jgordes <jgordes@earthlink.net>

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To
donald.downes@po.state.ct.us
cc
David.Anderson@snet.net, Gina.Mccarthy@ct.gov, John.Mengacci@ct.gov, Mary.Healey@ct.gov, gdeans@cerc.com
Subject
Large Scale Combined Heat & Power

Dear [DPUC] Chairman Downes,

Thank you for your letter of April 18th to me in my capacity as a member of the CEAB. I am particularly interested in your call to do an in-depth analysis of the application of combined heat and power (CHP) principles to large scale power generation. While you did not specify an exact size in megawatts or thermal, I am assuming that you mean something at least above the 65 MW figure set in Connecticut statute as the upper threshold for distributed generation (which I know, for some reason, is larger by definition than in any credible source-- please see attachment.)

Indeed, I believe what you may be referring to what is termed "district heating and cooling" and is a technology that has long been used in parts of Europe, particularly Eastern Europe and the former Soviet Union. Actually, our common dear friend and former representative, David Anderson, and I were discussing this just the other day and I recounted to him our first-hand experience with district heating and cooling on a trip that a number of us took together 20 years ago this year to the Soviet Union. One of the stops we made was to Kiev, Ukraine, which had such a district heating system. The time was May, just after the close of the legislature, when we arrived and the temperatures were still a bit brisk. While district heating has some great advantages, as we were to learn, it also has several distinct disadvantages, one of which was that our hotel was situated in a district where the district heating had broken and so we had to endure cold showers in the mornings as did everyone else in that quarter of the city. Commissioner and Commissar have the same route word and we were not happy with their Commissars. The operative lesson learned was that large, centralized systems when they fail, fail big-time.

While I know that neither the CEAB nor the DPUC have much heeded my suggestions to more thoroughly incorporate energy security considerations into their planning, large centralized systems are much easier to take out of commission than the more resilient small, modular, fuel-diverse and decentralized facilities using numerous distributed generation units. While district heating and cooling may gain certain cost advantages via economies of scale, the smaller distributed units can make up for much of this with what is termed economy of scope meaning they are more easily mass-produced in cookie-cutter uniformity in the production process.

If you wish to do a study, you could of course as you suggest, use the Connecticut Academy of Science and Engineering however I would caution you to ensure that the panel selected be chosen in such a way that it has a balance of electric utility personnel and others. I would also suggest a few specific names including Professor Emeritus of Mechanical Engineering Lee Langston and Joseph Camean, who deeply believes in large-scale combined heat and power, and is a practicing engineer at Van Zelm, Haywood & Shadford, a well known and highly respected engineering firm now in Farmington. In fact, you might wish to talk with him ((860) 284-5064) on this if you want to pursue it.

I look forward to further discussions on this topic as well as others.

Best,

Joel N. Gordes
Environmental Energy Solutions
38 Brookmoor Rd.
West Hartford, CT 06107
(860) 561-0566 Ph/Fax
http://home.earthlink.net/~jgordes

Definitions of Distributed Generation by Government/Industry Sources

Joel N. Gordes
Environmental Energy Solutions

Because ISO New England has, on several occasions, defined distributed generation in very limited terms, it is important that a widely acceptable definition be established. For that reason the attached ones by reputable organizations are presented to provide some basic commonality. I have also offered what I term a "consensus" definition that combines the most common attributes of the others.

US DOE I

Distributed power is modular electric generation or storage located near the point of use. Distributed systems include biomass-based generators, combustion turbines, concentrating solar power and photovoltaic systems, fuel cells, wind turbines, microturbines, engines/generator sets, and storage and control technologies. Distributed resources can either be grid connected or operate independently of the grid. Those connected to the grid are typically interfaced at the distribution system. In contrast to large, central-station power plants, distributed power systems typically range from less than a kilowatt (kW) to tens of megawatts (MW) in size. (http://www.eren.doe.gov/distributedpower/sublvl.asp?item=definition)

US DOE II

"Distributed energy resources (DER) refers to a variety of small, modular power-generating technologies... DER systems range in size and capacity from a few kilowatts up to 50 MW. They comprise a portfolio of technologies, both supply-side and demand-side, that can be located at or near the location where the energy is used.", (http://www.eere.energy.gov/der/basics.html)

Electric Power Research Institute (EPRI) I

Integrating distributed energy resources. The new system would also be able to seamlessly integrate an array of locally installed, distributed power generation (such as fuel cells and renewables) as power system assets. Distributed power sources under 20 MW per unit could be deployed on both the supply and consumer side of the energy/information portal as essential assets dispatching reliability, capacity and efficiency. Today's distribution system, architecture, and mechanical control limitations, prohibit, in effect, this enhanced system functionality. (Electricity Sector Framework For The Future, Volume I. Achieving The 21st Century Transformation, Aug. 6, 2003. p. 29. Full study at: http://www.epri.com/journal/details.asp?doctype=features&id=671)

EPRI II

"Distributed resources are small generation (1kW to 50MW) and/or energy storage devices typically sited near customer loads or distribution and sub-transmission substations," EPRI, http://www.epri.com/targetDesc.asp?program=262184&value=03T101.0&objid=287595)

American Gas Association

Distributed generation (DG) is the strategic placement of small power generating units (5 kW to 25 MW) at or near customer loads. Situated at a customer's site, distributed generation can be used to manage energy service needs or help meet increasingly rigorous requirements for power quality and reliability. Located at

utility sites such as substations, distributed generation can provide transmission and distribution (T&D) grid support and expand the utility's ability to deliver power to customers in constrained areas. Distributed generation technologies include such resources as industrial gas turbines, reciprocating engines, fuel cells, microturbines, wind-power, and photovoltaics.
http://www.aga.org/Content/ContentGroups/Newsroom/Issue_Focus/Distributed_Generation.htm

California Energy Commission

"Distributed energy resources are small-scale power generation technologies (typically in the range of 3 to 10,000 kW) located close to where electricity is used (e.g., a home or business) to provide an alternative to or an enhancement of the traditional electric power system." (http://www.energy.ca.gov/distgen/index.html)

Toward a Consensus Definition of DR/DG

Taking the common attributes of the preceding definitions, a consensus definition might be:

Distributed Resources (DR) include conservation, load management, and 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 (known as distributed generation or DG) with or without waste heat utilization and can either be grid-connected 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.

Point of Conflict

Wind energy presents a very special case in regard to distributed generation that makes it difficult to categorize. While individual turbines clearly fall within the generally agreed upon size parameters, a wind farm may lie outside the uppermost limit. For instance, is a 300 MW wind farm distributed generation? While it is a renewable source, exceeding the 50 MW upper limit may throw it out of the category. In addition, even if it is below 50 MW, if it is on a contiguous wind farm, it may not be adequately decentralized. Finally, because it may be located in a remote area far from the loads that it will serve, it requires vulnerable and costly transmission. On the other hand, a small wind installation whose loads have the ability to be used locally may satisfy all parameters to be considered DG.