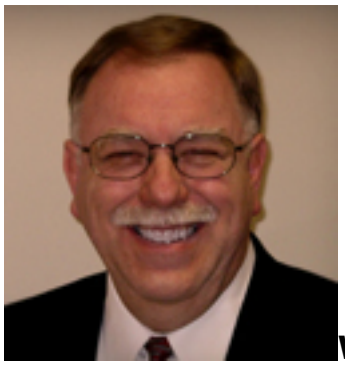
# Brainstorm: Smart Grid & Alternative Energy

Edited by Jason Lomberg, Technical Editor

**What is the biggest obstacle, morally or logistically, to implementing the smart grid?**



**William Mudge, Danfoss VLT Drives, www.danfossdrives.com** [1]

The smart grid is the modernization of the 19th-century electrical infrastructure to one that will support the needs of current and future building owners. The smart grid will support decentralization of generating plants and integration of remote and onsite wind and solar power. It also will usher in advanced data communications and information systems to empower building owners to more precisely manage their energy usage. With its many benefits, the Smart Grid also brings many challenges including storage, peak load demand, and cyber-security to name a few.

For commercial facilities many of the technologies needed to integrate buildings with the smart grid already exist. VFDs and controls that modulate energy usage in response to utility pricing signals or curtailment requests are widely used. But standardized approaches for smart grid applications are not yet available. Also, buildings are often not at their optimum when it comes to automation and controls, so the smart grid might actually help correct what has been a persistent problem.

Financial incentives have to be strong for owners to invest time and money for smart grid opportunities. In addition, utilities have to learn new business models and communications strategies as locked-in ratepayers become informed consumers.

**David Mayne, Digi International,** www.digi.com **[2]**

The biggest obstacle to implementing the Smart Grid is the broad scale implementation of dynamic pricing programs and the implications this has on how people use and pay for energy. The reality is that it costs more to create energy during peak periods. Utilities have historically subsidized this cost for most consumers. The Smart Grid is the technology that allows dynamic pricing to happen, but it will take years before broad utilization of these rates are authorized for use by utilities. I don't believe the Smart Grid can be cost justified without some form of broad dynamic pricing. There will continue to be automation added to the grid – but the cost of deploying large-scale networks to homes won't be easily justified until matching rate programs exist that leverage Smart Grid technology.

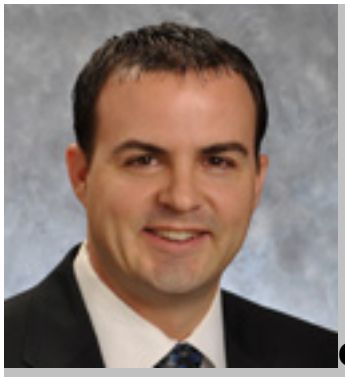
**Dr. Massoud Amin, IEEE,** www.ieee.org **[3]**

As our electric power grid is one of the largest, most complex systems ever built, ensuring security and reliability of this critical infrastructure is imperative to our economy and quality of life. With numerous technological, ROI, and policy challenges; rising electricity demand; and stagnant infrastructure investment, the grid has become increasingly stressed.

Minimally, Smart Grid faces three looming challenges: overall organization, investment and technological capacity for meeting 25- and 50-year electricity needs, and the ability to improve efficiency without diminishing reliability and security. Since 1995, utility construction expenditures have lagged behind asset depreciation, yet there is increased need for innovation in this sector, which achieves less than 0.17 percent revenue investment in R&D. The result is escalating pressure on already-strained infrastructures.

A smart, self-healing grid can overcome these challenges with advanced sensing, communications, and control technologies, solutions that facilitate energy

efficiency, real-time two-way communications and power flows, integration of intermittent renewable energy sources, electrification of transportation, and increased cyber security. Achieving these long-term developments requires sustained funding and greater infrastructure investment. The time has come for bold, forward-looking leadership and a deeper commitment to R&D. While it is a strategy that will not come cheaply, the cost of not doing so will be even higher.



**Clayton Pillion, Microchip Technology,** www.microchip.com/smartenergy **[4]**

In listening to experiences from utilities that are well down the path of smart-grid deployment, it becomes clear that they must strike a balance between the logistics with the moral/emotional aspects. Focusing purely on project planning and field testing may produce a technically sophisticated network that will simply struggle with if not fail to gain public acceptance.

The initial smart grid roll outs involved switching customers to new, complex rate plans upon installing AMI “smart meters.” When the new and complex rates impacted residential bills, this led some customers to believe the new smart meters were inaccurate, leading to substantial amounts of bad press. As a result, utilities are now investing more into customer education and outreach, while adding a significant time delay between smart-meter installation and new rate plans.

