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BEFORE THE PENNSYLVANIA PUBLIC UTILITY COMMISSION

Advance Notice of Proposed Rulemaking
Regarding Small Generation Interconnection
Standards and Procedures

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Docket No. L-00040168

Introduction

The Solar Energy Industries Association is the national trade association of solar energy manufacturers, dealers, distributors, contractors, installers, architects, consultants, and marketers, working to expand the use of solar technologies in the global marketplace.

We thank the Commission for the opportunity to comment in this proceeding. Standardized interconnection rules that appropriately address the safety and reliability issues of interconnected small generation are imperative to advancing solar installations. Solar photovoltaic technologies hold great promise for the operation and reliability of the grid now and in the future. Sited anywhere there is load, these generators produce power closely matching PJM's peak load profile. Their solid-state construction provides on-sun reliability that would be the envy of any piece of rotating machinery, and most come with warrantees for 25 years or more.

Comments

When developing interconnection rules, it is critical to remember that solar PV is interconnected exclusively via solid-state inverter technologies, which convert DC power to grid quality AC. Because these inverters are solid state electronic devices, as compared to mechanical or manually operated switchgear, they can respond significantly faster to grid problems, making them one of the easiest and most reliable technologies to interconnect. Under existing rules developed by the IEEE and Underwriter's Laboratories, inverters contain as part of their default circuitry all safety equipment needed to address all grid abnormal conditions. Photovoltaics, the actual generating technology, are a high-quality, high-technology commodity product with a preexisting certification regime. Their manufacturers – including major transnational corporations like BP, Shell, Kyocera, Sharp, and General Electric – operate under extremely high quality standards, and offer decades-long warrantees.

Many states have found that high-quality, pre-certified equipment such as this, installed in project sizes generally *de minimis* in comparison with local demand, obviates any need for costly interconnection studies. Providing redundancy with the already conservative safety equipment, or imposing additional requirements (or explicitly or implicitly allowing the utilities to do so) is not necessary, and simply erects a barrier to entry that will hamper other policy efforts ongoing in the state (not least the Alternative Energy Portfolio Standard currently before the Commission.)

SEIA believes that the New Jersey rules promulgated in September 2004 represent the national "best practice" model for interconnection - recognizing the safety and reliability requirements for grid interconnected generators, while also taking full advantage of the consensus standards and equipment used by solar and other technologies to meet those requirements. Perhaps most importantly, New Jersey has also struck the proper balance on costs – avoiding subsidization of installations while ensuring that transaction costs do not cripple the economics of small generators. The result has been a thriving new industry for the state.

We should keep in mind that a residential solar system, adequate to meet an average home's entire annual electrical needs, presents an instantaneous power generation capability equivalent to unplugging perhaps two or three hairdryers from the grid. Tiny, standardized and safe

distributed generators such as these should be approved for interconnected operation at little or no cost. The New Jersey rule exempts a set of small pre-certified inverters from an application fee, and sets short time frames for approval based on the date of submittal of a customer application for interconnection. We feel that 10kW is an appropriate ceiling for the expedited interconnection of these residential-sized machines, and this threshold is reflected in the current FERC consensus proceeding on small generator interconnection. (Docket No. RM02-12-000.)

Of course, larger systems require more thorough examination, and we submit that the more comprehensive standards used in New Jersey for generators of all types up to 2MW are also appropriate. These rules are fully compatible with the PJM standards for interconnection for these sizes of generators and are nearly identical to the consensus position filed by the stakeholders before the FERC Docket on Standardization of Small Generator Interconnection Agreements and Procedures (See Docket No. RM02-12-000 Filing by the National Association of Regulatory Utility Commissioners, Nov. 26, 2004 pp 26-27), going beyond these rules largely in the tailoring of study requirements, etc., to the requirements of a utility or state agency, vs. an RTO or federal regulator.)

SEIA would note that while New Jersey limits the application of their interconnection rules to renewable energy facilities who net meter, that this is an irrelevant technical distinction. The technical interconnection requirements should apply to all distributed generators - regardless of whether they net meter. Frankly, those generators that do not net meter, (as with those that meet only a portion of their host's electrical needs, and hence do not export any power to the grid,) appear to the grid operator as, effectively, a demand-side-management or load reduction measure, and are accordingly considerably easier to interconnect than those that must export.

