

**Massachusetts Technology Collaborative  
Advance Network Protector RFP Initiative  
Report on IEEE 1547.6 Working Group  
February 2007 Meeting**



MASSACHUSETTS  
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COLLABORATIVE

RENEWABLE ENERGY TRUST

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# Executive Summary

The IEEE 1547.6 standard is still under development. The issues of concern to utilities have been articulated and are in draft form. Interconnections types are classified, from the utility's perspective, as either "De Minimus" (i.e. small enough not to require significant protective measures) or those that require detailed case-by-case study and appropriate protective measures. A draft of recommended interconnection procedures is presently in the writing phase. During the February 1 & 2, 2007 meeting a presentation of the proposed RFP for Advanced Network Protector/DG Interconnection Technology was presented by James Bing of New Energy Options, on behalf of MTC. The concept underlying the RFP met with guarded interest. Several members of the working group made specific recommendations which are note in this report. Through discussions and observations over the course of the meeting a more detailed understanding of the technical issues pertaining to network protectors and their functions was acquired. The technical specifications for the RFP have been revised accordingly.

## Introduction

This report documents the proceeding of the February 1 & 2, 2007 IEEE 1547.6 working group meeting in Atlanta, Georgia. This working group is the key technical forum dealing with the issue of interconnection of distributed generation to secondary network distribution system in the United States today. On behalf or the Massachusetts Technology Collaborative a presentation was given by James Bing of New Energy Options, describing the proposed RFP for Advanced Network Protector/DG Interconnection Technology. Reactions to the presentation and this initial exposure to the concept, which were guardedly positive, are described in the body of this report. Some of the feedback and questions that were put forward after the presentation have led to a reexamination of the draft proposal. Some of the observations made and issues raised by the members of the working group will be incorporated into the solicitation itself, "Advanced Network Protector Initiative RFP."

This report also includes two appendices. Appendix 1 describes the IEEE Standards process and the specifics of the 1547 series of standards. Appendix 2 is the presentation of the RFP for Advanced Network Protector/DG Interconnection Technology to the working group.

# 1547.6: DG on Networks Meeting

Significant discussion and debate took place at the February 2007 meeting in Atlanta in the development of this standard. The meeting was chaired by Joseph Koepfinger. Dr. John Bzura, of National Grid was Vice Chair and moderated the discussion. Tom Basso of NREL served as secretary.

## Review of Previous 1547.6 Meetings

John Bzura provided a summary of some of the salient points discussed in previous meetings. The major concern of utilities with regard to interconnection to network distribution systems is that the quality of service not be impaired in any way. John pointed out that network service is the gold standard of reliability and that network system in Worcester, Massachusetts has had 40 years without interruptions due to distribution system failures.

John went on to mention the sections being worked on in the working group. The working group is working toward a standard sanctioned by IEEE. Topics within the standard that are being discussed include:

7. Overview of Network Distribution Systems
8. Primary Concerns of Operating DR on Networks
9. Means of Interconnecting DR to Networks
10. Recommended Solutions

## 1547.6 Working Group Breakout Discussions

After initial comments the working group divided into two breakout groups. One group, led by Mohammad Vaziri of Pacific Gas & Electric, addressed section 8, and focused on the concerns of utilities regarding the interconnection of DR to networks. The remaining group, led by John Bzura, addressed section 9, articulating the means (i.e. types of configurations) by which DR could be interconnected to electric power systems.

The starting point of the discussions of John's breakout group centered around clause 4.1.4.2 of 1547-2003, "Distribution secondary spot networks." In effect the clause requires that:

1. Reverse power flow not allowed through NP
2. NP shall not be used as a means of connection or disconnection DR
3. Operation of DR will not cause false trips
4. Operation of DR will not cause open NP to close
5. DR system shall be designed to ensure utility network fault current limitation to be exceeded
6. DR shall be designed so that operational failures of the DR shall not compromise or adversely affect the utility network system.

## Schedule for 1547.6 Standard Development

At the end of the second day of the meeting the two breakout groups reconvened. Writing assignments were made and a schedule for further development of the draft document was negotiated. At this writing a draft standard of 1547.6 is scheduled to be published, within the working group, in July of 2007. The next meeting of the working group is in August of 2007.

# MTC Advanced Network Protector RFP Presentation

## Focus on RFP process

Joseph Koepfinger, the chair of the IEEE 1547.6 working group, very graciously provided a half an hour at the end of the first day of the meeting for me to make a presentation of the Advanced Network Protector/DG Interconnection Technology concept. The presentation focused on the RFP process and not the technical details of the concept. The objective of increasing the acceptance of DG on spot networks was stated. The collaborative approach to providing funding was described. The nature of the solicitation was made clear, however no monetary figures were discussed. The technical goals of prototype development and eventual Phase I testing were described.

