Fast/Cheap Building Energy Networks and Automated Energy Efficient Products Needed to Achieve Optimum in Energy Efficiency for Non-Residential Buildings

Professional societies, the Federal Energy Regulatory Commission (FERC), electric utilities, as well as the Administration and Congress, has identified a Smart Electric Grid as a national priority. It is currently one of the primary topics of a number of study groups and forms the basis of a number of reports.[1],[2]

FERC recently identified the automating of the electric grid by outfitting the grid with new energy efficient products, smart controls, two-way communications systems, and sensors to have the potential to reduce power consumption through demand response, facilitate grid connection to intermittent power stations and distributed generation projects, enable storage of electricity, reduce carbon output, and improve grid reliability.[3]

On the electricity supply side, utilities will network and automate their generation, transmission and distribution systems. On the electricity demand side: government, commercial and industrial buildings will need to install Building Energy Networks (BENs), two-way smart meters, connected to networked/automated energy efficient-using devices to automate operations and extract maximum energy savings. Merging the networks and automation processes of the supply and demand sides of the nation's electric grid will yield the ultimate in energy efficiency potential between energy production and consumption, as outlined in The Electricity Economy report.[4]

The common bond between these two efforts is the need for a cost effective end user network platform so that all the endpoints in the value chain can be linked. Without the network platform, the United States can not progress to the next level of energy optimization and independence.

Utilities are well positioned with resources and talent to manage their end of the equation, and their numbers are few when compared to volume of end users. Clearly, there exists a critical need for a low cost, fast and easy to install Building Energy Network Platform from which energy using devices can be linked together with utilities to establish the Smart Grid of the future.

Building Energy Network platforms alone is not a solution, but an enabler. To achieve success:

- The network platform must be combined with an initial product that saves energy and operating costs, and therefore offers a higher compounded ROI and faster payback period in order for the private sector to buy it.
- The initial energy savings solution should be as ubiquitous as possible, so that it can be easily adopted by the largest amount of customers.

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[1] http://www.ostp.gov/pdf/final_energy_report_with_letters.pdf
[2] http://www.nae.edu/nae/bridgecom.nsf/weblinks/MKUF-5NTLBZ?OpenDocument
[3] http://www.ferc.gov/news/news-releases/2008/2008-1/02-14-08.asp
[4] http://www.smartgridnews.com/pdf/TheElectricityEconomy.pdf

- The network platform should use open protocols so that multiple vendors and organizations can access and optimize the performance of the Smart Grid over time.
- The network platform should be easy and fast to install, and interface with.
- The software and web-interface should be easy to operate and implement the integration of new products and services.
- The network platform should deliver immediate compound value – by connecting the initial energy efficient product's operation with the utility, while establishing the networked basis for future products and systems, and Smart Grid enablement.
- The combined system should be eligible for as many utility incentives and federal government incentives as possible in order to maximize the system ROI.

There are few if any known ubiquitous energy efficient products that are combined with a Building Energy Network platform from which multiple smart energy using systems can be layered upon over time. However, with the availability of such a system; benefits to the United States' goals of reducing energy consumption and carbon output can be realized quickly and cost effectively.

With a system that was common and applicable to all non-residential buildings in the United States, great progress could be made in a relatively short amount of time to achieving national energy goals. Considering the large volume of government buildings in which such a systems could be applied; significant private sector momentum can be generated towards expanding the breadth of potential national energy savings benefits, as well as provide the volume required to lower the manufacturing costs of such a system. The Federal government could also support the deployment of this dual benefit enabling technology through the use of tax incentives and other types of regulatory mandates.

Utilities already provide rebates as incentives to install energy efficient equipment. They are also increasingly giving separate rebates for the installation of networked energy using equipment that can reduce energy usage in real time for Demand Response; which utilities can use to reduce their need to build new peaker power plants used only in times of peak electric demand. Furthermore, utilities with such Demand Response programs provide either payments or electric rate reductions for customers that are simply available to reduce electric demand in real time, as well as payments when electric demand is actually reduced. This need was outlined in the energy Policy Act of 2005, which requires all the nation's utilities to develop such programs.

According to a recent article in Metering.com, named 'Demand Response in the US is barely scratching the surface'[5]: The current energy efficiency and demand response/load management programs are barely scratching the surface of what is achievable, according to the U.S. Electricity Advisory Committee (EAC) in a new draft report on the nation's electricity supply adequacy to the Department of Energy (DOE). Recent studies have found that demand response/load management programs can reduce peak demand by 4-22 percent, depending on geographic area and key assumptions. The article goes on to state: Recommendations to the DOE are to develop national measurement and verification protocols/standards that will better measure the savings that are being achieved and to place priority on expanding existing DOE programs that capture energy

[5] http://www.metering.com/node/14284

efficiency savings (e.g. updating federal appliance/equipment standards and national model building codes) and that help develop new energy-saving technologies that can be used in future decades (e.g. DOE's research and development initiatives). Policies should be promoted at the federal and state levels that can encourage expanded cost effective energy efficiency and demand response/load management efforts, and financing tools such as energy efficient mortgages and on-bill financing for energy-saving retrofits should be developed and encouraged. Energy performance ratings also should be created for existing buildings as a tool to help potential property purchasers and renters to assess relative performance.

