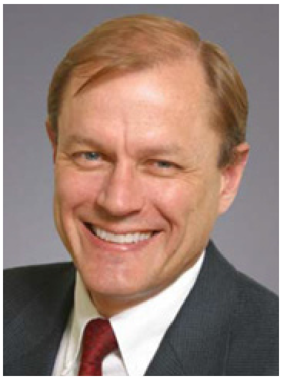
Perspective

Microgrids: Where's the Beef?

Integration beats islanding, anyway you slice it.

By Steve Huntoon

> "A microgrid is a throwback. It's anathema to what we know about economies of scale."
>
> – *Steve Huntoon, regulatory attorney*



A microgrid is to the grid as a microturbine is to a turbine. Nothing more.

Remember the Capstone microturbine? It was going to revolutionize the power industry. Every commercial and small industrial customer was going to want one. Capstone stock exploded in the wake of the Enron crisis, peaking at $98/share in 2000. Then it collapsed to $1/share two years later, when the anticipated market failed to materialize.

But some memories go back even further. So let's begin with some ancient history.

A microgrid marks a throwback to the turn of the last century. Yes, I'm talking about 1900, when cities were marked by many "microgrids" – what we might think of as islands of tiny utilities. Philadelphia stands as an apt example. According to Nicholas Wainwright's "History of the Philadelphia Electric Company," the city back in 1895 could claim more than 20 electric companies providing service.

Then came Samuel Insull, who instilled a new vision of the regulated franchised utility, and we got rid of that island model because it made no sense. Industry leaders discovered the enormous scale economies hidden in the transmission and distribution of electricity, and the enormous efficiencies to be had from interconnected generation, to allow the least-cost sources of electrons and ancillary services to run every hour, every day, and every week of the year. The secret was out – reliability through diversity.

Now move ahead to our own time.

The defining characteristic of a microgrid – a complete or episodic separation from the grid – was and is anathema to Insull's scale economies. The industry restructuring we've done has remained premised on the scale economies produced by a fully integrated grid – a longstanding premise that has not been invalidated in any way.

Let's think for a moment about the "seams" between RTOs that for years have bedeviled the U.S. Federal Energy Regulatory Commission. Under FERC's guidance, the nation's regional transmission operators already are assimilating and optimizing *giga*-watts of generation. Yet these "seams" are synonymous with incomplete integration. Why then should it make sense to *create* seams with *mega*-watt islands?

Can microgrids somehow recapture these economies? No.

Integration is what maximizes the ability of least-cost resources to reach load. By interfering with least-cost dispatch, microgrids can only raise energy costs. It's just math.

The microgrid likely will contain its own local resources. And at any given time those resources can run at a marginal cost that comes in either below or above the marginal cost of other resources from outside that are deliverable to the microgrid. If cheaper, then the microgrid's own resources should run. If costlier, then the microgrid should import resources from outside. And we can make sure this happens by using centralized and region-wide least-cost dispatch. Autonomous decision-making by a microgrid operator cannot

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improve on that – either for the grid or for the microgrid.

And how about reliability?

Well, the grid today is planned to avoid violations of reliability standards and to provide generation supply reliable enough to ensure, on average, that if load is lost, it will be lost no more frequently than once in ten years. A microgrid could potentially improve on that – at least within the microgrid's borders – by separating from the grid when there is an outage caused outside the microgrid perimeter. But for the microgrid to operate upon separation it has to have sufficient generation to meet load. That means, in effect, that any external generation that would otherwise be supplying load has to be duplicated inside the microgrid. If such generation already exists within the microgrid, then service restoration by the utility could reflect that. If such generation doesn't exist, then the microgrid entails construction of *redundant* generation – at extra cost to someone.

In short, where reliability is highly valued by a given customer, a microgrid needs to be superior to plain old back-up generation. Where, then, is the value added?

The microgrid phenomenon also ignores the fact that the vast majority of outages are caused by disturbances on the *distribution* system. That is the same distribution system that the microgrid would rely on when it separates from the grid. When a distribution system disturbance, especially a major event, would cause an outage for a given microgrid area, it is entirely possible that the same event would prevent the microgrid from functioning upon separation. If so, then the microgrid would have to duplicate the distribution system in order to create added reliability value, this time with with construction of redundant *distribution*.

