Minutes of IEEE SCC21 Distributed Resources (DR) P1547.2 Work Group (WG) Meeting of January 24, 2003 – Held at the Ritz Carlton, Arlington, Virginia

Executive Summary
The updated P1547.2 Preliminary Working Draft and Resource Document dated 1/17/03 was distributed and discussed. Chair, Dick Friedman noted that a P1547.2 Writing Group would be formed. Breakout groups met and established their schedules for progress. The next meeting of all P1547-series Work Groups will likely take place June 3 – 4 – 5, 2003, in Denver Colorado, with June 3 for the P1547-series officials, then June 4 – 5, 2003 for each of the P1547.1, P1547.2, and P1547.3 work groups to meet full days in parallel. Participants need to submit their volunteer assignments to respective task leaders/P1547.2 Officers in a timely manner.

1.1 Meeting Objectives
The objectives were to proceed with the organization and activities of the Work Group established to develop “IEEE P1547.2, Draft Application Guide For IEEE Draft Standard 1547 Interconnecting Distributed Resources With Electric Power Systems.”

1.2 Meeting Agenda and Meeting Pattern
The meeting agenda proceeded as follows:

8:00 a.m. Welcome & IEEE P1547 Status Report
Introductions
8:20 a.m. 1547.2 Work Group Update
• October 2002 Meeting Results and Ensuing Activities
• Writing Assignments
• Contributions to Date
8:45 a.m. “Walk Through” Work Group Resource Document
10:00 a.m. Break
10:30 a.m. Break-Out Sessions (to critique draft content and “refine” writing assignments)
11:30 a.m. Session Wrap-Up and Future Plans; Adjourn

1.3 Future Meetings
The next meeting of all P1547-series Work Groups will likely take place June 3 – 4 – 5, 2003, in Denver Colorado, with June 3 for the P1547-series officials, then June 4 – 5, 2003 for each of the P1547.1, P1547.2, and P1547.3 work groups to meet full days in parallel. After that, the next meeting is tentatively planned for fall 2003.

2.0 Opening of Meeting
IEEE P1547.2 Chair N. Richard Friedman (Dick) welcomed the attendees (Annex A) and invited them to introduce themselves. Dick referred to the handout of the Work Group Resource Document (see URL reference below), noting that this is a strawman document, and not yet a draft outline for the P1547.2 Guide. He then reviewed the agenda. Tom Basso, P1547.2 Secretary, gave a presentation on the P1547 status and the P1547 series of standards (Annex B). He discussed the new IEEE and IEC dual logo arrangement, through which the IEC would consider adopting IEEE standards under a dual logo designation.
2.1 1547.2 Work Group Update

Dick Friedman provided a summary of October 2002 meeting results and ensuing activities (Annex C). He noted that several group members had completed their writing assignments and those were provided in the Work Group Resource Document. Some submissions came in too late and will later be provided to the group.

Dick noted a suggestion made in October to reorganize the document. He indicated that the format of the NEC Handbook was mentioned as a potential model for 1547.2 as was the NRECA Application Guide. The latter document is posted on the P1547.2 WG password protected website. Another suggestion was to move some of the current introductory information to the Annexes. He noted that the document will not be reorganized at this time, with the focus on developing draft material.

The group discussed the scope of the 1547.2 Application Guide, and Dick noted that it is intended as the Guide to IEEE 1547 interconnection, not on DR as a whole. Dick discussed the three levels of IEEE documents: Standards, Recommended Practices, and Guides. P1547.2 is a Guide-it will not add any new requirements to IEEE 1547, but will assist the user in better understanding and using 1547.

Participants also suggested coordinating Guide development with other groups currently engaged in general topics of interconnection, including the IEC TC8 working group, the North American Energy Standards Board, NERC, and especially other IEEE efforts focusing on interconnection.

2.2 “Walk Through” P1547.2 Work Group Resource Document


Dick Friedman began a discussion of the Work Group Resource Document (WGRD), progressing through the document section by section. He noted that the document is currently organized into ten sections, but that the placement and inclusion of these sections may be subsequently modified.

Section 2. Dick noted that the work group resource document to P1547 included much on specific technologies. That information was not used in the P1547 standard itself. However, attendees might consider whether such information would be appropriate in the Application Guide, and if so, then, if it should be included in the main body or considered as an Annex. Dick discussed a suggestion made since the last meeting to move Section 2.3, Protection and Coordination Capabilities, of the original resource document to a major header. No definitive resolution was made.

Section 3. Dick noted that Section 3 was a placeholder in the original document to allow discussion of the distribution system. Again, the P1547.2 WG will need to determine how much information about the distribution system might be appropriate for the P1547.2 document. Dick noted that participants in the DOE Distribution and Interconnection R&D activity conference in the few days preceding this P1547.2 WG meeting suggested that they needed more information and education about distribution systems.

