Clean-Energy Profit Without Nuclear Risk

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- Combine Plasma, Solar and Fuel Cell Technologies
- Transition To Decentralized Power Plants
- Interoperate In A Distributed Network
- Use Existing Grid Infrastructure
- Build The System In Phased Increments

Abstract

Several proven clean-energy technologies, described herein, offer a lucrative, low-carbon footprint opportunity *today*. This paper begins by proposing to first establish one small-scale prototype; use it to replace one existing distribution substation, and use the substation's *existing* electrical grid infrastructure to distribute electricity to 1,000 homes and businesses. Because the prototype would be constructed using proven technology components, in the author's opinion, it could be operational in less than a year. Better than uranium or plutonium Light Water Reactors (which are not clean or safe), solar photovoltaic farms, wind farms, and even hydroelectric, it's based on two proven technologies: one disintegrates garbage and produces hydrogen; the other uses hydrogen to produce electricity. See references, p.7: Fuel Cell Energy Servers, Plasma Conversion.
This paper coins the term *Plasma-Cell* to refer to the integrated and combined operation of a Fuel Cell Energy Server with Plasma Conversion as a unified local power plant.

The paper then proceeds to propose phased incremental integration--with the existing electrical grid and complimentary to the emerging *smart grid*—of several types of solar technologies, one already in widespread use, one fully operational and currently in test as a likely near-term 24x7 replacement for nuclear, and then, the last phase, integrating another very promising solar technology, which also provides power 24x7 and, at 10GW, far surpasses any single nuclear power plant.

AN IQ BOOST FOR THE SMART GRID

The electrical system that generates power and distributes it to consumers, called "The Grid", is based on an obsolete 125 year-old central power station model (Figure 1) [NAT2010]. Even as computer and information technology is envisioned to be part of the 21st Century Smart Grid [DOE2009], the electrical system architecture still adheres to the century-old centralized model (Figure 2).

This proposal seeks to augment the Smart Grid vision by incorporating proven clean-energy power generation technology via an electrical analog to the distributed computer network model. This model commonly includes PANs, LANs and WANs (Personal, Local and Wide Area Networks), sometimes interoperating with central hubs.

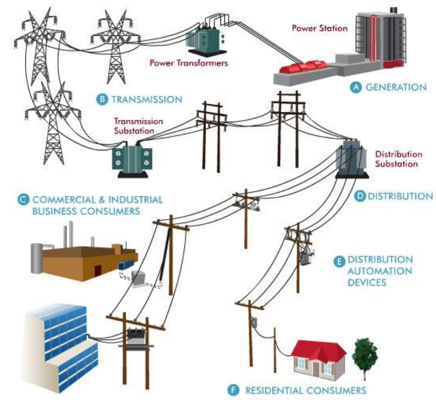

Figure 1 (click to enlarge)

Figure 2 (click to enlarge)

The central power station model leads necessarily to large-scale power plants that can generate enough power to supply a region or large city and can additionally generate enough excess to compensate for a 6% - 40% loss over the electrical grid's long-distance 50-400 mile power lines. This model and the requirements thereof is a major factor in the continuing pursuit of very large-scale power generation plants, such as unclean and unsafe nuclear power, or solar photovoltaic or wind farms, which cover 20 square miles for *just one* power station.

The electricity generated by one central power station is transmitted over long-distance power lines and is distributed to local residences and businesses via local distribution substations (Figure 3). These numerous distribution substations are located locally in the grid infrastructure that extends from each central power station to end-user homes and businesses. There are tens of thousands of existing neighborhood distribution substations nationwide, each providing power to 1,000 to 5,000 homes and small businesses. Each distribution substation uses a small amount of space. They are so commonplace in our communities that they have probably gone unnoticed by most for nearly 100 years.

Figure 3

Failures of these substation transformers are predicted to rise approximately 500 percent within the next 10 years, as many of the units installed in the 1950s through 1970s exceed their expected operational life cycle [MCS2003]. Furthermore, these older transformers are vulnerable to ground currents induced during geomagnetic storms which can melt their copper windings [NAS2009]. New transformer technology is available that protects transformers against damage from solar storms. Because utilities must soon upgrade these substations, the timing is good to investigate alternative replacements now.