In any interconnection and net metering regime, the devil is very much in the details, and we would urge the Commission, operating in a highly compressed timeframe, to hew as closely as possible to the results of a detailed stakeholder process that has already been completed. There are literally dozens of functional components of the New Jersey interconnection standard that are critical to its successful functioning, all of which were discussed at length by stakeholders in meetings organized by the staff of the Board of Public Utilities. The stakeholder groups in this neighboring state were extremely similar to those that we anticipate participating in Pennsylvania, and all of the supporting and opposing positions were fully aired. The New Jersey rules represent a comprehensive approach and proper balance of the issues.

Interconnection Processing Fees

SEIA believes the New Jersey BPU has implemented a fee structure which meets the goals of all parties. It sets a standard fee for interconnection, satisfying the absolute requirement of small project developers for fee certainty and transparency (even though there may be some cross subsidization amongst small generators), while adequately compensates utilities. The waiving of fees for generators less than 10kW should be adopted, together with the fee of up to $50 plus $1 per kilowatt for an "expedited Level 2" review.

Additions Needed to the New Jersey Rules

The New Jersey interconnection rules are excellent within their scope; however, they do not address dispute resolution, nor set forth procedures for the interconnection of generators larger than 2MW. An explicit dispute resolution procedure should be developed to resolve the highly technical disputes that often arise during interconnection. Because of the technical nature of these disputes, any effective process must provide the equivalent of a neutral technical master knowledgeable in interconnection and utility distribution system matters. Because many projects are on tight budgets and timetables, the master must be available at little or no cost and in a forum that is not procedurally burdensome (e.g. a telephone "hotline").

It is SEIA's belief that the stakeholders in the FERC discussions will find a consensus position on national dispute resolution, and that this service would be available to the states. In the alternative, and provided they were willing, PJM could provide the dispute resolution service. PJM already has in place dispute resolution for large generator interconnections and it should be able to streamline and simplify the existing service for small generators.

The New Jersey rules, as noted in the included flowchart, do not yet address proposed interconnection of generators larger than 2MW[1]. It is SEIA's understanding that PJM will soon attempt to address expedited interconnection for these larger generators; we respectfully request that the Commission participate in this proceeding as much as is possible, and wait until its resolution before adopting state interconnection rules above 2MW.

Insurance

Of particular importance to SEIA are the insurance requirements for customers who install solar. While in the New Jersey rules a utility may not impose any insurance requirement (see N.J.A.C. 14:4-9.3(k)), if the Commission decides to impose a requirement, it would be entirely adequate simply to require the customer carry general liability insurance with no specific exclusions for on-site generation. Even without a minimum, as a practical matter, insurance companies will not write abnormally low general liability policies for residential or commercial customers.

Nonetheless, insurance is not likely to be needed. As noted in the US Department of Energy, Office of Energy Efficiency and Renewable Energy, US Consumer's Guide to Small Wind Electric Systems, "In the 21 years since utilities have been required to allow small wind systems to interconnect with the grid there has never been a liability claim, let alone a monetary award relating to electrical safety" (see page 17)[2]. In a paper analyzing the insurance requirements for small PV systems, the author considers the liability risks from the both utilities and small generator owner's perspective. The author concludes,

> "In short, to our knowledge there have been no instances of small-scale, utility-intertied PV or wind energy systems causing power quality or islanding problems, much less creating potential property damage or personal injury liabilities to the connecting utility."[3]

In New Jersey, commenters suggested that a utility be added as a co-insured on any customer's insurance policy. The Board rejected this as a barrier to distributed generation, stating,

> "It is true that a customer-generator facility may, under some circumstances, contribute to damage of an electric distribution system. However, this is also true of equipment or conditions on properties owned by other customers, who are not required to carry utility-specific insurance to cover any damage they might cause. For example , improperly maintained trees regularly cause significant and costly damage to utility lines and the electric distribution system, yet EDCs do not require customers with trees on their property to carry specific levels of insurance or name the EDC as a covered party in order to retain their right to electric service. Therefore, the Board believes that imposing special insurance requirements on customer-generators is inappropriate and would conflict with the Board's mandate to promote distributed renewable generation in New Jersey."

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[1] The upper limit for the Pennsylvania interconnection rules would be 10MW. At 10MW PJM requires all generators to be interconnected under their rules because of stability issues.

