Shaiker[redacted], Benjamin

From: Joel Gordes <gordesj@comcast.net>
Sent: Friday, March 20, 2015 9:36 AM
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Cc: bdowling@courant.com
Subject: Conflicts on Distributed Resources Definitions in SB 570 AAC Elecric Fixed Bill Fees & Grid Modernization

Dear All,

While I support many aspects of this proposed bill, including capping the fixed rate, I find the definition of Distributed Energy Resource is in conflict with current statute and this proposed, much narrower, definition may seriously cripple the ability of distributed resources to provide power during emergencies when it will be most needed to provide safety and security to Connecticut residents if only those listed sources qualify. I have also copied in after these two definitions a fairly recent, well-footnoted, article on the semantics of grid security which goes into this in more detail. If you have questions, please contact me at your convenience at (860) 561-0566 or have OLR do the same.

Committee Bill 570 *AN ACT CONCERNING ELECTRIC FIXED BILL FEES AND GRID MODERNIZATION.*
"(NEW) (48) "Distributed energy resource" means any zero-emission customer-side distributed resource, demand response, end user energy efficiency and conservation measure, combined heat and power system, thermal energy generated by a thermal energy transportation company, distributed intelligence, microgrid or energy storage device, including but not limited to, a battery, flywheel or electric vehicle. "

Current Statute
16-1 (34) "Customer-side distributed resources" means (A) the generation of electricity from a unit with a rating of not more than sixty-fivemegawatts on the premises of a retail end user within the transmission and distribution system including, but not limited to, fuel cells, photovoltaic systems or small wind turbines, or (B) a reduction in the demand for electricity on the premises of a retail end user in the distribution system through methods of conservation and load management, including, but not limited to, peak reduction systems and demand response systems;"

Understanding Semantics of Grid Security Strategies

Posted on December 29, 2014
Posted By: Joel Gordes
Topic: Communications & Security

Frequently we have been exposed to the terms "redundant," "distributed generation," and "decentralization" but they are rarely, precisely explained or the properties that may or may not make them candidates as a likely solution for both cyber and physical threats. I have to plead "guilty" to this charge in my recent articles and have been called on the carpet to provide deeper meaning of what we all too often take for granted but might not be universally understood. I should have known better than to not explain this earlier. Here I hope to provide some characteristic-based definitions.

The term distributed utility (which has morphed into distributed resources) is a great example and is credited to Dr. Carl Weinberg, Manager of R&D at Pacific Gas & Electric and Joe Ianucci who were the co-originators of the concept that goes back at least to the early 1990's. As in many creations, the original definition has had many amendments each tailored differently to meet a specific point of view. [1] The best that can be done is to provide the definition below that is a composite of six others: [2]

Distributed resources include conservation and load management with modular electric generation and/or storage located near the point of use either on the demand or supply side. DR includes fuel-diverse fossil and renewable energy generation and can be grid-connected at the distribution level or operate independently. Distributed resources typically range from under a kilowatt up to 50 MW. In conjunction with traditional grid power, DR is capable of high reliability (99.9999%) and high power quality required by a digital society.

Notice that it can be "grid-connected or operate independently" and even back-up generators may qualify under this definition [3] nor is it confined to renewables. In fact, wind energy, mostly remote from loads, is excluded by this. They can also have a 50 MW upper limit. This last point became very important in one real-world episode due to erroneous information provided to regulators by an ISO official who during a 2002 docket denigrated DG which he said ranged in sizes from 25 kW to 200 kW (not MW). Then, he chose his lower limit to illustrate his point that thousands of units would be required to equal 50 MW blocks of power that might help relieve transmission congestion. What was left unsaid is that it would require far fewer microturbines in the 200 kW range and that official totally ignored the immense range of turbines over 200 kW up to 50 MW that could also be considered "distributive generation" under the definition above. The ultimate irony was the utilities were already using three TM-2500 gas turbines to relieve that congestion which, at ~22 MW each, fell within the definition of DG above! Because the regulators had a "presumption of expertise" on the part of that official some potentially poor decisions may have been made over a faulty definition. So maybe now the importance of all parties speaking the same language can be more greatly appreciated.

Perhaps the most quintessential "definition" of decentralization has been by Amory Lovins considered by many to be the guru of energy security. He is also the Cofounder, Chief Scientist and Chairman Emeritus of Rocky Mountain Institute (RMI). In their 1982 book *Brittle Power*, Amory and L. Hunter Lovins set out the following characteristics that define decentralized systems: [4]

Ø Consist of many small units of supply and distribution with redundancy to back each other up;
Ø Units are geographically dispersed but close to demand centers;
Ø Interconnected with many units and not dependent on just a few critical links and nodes;
Ø Continue to operate if in isolated modes, so failures tend to be more isolated;
Ø Provides storage as a buffer so that failures tend to be gradual and "elegant" rather than abrupt;
Ø Short links at the distribution level;
Ø Employ qualities conducive to user-controllability, comprehensibility, and user independence.