A SMART ENERGY ALTERNATIVE: FUEL CELL ENERGY SERVERS and PLASMA CONVERSION (see references, p.7)

TODAY, power utilities (for example, ConEdison, PG&E, PP&L) can realistically consider replacing these substations with *Plasma-Cells*, which refers to the integrated and combined operation of a Fuel Cell Energy Server [BEN2010a] with Plasma Conversion [SCI2008]. Plasma Conversion could produce hydrogen gas for the Fuel Cell Energy Server and simultaneously provide local garbage disposal, including disposal of toxic waste [PLS2008].

With this alternative energy and waste disposal solution, garbage would go to the local neighborhood substation, eliminating the huge cost of transporting tons of garbage each day 25-125 miles to central garbage sites. Instead, the garbage is disintegrated in the local plasma device, and the resultant synthesized hydrogen gas feeds the fuel cell energy server. The electrical output is then distributed to the local homes and small businesses through the existing neighborhood electric grid. Unlike today's central power plants, a system using a plasma disintegrator can store an excess production of energy as hydrogen gas, providing for both on-demand load-leveling and reduced energy waste.

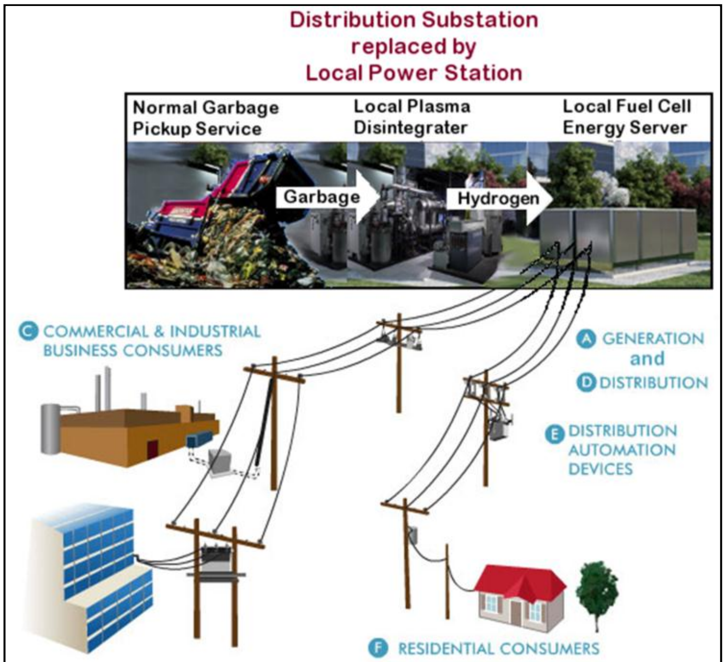

Figure 4 (click to enlarge)

None of this is "blue sky." These technologies have been operating for at least several years and proven on a small scale—sufficient to support distributed power generation on a local scale [BEN2010b] [POP2007]

With this proven technology now available, the exclusively centralized model for power plants can be transformed to a network model. Just as large-scale central mainframe computers have been included in the distributed networked computing model, so too can large-scale central power plants become part of a distributed networked power generation model. (Figure 4).

PG&E, ConEdison, PP&L or others can afford to do just ONE proof-of-concept neighborhood distribution substation prototype using fuel cell energy servers and a plasma disintegrator. These utilities could even establish a consortium and share the cost of implementing one successful substation prototype, by replacing just ONE transformer-substation (of many thousands in the U.S. alone) to serve 1,000 or so homes.

A successful prototype, like a picture replacing a thousand words, bypasses theoretical arguments, pro's, con's, maybe's, and what if's: When a prototype is successful, it's tangible; the completion cost is known; scaling costs can be more accurately estimated; the risk, if any, is known; and it is the spark that can ignite a wildfire.

A successful prototype represents a huge lucrative potential (replacing substations nationwide and worldwide) for companies manufacturing fuel cell energy servers or plasma disintegrators. It represents the possibility of an improved profit margin for utilities, because maintenance costs, need for back-up power plants, and other costs would be reduced. And because swapping an existing substation with a local power station utilizes the existing local distribution subsystem, utilities can replace failing substations on an as-needed basis; consequently, transition and capital equipment costs would likely occur gradually over one or two decades.

Utilities and manufacturers ought to be willing to work together to establish just ONE prototype, at the least cost possible. There's honest big money to be made; lots of clean energy to be generated; CO2 emissions to reduce; and greater independence from coal and nuclear to be gained! And no federal loan guarantee is required.

The next step is to get this idea to utility company decision-makers and to convince them to invest in producing just one operational plasma-disintegrator and fuel cell energy server substation prototype.

