

## **TOWARD LOCAL SELF-RELIANCE: Reducing Infrastructure Vulnerability**

**by Vic Berecz**

Let's make the very optimistic assumption that America is able to gain energy independence in the next decade by exploiting our domestic resources and building nuclear power plants ... and can then sustain it by moving toward a long-term solar solution. That's great because we're no longer pouring our wealth into a bunch of sandpits. But, remember, we'll have greater dependency on electricity and that dependency will only increase as time passes. That means our electrical distribution system will become an even more critical vulnerability than it is today.

Think how vulnerable are those high-voltage power lines that go seemingly everywhere. A terrorist attack against them could leave some cities without electricity for a few days. A major concerted attack could leave large areas of our nation without power for weeks or perhaps more. Brief losses of electrical power are a nuisance we've learned to live with. Extended losses put lives in jeopardy and have significant economic impact. As with most risks, we can't eliminate power line vulnerability, but ... electric companies and government agencies are doing things to mitigate that risk.

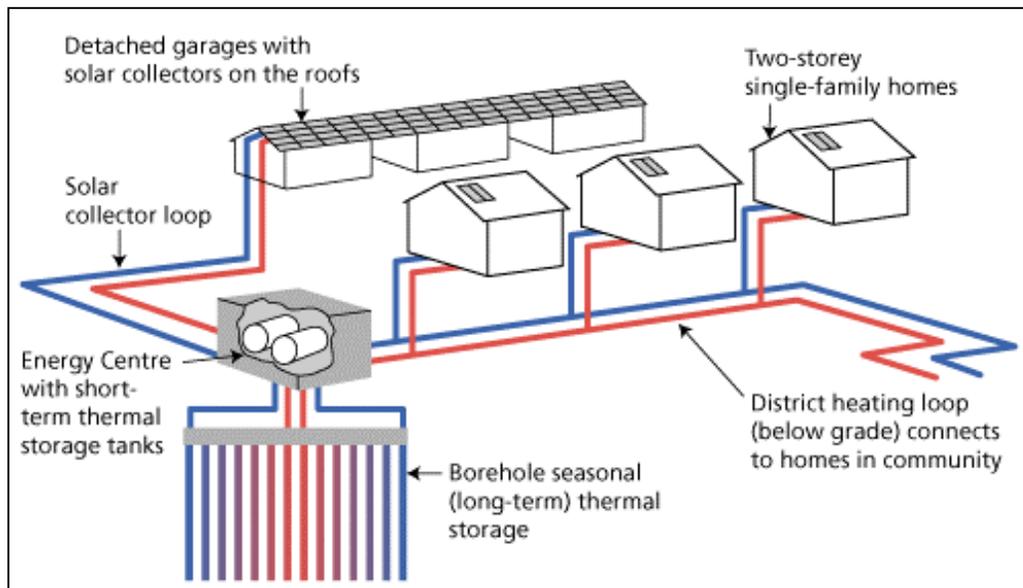
In addition, we must ask the question: can self-reliant actions either on a personal or local level further mitigate the risk of power outages? I answer an emphatic YES. Here's how.

First, let's address the personal side of the coin. In a recent letter to the editor of our local paper, the *Fort Myers News-Press*, Michael Bartley noted a "missed opportunity." He wrote:

Imagine if we had gone forward with continued funding of solar roofs in Florida and across America (in spite of the oil lobby) and many of us were driving the now practical electric cars. You could charge your car at home from your solar panels and do the same at work. ... It's time to end the dreaming. Florida along with half the U.S. will reach grid parity in 2012 without subsidies.

But, many of us don't have to dream or imagine ... we simply prefer conservation and self-reliance. Our son is such a person. He installed roof-top solar panels on his home, and it was a costly project. During the first year of operation those panels produced sufficient electricity to serve his house *and* sell some power back to the local utility. BTW ... he doesn't live in sunny Florida, rather he lives in Connecticut. Yes, his expanded WWI-vintage cottage is ideally situated to gather sunlight ... with a large south-facing roof surface on an unobstructed hilltop. What he did is not practical for everybody, but it is for many. In addition to location, what it takes is that spirit of independence that we call self-reliance and a willingness to make commitments for the long-haul.

There is other ways by which self-reliance can be tapped to make electricity available locally and to separate a community from the vulnerability of being part of the electrical network infrastructure. When I'm talking about a local community here, I mean communities much smaller than cities ... for instance neighborhoods, condo communities, apartment buildings, and even commercial centers such as factories and shopping malls. In the February 23 issue of *ScienceDaily* an article discussed European researchers who are creating technology that will treat neighborhoods like a miniature power grid, sharing energy generated at each house according to need. Their system diagram looks like this:



We can do it too! ... and I suspect we can employ newer technologies to provide distributed generation. Distributed generation refers to power generation at the point of consumption. Generating power on-site, rather than centrally, eliminates the cost, complexity, interdependencies, and inefficiencies associated with transmission and distribution. Like distributed computing (PCs) and distributed telephony (mobile phones), distributed generation shifts control to the consumer's site.