Group comments on this section included suggestions to coordinate with the IEEE relay committee’s T&D Group that will likely have a White Paper as a potential resource (forthcoming during the next year), and, to coordinate with the Power System Relaying Committee, Working
Group K10. Discussion ensued about how to engage these groups, e.g., drafting a letter to these potential contacts, or meeting with these groups. Suggested resources for this section included the IEEE Color Book series, and a number of other documents developed by Work Group participants.

Sections 4, 5, 6 and 7. These sections are the central focus of the Guide and provide guidance related to P1547 requirements. Dick proposed that these sections might be more appropriate earlier in the Guide. If we adopt the NEC Handbook model, we would then have “original copy of P1547 clauses” immediately followed by “guide wording.” This proposal needs to be further discussed by the P1547.2 group. Dick then discussed the current structure of the resource document -- background, tips, techniques and rules of thumb -- and again requested feedback. Dick addressed a suggestion made earlier to delete Section 5.6 (which is Section 4.2.6, Reconnection to Area EPS in IEEE 1547) as that topic can be covered elsewhere. He stated that we cannot just delete a section in the Guide that corresponds to an IEEE 1547 requirement. One option is to include the section heading in P1547.2, list the 1547 requirement, and then refer the reader to the applicable sections in P1547.2 that cover the topic.

Group comments centered on resource suggestions, including the NRECA Guide and contributions made through the course of P1547 development. Dick noted that resource documents are available on P1547 and P1547.2 password protected web sites, and Tom Basso will provide those usernames and passwords for P1547.2 development. Arrangements will be considered for future documents that are not available electronically.

Section 9. The structure of this section was discussed briefly, with the comment made that participants must be careful about interpretation when drafting Annexes.

Dick then commented that when P1547 is approved this year, there will be a pressing need for the P1547.2 Application Guide. He asked that participants be diligent in completing their writing and other assignments, and asked also for additional comments on the outline structure.

3.0 Break-Out Sessions

The attendees participated in their choice of three break-out sessions to review different parts of the WGRD outline. The break-outs were organized as follows:

1) Breakout 1 (facilitator: E.J. Honton of the Resource Dynamics Corporation -- RDC). Introductory Sections – Sections 1-3 of the outline;
2) Breakout 2 (facilitator: N. Richard (Dick) Friedman of RDC). Technical Requirements with Application Guidance – Sections 4-7 of the outline;

Attendees for each breakout were encouraged to take on writing assignments, and review available resource materials, with the goal of producing updated material prior to the next meeting.

At the suggestion and request of some of the Work Group members, an ad hoc group met concurrently with the breakout sessions to explore options for documenting the rationale for each of the IEEE P1547 requirements. This group was organized by Lynnda Ell of Entergy Services.
and Dan Sammon of Con Edison (NYC). The group’s initial recommendations are summarized below.

### 3.1 Breakout 1 -- Introductory Sections.

This group dealt with the three introductory sections: Introduction to IEEE P1547, Draft Standard for Interconnecting Distributed Resources with Electric Power Systems; Overview of Distributed Resource (DR) Technologies; and, Discussion of Distribution Systems. Attendees included E.J. Honton (facilitator), Bill Steeley, Joe GALdo, Andy Garsils, Craig Taborsky, Bill Feero, Mike Pehosh, Wayne Stec, S.S. Venkata, Andy Skok and Mac Brodie.

The group first discussed the purpose of the introductory section(s). They then discussed the audience for the Application Guide. The primary users were felt to be 1) distribution engineers, 2) DG developers including electrical contractors and construction engineers, and 3) equipment manufacturers. The group suggested that generally the introductory material should attempt to inform utilities about DG needs, and inform DG installers about utility needs. The level of the audience was determined to be IEEE engineer readers. The audience is not composed of experts on interconnecting DG with the grid, nor of novices that understand little about the power system.

The group suggested that Section 2.1 focus on the dynamics of interconnecting the prime mover to the electric distribution system rather than covering the details of prime movers. In practice this means having a solid discussion of inverters, synchronous machines, and induction machines rather than prime movers. Another suggestion was to use a cross-reference matrix of inverter/synchronous/induction by prime mover in the main text, and move all prime mover material to an Annex or as part of references.

It was suggested that a glossary of terms is needed in the document, and that an initial list of terms be developed from the P1547 Standard itself. Additional terms might come from other relevant IEEE materials, especially any existing IEEE glossaries of terms. It was discussed that the document needs to provide additional details, or refer to other sources of material that provide a more textbook approach to the material. The group reiterated the need for a bibliography of related IEEE and interconnection materials, such as state interconnection standards and rules, and suggested that early on in Section 1 there may need to be flowchart, or a short quiz of leading questions, that helps the reader know where to go in the document.