The state of the industry is that there are few, if any, technologies that deliver both energy efficiency and an open source network platform combined into one system; especially a network platform that can be used to enable further future smart building applications. Companies today concentrate on separate silos of capabilities, i.e. they offer energy efficiency equipment, or they offer network systems. However, with such a system available, significant and rapid societal progress can be made towards realizing a nationwide shift to energy independence and carbon reductions, as well as create many new jobs. Furthermore, with such an open protocol network platform in place, many new products and services can be developed that did not exist or is possible today. The Smart Grid is poised to become the Web 3.0 – for the nation's energy infrastructure.

The technologies that will need to be developed must include the following attributes:

1. They must offer significant energy savings
2. The application must be ubiquitous to all non-residential buildings
3. They must be cost-effective
4. They must be easy to implement, and have a high ROI and fast payback
5. They must qualify for the multiple utility and government incentive programs
6. Networked functionality must be embedded in each product, at the device level
7. The network platform must be open source so that other vendors can develop additional applications that can be layered on this network
8. The network must be inexpensive and fast to implement
9. The network must piggyback on existing systems (building's wiring networks) to ensure that costs are as low as possible

One solution that addresses these requirements would be the replacement of today's lighting with LED-based solutions with embedded intelligence that carries data over the buildings' electrical wiring network that obviates the need install a separate wired or wireless energy data network. Such a product will need to be:

1. Ubiquitously applicable
2. Save considerable energy
3. Lasts 2-3 times longer than existing lighting
4. Eliminates the use of mercury present in much of today's lighting
5. And, because it uses the buildings' wiring network to transmit data, through an Internet–connected modem to a web based control interface, costs and time to implement the networking are low
6. With this Building Energy Network in place, many new applications can be layered on quickly an cheaply; and thus spur an unprecedented growth in new networked energy savings building products and services

Such a network could generate multiple new technologies and capabilities, such as:

1. A building-wide Demand Response platform that could be expanded to control the Heating-Ventilation-Air Condition (HVAC) and trigger backup generators
2. Inclusion of other lighting to be Demand Responsive
3. Inclusion of novel non-lighting/non-HVAC Demand Response applications
4. It could be used as a Smart Meter network gateway to the utilities
5. CO2 sensor signals riding over the network that can determine how many people in a room and automatically adjust the HVAC output on a room-by-room basis
6. Personal control of lighting and HVAC by occupants
7. Advanced sensor-based building automation to extract and measure maximum energy and operational savings
8. Real-time carbon measurement and verification
9. Real-time carbon trading platform (either with cap & trade or as a carbon tax)
10. Communications platform for on-site renewable energy generation to optimize distributed energy generation with building energy usage

Government funding is critical to the United States' future. Without this systemic solution approach to the nation's energy goals, progress will be slow. The goals of such a program include:

1. Development of an initial ubiquitous LED lighting application
2. Development of a network platform that runs on the building's electrical wiring
3. Develop a software and User Interface that is easy to program around and use
4. Develop a roadmap of potential applications, capabilities and needs of the network
5. Develop secondary applications that prove the expandability of the network
6. Engage multiple vendors, research resources and other market players to build and implement add-on applications
7. Review existing government and utility incentive programs and develop a more streamlined and comprehensive approach to encourage the adoption of such Building Energy Networks as rapidly as possible across the United States

Multiple government, private and academic efforts and funding are being directed today at the various pieces of this puzzle, but few if any take this systemic approach. Taking this systemic approach enables many existing programs and funding to be brought together in a more comprehensive and synergistic manner, to deliver maximum value in the expeditious manner possible. A top-down government mandate and encouragement could combine existing and new programs to make this a reality. It would also generate the market impetus for a massive and rapid societal and national transformation.

Eutricity, Inc.; a Delaware company operating in San Francisco, is developing such a solution as described in this whitepaper. Technical issues are currently being addressed towards the development of the initial lighting and Building Energy Network technology. The Company expects to begin deploying the initial system by Q4, 2009. As a start-up company in a financially challenged time, only limited progress can be made without Federal financial, administrative and legislative support. $3 million would be needed to expand upon the goals of the Building Energy Network program outlined above. The individual technologies to achieve these goals are available today, but without government systemic support, efforts to reach these goals will be fragmented and halting.

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The Company is currently in ‘stealth mode’, and the web site has not been established.

Further information is available by contacting Brent Marsh.

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