The Local Smart Grid

This article introduces a creative approach to energy consumption as one of the 100 innovations that shape "The Blue Economy". This article is part of a broad effort to stimulate entrepreneurship, competitiveness and employment.

The Market for Smart Grid Technologies

The world market for smart grid technologies is expected to top $ 110 billion in 2011, and is projected to continue to expand to an estimated $171 billion by 2014. The biggest growth is expected in the market for smart sensors that is projected to more than double from $37 in 2009 to $85 billion in 2014. The IT hardware and software is also benefiting from a rapid expansion over the same period from $15 to $40 billion, while the integrated communication systems will grow nearly threefold from $10 to $27 billion. However, the highest compounded annual growth rate is expected in smart metering hardware and software, from a low $6.4 billion to just under $20 billion five years later. The US market was in 2010 the largest in the world, valued at $21.4 billion and the prognosis is that it will hit $43 billion in 2014. However by then it will be eclipsed by the Chinese market which is poised to reach $61.4 billion.

The smart metering transmits and organizes waves of data collected by meters. This stimulates the growth for companies like General Electric, Siemens, IBM, Itron, Landis+Gyr who supply utility companies with equipment to install in millions of homes. The smart grid network providers like Silver Spring Networks, and the home energy monitoring companies Tendril, OpenPeak and Control4 are battling for dominance. However behind the dozens of start-up companies are the pillars of the internet boom like Intel and Cisco Systems providing additional income for the utilities which are evolving from energy and water providers into full service corporations.

The Innovation

Most of the utilities deployed in the industrialized nations were built between 60 and 80 years ago. It was designed to provide as much energy, water and gas as customers could consume, generated from a huge fossil fuel plant. Climate change preoccupations and renewable energy mandates force utilities to upgrade their infrastructure. In order to accommodate renewable sources of energy on an intermittent basis, there is a need for accurate measurement, monitoring, control, analysis and correction. The innovations have therefore focused on mobile communications, IP-standards, data processing and mining. The meters and the grid are connected, communicate and get smarter, while the average American home has 24 pieces of consumer electronics, up from 3 in 1980. Electronics now represent 31 percent of home energy use and the satellite and cable television control unit today consumes more energy than a family sized refrigerator. Time has come to go beyond smart metering beyond aggregate data.

Dan Yates, who graduated from Harvard University with a degree in Computer Science, started his entrepreneurial career as the founder of Edusoft, an educational software company that assesses performance. After selling the company, he set out to realize a childhood dream, driving with his wife from Alaska's Arctic coast to the southernmost tip of South America. During the trip, Dan become aware of the environmental degradation and resolved to dedicate his professional life to turn business sustainable. He realized that energy consumption is one of the main culprits and committed to exploit his computer skills to engage millions of people who are in the dark about their energy use. In 2007 he went on to create Opower starting with a rented desk in San Francisco. In 2011 he was the finalist for the Ernst & Young Entrepreneur of the Year Award and has already over 200 employees - and growing.

The First Cash Flow
Dan and his team invented a new platform for utility companies to interact with its customers - from the quality of the information provided to the way it is presented and delivered, helping people to use energy efficiently, saving money through making energy use personally relevant. It starts with a home energy report reviewing how much a home consumed when and at what price. Today Opower is delivering reports to more than 3 million households, putting people on track to save hundreds of millions of dollars. The utility companies put a lot of tariff information - only to realize that their customers hardly browse their web. Dan and his colleagues turn the utility website into highly personalized engaging energy management tools. This includes alerts indicating peaks in consumption, along with immediate tips on how to avoid it. Since Dan does not believe in inundating people with data and charts, he has applied for a patent to convert this tidal flow of information into simple, actionable and personal advice. Opower does not generate electricity, it works with what is available, and makes the network more efficient, thus applying one of the core principles of the Blue Economy. Working with more than 50 utility companies, Opower saved as much energy in a few years as what is produced by 40 percent of the American solar industry without any compromise on quality of life.

The Opportunity
A study undertaken by the University of Oxford confirmed that when consumers have real time information on their electricity use, they can act and cut its use by 10 percent without changing anything in their existing system. A Chilean team headed by Gabriel Antonio Villalón Sepúlveda and Robinson Eduardo Gálvez Herrera, both electric engineers have gone one step further than Opower. Their smart grid offers real time electric consumption data and displays real time performance data, both in kW consumed as in cost for each electric apparatus switched on at home. Their software compares actual consumption with theoretical performance, detecting under performance and over consumption. It also verifies if the equipment is actually needed at that particular time, and if the stand-by mode is not better converted to an outright shut off through a remote control. If on the other hand data indicate that some machines should be turned on, then the system provides for a switch on

code. The whole management starts with the existing installation, evolving towards an optimization including the instant calculation of carbon emission savings, depending on the source of power for the electric provider. This Santiago de Chile-based team went on to create the eKeeper, and each client is equipped with a portable screen, the size of a GPS, which provides all information and permits corrective action through any cellphone or computer interface.

These experiences of Opower and eKeeper are soon to be expanded with smart grids that will regulate energy production from multiple renewable energy sources created within the home or office, not just from the utility company. The next smart grid combines home-based production and consumption in order to create real sustainability, monitoring all uses as is done today, complementing this with the management of local sourcing of electricity ranging from the compression strength of the building (Case 59), the recovery of energy from the hot water tanks (Case 60), the power generated from the flow of water (Case 42), the thin film solar cells on the windows, the flutters in the wind (Case 12), the biogas from the black water and organic solid waste (Case 51), plus the heat exchange from the black walls (Case 14). None of these sources of power provide energy all day, or supply sufficient power to meet all needs on their own, there is a need for a smart grid to manage the supply of these rather minute sources of electricity. The smart grid of the future will not only monitor individualized consumption and cost, it will also regulate individual supply of power from over a dozen of sources in order to secure availability of electricity all the time. This is one of the essential characteristics of the Blue Economy Centre that will incorporate not only the energies described, it will have the next generation of smart grids.

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… Further information on the 100 innovations at www.theblueeconomy.org.