The group suggested, as noted in the Table of Contents of the current draft outline, Power Conversion Technologies should become Section 2. Protection and Coordination Capabilities should become Section 3, as noted in the box at the right of the outline. For the first part of this new Section 3, Wayne Stec’s contribution on Protection and Coordination Capabilities will be circulated to all members, as will an alternate outline provided by Mac Brodie.

The group discussed resources to be considered, including the Westinghouse T&D manual, the NEC, material from Drafts 5 and 6 of the P1547 development effort, other IEEE resource documents, University of Wisconsin Report, K10 Relay Committee of the Power Engineering Society and E-source/Electrotek material. Some action items were:
• Determine whether it is permissible to use resource material as noted. (Bill Feero)
• Complete writing assignments, as agreed. Andy Garsils will continue work on 3.2.2 underground systems, but not on the transformer section.
• Meld existing contributions into a draft.
• Note remaining holes and make further writing assignments.
• Circulate via email suggested Table of Contents revisions and other contributions for comment to all Breakout 1 members, with deadlines for response.

3.2 Breakout 2 -- Technical Requirements and Application Guidance.

The break-out attendees addressed the technical requirements of P1547. Attendees included N. Richard Friedman (facilitator), Charles Rogers, Chuck Whitaker, Dave Costyk, Gerald Johnson, Jason Lin, Jeff Pope, Jim Daley, Jim Lemke, Jim Watts, Joe Debs, Kevin Donahoe, Kevin Loving, Martin Baier, Micky Pitt, Mike Behnke, Paul Williams, Per Drewes, Reigh Walling, Rob Wills, Ron Hartzel, Ross Guttromson, Sam Ye, Simon Wall, Steve Chalmers, Steve Early, Tim Wall, Tom Duffy, Tom Gordon, Tony Mazy, Travis Johnson and Yuri Khersonsky.

Attendees volunteered to work on and write different sections as follows. Individuals in italics have already provided contributions in the indicated section. The group set a deadline for contributions to be due to Tom Basso (and Dick Friedman) by March 15, 2003. Preliminary volunteers/contributors are listed in the following table.

<table>
<thead>
<tr>
<th>Section</th>
<th>Coordinator</th>
<th>Contributors</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.1 Voltage Regulation</td>
<td>Steve Early</td>
<td>Kevin Loving, Steve Early, Jason Lin, Jim Watts, Ross Guttromson, Tim Wall, Reigh Walling, Travis Johnson</td>
</tr>
<tr>
<td>4.2 Integration with area EPS grounding</td>
<td>Jim Lemke</td>
<td>Charles Rogers, Jim Lemke, Jason Lin, Tim Wall, Travis Johnson, Tom Duffy</td>
</tr>
<tr>
<td>4.3 Synchronization (Common with Loss of Sync, Flicker)</td>
<td>Mickey Pitt</td>
<td>Gerald Johnson, Jason Lin, Jeff Pope, Micky Pitt, Jim Daley, Travis Johnson, Charles Rogers</td>
</tr>
<tr>
<td>4.4 Distributed Resources on Distribution Secondary Grid and Spot Networks</td>
<td>Joe Debs</td>
<td>Joe Debs, Reigh Walling (liaison to PES), Tony Mazy, Dave Costyk, Kevin Donahoe, Paul Williams, Dan Sammons, Martin Baier</td>
</tr>
<tr>
<td>4.5 Inadvertent Energization</td>
<td>Jason Lin</td>
<td>Gerald Johnson, Jason Lin, Yuri Khersonsky, Tom Duffy</td>
</tr>
<tr>
<td>4.6 Monitoring</td>
<td>Charles Rogers</td>
<td>Charles Rogers, Tony Mazy</td>
</tr>
<tr>
<td>4.7 Isolation Device</td>
<td>Jason Lin</td>
<td>Jason Lin, Jim Watts, Ron Hartzel, Yuri Khersonsky, Rob Wills, Travis Johnson, Tom Duffy</td>
</tr>
<tr>
<td>4.8 Interconnect Integrity</td>
<td>Mike Behnke</td>
<td>Charles Rogers, Mike Behnke, Yuri Khersonsky, Kevin Loving</td>
</tr>
<tr>
<td>5.1 Faults</td>
<td>Charles Rogers</td>
<td>Charles Rogers, Tim Wall, Simon Wall, Tom Duffy</td>
</tr>
<tr>
<td>5.2 Reclosing Coordination</td>
<td>Reigh Walling</td>
<td>Reigh Walling, Ross Guttromson, Tom Gordon, Gerald Johnson, Tim Wall, Charles Rogers, Tom Duffy</td>
</tr>
<tr>
<td>5.3 Voltage</td>
<td>Jim Watts</td>
<td>Charles Rogers, Mike Behnke, Jim Watts, Paul Williams, Tom Duffy</td>
</tr>
<tr>
<td>5.4 Frequency</td>
<td>Jim Watts</td>
<td>Charles Rogers, Mike Behnke, Jim Watts, Paul Williams, Tom Duffy</td>
</tr>
<tr>
<td>5.5 Loss of Synchronism</td>
<td>Mickey Pitt</td>
<td>Same group as 4.3, Synchronization</td>
</tr>
<tr>
<td>5.6 Reconnection</td>
<td>Gerald Johnson</td>
<td>Gerald Johnson, Tom Gordon</td>
</tr>
<tr>
<td>Section</td>
<td>Coordinator</td>
<td>Contributors</td>
</tr>
<tr>
<td>---------</td>
<td>-------------</td>
<td>--------------</td>
</tr>
<tr>
<td>6.1 DC Injection</td>
<td>Steve Chalmers</td>
<td>Steve Chalmers, Reigh Walling, Rob Wills</td>
</tr>
<tr>
<td>6.2 Flicker</td>
<td>Mickey Pitt</td>
<td>Same group as 4.3, Synchronization, and 5.5, Loss of Synchronism</td>
</tr>
<tr>
<td>6.3 Harmonics</td>
<td>Bob Saint</td>
<td></td>
</tr>
<tr>
<td>7 Islanding (combined Unintentional Islanding and Intentional Islanding)</td>
<td>Chuck Whitaker</td>
<td>Tony Mazy, Steve Chalmers, Joe Debs, Jason Lin, Dave Costyk, Travis Johnson, Chuck Whitaker, Paul Williams, Gerald Johnson, Sam Ye, Jeff Pope, Per Drewes, Rob Wills</td>
</tr>
</tbody>
</table>

