Power Generation

July 28, 2003

Burl W. Haar
Executive Secretary
Minnesota Public Utilities Commission
121 7th Place East, Suite 350
St. Paul, Minnesota, 55101-2147

RE: Reply Comments
In the Matter of Establishing Standards for Utility Tariffs for Interconnection and Operation of Distributed Generation Facilities
Docket No. E999/CI-01-1023

Dr. Haar, the reply comments of Cummins Power Generation to the comments of several interested parties in the referenced Docket are enclosed. A copy of this correspondence has been provided to all parties on the enclosed service list.

Any questions on these documents can be directed to either myself at (763)575-5055, or Eunice Kwei, also of Cummins Power Generation, at (763)574-5000.

Thank you for considering the issues brought forward in our previous comments. We greatly appreciate the opportunity to respond to the comments of others on the important issues that have been raised.

Sincerely,

Gary Olson
Technical Counsel

Attachment
Service List (July 16, 2003)
(15 duplicates)

Overview

The major issues raised in the previous comments of Cummins Power Generation were disputed in several responses received by the Commission. Cummins Power Generation would like to offer the following further explanations and rebuttals to these responses.

1. Adequacy of IEEE1547 as a technical basis for the Minnesota requirements.

Many of the comments on technical issues raised relate to the adequacy of IEEE1547 as a technical basis for the Minnesota requirements for interconnection. Several of the comments indicate that the IEEE1547 is not complete, or is a minimum standard, and doesn't include all the technical requirements necessary for a safe and reliable installation.

It is important to understand that the IEEE1547 is complete in its *technical requirements* for *interconnection equipment* for most applications. This is specifically stated in the document in a number of locations. The document is quite limited in scope, but clear in the requirements for features and performance of interconnection equipment.

It's also important to understand what it doesn't cover:

- Area EPS (utility) equipment and systems
- Customer-owned equipment that is not a part of the interconnection equipment
- Testing requirements (for interconnection equipment)
- Application requirements
- Monitoring equipment and requirements

Testing requirements will be covered in IEEE1547.1 (previously called IEEE P1589). Application guidelines will be covered in IEEE1547.2 (previously called IEEE P1608). Monitoring equipment and practices will be covered in IEEE1547.3 (previously called IEEE P1614).

Simply, Cummins Power Generation's position is that where a national standard exists, it should be used. There is no need to either add to it, and it's dangerous to ignore parts of it. Our specific comments, which follow, reiterate and clarify where changes have been made in the Minnesota rules that could be interpreted as changes (and potentially conflicts) with the IEEE1547 requirements.

IEEE1547 will undoubtedly change over the coming years, but it is finished, complete, and usable in its current form. The state of Minnesota should take advantage of all the work of literally hundreds of engineers and contributors to this standard, and simply require compliance. Care should be taken so that any text that describes technical requirements be consistent with IEEE1547. Since qualified consulting engineers will almost always be involved in the design of large, complex systems, and certified equipment is likely to be involved with small systems, it should not be an excessive burden for anyone to read and follow the 30 pages or so of requirements in IEEE1547.

With that being said, as noted in our previous comments, there are several places where the standard is silent, or specifically has not considered certain equipment. In those cases, the Commission should make rules where necessary—remembering that the rules being written apply to interconnected equipment. Utility practices govern the utility side of the system, and

generally local electrical codes govern the installation of customer equipment. By concentrating on only the interconnecting equipment requirements conflicts with requirements in the overall system can be avoided.

2. Establishing rules, fees, and procedures for open transition transfer switches.

In reviewing the comments that relate to this subject, it is clear that there has been a small bit of miscommunication between the parties on this subject.

In the emergency/standby power equipment marketplace in the US, a transfer switch is by definition a UL-listed device that is specifically approved (by UL or another national testing service) for use in switching power between sources. It appears that the term is used more broadly in utility circles, to include other types of switching systems that are not evaluated as systems. These systems would commonly use circuit breaker pairs at low, medium, or even high voltages. These systems, as correctly noted in responses, are not 3rd party listed as system equipment.

It was also correctly noted that non-certified systems may not include mechanical interlocks, or meet other system safety and performance requirements that UL-listed equipment would meet.

It is easy to understand why a utility service provider would be nervous about having uncertified systems connected to their grid. As correctly noted, these systems might either intentionally or unintentionally be interconnected without their knowledge. The result would be unexpected risks to customer and utility-owned equipment and to workers in the utility system.

The concern of Cummins Power Generation is not with that type of equipment. The commission should judge whether or not the risk is sufficient to warrant attempts to regulate non-certified power transfer equipment, and what procedures are necessary to assure required levels of safety and performance with that type of equipment. We believe that when system designs are supervised by a qualified consulting engineer, the risks are minimal. This practice has been in place for many years, and should not be changed unless there is clear evidence that a change is necessary.