Another area where smart grid deployment needs to strike a balance is in the areas of communications network, Meter Data Management Software (MDMS), and back-office information technology. An important aspect of smart grid is a real-time awareness of transmission line conditions, substation controls, and direct interaction with meters, which are the utility’s cash registers. In order to have “real-time” communications, which typically means 15-to-60-minute intervals, North America utilities are deploying RF-based mesh networks to move data to and from meters, RTUS, and other grid equipment. Consumer energy usage data is then stored and analyzed in new MDMS and other databases under the utility’s control. Consumers demand that this information be protected during transmission and storage. Some may question the value of energy usage data outside of the utility—however, respect for consumer privacy is a must, in order to gain public support of a smart-grid deployment.

An important technical promise of installing a smart grid is the improvement in peak-load management, leading to a moral argument of reducing energy consumption and “carbon footprint” per consumer. However, most utilities have fixed-rate plans

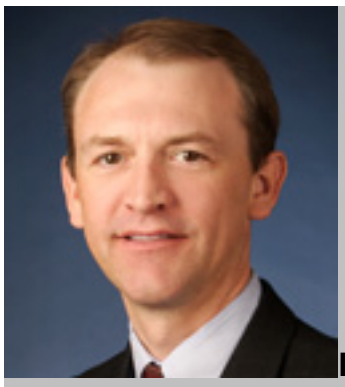
by which a reduction in energy usage leads to a direct drop in revenue, while costs remains relatively flat. Regulators have strict control over rates, meaning the utility will face lowered cash flows. A balance needs to be reached such that utilities can incentivize energy reduction without compromising economic viability. A solution called de-coupling separates a utility's revenue from the volume of energy it sells. Public commissions are beginning to adopt de-coupling across the U.S.

In summary, a smart-grid deployment is a massive undertaking that touches all aspects of an utility's technical design and relationship with the customer. This broad reach requires the moral aspects to be in harmony with the logistics and technical factors, to ensure a successful overhaul of America's grid—the very lifeblood of our economy.

**Keith Blaha, Memory Protection Devices,** www.batteryholders.com **[5]**

The smart grid is an idea with so much potential in today's electronic world. By being able to charge a higher price for electricity when most people are active, it is possible that energy over-consumption could be reined in. However, we must further examine this overall benefit, and consider who would bear the potential burdens of thesmart grid as well. The first example that comes to my mind is the case of factories looking to save money on large electricity bills.

Would these factories, employing unskilled and easily replaceable labor, not shift operations from peak hours, presumably during the day,into the off-peak hours of the night? This would have damaging effects on not only the lives of these factory workers, but their families as well - and it is unlikely that the factory would compensate for this damage, despite having increased profitsthrough lowering costs. Meanwhile, those with morecompetitiveness in the labor marketwould be able to maintain a normal work schedule, and thus not suffer the same consequences. Although thiseffect alone doesn't necessarily outweigh the potential benefits of the smart grid, it is only oneamong many that showcases the moral complications of this issue.



**Doug Bailey, Power Integrations,** www.powerint.com **[6]**

In my opinion, both the challenge and the opportunity of the Smart Grid is the lack of any obvious and compelling 'Killer App' that might inspire consumers of the products and services enabled by the technology. Media and political attention have been focused on the infrastructure benefits; what's needed now is a persuasive and appealing answer to the consumer's question: "So what's in this for me?" Lacking this, the reaction of consumers is likely to be negative and along the lines of: "Big Brother can peek into our homes, monitor our behavior, and make changes without even asking for our permission? NO THANKS!" Consumers have shown willingness, if not eagerness, to trade away their theoretical privacy for networked communication convenience; opportunities abound for companies that can offer them an appropriate power grid convenience or utility application quid-pro-quo.

Certainly technology is not the limiting factor. Power Integrations, the company I work for, provides high efficiency and high reliability power supply ICs for a large percentage of the smart meters that are currently available. We (and our competitors) stand to gain substantially from the transition to AMR and smart meters. We're enthusiastic about the opportunity to support grid-savvy entrepreneurs and investors in the development of hardware, equipment, and applications as they leverage every power-connected smart home in some fashion. Something good comes out of most revolutionary technology developments. I am hopeful that the Smart Grid's contribution to residential consumers will amount to more than having dim lights and cold showers, courtesy of the utility, at times of peak electrical demand.

**Zeev Collin, Semitech,** www.semitechsemi.com **[7]**

What makes the "smart grid" smart is communications. Communications deployments have enabled huge changes and benefits in society. However, implementing communications is fraught with challenges. Power line communications is no different. Power line communications brings huge impact in managing energy and yet deployment obstacles slow adoption. These obstacles include security and privacy concerns, reliability, and general consumer concerns about the new and unknown.