### 3.3 Breakout 3 -- References, Process and Supporting Material

Attendees of this break-out group included Elizabeth Kime (facilitator), David Van Holde, Steve Rosenstock, Matt Romanow and Holly Thomas. Attendees first discussed Sections 9.1 and 9.2 of the interconnection procedures section. The group drafted a list of resources that can help provide a preliminary list of information that must exchanged between the DR developer/owner and the utility, and set a timeline for gathering and reviewing these documents. This list included, but is not limited to the NARUC Guide, FERC ANOPR, Boiler-plate framework documents, e.g., collection of interconnection agreements, and, NRECA documents. The Group will examine these documents and narrow the items down to the minimum required by P1547 and additional items. The group also discussed preparing a flowchart or similar pictorial representation of a generic installation process either for inclusion in the document, for group purposes, or both.

For Section 10, Annexes, the scope of case studies was discussed. Group members will search for and make available to the group collections of case studies. The group determined it would touch base again on February 6th for a conference call at 1 PM East Coast time to discuss progress to date. Steve Rosenstock and Holly Thomas will coordinate the logistics of the conference call. Preliminary volunteers to contribute draft information are:

- Compile Resource Interconnection Documents - David Van Holde
- Review Interconnection Documents for Information Requirements - All contribute
- Gather example flowcharts - Elizabeth Kime
- Summary Tables Templates - Elizabeth Kime
- Case Example of Procedure - Holly Thomas
- Case Studies - All contribute
- Bibliography - All contribute

### 3.4 Ad Hoc Group Meeting on IEEE 1547 Rationale

Attendees included Dan Sammon and Lynnda Ell (co-facilitators), Carl Williams, Roger Dugan, John Stevens, Timothy Zgonena and Joe Koepfinger. The group sought to describe the rational for the technical requirements in IEEE 1547. As a first task, the ad hoc group identified a number of terms within IEEE 1547 that may require further explanation. Some participants agreed to take a first cut at developing this explanation. Any material developed could then be incorporated within the relevant section of the Guide. It was also suggested that some of this material may eventually be included in a “Frequently Asked Questions” document accompanying the Guide.
4.0 Concluding Remarks

Dick Friedman thanked all for their participation. He noted that a Writing Committee would be formed, and requested that attendees inform him if they are interested in participating. Tom Basso presented a draft schedule plan. The next meeting of all P1547-series Work Groups will likely take place June 3 – 4 – 5, 2003, in Denver Colorado, with June 3 for the P1547-series officials, then June 4 – 5, 2003 for each of the P1547.1, P1547.2, and P1547.3 work groups to meet full days in parallel. After that, the next meeting is tentatively planned for fall 2003. The meeting was adjourned at 12:00 p.m. on January 24, 2003.