With regard to the use of certified automatic power transfer equipment, Cummins Power Generation continues to maintain that there is no need for rules that would require submittals and fees to verify compliance to requirements. While we appreciate the comments that indicate that the intent is to eliminate unnecessary utility-required visible disconnects (and potentially other equipment) for systems using this equipment, Cummins believes that a simple statement indicating that there are no requirements other than local electrical code requirements would be sufficient in these rules. A figure, such as is shown in attachment 2, specifically covering that point should work well.

It is true that low voltage transfer systems can get quite large (currently up to 4000 amps at up to 600 volts AC). It's also true that switching large loads can result in transient voltage variations on the power grid. However, many conditions can cause voltage variations on the grid, and the systems do not have to be large to cause them. There are literally thousands of certified power transfer systems in place in Minnesota today that operate without problems to either their owners or to the utility. There has been no demonstrated problem that would

require more restrictive rules here—only a statement that it could happen. I would prefer to see the problem conditions addressed as they come up, rather than burdening every facility owner with additional paperwork, cost, and potential delay.

3. Closed Transition automatic power transfer equipment.

Certified closed transition automatic power transfer equipment is currently available in the marketplace, and is commonly used in Minnesota today.

It has been correctly noted that this equipment is not covered in IEEE1547. Because it is not covered, as we previously noted, it is reasonable to consider rules for this type of equipment. However, in the development of rules, it should be considered that Underwriters Laboratories (UL) has already established approval procedures for this equipment which, in effect, are a national standard. They require provisions to protect against common failure modes, such as a failure to disconnect. The addition of other features to this national standard should be taken with great care to avoid unnecessary burden on the owners of facilities, and also the utility staff that would be forced unnecessarily divert their time and resources to reevaluate them.

We have another potential terminology misunderstanding in this area. In the synchronous generator business, the use of the word "synchronize" implies use of equipment that *actively controls* one of the sources to establish and maintain a synchronous condition prior to allowing an interconnect of two live systems. In the context of our previous comments, we did not mean to imply that sources should be interconnected when out of phase with each other. We simply point out that sources can be synchronized without active synchronizing controls. Most momentary closed transition transfer equipment does not use active synchronizing controls, but still does not allow closure of out of phase sources. We suggest that the text of the Minnesota rules require sources to be in phase when interconnected, but that for closed transition transfer equipment, they not be required to have an active synchronizer, as is implied in the current rules. IEEE1547 includes a good set of requirements for defining the performance of the equipment that supervises the interconnection of live sources.

Again, unless there is clear indication of a problem, we advise acceptance of certified equipment as long as it meets local installation requirements, and the performance requirements of IEEE1547.

5. Comments from Dakota Electric Association and Minnesota Power (Douglas Larson)

The commission should be aware that Mr. Larson visited me to discuss our previous comments, and wrote his comments prior to that meeting. He was very helpful in bringing me up to date on how the proposed rules were developed, and what thinking was behind them. Cummins Power Generation would like to publicly recognize him and thank him for that effort.

The following comments relate to Mr. Larson's submitted document.

II. General Comments

Cummins Power Generation has suggested, and continues to suggest that a technical document should be as free of contractual requirements as possible. It was not our intent to suggest that the entire technical requirements document be struck, but rather that it be modified to segregate the contractual requirements and explanations from the actual requirements. Further, we believe that there are clear cases in the Minnesota rules where the rules could be interpreted to include technical requirements that are not in IEEE1547 and these specific problem areas should be adjusted so that they do not conflict.

Mr. Larson is correct in his comment that the extensions to the core IEEE1547 document will not be ready for some time into the future. For example, the current estimate for IEEE1547.1 indicates that it is more than a year from approval and publishing. Because of this, we agree with Mr. Larson that because of the timing requirements in Minnesota, some rules related to the technical requirements in IEEE1547.1, 1547.2, and 1547.3 will need to be included.

We also recognize that in the interest of time it may not be possible for a wholesale re-write of the document. However, we believe would be highly desirable to eliminate conflicts with IEEE1547.

We agree with Mr. Larson's suggestion that a forum be established to at least annually review the Minnesota rules related to interconnection, and update them based on the current state of hardware available, the availability of new standards, and other changes that could improve the Minnesota rules. Cummins Power Generation will assist in that effort.

III. Specific Comments

The proposed Minnesota rules conflict with the IEEE1547 requirements primarily in that they require, or perhaps imply requirements that are not in IEEE1547.

For example:

Attachment 2, Figure 2

There is a requirement for a 62 device (parallel limit timer), a 25 (active synchronizer), 25SC (sync check), 50/51 (overcurrent), and 51N (ground overcurrent) devices.

