Smart Grid 101 - The key drivers of a Smart Grid

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September, 2013
Meet the Author:

An IEEE Fellow, electricity industry visionary, and leader, Dr. Mani Vadari delivers strategic services to a global set of utilities, vendors, and service providers seeking deep subject matter expertise in setting the business and technical direction to develop the next-generation electric/energy system. As a Business Architect, Dr. Vadari has been delivering solutions focusing on Transmission/ Distribution/ generation operations, Energy markets, and Smart Grid for over 35 years. In addition, he is an Adjunct Professor at Washington State University and an Affiliate Professor at the University of Washington. He has published two popular books, "Smart Grid Redefined: Transformation of the Electric Utility" and "Electric System Operations – Evolving to the Modern Grid, 2nd Edition", in addition to over a hundred industry papers, articles, and blogs. His books are serving as textbooks at several universities in the US and around the world

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"In previous articles, author, trainer and smart grid pioneer Mani Vadari has explained the smart grid's key players and helped us understand the crucial system operations function. Now he is back to explain the powerful forces that are pushing us towards a smarter future. -- Jesse Berst"

The utility industry is embarking on a transition whose end isn't fully understood. Many utilities and regulators aren't yet comfortable relying on smart grid technologies as a substantive resource planning tool. They are questioning the assumptions used in smart-grid investment planning. And they worry that we are putting too many eggs into the smart-grid basket -- something we'll regret as we did our heavy reliance on nuclear and gas during their past boom periods.

The underlying problems that will NOT go away:

However, the underlying issues have not gone away. Worldwide electricity demand is estimated to double by the year 2030. Meeting that need simply by building new power generators is not a reasonable alternative. Meanwhile, electric power customers expect quality, reliability, and power increases on one hand, while simultaneously demanding reductions in carbon emissions on the other.

The future will see diverse energy sources both at the bulk/wholesale level as well as at the distribution level. Those sources may even include hydrogen (fuel cells) and bio-fuels, not to mention wind and solar. Managing the grid will become more complex with the implementation of state renewable portfolio standards (RPS), which will require that utilities use more renewable sources of energy. Those highly variable sources put great strain on a grid when installed at scale.

We can also envision distributed energy storage at the community level. At the retail end, smart homes and smart buildings will participate in the grid of the future through automated and semi-automated control of their consumption. The system operator of the future will have to manage this diversity of supply and consumption while also providing choice and flexibility to customers.

The key drivers for a Smart Grid are:

- *The blackout of August 2003, which exposed the aging and vulnerable electric power infrastructure.*
- *Customer expectations: Customers are demanding higher levels of service. Utilities need to ensure that their service at least matches, and perhaps surpasses, the standards set by other industries.*
- *Workforce skills shortage: The utility workforce is aging. It is anticipated that the industry could lose half its skilled workers in the next five to 10 years to retirement.*
- *Infrastructure replacement: Aging physical infrastructures will require extensive replacement, and those costs are expected to outstrip historical capital spending rates by more than $14 billion over the next 10 years. There is growing recognition that utilities need to be smarter in implementing replacements.*

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- *Environmental constraints: There is a concerted movement toward Renewable Portfolio Standards (RPS) and reductions in greenhouse gas (GHG) emissions. This fact, combined with rising fuel costs and rising load, is making the delivery of power more expensive and difficult.*
- *Technology: Technology costs continue to decline while performance improves*

These factors necessitate the implementation of a smart grid capable of monitoring transmission and distribution and responding to disruptions. The implementation of a smart grid, along with a demand management system, will help provide the lower-carbon-emissions future that has become a necessity.