Implementing load shedding technology: A possible solution

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According to the 2005 Infrastructure Report by the American Society of Civil Engineers the U.S. electric grid is in urgent need of modernization. The demand for electricity is outpacing the investments in delivery infrastructure creating potential bottlenecks "which increase costs to consumers and elevate the risk of blackouts." Mark Gabriel points out that "we will have increasing frequency, severity and size of blackouts" (Visions for a Sustainable Energy Future, presentation to Hill House Club, San Francisco, March 14, 2008). In my opinion, this is due mainly to overwhelming market demand, limited generation capacity and aging transmission systems infrastructure not designed to accommodate the huge increases.

Since the grid is not owned by any one entity, modernizing efforts, such as smart grid initiatives, tend to be slow and protracted. Interim solutions that use existing technologies could provide temporary relief and buy time for the nation to upgrade its power transmission system. Such technologies, that may employ methodologies such as distributed generation where net zero initiatives create a grid friendly solution, are but a small aspect of what can be implemented now. Many alternative energy solutions employ technologies that relieve the grid of its distribution overload problems by eliminating the need for power from the grid itself.

In spite of the availability of alternative solutions, not all technology implementations will resolve the continual growth in demand for energy or the aging factor of the national electric grid. The use of load shedding will still be necessary and so will schedule blackouts. What is needed is a means of load management and load shedding that is not grid dependent. Many utilities are doing just that – though most are using archaic methods, by enlisting the residential and commercial property owners in a joint effort at reducing consumption. A similar approach was defined by the late Fred Schweppe, in his pioneering work on electricity markets, in his vision of homeostatic control where the consumer has an active role in adjustments to energy shortages and prices. Homeostatic control (demand response) seeks equilibrium between consumption, market demand and the grid capacity for distribution. Marija Ilic states that "the time has come now for working out the details of homeostatic control, since automation and its cost make this a truly viable concept. This represents a huge opportunity for using distributed sensors and controls." (The Intellectual Challenge: Behind Bundling Diverse Energy Systems of the Future, ESD Reports Winter 2006.) Implementing a Home Automated Network (HAN) solution at the source of the load demand would be a first step towards the balance of load inequalities.

What makes this difficult is the lack of products that automate the process of load management and load shedding that is both easy to implement and cost effective per endpoint. One of the most promising technologies that resolve this issue is the use of grid sensors within a HAN. Grid sensors sense the grid conditions and cause appliances, particularly motor types, to shutdown until the grid is stabilized. Developing and implementing low cost, plug and play grid sensing technology as a means to alert a HAN of impending brownout, blackout or irregularities in the grid could impact the grid's capability of maintaining sustainability. In an era of aging infrastructure, this may be the best low cost alternative.

Adding a grid sensor is a definite requirement to any HAN since the approach others are taking will only work in a small and limited wide area network (WAN). Right now the emphasis is on the utility broadcasting a shutdown message to homes as a means to manage load shedding. In a scenario with several million homes, that would not be timely enough to have an impact on the blackout or brownout. And there is no guarantee that the message will ever be received by all until the utility gets an acknowledgement back. A customer in California whose thermostat was set for demand response shutdown and control saw his thermostat shutdown for eight hours instead of the planned ten minutes. In this real life situation, the utility was unable to send the needed message reactivating the air conditioning system in this particular home. In contrast, a plug-in grid sensor approach has the home networks responding immediately to the grid and shutting down appliance loads that impact the transmission system. As an after the fact, the HAN notifies the utility of actions taken. The home appliance shutdowns would be preset based on what the utility and the homeowner agree upon previously. This approach takes into account the time sensitive actions needed to overcome the blackout before and after, should one actually occur. The same sensor can also tell the home network that the grid is back to normal and that the appliances could be turned back on.

While this is a "thinking outside the box" approach to grid load management, ultimately, the endpoints are the biggest factors in issues related to energy demand. Incorporating and partnering with those very endpoints that consume energy not only helps reduce consumption, but avoids generating excessive energy to compensate for loads. In the final analysis, consumers will not wait for the infrastructure to be replaced or improved, particularly

when the number of blackouts, brownouts, and so on increase each summer. Including the consumers in regulating the load at the residential or commercial location versus shifting distribution to compensate for demand in the actual grid makes sense. This approach minimizes the need to develop extensive grid upgrading to garner savings today while providing time and resources for critical infrastructure issues such as the smart grid initiatives.

What the industry needs now is a comprehensive solution based on sound energy policies that are integrated into the realities of the market. AMI is a positive step. Linking AMI to a home energy management network is another. Shifting the focus of responsibility to the actual consumers of energy is the fundamental premise of the HAN and the eventual evolution of AMI.

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HEMS Technology provides a demand side management/demand response solution designed as open architecture. The company's solution enables a utility to get past the meter for monitoring and controlling home demand at a reasonable price point while providing a potential means of managing rolling blackouts and peak demand.