From this we can also clarify the use of other terms often confused with decentralization:

1) A system can have redundancy of components without being decentralized. In 1992 an unlikely source framed it this way: [5]

Dr. RUSSELL: Overdesigned. Klingon anatomy. Twenty three ribs, two livers, eight-chambered heart, double-lined neural pia mater. I've never seen so many unnecessary redundancies in one body.
Dr. CRUSHER: ... Almost every vital function in their bodies has a built-in redundancy in case any primary organ or system fails.
Dr. RUSSELL: It's a good design in theory, but in practice, all the extra organs means just that much more that can go wrong.

It took a decade for the National Research Council to catch up with them and observe much the same, "The likelihood of hidden failures in any large-scale system increases as the number of components increases." [6]

2) You can have distributed generation (DG) which are generally small, modular and located close their place of use but they can be either centralized or decentralized. For instance, photovoltaics (PV) is a form of DG but most existing PV installations are within the centralized grid and not set up to be operate on their own; when the grid goes down, they goes down too.

3) Only a truly decentralized system can "island" and run totally independent of the larger grid.

4) A well-designed microgrid can function as part of the larger grid or as a decentralized system and, ideally, have multiple, diverse sources of dispersed generation and/or storage.

Amory Lovins makes another essential point in his seminal 1976 work *Energy Strategy: The Road Not Taken* [7] where he clarifies the grid can be centralized or decentralized but these two philosophies are mutually exclusive. He also makes it implicitly clear that dollars invested into centralized systems are not only unavailable to fund decentralized systems but may also foreclose future choices. Lack of relevant discussion on these diametrically opposed paths by many policymakers, unfamiliar with the nuances, show little appreciation how introducing increases in centralization may have negative public health, safety, economic and grid security implications be they purely physical or cyber.

Regulators and policymakers should be acutely aware that large transmission projects are not only as worthless as a Maginot Line for defending the grid by making it more centralized, complex and prone to failure but will likely result in stranded cost for the future. With the pace of technological development accelerating, including near-term, lower cost storage, that future has the potential to come sooner than expected and may not even be a NIMTO [8] issue.

But Lovins is far from alone in looking at decentralization as a way to address grid threats in an all hazards approach. In previous articles I have cited a number of others who share his views including former FERC Chairman Jon Wellinghoff and Prof. Nassim Taleb, well-known author of the popular book *The Black Swan* on the nature of unlikely events that have immense consequences, and an NYU Polytechnic Institute Professor of Risk Engineering. These diverse practitioners have either espoused decentralization or aspects of it as a way in which to deal with cyber as well as other, entirely physical security threats.

[1] For instance, by statute, Connecticut has a 65 MW upper limit to accommodate one existing combined heat & power project that a talented and knowledgeable lobbyist was successful in representing.
[2]This definition is a composite of six definitions: US DOE (2), Electric Power Research Institute (2), American Gas Association(1) and California Energy Commission (1).
[3] Actually, this author doubted that backup units should have been included but in checking with Dr.

Weinberg, he clarified that "We meant distributed generation anything connected at the Distribution level/voltages…When we tried to get the definition to[o] tight we ran into all kinds of comments." E-mail of 12/11/2008 from Dr. Carl Weinberg.
[4] Lovins, Amory and L. Hunter. *Brittle Power*. Brick House Publishing. 1982. pp. 215-219.
[5] *Startrek: The Next Generation.* Season 5 Episode 16, March 2, 1992 Stardate: 45587.3.
[6] *Making the Nation Safer: The Role of Science and Technology in Countering Terrorism.* National Academy Press. Committee on Science and Technology for Countering Terrorism, National Research Council. p.302. 2002.
[6] Lovins, Amory. *The Road Not Taken.* Foreign Policy. Vol. 55, No. 1. October 1976. pp. 65-96.
[8] NIMTO: Not In My Term of Office.

Best,

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"...the problem at hand, which is that centrally generated electricity is a vulnerable genie. In order to be used it must travel on an ugly, complex and inefficient labyrinth of wires and substations...Even from a security view (national or otherwise) such a fragile system is suicide." Gordes-February 1978 in a published Hartford Courant Letter to the editor.

"There's a strong likelihood that the next Pearl Harbor we confront could very well be a cyberattack that cripples our power systems, our grid, our security systems, our financial systems, our governmental system," Leon Panetta, the U.S. defense secretary.