Respectfully Submitted, Thomas Basso, P1547.2 Secretary

Approved, Dick Friedman, P1547.2 Chair.

Annexes
Annex A - List of Attendees
Annex B - Standards Status Presentation (Tom Basso)
Annex C - P1547.2 October Meeting Summary/Ensuing Activities (N. Richard Friedman)
# Annex A

## List of Attendees

**IEEE SCC21 Distributed Resources (DR) P1547.2 Work Group (WG) Meeting**  
**January 24, 2003 Arlington, VA**

<table>
<thead>
<tr>
<th>Name</th>
<th>Organization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr. Gobind H. Atmaram</td>
<td>Florida Solar Energy Center</td>
</tr>
<tr>
<td>Mr. Martin Baier</td>
<td>Cutler-Hammer</td>
</tr>
<tr>
<td>Robert Bammel</td>
<td>Elliot Energy Systems</td>
</tr>
<tr>
<td>Mr. Thomas S. Basso</td>
<td>National Renewable Energy Laboratory</td>
</tr>
<tr>
<td>Mr. Michael Behnke</td>
<td>Xantrex Technology Inc.</td>
</tr>
<tr>
<td>Robin Blanton</td>
<td>Piedmont EMC</td>
</tr>
<tr>
<td>Mr. M. N. (Mac) Brodie</td>
<td>Fluor Daniel Wright Ltd.</td>
</tr>
<tr>
<td>Mr. Steve Chalmers</td>
<td>Powermark Corp.</td>
</tr>
<tr>
<td>Mr. Scott Choinski</td>
<td>NEMA</td>
</tr>
<tr>
<td>Mr. Herb Clowers</td>
<td>Hess Microgen</td>
</tr>
<tr>
<td>Mr. Dave M. Costyk</td>
<td>DTE Energy, Detroit Edison Company</td>
</tr>
<tr>
<td>Mr. Richard DeBlasio</td>
<td>National Renewable Energy Laboratory</td>
</tr>
<tr>
<td>Mr. Joseph Debs</td>
<td>FuelCell Energy, Inc.</td>
</tr>
<tr>
<td>Mr. Kevin E. Donahoe</td>
<td>GE-SAS</td>
</tr>
<tr>
<td>Mr. Per Drewes</td>
<td>Kinectrics Incorporated</td>
</tr>
<tr>
<td>Mr. Thomas Duffy</td>
<td>Central Hudson G&amp;E Corp.</td>
</tr>
<tr>
<td>Mr. Stephen (Steve) E. Early</td>
<td>American Electric Power</td>
</tr>
<tr>
<td>Ms. Lynnda Ell</td>
<td>ENTERGY</td>
</tr>
<tr>
<td>Steve Englebretson</td>
<td>NREL</td>
</tr>
<tr>
<td>Robert Erhardt</td>
<td>Philips Lighting</td>
</tr>
<tr>
<td>Mr. William E. Feero</td>
<td>W E Feero, PE</td>
</tr>
<tr>
<td>Mr. N. Richard (Dick) Friedman</td>
<td>Resource Dynamics Corporation</td>
</tr>
<tr>
<td>Dr. Joseph (Joe) F. Galdo</td>
<td>Fairfax Energy</td>
</tr>
<tr>
<td>Mr. Andris Garsils</td>
<td>KeySpan Energy</td>
</tr>
<tr>
<td>Bernadette Geyer</td>
<td>U.S. Fuel Cell Council</td>
</tr>
<tr>
<td>Mr. Tom Gordon</td>
<td>Siemens Westinghouse Power Corp.</td>
</tr>
<tr>
<td>Mr. George T. Gurlaskie</td>
<td>Progress Energy</td>
</tr>
<tr>
<td>Mr. Ross Gutromson</td>
<td>Battelle Pacific NW National Labs</td>
</tr>
<tr>
<td>Mr. Ronald D. Hartzel</td>
<td>Eaton Corporation/Cutler-Hammer</td>
</tr>
<tr>
<td>Ms. Christy Herig</td>
<td>National Renewable Energy Laboratory</td>
</tr>
<tr>
<td>Mr. E.J. Honton</td>
<td>Resource Dynamics Corporation</td>
</tr>
<tr>
<td>C. Travis Johnson</td>
<td>Georgia Power</td>
</tr>
<tr>
<td>Mr. Gerald Johnson</td>
<td>Basler Electric Co.</td>
</tr>
<tr>
<td>Dr. Yuri Khersonsky</td>
<td>L3 Communications SPD Technologies</td>
</tr>
<tr>
<td>Ms. Elizabeth A. Kime</td>
