 1547 revision, IEEE 1547.1 will be revised to update testing procedures; as will UL 1741. The Commission and members of the DGWG are monitoring this issue and will consider the revised standards when they become available (IEEE 1547.1 is anticipated in Spring 2019, and UL certification will happen after that.)

[IEEE C37.90-2005 IEEE Standard for Relays and Relay Systems Associated with Electric Power Apparatus](#)

[IEEE Std C37.90.1\(2012\) \(Revision of IEEE Std C37.90.1-2002\), IEEE Standard for Surge Withstand Capability \(SWC\) Tests for Protective Relays and Relay Systems Associated with Electric Power Apparatus](#)

[IEEE Std C37.90.2 \(2004\) \(Revision of IEEE Std C37.90.2-1995\), IEEE Standard for Withstand Capability of Relay Systems to Radiated Electromagnetic Interference from Transceivers](#)

[IEEE C37.95-2014 Guide for Protective Relaying of Utility-Consumer Interconnections](#)

[IEEE C37.108-2002, IEEE Guide for the Protection of Network Transformers](#)

[IEEE C57.12.44-2014, IEEE Standard Requirements for Secondary Network Protectors](#)

[IEEE C57.32-2015 Standard for Requirements, Terminology, and Test Procedures for Neutral Grounding Devices](#)

[IEEE Std C62.41.2-2002, IEEE Recommended Practice on Characterization of Surges in Low-Voltage \(1000V and Less\) AC Power Circuits](#)

[IEEE Std C62.41.2-2002 Cor 1-2012 \(Corrigendum to IEEE Std C62.41.2-2002\) - IEEE Recommended Practice on Characterization of Surges in Low-Voltage \(1000 V and Less\) AC Power Circuits Corrigendum 1: Deletion of Table A.2 and Associated Text](#)

[IEEE C62.42-2005 Guide for the Application of Component Surge-Protective Devices for Use in Low-Voltage \(1000 V and less\) AC Circuits](#)

[IEEE C62.45-2002, IEEE Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage \(1000V and Less\) AC Power Circuits](#)

[IEEE C62.92.2-2017 Guide for the Application of Neutral Grounding in Electrical Utility Systems, Part II – Synchronous Generator Systems](#)

[IEEE Standards Dictionary Online, \[Online\].](#)

[IEEE 141-1993 Recommended Practice for Electric Power Distribution for Industrial Plants \(141-1993 Errata\)](#)

[IEEE 142-2007 Recommended Practice for Grounding of Industrial and Commercial Power Systems](#)

[IEEE 242-2001 Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems \(IEEE Buff Book\) \(242-2001 Errata\)](#)

[IEEE 446-1995 Recommended Practice for Emergency and Standby Power Systems for Industrial and Commercial Applications](#)

[IEEE 519-2014, IEEE Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems](#)

[IEEE 1453-2015 Recommended Practices for the Analysis of Fluctuating Installations on the Power Systems](#)

**Technical Requirements Subgroup**

The Technical Requirements Subgroup will be comprised of utility and non-utility individuals with technical electric and power system engineering expertise. The Technical Requirements Subgroup will work over email and web conference to draft the technical requirements document to replace Attachment 2 Technical Requirements in the Commission’s September 28, 2004 Order in Docket No. E-999/CI-01-1023.

Jeff Schoenecker/Craig Turner, Dakota Electric	Robert Jagusch, MMUA	Patrick Dalton/John Harlander/Alan Urban, Xcel Energy
Lise Trudeau, Dept of Commerce	Kevin McLean/Jenna Warmuth, MN Power	Natalie McIntire/TBD, Wind on the Wires
Mike McCarty/Katie Bell, EFCA	Kristi Robinson, MREA	John Dunlop/Chris Jarosch, MNSEIA
Brian Lydic/Sky Stanfield/Laura Hannah – Joint Movants	Dean Pawlowski, Otter Tail Power	Commissioner Matt Schuerger; Michelle Rosier; Cezar Panait
Tam Kemabonta/Professor Mahmoud Kabalan, St. Thomas Affiliation		Technical Assistance*: Michael Coddington and Michael Ingram, National Renewable Energy Laboratory  Tom Key, Jens Boemer, Nadav Enbar; Electric Power Research Institute  Possibly DOE Solar Energy Innovator Fellow

\*Technical assistance is not a participant or party to the docket and does not advocate for specific outcomes in the proceeding. The role of technical assistance is to support Commission staff in the process for these proceedings, and to provide an objective source of information or data, as requested, by Commission staff to understand areas of disagreement amongst participants.

**Anticipated Timeline**

The Commission’s January 24, 2017 Order in the instant docket noted anticipation that the technical requirements would be considered within 24 months of the Order. The expectation is all Distributed Generation Workgroup Participants from Phase I and Technical Subgroup members participate in the educational In-Person and webinars on the standards under consideration (1Q-2Q 2018) and DGWG In-Person Meetings listed below.

<b>In Person Meetings</b>	<b>Webinars/Working WebEx</b>
	<i>January X TBD</i>  Review of standards to be considered
March 12, 2018 8am – 4:30pm  IEEE 1547 Workshop	<i>TBD</i>  EPRI Webcast on IEEE 1547; including Annex B and Distribution considerations

<p>David Narang, NREL, Section Manager, Applied Power Systems – Distributed Energy Systems Integration Group – IEEE 1547 Chair</p> <p>Bob Cummings, NERC, Senior Director of Engineering and Reliability Initiatives</p> <p>Ravi Subramaniam, IEEE, Technical Director, ICAP</p> <p>Jens Boemer, EPRI</p>	
<p>June 1, 2018– Full DGWG In Person Meeting</p> <p>Topics: Review Technical Subgroup progress; Compensation and consumer protection issues</p>	<p>March 16, 2018 (first webex meeting of subgroup) – September 2018– Technical Subgroup Web Conferences – monthly or bimonthly as needed. Assignment follow up over email between the meetings.</p> <p>Fridays 9:30am – 12:30pm CST: March 16; April 20; May 18; June 8; July 13; Aug 10; Sept 14</p>
<p>September 28, 2018 – Full DGWG In Person Meeting re: Preview Technical Subgroup’s Draft Technical Requirements Language</p>	<p>October 5, 2018 – Webex Follow up Discussion on Draft Language</p>

Dec 2017 – Oct 2018 (tent)	Phase II Notice for comment; workgroup meetings; conference calls
December 15 - Jan 29	Notice for Comment on Phase II Scope, Plan, DEA proposed Technical Requirements as starting draft
1Q 2018	IEEE 1547 Workshop with IEEE
2Q 2018 (Tentative)	Final approval of new IEEE 1547 standard
Feb – Apr 2018	Comment Period on Phase I Recs/Standards Language
May 2018 (Tentative)	PUC Agenda Meeting re: Phase I
Sept/Oct 2018 (Tentative)	Public Utilities file for Commission approval; Cooperative and Municipal Utilities adopt updated tariffs re: Phase I
Nov 2018 (Tentative)	Notice for Comment on draft staff Phase 2 summary and recommendations
Nov/Dec 2018 (Tentative)	Comment period on public utility Phase I tariff revisions
Feb 2019 (Tentative)	PUC Agenda meeting for consideration and decision on new Interconnection Technical Requirements (Phase II)
April/May 2019 (Tentative)	Final approval of new IEEE 1547.1 testing requirements