




Utility Transformation: Distributed Energy – Supply from the edge of the Grid.

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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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Let us continue to use the hypothetical case study from last article.

“I just returned from Houston and my friend got a message on her cell phone that the power was out at their house, but that it would be back on in 2 hours, so we kept playing tennis. When she checked the app, she also showed me her car was only charged 80% but it was ok, because she was using her solar cells to charge it and it would be complete in 3 hours. She smiled and said she sold \$75 worth of power last month back to her retailer and it paid for lunch today. She said her electricity bill now only includes a connection charge unless she does her clothes washing and baking on the same day. I am calling PSE to see what they can provide.”

Case credit to Charles Filewych, CEO, Smart Grid Interconnect. Used here with permission

Using this same case study, let us focus on another aspect of utility transformation

Distributed Energy Resources (DERs). DERs are all about providing energy into the grid closer to the edge – meaning, closer to where the customers are. So, what does this mean?

- What types of generation are called DERs?
 - The list of DERs is broad and very often also varies from location to location. However, between NY and CA, a standardized list is emerging which includes Solar (PV, CSP), Fuel cell, Wind, Thermal, Hydro, Biogas, Cogeneration, Combustion generators. They also include various forms of storage and demand response.
- Size, number and location:
 - As we move from centralized sources of supply to DERs, the first thing that becomes evident is that there are many of them and they are small. They are also moving away from needing to use the transmission system and are located directly on the distribution system closer to the consumption.

Not all of them are from renewable sources: An assessment of the list of DERs will lead to the realization that not all DERs get their energy from renewable sources. Some of these are not even sources of energy in the traditional sense – Energy storage and demand response are examples of these. This is a typical misunderstanding that exists in the vernacular and needs to be corrected.

What does this mean to the Utility?

- 2-way power flow. The distribution system worldwide is designed to be radial in nature. This means that the system is designed for one-way power flow – from centralized generation sources to consumption.
 - This paradigm is being upended by the introduction of DERs that are generating closer to consumption. This is a change of a very fundamental nature and impacts everything in the grid from design of the infrastructure, infrastructure protection, people work procedures and safety, all the way to grid operations, system planning, commercial operations and beyond.

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- *New technical and business configurations: The advent of DERs and reductions in their costs are also allowing entities to start thinking of the possibility of reducing their dependence on the utility and the grid. Enter the Microgrid.*
 - *Microgrids can be defined as a group of interconnected loads and DERs with a clear set of electrical boundaries and can act as a single entity both physically and from a control perspective. These entities can also result in the reduction of the load from a utility (reduced revenues) and also entities fully within a utility environment but controlling themselves.*
- *New players entering the marketplace: The advent of DERs is also bringing in new players such as DSO (or DSPs as defined in the NY REV), aggregators, and other players who will all have a role in this new energy equation.*
 - *The main impact of these new businesses being created is (1) a new set of companies may be servicing the customer who for the most part was being serviced by the utility leading to reduced revenues for the utility as well and (2) DSOs will also be bringing in retail market operations with them forcing the utility industry to once again transform itself to provide market-based services to its stakeholders.*
- *New business models: The advent of DERs into the marketplace and the new players will result in the traditional utility with the situation of losing customers, and reduced energy sales thereby resulting in an overall reduction in revenues.*
 - *Companies such as Edison Energy, Con Edison Solutions, and others are examples of utilities that are going outside their traditional rate base but delivering unregulated services to their (and other) customers this time around, it is a very different situation. They are not providing services such as internet services and so on – not aligned with their core capabilities. This time around, the services offered are somewhat aligned with the utility's core competencies.*

Conclusions and Closing Thoughts - How does the utility transform itself with these Generation at the edge capabilities?

The future in this area is moving more and more towards increased penetration of DERs in the utility and reduced costs for their installations.

This means that more and more of the customers will install some level of DERs at their residence or place of business leading to reductions in the utility's core rate base.

- *This also means that the utility will need to look at other sources of revenue in order to maintain themselves as viable businesses in the future – or revert to a wires-only business that will still stay fully regulated at least in the near future.*
- *However, this also means that utilities and their solution providers will also need to continue their process of innovation and define and develop new tools that will allow the utility to still deliver reliable and resilient power to the customer*

Utilities will need to transform. While the present pace of the movement towards a distributed world is slow, the pace is slowly moving up exponentially as it accelerates and at some tipping point in the future, the course will change irreversibly.

Author's note: This is a part of series of articles written by this author for Intel. This is the Fourth article and the next set of articles will continue the focus on expanding on the concepts introduced in first and second article.