THE NEED FOR A VIABLE ALTERNATIVE TO CONVENTIONAL NUCLEAR POWER

Three major reasons not to build or operate nuclear power plants worldwide:

1) *Nuclear waste* is as radioactive now as it was 30+ years ago when California stopped licensing construction of new nuclear power plants, specifically because of concerns over safe waste disposal. It's still hazardous to human and all other life for 1,000 to over 100,000 years, depending on the radioactive element. Is there any foreseeable commercial capability to neutralize the radioactivity? No. Has safe storage so far been achieved for even 50 years, let alone 1,000 or more years? No.

The risk of using nuclear power is not worth taking. And reduced CO_2 emissions or global warming aren't reasons for taking this risk, because radioactive waste accumulates and, if a storage system fails, presents a potentially greater risk of global poisoning.

2) *System failure* can be caused by foreseeable vulnerabilities, such as earthquakes, internal component failure, terrorist attacks, operator error or other causes.

During the March 29th, 2011, Senate briefing on the safety of U.S. nuclear power plants [CSP2011], the senate panel heard one expert after another offer assurance that modern plants are safe and include multiple backups to mitigate or eliminate nuclear hazards and risk scenarios. They offered assurances even as the extent of the earthquake and tsunami damage to the Fukushima reactor in Japan continued to become clearer. Despite the experts' background chorus of "nuclear power is safe," the Fukushima plant situation has been upgraded from a level 5 to a level 7 nuclear disaster.

The situation in Japan underscores the disconnect between the belief that vulnerabilities are foreseeable and can be mitigated through good design, backup, and passive safety systems, featured in G.E.'s new ESBWR technology. For example, Japan's reactors were protected by an 18-foot sea wall, even though this area has recorded tsunamis frequently exceeding 18ft since 1700, with a high of 100ft in 1933 [WIK2007]. Why didn't engineers in the 1970's design for a tsunami exceeding 18 feet? Apparently, disregarding or not researching the historical data, believing the power plant was protected, engineers placed diesel backup generators in the basement. The March 11, 2011 tsunami was over 30 feet, the basement was flooded, and the diesel generators couldn't provide the backup power to operate the cooling system. The consequent domino effect compounded the emergency. Regardless of a 40 or even a 100 year safety track record and regardless of continuing advancements in nuclear plant engineering, unforeseen or ignored vulnerabilities will always exist—the ultimate failure of a nuclear power plant need only happen once to cause massive loss of life and environmental poisoning.

Despite their assurance that nuclear power is safe, the experts' lack of substantive acknowledgement of risk only underscored the inherent hazards, possibly lethal, of nuclear power plants What happens if some catastrophic event occurs that was not considered—or even imagined—as a foreseeable vulnerability by the designers? How can engineers design for the unimagined? [WAL2011]

3) *Construction companies* can take short-cuts in plant construction, as they did at the Washington Public Power Supply System project (WPPSS) [ALE1983]. To increase profits, engineering specifications were not always followed. Certifications that qualify workers for nuclear power plant construction were frequently forged to enable the hiring of workers, untrained in nuclear construction practices, at lower cost. Concrete or weld quality in containment vessels was sometimes reduced to save time or material costs, thereby increasing profit—but also and more

critically, undermining designs intended to protect against severe hazards. Even with advances in prefabrication and standardization, contractors are still required to construct a nuclear power plant.

WPPSS, with its construction failures and consequent budget overruns, is the reason a federal loan guarantee is now needed to build new nuclear power plants. The WPPSS problems also demonstrate good reasons to stop pursuing nuclear as a source of power. If Japan's current problems, combined with WPPSS, are not convincing, this Mother Jones article makes an additional strong anti-nuclear argument [WAR2011] pointing out that bribery and graft also undermines nuclear safety.

With right-wing Republicans driving deregulation legislation to enable their privatization, free-market, small government, and greedy profiteering ideology, substandard construction practices could be a greater hazard today than they were 30 years ago.

It's time to move on and leave conventional nuclear power behind [IBT2011]. The proven alternative poses NO potentially lethal long-term hazards to life on Earth.

SAME GRID, NEW PARTS, CLEAN-ENERGY, NO NUCLEAR

The paper will propose phased incremental integration--into the existing electrical grid—of several types of solar technologies, one already in widespread use, one fully operational and currently in test as a likely near-term 24x7 replacement for nuclear, and the last phase integrating another very promising solar technology, after four decades of design and partial development, which also provides power 24x7 and, at 10GW, far surpasses any single nuclear power plant.

Stay tuned—still in draft form and not ready for publication…

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