<td>Resource Dynamics Corporation</td>
</tr>
<tr>
<td>Mr. Brenon Knaggs</td>
<td>Ballard</td>
</tr>
<tr>
<td>Mr. Joseph L. Koepfinger</td>
<td>Koepfinger Consulting</td>
</tr>
<tr>
<td>Mr. Frank Lambert</td>
<td>Georgia Tech</td>
</tr>
<tr>
<td>Mr. Richard (Rick) Langley</td>
<td>EPRI PEAC Corp.</td>
</tr>
<tr>
<td>Mr. James W. Lemke</td>
<td>Cinergy-PSI</td>
</tr>
<tr>
<td>Name</td>
<td>Organization</td>
</tr>
<tr>
<td>-----------------------</td>
<td>-------------------------------------------</td>
</tr>
<tr>
<td>Mr. Jason Lin</td>
<td>GE Inc.</td>
</tr>
<tr>
<td>Mr. Kevin P. Loving</td>
<td>American Electric Power</td>
</tr>
<tr>
<td>Mike Martin</td>
<td>Virginia State Corporation Commission</td>
</tr>
<tr>
<td>Mr. Anthony Mazy</td>
<td>California PUC</td>
</tr>
<tr>
<td>Mr. Robert L. (Larry) Morgan</td>
<td>Duke Energy Corporation</td>
</tr>
<tr>
<td>Michael Pehosh</td>
<td></td>
</tr>
<tr>
<td>Mr. Chris Pink</td>
<td>NREL</td>
</tr>
<tr>
<td>Mr. Jeff G. Pope</td>
<td>Encorp, Inc.</td>
</tr>
<tr>
<td>Mr. Tom Rizy</td>
<td>Oak Ridge National Laboratory</td>
</tr>
<tr>
<td>Mr. Charles Rogers</td>
<td>Consumers Energy</td>
</tr>
<tr>
<td>Steve Rosenstock</td>
<td>Edison Electric Institute</td>
</tr>
<tr>
<td>Mr. Anthony Russo</td>
<td>SKAE Power Solutions</td>
</tr>
<tr>
<td>Mr. Bob Saint</td>
<td>NRECA</td>
</tr>
<tr>
<td>Mr. Daniel P. Sammon</td>
<td>Con Edison</td>
</tr>
<tr>
<td>Viggo Selchau-Hansen</td>
<td>Solectria</td>
</tr>
<tr>
<td>Mr. Andrew Skok</td>
<td>FuelCell Energy, Inc.</td>
</tr>
<tr>
<td>Mr. Wayne Stec</td>
<td>Distreger Advisory Group</td>
</tr>
<tr>
<td>Mr. William J. Steele</td>
<td>EPRI</td>
</tr>
<tr>
<td>Mr. John Stevens</td>
<td>Sandia National Laboratories</td>
</tr>
<tr>
<td>Mr. Craig Taborsky</td>
<td>Maryland Public Service Commission</td>
</tr>
<tr>
<td>Ms. Holly Thomas</td>
<td>National Renewable Energy Laboratory</td>
</tr>
<tr>
<td>Mr. David Van Holde</td>
<td>E Source</td>
</tr>
<tr>
<td>Mr. Mani Venkata</td>
<td>Iowa State University</td>
</tr>
<tr>
<td>Mr. Joseph Waligorski</td>
<td>FirstEnergy Corporation</td>
</tr>
<tr>
<td>Dr. Simon Wall</td>
<td>Capstone Turbine Corporation</td>
</tr>
<tr>
<td>Mr. Tim (Carl T.) Wall</td>
<td>Alabama Power Company</td>
</tr>
<tr>
<td>Mr. Reigh A. Walling</td>
<td>GE Inc.</td>
</tr>
<tr>
<td>Mr. James (Jim) Watts</td>
<td>Ingersoll-Rand</td>
</tr>
<tr>
<td>Mr. Randall (Randy) West</td>
<td>ENCORP</td>
</tr>
<tr>
<td>Mr. Charles Whitaker</td>
<td>Endecon Engineering</td>
</tr>
<tr>
<td>Carl Williams</td>
<td>Keyspan</td>
</tr>
<tr>
<td>Mr. Paul H. Williams</td>
<td>Heliotronics, Inc.</td>
</tr>
<tr>
<td>Dr. Robert Wills</td>
<td>Intergird, Llc</td>
</tr>
<tr>
<td>Zhihong Ye</td>
<td>GE Global Research Center</td>
</tr>
<tr>
<td>Bob Yinger</td>
<td>Southern California Edison Company</td>
</tr>
<tr>
<td>Mr. Timothy P. Zgonena</td>
<td>Underwriters Laboratories Inc.</td>
</tr>
</tbody>
</table>
Interconnection Standards: IEEE SCC21 P1547 Series