Given these analytical truths, what is the case for microgrids? Advocates stand ready to offer presentations, but these presentations are long on buzzwords and bubble diagrams, and short on rigorous analysis and economics.

To uncover such analysis, we can turn to microgrid case studies sponsored by the New York State Energy Research and Development Authority (NYSERDA), available on line at http://www.nyserda.ny.gov/-/media/Files/Publications/Research/Electic-Power-Delivery/Microgrids-for-Critical-Facility-NYS.pdf (Appendices C-G). There are five case studies (Broome County, New York City Upper East Side, Rockland County, Nassau County, and Suffolk County), and the results of the first one are illuminating. The average annual outage period in Broome County is two hours. And here's the effect of a microgrid, as documented by NYSERDA: "The analysis of the Broome County site indicates that the benefits of a microgrid would exceed its costs only if the probability of a major power outage is assumed to be extremely high. As Table C-15 shows, this is particularly true for scenarios that do not include participation in a peak load support program. In those cases, the expected number of days without power must be 17 or more *each year* in order for the project to be cost-effective."

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In other words, a microgrid for the Broome County site would make sense only if expected outages each year were measured in *weeks, not hours. Q.E.D.*

Amazingly, these case studies have had no discernable impact upon the microgrid bandwagon.

Another cautionary note is sounded by a recent study from the Lawrence Berkeley national laboratory (https://emp.lbl.gov/sites/all/files/lbnl-188741.pdf) that found no clear correlation between increased spending and greater reliability: "… increased T&D spending in the previous year was not correlated in any statistically significant fashion with improvements in reliability in the following year."

Bottom line: Don't assume that throwing money makes sense.

But why care, you may ask. Why should anyone object to microgrids in concept? Why not allow a utility customer or group of utility customers to form a microgrid of some sort if it doesn't impose a burden on other customers? There is nothing inherently wrong with that, just as there is nothing wrong with customers who value reliability so much that they install back-up generation on their own, as they have been doing for decades.

The problem is that microgrids – by virtue of their fad status – are being proposed in a way that will impose burdens on other customers. A burden can arise from subsidies for microgrids paid for by other customers and/or taxpayers. The subsidies can be direct, such as in Illinois, where Commonwealth Edison is seeking a legislative requirement for $250 million of microgrid spending that it would add to rate base – to be billed to its non-microgrid customers. *(See amendment to SB 1879, proposed on March 19, 2015.)* Or subsidies can be indirect, such as in New York City's Hudson Yards, where the developer wants Consolidated Edison to provide standby service at low cost, also known as "leaning on the system." (See, http://www.crainsnewyork.com/article/20140708/REAL_ESTATE/307069988/con-ed-rains-on-the-off-grid-parade.)

More recently, we learn that more than $1 billion of microgrid proposals have poured into the New York Public Service Commission as part

of its regulatory initiative known as *Reforming the Energy Vision.* (See, http://breakingenergy.com/2015/09/03/reviewing-rev-new-yorks-transformational-energy-proposal/.)

And the burden may be more than financial. Consider reliability.

Grid reliability is maintained now through a single boss (in military parlance, "unity of command") for each region of the country. An obscure entity called a "Reliability Coordinator" (RC) retains absolute authority over the operation of the grid and is charged with maintaining overall reliability to the greatest extent possible, to the point of ordering "load shed" (outage) in a given area if necessary to prevent cascading outages in the rest of the grid. Micrograids of significant size would pose an operational challenge to this paradigm if allowed to operate autonomously. The RC couldn't direct microgrid generation to run or direct microgrid load to drop. Equally important, the RC wouldn't necessarily know what the microgrid operator will do. Thus, the RC's task of maintaining reliability would be complicated by lack of control and lack of knowledge. There may be ways of dealing with this but as of now it is uncharted territory.

So what's my point?

Yes, microgrids today are all the rage, but they should stand on their own two feet. Let's encourage innovation and competition. But let's not have government put its thumb on one side of the scale, just because it's fashionable.