In most cases, apartment buildings (whether rental, condo, or co-op) have a large unused roof expanse ... as do most large commercial structures. Many of these situations can take advantage of the same roof-top photovoltaic solar panels that are working so well for my son ... though it takes community or corporate initiatives to make it happen. OK ... but that's old technology that's getting cheaper each day. As Mr. Bartley noted, in 2012 those type of installations will be cost-effective without the government subsidies my son received in 2009. But, there are new technologies coming along.

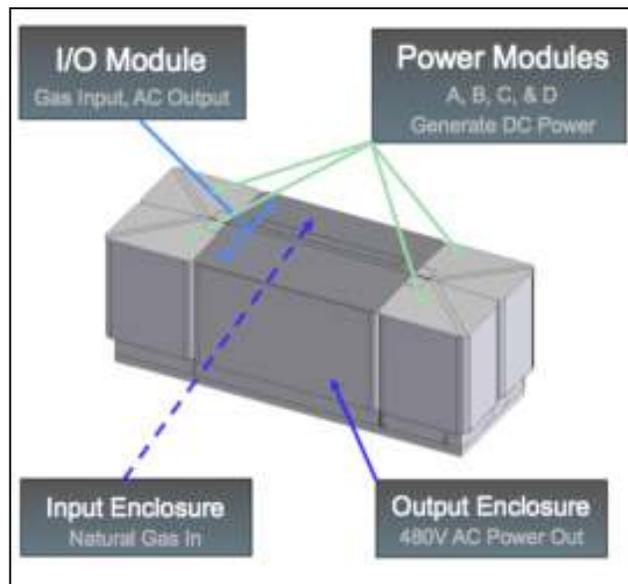
This is not intended as a promotion of a specific product or company. But, CHANGE HAPPENS and many new technologies like the one described here are progressing through the developmental pipeline. Their quality is improving, and their cost is decreasing. They're worth a look by communities that take pride in a modicum of self-reliance. So, here's my example:

*Bloom Energy* is a company that produces natural gas fuel cells for electricity production. Venture capital powerhouse *Kleiner Perkins Caufield & Byers* has provided much of their funding, and Gen. Colin Powell is on their Board. A recent *60 Minutes* feature on CBS, has increased their credibility. So, they are a real company, and a force to be reckoned with.

Each *Bloom Energy Server*<sup>™</sup> provides 100kW of power, enough to meet the baseload needs of a neighborhood of 100 average single-family homes or a small office or apartment building ... day and night, in roughly the footprint of a standard parking space. Bloom employs solid oxide fuel cells (SOFCs) which are built from low cost ceramic materials, and provide extremely high electrical efficiencies. But until recently, there were significant technical challenges inhibiting the commercialization of this promising new technology. SOFCs operate at extremely high temperature (typically above 800°C). This high temperature gives them extremely high electrical

efficiencies, and fuel flexibility, both of which contribute to better economics, but it also creates engineering challenges. It appears that Bloom has overcome these challenges.

At the heart of every *Energy Server*<sup>™</sup> is Bloom's patented solid oxide fuel cell technology. Each server consists of thousands of Bloom's fuel cells. Each cell is a flat solid ceramic square made from a common sand-like *powder*. Each Bloom Energy fuel cell is capable of producing about 25W ... enough to power a light bulb. For more power, the cells are sandwiched, along with metal interconnect plates into a fuel cell *stack*. A few stacks, together about the size of a loaf of bread, is enough to power an average home. In an *Energy Server*<sup>™</sup>, multiple stacks are aggregated together into a *power module*, and then multiple power modules, along with a common fuel input and electrical output are assembled as a complete system. Schematically, it looks like this:



Presently, a Bloom *Energy Server*<sup>™</sup> costs on the order of \$750K which means an up-front investment of \$7500 per home for a typical neighborhood. Their figures show that operational cost savings will produce a full payback of that investment in 3-to-5 years, depending on the electricity costs in your area. Bloom also has initiated a program of paying only for usage, with no up-front cost for the equipment. Again, I'm not recommending this product. I'm simply saying that self-reliant communities ought to take a look at the options available that will ensure them both cost-effective and reliable future electrical energy. A recent TV commentator, discussing Bloom Energy, noted that when this type of product comes into widespread use, it is unlikely that it will still have a *Bloom Energy* label on it ... more likely it will be GE or Honeywell or United Technologies. We'll see.

That's my story for today, for what it's worth. But, don't forget ... there are many other infrastructure vulnerabilities. Just like electricity distribution, some of those risks can be mitigated by self-reliance in individuals and communities. Perhaps we'll examine others in the future. In the meantime, think about mitigating risks by stepping up to the all-American ideal of self-reliance.