Status Presentation Prepared for The P1547.1, P1547.2, and P1547.3 Meetings

Tom Basso, Secretary IEEE SCC21, P1547, P1547.2, and P1547.3
(Technical Lead Interconnection Engineering and Standards
NREL Distribution and Interconnection R&D)

Richard DeBlasio
(Technology Manager: NREL Distributed Energy and Electricity Reliability;
IEEE Standards Association Board Member, and, Chair IEEE SCC21 and P1547)

P1547 Series of Standards for Interconnection

P1547 Draft Standard for Interconnecting Distributed Resources with Electric Power Systems

Guide for Networks

P1547.3
Draft Guide for Monitoring, Information Exchange and Control of DR Interconnected with EPS

Guide for Impacts

P1547.2

Guide for Islanding & Anti-Islanding

P1547.1
Draft Standard for Conformance Test Procedures for Equipment Interconnecting Distributed Resources with Electric Power Systems

The above schematic identifies existing standards development projects (P1547 series) and activities under discussion by P1547 Work Group members.
IEEE Standards Development Approach

• Voluntary consensus standard
  – Hallmark of the standards process
  – Open to all dedicated parties
    ➢ P1547 promotes industry driven partnerships
  – IEEE ballot member categories:
    ➢ General Interest, Producer, User: e.g., Manufacturers, Utilities, Test Labs, Engineering Companies

• Worldwide recognition
  - IEEE and International Electrotechnical Commission (IEC) dual logo arrangement for IEC to accept IEEE standards for international use

IEEE P1547 Series Timeline

• 1999 March: P1547 (Standard for Interconnecting) development authorized by IEEE
  – Chairman: Richard DeBlasio, NREL

• 2001 June: P1547.1 (Test Standard) development authorized by IEEE
  – Chairman: Jim Daley, ASCO Power Technologies, Inc.

• 2001 December: P1547.2 (Guide to P1547) development approved by IEEE
  – Chairman: Dick Friedman, Resource Dynamics Corporation

• 2002 June: (Guide for Monitoring/Information Exchange/Control) development approved by IEEE
  – Chairman: Frank Goodman, EPRI

• TARGET DATES:
  – 2003: P1547 Standard for Interconnecting published by IEEE
  – 2004: P1547.1 Voting Draft Completed
  – 2004: P1547.2 Voting Draft Completed
  – 2005: P1547.3 Voting Draft Completed
IEEE P1547 Draft 10 Status

- 2002 August - September: P1547 Ballot Vote (230 Ballot Members)
  - 90% (187) Affirmatives   - 7 Abstentions
  - 10 % (20) Negatives     - 93% returns

- 2002 September – 2003 January: Negative Ballots Addressed
  - About one-third negative votes changed to affirmative

- 2003 February – March: P1547 Draft Revision Recirculated

- 2003 April – June: Recirculation Results Addressed
  - When >75% of votes are affirmative, IEEE Standards Board has an
    obligation to the majority to timely consideration of publishing the
    standard.

- 2003: Target Date for IEEE publication of P1547 Standard

Summary

- **Industry driven partnership a success**-- on average 100 members
  participate in a P1547 meeting. Estimated cost shared by the DER
  industry is $300K/meeting times 15 meetings to date = $4.5M.

- **P1547 Series of Standards** development gains sustainable support
  as state and federal activities heat-up. Need for technical standards
  becoming more evident as part of industry acceptable
  interconnection agreements.

- **The DOE DEER** support plays an essential DER role and provides
  resources in facilitating and leading the IEEE efforts.
Contact Information

- Mr. Richard (Dick) DeBlasio
  email: ddeblasi@nrel.gov
  voice: (303) 275 – 4333
- Mr. Thomas (Tom) S. Basso
  email: thomas_basso@nrel.gov
  voice: (303) 275 - 3753
- IEEE SCC21 Standards Coordinating Committee 21
  on Fuel Cells, Photovoltaics, Dispersed Generation, & Energy Storage
  http://grouper.ieee.org/groups/scc21/
- P1547 Series of Standards for Interconnection
  http://grouper.ieee.org/groups/scc21/1547
- DOE
  http://www.eren.doe.gov/distributedpower/

Future Meetings: P1547-series

DRAFT SCHEDULE/PLAN (1/24/03 onsite feedback):
  SCC21 WG Officials; then parallel meetings of P1547.1, .2, .3
  - Tuesday  1PM – 5PM SCC21 (WG Officials)
  - Wednesday  8AM - 5PM (P1547.1, .2, .3  WG Participants)
  - Thursday  8AM - 5PM P1547.1, .2, .3 WG Participants)
    - February – May: each WG will have their own sub-WG meetings/electronic exchanges (e.g., sub-WG of P1547.1 considering June 14-16 in Las Vegas)
    - June 3-4-5: P1547-series in Denver (NOT June 21 – 26, NOT July 11-25)
    - October/November: Chicago or Las Vegas (NOT 2nd wk Oct)