[2] See web reference http://www.eere.energy.gov/windandhydro/windpoweringamerica/pdfs/small_wind/small_wind_guide.pdf

[3] "Allocating Risks: An Analysis Of Insurance Requirements For Small-Scale Pv Systems", Thomas J. Starrs, ASES Proceedings, June 2000. See web reference http://www.millionsolarroofs.com/articles/static/1/1035830720_1023713887.html

Redundant External Disconnect Switch

Redundant external disconnect switches are often proposed as an interconnection requirement. SEIA believes these extra switches on certified, inverter-based solar generators add nothing to safety protection, while imposing significant costs. SEIA would note that the National Electric Code and IEEE standards already require *two* manual disconnect switches and one automatic switch, any one of which would completely isolate the generator from the grid.

Staff of the New Jersey BPU dedicated a significant portion of their stakeholder meeting of September 2, 2004 to addressing the issues surrounding this redundant safety device. After hearing all sides, the staff recommended that the current requirement for such a switch be eliminated; the new rules promulgated in September 2004 did so. Maryland also does not require an external disconnect switch (EDS), while Delaware leaves it up to the customer (who can designate "pulling" the meter as the means of disconnection).

SEIA is concerned about the added cost of an added EDS, especially when the utility is allowed to designate the location of the switch so that it is "accessible at all times". This could require a customer to locate the switch at a distant location, at significant additional cost[4]. Even in the simplest installations, the additional cost of an EDS can run into the hundreds of dollars. For small systems producing only ten or so dollars a month in electricity, the cost of the switch can consume more than a year's worth of economic output.

In most cases, the added cost of an EDS is not justified by a concomitant increase in safety value. Arguably, the EDS provides critical safety protection under only one of three distribution system lineworker safety procedures described below. For the other two safety procedures, the EDS provides little if any added safety value and actually could confuse lineworkers with respect to safe working conditions. Furthermore, under these conditions, the widespread use of EDS on distributed generators can elongate distribution system outage restoration times.

Distribution line repair procedures must address the potential for accidental contact with an energized line. DG equipment on a distribution line can pose a threat to the lineworker unless safety procedures are incorporated to protect workers from accidental voltage from the DG system. The procedures utilities follow fall generically into three categories:

The first is to require all line workers to work on distribution circuits as if they were energized (i.e. live). This is analogous to the safety maxim of treating all guns, at all times, as if they were loaded, even if you have verified that they are not. Even if the line worker has disconnected a circuit, she must wear protective gloving that would insulate them from any electrical current accidentally introduced into the wires. Since lineworkers assume the line is energized for safety purposes, it poses little hazard if the line is accidentally energized by a DG system[5], and the the EDS serves no critical function.

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[4] SEIA notes that there is both a small solar and small wind generator located in the middle of Hershey Park in Hershey, Pennsylvania. Were the park owners required to run conduit miles across the park to the fence and back so that there was an EDS, the cost would likely have been more than the entire installation cost of the generators.

[5] It is important to note that the probability of accidental energization is extremely rare. First several automatic safety components on the DG system would have to fail, and specifically to fail into the "on" mode (an event that based on SEIA's knowledge has never occurred in inverter systems). Second, the DG system would have to exactly match the load on the isolated portion of the circuit and follow that load over time. Most DG systems would not have a capacity to support even a small portion of load on a distribution circuit and most would not have load following capability when interconnected to the grid.

The second approach is for line workers to ground[6] both upstream and downstream sides of the circuit on which they are working. The grounding prevents any current from flowing into the work area from either direction and ensures that the line worker cannot contact harmful electrical currents. Since the downstream side is grounded, any customer sided generation would be short-circuited and could not back feed lethal current. Under this lineworker safety approach, an EDS serves no safety purpose.

In the third case, the distribution safety procedure involves only grounding the upstream side of the circuit. Since there is no downstream grounding, any back feed current could pose a significant risk to line workers. Under this safety approach, requiring an EDS and opening the same would be a critical part of the distribution safety procedure, and all such switches would have to be opened and locked before repairs could commence.