Use of ANSI symbols for these devices implies that they are separate "utility grade" devices,

when in fact they are commonly integrated control devices in the customer equipment provided. IEEE1547 requires that these devices will perform to the standards of traditional "utility grade" devices, but they often not be equipment that a utility is familiar with.

In my discussions with Mr. Larson, I understand that the intent of the drawing was not to specifically extra utility grade relaying for all functions, but if they are shown as they are now, they may be interpreted as additional requirements to equipment that is commonly provided in commercial applications.

We suggest that the figures in attachment 2 be slightly modified to more clearly indicate which is required interconnect equipment, and which functions are depicted for information only.

In this case, that would mean that the parallel limit timer and 25SC device would be interconnect equipment (subject to interconnect rules and standards of performance), but the other equipment noted would be commonly supplied equipment for protection of the customer owned distribution and generation equipment.

Attachment 2, Figure 3

Requirements 50/51, 51N, 62PL, 25, 47, 50/51 (genset), 51N (genset), 86, 25, and 25SC are all in excess of the IEEE1547 requirements. They are commonly provided as customer equipment, but should be shown as customer protection equipment and not covered by the Minnesota interconnection rules. Many of these functions are required by other rules for systems that parallel with the grid, such as the National Electrical Code.

Note that the 32 device is used in IEEE1547 as an acceptable anti-islanding device in some situations. It is not always required for the interconnection.

Attachment 2, Figure 4

Requirements 50/51, 51N, 62PL, 25, 67, 86A, 47, 50/51 (genset), 51N (genset), 86B, 25, and 25SC are all in excess of the IEEE1547 requirements.

Again, 50/51, 51N, 25, 67, 86A, 47, 50/51 (genset), 51N (genset), 86B, 25, and 25SC are for protection of the customer-owned facility, and commonly provided.

TT is often used for the protection of utility (and customer owned) equipment, but is not covered by 1547 because it is not in the interconnect package. This equipment falls into the area of "system improvements"—one of many improvements that may be necessary to safely parallel in a specific location.

Regarding Flicker:

IEEE1547 includes specific requirements for flicker that is caused by the DG equipment. The wording in the current rules would allow evaluations that are not as technically specific as those in IEEE1547.

Other Comments:

Mr. Larson has said in his comments that the intent of the writing committee for the Minnesota rules was to come up with a "maximum requirements" document vs. the "minimum requirements" in IEEE1547. Again, while we applaud that position and goal, we do not favor the current writing, because first, we consider that 1547 is a complete document in terms of technical requirements, and secondly, the wording of the current version of the Minnesota rules does not clearly limit the utility from other requirements that are not shown in the document.

Comments of Excel Energy

First, we wish to reiterate that the intent of our previous comments was to state that where there are technical requirements in IEEE1547, they should not be changed. We recognize that there are many other considerations that must be covered in the Minnesota rules, and these, in general, we don't disagree with, except where we have specifically noted them in our comments.

Differences between Minnesota Rules and IEEE1547

The comments of Excel indicate that there are no technical requirements in the Minnesota rules that are not in IEEE1547. Hopefully our reply comments to Dakota Electric highlight some very specific areas where they are clearly in excess of the IEEE 1547 requirements. It should also be recognized that in addition to these noted areas, any place where there are specific technical requirements not in 1547 leaves open room for interpretation that, even though they are not intended to be in excess of 1547, other features are required.

Here are other examples of areas where there are potential differences in technical requirements:

Attachment 2, part 2; in which there is reference to ANSI/IEEE Standard 80
Attachment 2, part 3, B, i, inclusion of open transition transfer switches
Attachment 2, part 3, B, ii, quick open transition switches
Attachment 2, part 3, B, iii, closed transition transfer switches
Attachment 2, part 3, B, iv, soft loading transfer switches (IEEE1547 does not draw different requirements for equipment that parallels for different periods of time.)
Attachment 2, part 4, A, i; text here requires visible disconnect to be a manual safety switch. IEEE1547 would allow other devices, such as breaker drawout units.
Attachment 2, part 4, A, iii; wording may be interpreted to require a synchronous machine to operate at a leading power factor, which is not required by 1547 and is technically not advisable.
Attachment 2, part 4, B, i; requires clearing any fault, which is technically impossible, in addition to being in conflict with 1547; also voltage swell requirement is different than 1547
Attachment 2, part 4, B, iii; flicker requirement different than 1547
Attachment 2, part 4 B, iv; different than 1547—which requires specific performance that will result in this end being met
Attachment 2, part 4, B, v, 1; requires a synchronizer (active device), where 1547 does not
Attachment 2, part 4, B, v, 3; islanding requirement different than 1547
Attachment 2, part 5; grossly different than 1547