**Security**
As other communications technologies, power line communications must address security concerns. Like PC and smartphone networking, power line communications raises questions like "Is the data communicated secure?", "Am I going to see

Internet virus on my power grid?” and “Can a hacker use the power line to access, control or attack utilities, homes, appliances?”. Like with computer networking, power line communications provides the capabilities to ensure security via strong encryption and unique device identification.

**Privacy**
Communications is about controlling where information goes and who has access to it. Smart grid communications is no different and the power usage related information is a sensitive one. Consumers worry that their energy usage will be misused. Utilities worry that the wrong people will access billing information. Power line communications systems must implement high degree of privacy protection via hardware and software.

**Reliability**
Power line communications results from overlaying communications capability over a medium and network that was not designed for that. Dial-up modems/DSL is a good analogy. It required a lot of time to develop technology that worked and still it was not that reliable and performance greatly varied regionally. Only after the phone network was augmented to become digital communications friendly (late DSL era), did it became reliable. Power line is all that, only more extreme. We must make devices and systems that ensure communications reliability over noisy power grids and ever-changing noisy environment.

**So what is the biggest obstacle, morally or logistically, to implementing the smart grid?**
That would be establishing trust. Without knowing specifics, people are skeptical of new technologies, and consumers are wary of technologies that fail to deliver. Particularly to the Smart grid case, people are psychologically resistant putting data on their power lines. It appears like sending a wrong packet, might burn the TV set, just like bad piece of software causes PC to crash. Of course people are concerned about security and don’t trust that their privacy is properly protected. Reliability is another major concern. Our job as technology suppliers into smart grid implementations is to win the trust of our customers and the end users by delivering on the promises that we have made for power line communications. This is our mission at Semitech – we deliver technology and products that have proven reliability, security and privacy capabilities.

**Balu Ambady, Sensus,** www.sensus.com **[8]**

Utilities moving forward with smart grid deployments must secure the two-way communications network that encompasses a broad network footprint with many elements requiring safeguards to ensure the confidentiality, integrity and availability of this critical utility infrastructure.

Sensus' security strategy is focused on protecting all points of entry into the FlexNet smart utility communications network, thereby making reconnaissance difficult from both inside and outside the network. This also limits points of vulnerability and thwarts attempts to misuse or compromise the network and its messages.

However, protecting points of entry is not enough. Sensus enlists a multi-layered approach to security, including physical and logical controls, virtual private networking and the 2010 introduction of FlexNet 2.2, the first Sensus product complete with end-to-end encryption. In addition to using a multi-layered approach to security, Sensus conducts ongoing security validation and testing.

Sensus is also the first smart grid technology company to achieve overall industrial cyber security certification, earning the Wurldtech Achilles Communication and Practices certifications, a security best practices benchmark recognized by global leaders including Shell, Honeywell and the International Instrumentation Users Association (WIB).

As standards evolve, utilities will continue derive guidance from best practices of security proven in enterprise networking, control systems and other models.

**Matt Williams, TE Circuit Protection,** www.circuitprotection.com **[9]**

With telecom regulations in place, being able to communicate on the smart grid is less of an obstacle than actually implementing the technology. The biggest hurdle may be complying with the myriad government regulators and approval organizations that will allow public utilities to make the necessary investments required to update power grids throughout the world.

Power grids are 100-plus years old in many parts of the U.S. I recently attended a breakout session at APEC on smart grid connectivity where it was estimated that the cost of updating the old grid to new standards will be at least $1T dollars. Yes, trillion.

Building a strong business case to implement the smart grid initiative affects the

utilities' bottom line. Also affected are the manufacturers of applications and components used for connecting and communicating with the end customer. They must also be able to realize a financial benefit in order to make investments in the appliances, lighting, HVAC equipment and other devices that will be installed in industrial buildings and consumer residences. Being environmentally "green" is good; however being financially green is a critical imperative for moving forward.

**Markus Staeblein, Texas Instruments,** www.ti.com **[10]**

There is no question the Smart Grid is an integral part of the energy infrastructure of the future, but it won't be fully implemented by tomorrow. Beginning with the power grid, the transmission and distribution facilities in the U.S. were created 50, some even 100 years ago, and therefore limit efficient transfer and integration of decentralized renewable energy such as solar or wind power. The cost of installing renewable energy sources today is far too high when compared to other countries. One way power plants are trying to improve efficiency is by migrating from power generation by demand, to power utilization by power availability. In other words, they optimize efficiency when usage is rescheduled and decentralized energy sources are managed by their availability. Before implementing the Smart Grid, several questions must be answered: What's in it for the consumer? Will consumers accept control demands, or do utility companies offer hourly pricing that encourages consumers to use energy during times of high availability? How can it be ensured that such benefits of the Smart Grid are available to all people, regardless of income level? The first step is implementing technologies available today that enable energy measuring, switching, controlling and communicating (RF, PLC, WiFi, etc.) to build cost effective and innovative Smart Grid solutions including HAN.

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