While under this third case, lineworkers are at some risk from approved interconnected generators, they face a much more dangerous and prevalent safety risk – the unauthorized interconnection of a portable generator system. These generators, sold by the thousands at home improvement centers and other retail establishments, have no protection whatsoever against back feeding a distribution circuit. The only piece of equipment needed to interconnect these generators to the entire grid is a male-to-male "pigtail" modified extension cord. Anyone with such a cord could potentially re-energize an entire distribution circuit. Including an EDS on every approved generator in the State does nothing to protect line workers from these rogue interconnections - the only plausible safety approach is for utilities to move to a lineworker safety approach described in the first or second scenarios above. Doing so would, of course, eliminate the need for an EDS.

With the rogue generator safety threat in mind, the Arkansas Public Service Commission decided that a "redundant visible, manual, lockable disconnect switch" did not need to be installed on customer's facilities if that equipment met IEEE requirements, was installed correctly and operated as designed. Despite a request for such a switch from every Arkansas utility and Commission Staff, the Commission reasoned that the safety requirements of IEEE were sufficient to ensure that generation equipment would disconnect when utility voltage "drops off"[7].

Were the Commission or a utility require an EDS under either of the first two distribution line safety procedures, the likely result will be confusion and an elongation of outage restoration times. If a utility includes a requirement for each DG customer to install an EDS, it would be remiss if it did not incorporate the use of that switch into its line repair safety procedures. Line workers would be required to visit the switch on each DG system and open and lock it out before beginning repair work. When the work is finished, the line worker will need to re-visit and close each switch. On distribution circuits with many DG facilities, or where there is but one customer in a remote location, these two visits could consume significant time.

During storms or other conditions when line workers are taxed (arguably the time when the EDS offers the most safety value), this added requirement could significantly add to restoration time. Moreover, a lineworker may face a dilemma when inclement weather makes the EDS difficult to access. In the case of a remote system, a lineworker may have to decide between traversing a long, snow-covered driveway to access the EDS, or violating procedure to work on a distribution circuit without opening the switch. Several small generator installers in New Jersey suggested to

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[6] According to John Wiles, of the Southwest Technology Development Institute at New Mexico State University and author of "Code Corner" in *Home Power* magazine, utility line workers use grounding conductors (often called chaining) of sufficient size to eliminate the possibility of shock from full load on a distribution circuit. A conductor of this size would easily ground any customer DG equipment, whether IEEE compliant or otherwise, and protect the workers from an accidental energization of the line. A customer's generator that remained connected to a grounded circuit would literally burn up.

[7] In the Matter of a Generic Proceeding to Establish Net Metering Rules, Arkansas Public Service Commission Docket no. 02-046-R Order no. 3, June 3, 2002.

BPU staff that even though the EDS was formerly a requirement, they were not operated during outages or at any other time.

The external disconnect switch is required under neither the National Electric Code nor IEEE standards 1547 or 929. While an external disconnect is discussed in a section on isolation devices in IEEE 1547, that section states only "When required by the Area EPS [utility] operating practices, a readily accessible, lockable, visible-break isolation device shall be located between the Area EPS and the DR unit." Similar language is contained in IEEE 929.

The National Electric Code requires at least one disconnect switch external to the inverter on a DG system that can be used to isolate a system from building electrical service (and hence the utility grid). This switch is typically located inside the building, as the Code requires that the switch be located near the main disconnect for the utility service and available for operation during emergencies. Since emergency personnel must have access, it is unclear why a utility would need a separate switch for non-emergency use.

In non-emergency situations, the utility is expected to contact the owner of the generator and schedule an outage of the generator to perform repairs. In this case, the customer can provide access, or open the switch themselves. Notice to the customer of non-emergency repairs is typically required as part of the interconnection agreement.

In sum, there is no critical safety purpose served by the EDS. The requirement could serve only to increase the cost of solar installations and becomes a barrier to installations. If the Commission truly wanted to see if there was any safety value that justified the cost, it could leave the requirement up to the utilities and at their cost. SEIA firmly believes that were utilities to bear the cost of installing an EDS, they woquickly dispense with the requirement.

Conclusion

SEIA believes the Commission would serve the purposes set forth in the ANOPR by adopting the interconnection rules recently promulgated by the New Jersey Board of Public Utilities in their entirety. The technical components are correct and dovetail with both the anticipated PJM and FERC interconnection requirements for generators up to 2MW. The fee structure, timing, and other requirements also strike the proper balance between eliminating barriers for distributed generation while compensating utilities for their costs. By adopting the interconnection rules from New Jersey, the Commission will have taken the first step towards a seamless renewable energy market between the two neighboring states.