Some time was spent in describing the technical details of the RFP, however this was kept to a minimum because Bill Feero had presented the concept in great detail in August of 2006 at the last meeting of the working group. Only the most advanced of the technical details were given treatment. The presentation stressed the need to work within the framework of existing network protector technology. It emphasized a collaborative approach, seeking consensus amongst network protector manufacturers, DG manufacturers and utilities.

The technical aspects of the concept that were emphasized were the those that distinguish it from existing approaches to protective relaying in low voltage distribution networks. Specifically noted were:

- The development of the capacity, within the network protector itself, to control customer sited DG across the point of common coupling (PCC).
- The development of high speed systems for monitoring and control, with supervisory functions, with consensus protocols, for linking network protectors and DG.
- The development of operational protocols and best practices for system security.

It is worth noting that within the minutes from the August 2006 meeting, and again in the discussions of the current meeting, on several occasions tactics and approaches for dealing with DG installations on networks were discussed that appear to entail the same capabilities present in the Advance Network Protector RFP. A paper contributed by Murray Davis to the 2006 meeting minutes describes a mechanism for taking a generator offline through the use off a network protector trip coil. Also, in his discussions of possible solutions for locating DG on networks, James Daley suggest the possible need for a "NO Go' signal from NP interaction with DR" system. In conversations with Chuck Whitaker, of BEW Engineering, it was learned that a configuration such as this is presently being employed at the Moscone Center in San Francisco. While these are encouraging signs, the advance network protector which the RFP envisions does not presently appear to be commercially available.

The presentation concluded with proposed schedule for the solicitation, development and subsequent prototype testing.

## Participant Feedback

Although several of the participants in the meeting had been present at Bill Feero's presentation of the technical details in August of 2006, I believe that this was the first time that most of them had seen the program details of the RFP. Immediate reaction from the group was somewhat muted. I explained that, subject to acquiring sufficient co-funding, and barring any major objection from the stakeholders, MTC intended to proceed with the solicitation. There was no negative feedback. The comments that were received were guardedly supportive of the idea.

Joe Koepfinger asked if a specification had been written. I explained that none existed at this time but that a formal performance specification would be written before the RFP was released. The discussion then continued on the topic of communications protocols. Mr. Koepfinger was extremely helpful in pointing out the multiplicity of potentially relevant communications standards that might be applicable to this development effort.

Thomas Kenny of Eaton Cutler-Hammer was present at the meeting. There was no representative present from the other network protector manufacturer, Richards Manufacturing Company. When asked for a reaction to the RFP Mr. Kenny seemed to indicate that, even if all of the functionality described in the RFP was not present in their current line of relays, the addition of these functions appeared to present no fundamental obstacle.

Based upon the discussions and debate of the issues in the standards meeting it is by no means certain that the Advanced Network Protector concept will be able to *guarantee* that customer sited DG will not contribute to the tripping of a network protector. To some extent acceptance or rejection of the DG on spot networks by the utility becomes a matter of risk tolerance. That said, none of the working group members seemed to be apposed to the idea of development of a more intelligent network protector. No one seemed fundamentally apposed to the idea of some amount of control of the customer's generation being transferred to the utility side of the PCC. In fact the meeting host from Georgia Power provided an example of a contractual arrangement where customer's standby generation was maintained and dispatched by the utility.

One thing that the response to the presentation made clear is that more work needs to be done to articulate the performance specifications of the device being described in the RFP. Additional information will need to be collected from utilities, DG manufacturers (of which there is a great variety) and network protector manufacturers. The issue of what is necessary to achieve the operational objectives of the RFP vs. what is possible given the physical constraints of existing technology needs to be reconciled. Communications standards, of which there are a great many, need to be selected, if only for the prototype phase of the development effort. In order to move forward at least a preliminary consensus will need to be achieved.

# Appendix 1: IEEE Standards Process

Creation of standards through the IEEE Standards Coordinating Committee (SCC) is a formal consensus process for the development of technical standards through voluntary participation of expert stakeholders. IEEE SCC21 applies to the development of standards for a variety of forms of distributed generation<sup>1</sup> and their interconnection to electric power systems (EPS).

The IEEE website describes the scope and purpose of SCC21:

“SCC21 oversees the development of standards in the areas of fuel cells, photovoltaics (PV), dispersed generation, and energy storage and coordinates efforts in these fields among the various IEEE Societies and other affected organizations to ensure that all standards are consistent and properly reflect the views of all applicable disciplines. IEEE SCC21 reviews all proposed IEEE standards in these fields before their submission to the IEEE-SA Standards Board for approval and coordinates submission to other organizations.<sup>2</sup>”

The core IEEE 1547 standard, in its final form, was adopted in 2003. Subsequent to this six supplemental standards were initiated. They are 1547.1, 1547.2, 1547.3, 1547.4, 1547.5, and 1547.6. Certain of these standards, such as 1547.1, will become required standards for interconnection. Others, such as 1547.6, will have the force of recommended “best practices.” A brief description of each of the standards and an update on their status follows.