Attachment 2, part 6, A; requires customer to provide equipment to detect flicker—not a requirement of 1547; requires physical requirements for testing protection systems that are in excess of 1547; relays in excess of 1547 might be required (ii, 4), again in conflict with 1547
Attachment 2, part 6, A, f; reverse power relay setting different than 1547
Attachment 2 part 6, A, g; requirement for a specific lockout relay that can be interpreted as in excess of that required in 1547 (1547 requires function, not a specific device)
Attachment 2, part 6, A, h; transfer trip is not specifically required in 1547.
Attachment 2, part 6, A, i; parallel time limit relay is not in 1547. However, since 1547 does not cover momentary interconnections specifically, this is understandable.
Attachment 2, part 8, B, b; IEEE1547 does not allow utility to specify make, model of protection equipment
Attachment 2, part 8, C; commissioning requirements very different than 1547

Finally, there is a comment at the end of the "Discussion" section of Excel's comments that implies that the IEEE1547 committees "agreed to disagree" and subsequently left things out. Cummins does not agree with that statement. There was agreement that the 1547 standard could not address many issues, and these were moved to other standards. However, the requirements for features and performance of interconnect equipment were not compromised.

Transfer Switch Issues

We have already commented on transfer switch issues, so will not repeat those here.

Item C, Specific Comments on Attachment 2.

Please note that IEEE1547 is only about 30 pages long, so clear, detailed requirements need not be excessive in length. We do understand better now the intent of the writers of the Minnesota rules, but again, caution that the rules, as written, could be interpreted to add significant technical requirements to a specific facility. These requirements may not be demanded by a utility, but they *could* be.

1. Introduction, B:

The word "minimum" in 1547 should be read in concert with other words in the document that indicate that the requirements listed are sufficient for most installations.

3. Types….

Cummins would agree that if equipment is not pre-certified, other requirements would be reasonable in some cases, as long as they are not in excess of the 1547 requirements.

5. CMM&C…

The concern here is that there is no real concrete guidance on when the monitoring will be required, and also that the requirements are in excess of 1547.

6. Protection…

1547 does not address testing requirements (that detail is in 1547.1). However, it does not require that protective equipment have the specific physical test provisions that are in these rules.

DG Coalition Comments

In general, Cummins accepts the explanations in the DG Coalition document, but we stand by our previous position. In cases where we have offered no specific comment, we have not offered further comments because there were no specific technical issues raised. Specific areas where further comments are required follow.

3. Types…B)iii
As previous noted, we object to the language that implies that active synchronizing is required. We agree that sources must be within the phase angle limits of IEEE1547 in order to be paralleled, for any period of time.

4. I & T…A)iii
We reiterate: synchronous generators should never be intentionally operated at a leading power factor while paralleled with another source. This can lead to catastrophic damage to the machine. It is acceptable for the facility power factor to operate in the range noted, but the power factor with respect to the DG should never be required to operate in a leading state.

Most synchronous machines can operate at slightly leading power factor, but there is not technical advantage to intentionally operating in this state. Active controls required by IEEE1547 would control the synchronous machine so that leading power factor operation would not occur.

6. Protection

IEEE1547 does make specific requirements for protective relaying functions and performance for various sizes of systems. As stated numerous times in this document, additions to or subtractions from the IEEE requirements are not supported by Cummins. There was vigorous discussion on the IEEE committee regarding what was required, what settings were appropriate, and there is no stated reason why these should be abandoned in this document.

Because the relative cost of the protection required versus the cost of rest of the system is very low, we commonly utilize the protection equipment requested by a utility. However, as system sizes become smaller, or projects become more competitive, there will be movement to use integrated protection schemes that are allowed under IEEE1547. There should NOT be a requirement that would allow a utility to standardize on a specific manufacturer or type of relay for any function, as this could hurt the economic viability of some DG projects.

8. Testing…A)

IEEE1547 states what testing is required, but does not define a testing process. Testing process is to be covered in IEEE1547.1. As with the balance of the document, we maintain that the Minnesota rules should not conflict with the specific tests required and described in IEEE1547. However, it is reasonable that comments related to test process may be made since they are specifically not covered by any current standard.

Comments regarding Figures:

We disagree with the DG Coalition on these points. Please refer to other sections of these documents for our suggestions in this area.

Comments of Kate O'Connell

The only comment of Cummins on Ms O'Connell's documents is that we would prefer to see a shorter time period than 2 years before a review group begins looking at changes in the required rules. We suggest that a group convene after approximately one year, review the situation, and recommend whether or not changes are needed at that time.

We expect the situation to stabilize so that annual work on rules is not required.

As noted previously, Cummins will support this work.

GLO
07/28/03