(Basso to send passwords of all P1547 series URLs to all P1547 series WGs)
1547.2 Work Group Update

- October 2002 meeting results and ensuing activities
- Writing assignments
- Contributions to date
October 2002 Meeting Results

- Reviewed Preliminary Work Group Resource Document
  - Reference material
  - Guide organization and content
- Breakout sessions and preliminary writing assignments
  - Introductory sections
  - Technical requirements and applications guidance
  - References, process and supporting material

Writing Assignments

Introductory Sections

- Introduction to IEEE P1547 - Joe Galdo
- Overhead distribution systems - Bill Steeley
- Underground distribution systems - Andy Garsils
- Other considerations - Rob Wills, Ed Quiroz
- Protection & coordination - Wayne Stec
- SCADA - Rob Wills
- Transformer connections - Andy Garsils, Bill Steeley
- Interconnection Systems - Joe Galdo, Dick Friedman
Writing Assignments - Technical Requirements & Application Guidance

- Voltage Regulation - Kevin Loving, Steve Early, Jason Lin
- Synchronization - Gerald Johnson, Jason Lin
- Inadvertent Energization of the Area EPS - Gerald Johnson, Jason Lin
- Isolation Device - Jason Lin
- Loss of Synchronization - Mickey Pitt
- Reconnection to Area EPS - Gerald Johnson
- Limitation of DC Injection - Steve Chalmers
- Limitation of Flicker Induced by the DR - Mickey Pitt
- Harmonics - Bob Saint

Writing Assignments - References, Process and Supporting Material

- Draft of Interconnection information - Matt Romanow
- Case Example of Procedure - Holly Thomas
- Sample Cases (example write up) - Thomas Wind
- Bibliography - All contribute
1. Introduction to IEEE P1547, Draft Standard for Interconnecting Distributed Resources with Electric Power Systems
2. Overview of Distributed Resource (DR) technologies
   2.1. Generation and Storage Technologies
       2.1.1. Reciprocating engines
       2.1.2. Turbines
       2.1.3. Microturbines
       2.1.4. Fuel cells
       2.1.5. Renewables
       2.1.6. Storage
   2.2. Power conversion technologies (suggestion to relocate)
       2.2.1. Synchronous generators
       2.2.2. Induction generators
       2.2.3. Inverters
   2.3. Protection and coordination capabilities (Suggested for major revision and addition)
       2.3.1. Failure modes
       2.3.2. Safety considerations
       2.3.3. Isolation
3. Discussion of distribution systems
   3.1. Introductory Discussion (PCC implications, operating
       considerations, islanding, what 1547 is intended to discuss)
   3.2. Radial Systems
       3.2.1. Overhead
       3.2.2. Underground
   3.3. Other Considerations (microgrids, intentional islanding)
       3.3.1. Monitoring

4. General requirements for interconnection of DR to Electric power
   system (EPS)
   4.1. Voltage regulation
   4.2. Integration with area EPS grounding
   4.3. Synchronization
   4.4. Distributed Resources on Distribution Secondary Grid and Spot
       Networks
   4.5. Inadvertent Energization of the Area EPS
   4.6. Monitoring
   4.7. Isolation Device
   4.8. Interconnect Integrity
5. Response to Area EPS abnormal conditions
   5.1. Faults
   5.2. Reclosing coordination
   5.3. Voltage
   5.4. Frequency
   5.5. Loss of synchronism
   5.6. Reconnection (Suggestion to delete)

6. Power Quality
   6.1. DC Injection
   6.2. Flicker
   6.3. Harmonics

7. Islanding
   7.1. Unintentional islanding
   7.2. Intentional islanding

8. Summary table of IEEE P1547 requirements and application guidance

9. Interconnection procedures
   9.1. Information required from the DR
   9.2. Information required from the EPS

10. Appendices
    Sample cases
Break-Out Sessions

- Critique draft content
- Refine writing assignments
- Prepare written report for distribution

IEEE P1547.2 Work Group Meeting
January 24, 2003

Break-Out Sessions

60 minutes with appointed recorder

Reconvene at 11:30
Session Wrap Up & Future Plans

- Review progress to date
- Minutes will include breakout reports
- New writing assignments (perhaps more serious this time)
- Form Writing Committee and schedule first meeting
- Establish schedule aimed at voting draft by 2004
- Next Work Group meeting - June 2003