Smart Grid, Smarter Design

Jeff Reinke, Editorial Director

We all fall for them. The allure of buzzwords and hot topics captures our attention and appeals to an optimistic nature for all things that will make our world better. However, they can also lead us to fall for the hype instead of focusing on credible, real-world applications.

This leads into our discussion of the smart grid. Just like every designer strives for efficient power distribution within a given design, every electric-bill paying consumer loves the notion of a smarter system supporting every switch flipped and every outlet accessed. Fortunately, the promise behind the smart grid offers more than just universal appeal and the solutions enacted will most definitely have an impact on the electronic design engineer.

First, let’s provide a little background on how our current electrical grid has developed its shortcomings and why a “smarter” approach is necessary. Today's alternating-current power grid was developed in the late 1890s based, in part, on Nikola Tesla's design. It was conceived and constructed as a centralized, unidirectional system based on localized, demand-driven controls.

However, as population centers and household technology grew, so did local grids. This lead to the building of more power stations (as well as all the fun debate they spawn) and eventually all these local grids became interconnected. The growth also ignited a supply and demand issue that has led to peak time electricity production concerns and the resulting combination of outages and price increases that we all have experienced. It’s also made energy efficiency a key element of product design as society looks to lighten its power load.

Drawing from a combination of sources, let’s define the smart-grid solution as a digitally-enhanced electrical grid that gathers and distributes electricity based on user and application data. Ideally, this will help improve overall efficiency and

quality, while keeping prices down by funneling electricity out in a more even nature, based on the dialogue the grid receives from everything accessing it. No more peak times that drive up costs and cause brown-outs.

So in order to better manage resources and leverage the available technology, the concept of a smart grid continues to evolve. More importantly, it has been championed by those in electrical production and consumption, meaning new design elements need to be addressed to capitalize on the benefits of smart grid.

The key components to an efficient, well-designed system include embedded communications systems to track usage. This data educates the individual or product consuming the electricity on costs associated with peak time charges so metering platforms can ensure the utility is accurately assessing and charging for their services. This is where the design engineer’s role becomes so crucial to the success of smart grid.

Smarter design

Perhaps the best place to start is with the communication process that will need to take place. Although much attention is rightfully given to metering applications (estimates put the number of smart-grid meters in use at about 40 million globally), there’s also a great deal of information that will come from the device receiving power and in handling data originating from the utility. In the case of an appliance like a refrigerator, fully optimizing the potential of a smart grid will demand internal components and control systems that can understand peak vs. down times and adjust functionality accordingly.

So this means the integration of sensors and antennas that can process, share and receive all this information going to and from the grid will be crucial. As it was explained to me by Ryan Maley and Jos Bruins from ZigBee Alliance, the ability to communicate with the smart grid shouldn’t present any new technologies that individually pose a challenge for the design engineer. However, embedding these systems into new applications will take some engineers down non-traditional paths.

At its core, ZigBee Alliance establishes the wireless communication standards that allow products, meters and the smart grid to talk with each other. When asked about the potential challenges or obstacles this platform would offer design engineers, the duo felt that time-to-market could be the area where the most impact is felt internally. Dealing with new sub-systems could add to product development timeframes, as some of these OEMs have not historically dealt with the controls or communication systems that “smart” products will need.

In keeping with the paradigm shift the smart grid represents, it will demand design considerations that are not typically associated with appliances and other electronic devices found throughout the home or building, including:

- Automation controls and embedded software that will allow for receiving information from the grid and then reacting appropriately in order to ensure optimized energy usage.

- Wireless communication platforms and hardware, including various transmission componentry that has not typically been designed into items like refrigerators and HVAC equipment.
- Potentially working with new chip and micro-controller suppliers to ensure ZigBee and smart grid compliance. More information can be found at www.zigbee.com [1].

Smart grid update

In our efforts to help educate and inform the design engineering community, ECN will be working with our sister publication, Product Design & Development in hosting a webinar on smart grid developments. In partnership with IET (The Institute of Engineering & Technology) and Automation Federation, Heath Knakmuhs from the U.S. Chamber of Commerce will be presenting The Smart Grid: Smart Homes, Smart Roads, and Beyond on June 26. Registration information can be found at www.pddnet.com [2].

Knakmuhs will offer his insight on the shortcomings of the current grid, ranging from outages to security threats, and the impacts that could be felt on the design and development of products that look to maximize energy efficiency-focused technologies and properly manage power supply. He'll also discuss how this paradigm needs to be and will be broken through:

- Enhanced clean energy generation and use
- Improved energy efficiency practices and procedures
- Smarter transmission strategies
- Increased automation
- Balancing generation and load with off-peak storage
- Large-scale battery storage

His discussion will also encompass integration strategies focused on application solutions for products that include smart meters, appliances, time-of-use rates and demand response strategies impacting consumer electronics.

Source URL (retrieved on *03/10/2014 - 1:14am*):
http://www.wirelessdesignmag.com/blogs/2012/06/smart-grid-smarter-design?qt-blogs=0

Links:
[1] http://www.zigbee.com
[2] http://www.pddnet.com