## Description of 1547.x Standards

### 1547.1™

“IEEE 1547.1 2005 Standard for Conformance Tests Procedures for Equipment Interconnecting Distributed Resources with Electric Power Systems”

1547.1 is a standard for testing of DG equipment for suitability for interconnection to EPS. It has been finalized, balloted and adopted. It is our understanding that it has or will replace (by reference within) the testing standard embodied in UL1741.

### 1547.2™

“IEEE P1547.2 Draft Application Guide for IEEE 1547 Standard for Interconnecting Distributed Resources with Electric Power Systems”

1547.2 is an applications guide intended to facilitate the understanding and use of 1547. At present it is under development.

### 1547.3™

“IEEE P1547.3 Draft Guide For Monitoring, Information Exchange, and Control of Distributed Resources Interconnected with Electric Power Systems”

1547.3 is a communications standard for distributed generation system<sup>3</sup>. The development of this standard is presently complete and it is in the balloting stage. Note that this standard will likely

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<sup>1</sup> For the purposes of this document the terms distributed generation (DG) and distributed resources (DR) will be used interchangeably. The preferred term in IEEE 1547.6 nomenclature is “distributed resources,” or “DR”.

<sup>2</sup> <http://grouper.ieee.org/groups/scc21/>

<sup>3</sup> Note that the standard specifically refers to “Monitoring, Information Exchange, and Control” and omits the term “communication.” This is intentional as “Communications” is a large and distinct area of standards development within IEEE.

become very relevant to the proposed work of the developers of the advanced network protector RFP.

### **1547.4™**

“IEEE P1547.4 Draft Guide for Design, Operation, and Integration of Distributed Resource Island Systems with Electric Power Systems”

1547.4 is a standard intended to develop recommendations and best practices of systems that include “the ability to separate from and reconnect to part of the area EPS while providing power to the islanded local EPSs.” This standard is presently in the development stage. The meeting of this working group was being held concurrently with that of 1547.6 in Atlanta. (While this standard does not relate directly to concerns of DG on secondary networks it is worth noting that it deals with some of the “ride-through” issues and concerns articulated in the recent MTC DG Collaborative workshops.)

### **1547.5™**

“IEEE P1547.5 Draft Technical Guidelines for Interconnection of Electric Power Sources Greater than 10MVA to the Power Transmission Grid”

1547.5 deals with the interconnection of large DG systems at the transmission level. It is presently under development.

### **1547.6™**

“IEEE P1547.6 Draft Recommended Practice For Interconnecting Distributed Resources With Electric Power Systems Distribution Secondary Networks”

1547.6 deals with the interconnection of DG systems to secondary distribution networks, both “grid”<sup>4</sup> and “spot.” This standard is in the development stage. Attendance at this working group meeting was the purpose of our trip and the subject of this report.

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<sup>4</sup> There are a number of different terms used to describe “grid” network configurations. Among them are, “street” networks and “area” networks. In this report we will use the IEEE term, “grid.”

# Appendix 2: MTC Advanced Network Protector RFP Presentation



**RFP for Relaying and Control Technology Development for Spot Networks**

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## MTC Advanced Network Protector RFP

- **Objective:**
  - To advance acceptance of DG on Spot Networks through hardware development
- **Approach:**
  - Collaboratively funded RFP
  - Prototype development and testing
- **Methodology:**
  - Provide control of DG to utility across PCC
  - High speed communication from utility to DG



## Advanced NWP RFP Objective

- To advance the acceptability of DG on Spot Networks by utilities
- To sponsor the development of a hardware solution compatible with existing Network Protector technology
- To create a consensus solution amongst stakeholders on both sides of the Point of Common Coupling



## MTC NWP RFP Program Approach

- Seek collaborative funding from state & federal agencies & other sponsors
- Solicit technical input from stakeholders
- Seek “open source” standard
- Finalize RFP, based on draft at:  
[www.masstech.org/DG/02-38-C\\_Attachment-F\\_Network\\_RFP.pdf](http://www.masstech.org/DG/02-38-C_Attachment-F_Network_RFP.pdf)
- Request/evaluate/award proposals
- Develop and test prototype



## Technical Methodology

- Develop capability resident in the Network Protector for control of remote customer sited DG
- Develop supervisory systems, high speed communication and consensus protocol for NWP-DG communication
- Develop operational protocols & best practices for system security



## Potential RFP Timeline

- Milestones (proposed):
  - RFP published: 4/1/07
  - Proposals due: 6/1/07
  - Award: 7/15/07
  - Lab demonstration: 6/1/08
  - Prototype testing: 8/1/08



## Questions & Follow-Up

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