Data Analytics Transforms Utilities

Dr. Mani Vadari

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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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Data analytics is not new to the electric utility industry. Utilities have always analyzed data to improve the operation of the electric grid and their processes. However, for the longest time, there was not much data to analyze. This is now changing with the advent of new sources of data:

- *Transmission data — Technologies such as phasor measurement units (PMUs) are bringing data at speeds of 30 times a second to 60 times a second.*
- *Distribution data — Distribution automation device deployment is growing rapidly, bringing large amounts of data into the utility.*
- *Meter (customer consumption) data — Advanced metering infrastructure (AMI) and smart meters are bringing in more than 35,000 data points per year based on 15-minute reading intervals per customer.*
- *Asset data — Utilities can bring large amounts of asset health data, in an economical way, into core systems such as asset health centers.*
- *Geographic information system (GIS) data — Utilities are using GIS to store and correlate their asset characteristics and location (global positioning system coordinates) along with connectivity and geospatial rendering.*

Data analytics must be a critical tool in the utility's arsenal. However, for the utility industry, advanced analytics are still nascent. Utilities need to define where the sources of value are as well as what services and capabilities they want to provide to their customers, employees, regulators, and shareholders.

Today's Approach:

Currently, data analytics at utilities is a targeted task, which has resulted in islands of analytics like the following:

- *Customer — Meter and beyond the meter*
- *Operational — Real-time, near real-time and historical*
- *Asset — Financial, health, and device-experience data.*

In addition, there is other performance data for improving supply-chain decisions and restoration predictions. This approach is inefficient. It restricts users to a subset of analytics applications and constrains them from crossing analytics systems to extract greater value from related data.

A change in approach is warranted. The various data models could work together to move away from islands of analytics and toward master data management to deliver increased value-add to the utility.

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Utility Transformation Examples?

Here are three tangible examples of how data analytics can impact utility transformation.

- *Predictive asset management — Most major outages result from failure happening at the most inopportune moment. Data on equipment usage is present in a broad set of sources (AMI, supervisory control and data acquisition, distribution automation and others). Using information effectively enables better prediction of equipment failures, resulting in lower cost and reduced customer counts.*
- *Asset utilization — Smart meter data can be aggregated to reflect transformer loading, enabling utilities to compare usage to capacity and perform capacity utilization trend analysis. For example, the following questions can be answered: Which transformers are loaded beyond their electrical or thermal rating and for what duration? What percentage of time is a transformer operating within 10% of its peak rating? What is the minimum size replacement transformer for an aging transformer that can provide adequate capacity and reduce losses?*
- *Power-quality issues — Distributed energy resources (DERs) at the residential level are making power quality an important issue. For example, a customer may have issues even if their neighbor installed rooftop photovoltaic solar power. Using AMI data, utilities can analyze residential DER installations to respond to issues like this proactively, resulting in satisfied customers and improved regulatory relationships.*

Utility of the Future

The utility environment is changing in ways even progressive utilities are not able to comprehend. Over the next 10-plus years, utilities will face multiple challenges requiring a strong response:

- *DERs and associated technologies such as distributed generation, renewables, demand response, storage, plug-in electric vehicles and others will become pervasive, changing the way power flows over the distribution grid. This will impact all areas of the utility's business, ranging from generation planning and dispatch, grid design, and operations to field and customer services. Imagine future scenarios in which non-wires alternatives (NWAs) result in customers becoming generators and utilities rely on this segment to deliver on their mandate of a reliable and resilient grid.*
- *Prosumers are creating new business models with the introduction of entities such as aggregators, who appear to be positioning themselves to take customers away from the utility.*
- *Utilities depend on institutional knowledge to solve many problems. With every retirement, much of that knowledge is walking out the door.*

Analytics-based technology will be required to augment the utility staff's skills to ensure utilities can support their evolving business model. It is crucial for utilities to convert all their data to useful information, so the new utility worker will have the right tools to make the right decisions at the right time.