




# Smart Grid, System Operations and the Management of Big Data to drive Utility Transformation

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October, 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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The utility industry has been in a slow evolutionary mode since the middle of the 20th century. However, over the last 10-15 years, the pace of change has dramatically changed and much of this happening through the implementation of technology. New technologies are flowing into utilities at unprecedented rates in a variety of different ways.

The first set is the increasing presence of electric vehicles, distributed generation like wind and solar PV, and electric storage. These technologies, in addition to creating new system requirements, continue to increase the stress on already loaded feeders and low-voltage transformers. Some of these stresses are also hitting the transmission infrastructure as large wind farms with reduced capacity factors are setting new expectations in terms of transmission availability.

To combat these new stresses, a new set of technological changes is coming in the form of utility automation levels that have been rising steadily over the last few years. There are several examples of these including substation automation and distribution automation; phasor measurement units, smart meters, Volt/VAR control, demand response, and others.

Many of the changes covered in the two sets of technologies above go under the mysterious moniker of Smart Grid. This term Smart Grid means so many different things to everyone – if you ask 3 people, it is possible to get 4 or more definitions. Regardless of what the definitions are, it represents the biggest change that is being faced by the utility industry and has the potential to change everything that we have faced in our industry. These changes are causing utility CIOs to have nightmares about the impacts on the stability and resiliency of the grid and the potential for these problems to show up on the evening news.

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*While utilities always have had to deal with data, nothing could prepare them for the new onslaught of data from PMUs in transmission and the new sensors, controls, and smart meters in distribution. As an example, just Smart Meters alone have moved the amount of data per residence from 12 data points per year (one per month) to multiple data points per premise every 15 minutes. These incredibly large quantities of data are all sitting in their individual silos. The problem is that there is a lot of intelligence in the data and utilities are not yet taking advantage of it. Utilities are just beginning to start taking advantage of this data and drive insight to improve their own operations, provide better service to customers, and deliver improved returns to shareholders – leading to the 4th set – Big data and analytics.*

## **Can we stop??**

*Moving any further as if these challenges were not enough – could cause any person looking at you to act as if you just dropped in from Mars. While each area is distinct and challenging in itself, the combination has incredible potential but to deliver real value, it must also be supported by a combination of business process changes and change management. Looking at it totality, also allows the utility to prioritize their investments both from answering the question (1) WHAT – technological changes to make (2) WHERE –to make them, and (3) HOW MUCH – to spend on it?*

## **Let us look at some examples:**

- *Asset Management: Technologies like electric vehicles and solar PV are putting hitherto unknown amounts of increased stress on the system by utilizing it in very different ways. Utilities are adding new sensors to get a better view into how these components are being used and new systems like DMS and DEMS to operate the systems, all resulting in a tremendous amount of new data that is coming into the utility all of which contains a lot of insight. A good asset manager needs to be able to tap into this information and the operational insight to drive new value out of the asset management processes specifically focused on asset health and its impact on maintenance schedules and priorities.*
- *Improved Outage Management and Restoration: Outages will happen but now we have sensors like smart meters that tell where they are and who is affected. Systems like OMS and DMS will allow us to understand the extent of the outage and the controls available to reroute power quickly. Distributed energy sources can allow us to identify new sources of supply that can be commandeered during storm conditions and the analysis of the data can allow us to plan systems and assets in such a way that we can reduce the outages the next time around.*
- *Improved Customer Service: Utility customer service for the most part was about customer billing. Now, for the first time, utilities have access to data (in this case mostly smart meter data) that can give them a tremendous amount of insight into customer use of energy. Proper analysis of this data can provide insight both for better customer service but also better rate design in the future.*

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*Utility transformation cannot happen without technology infusion of the right kind – but at the same time, technology infusion alone cannot deliver value without the utility transforming itself. For this to happen in an effective manner, IT and OT will need to work together – meaning the CIO needs to work effectively and closely with the business leads across traditional silos and the regulator also has a role to play in this. Focusing on transformation will result in better operations at the utility and improved service beyond what can be achieved through technology alone.*