



**What skills sets will utilities need in the future, how will utilities acquire, train, and retain these people, & impact upon utility salaries? Lastly, some advice: what do current utility employees need to do to prepare themselves? What other actions will regulators need to take to ensure that utilities will have the necessary workforce to accomplish all that will be asked of them in the future?**



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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**Utilities are in the throes of some phenomenal change – Technology is changing everywhere and organizations are also changing and several mergers and acquisitions are taking place both at utilities and at vendors. Lastly, if the states of New York and California are any indication, the regulatory regime is also slowly waking up to this new reality.**

## So, why do we need to worry about these changes?

The changes heralded under the banner of the Smart Grid are unlike any our industry has seen in the past. Let us look at some examples:

- *Customer expectations are changing: The customer who is more used to the iPhone era, is expecting a similar response from the utility with smartphone apps that provide them with instant feedback on status of outages, accurate ETOR (Estimated Time of Restoration), consumption, power quality, and so on.*
  - *So What: The customer service department and the call centers need to do more things than helping the customer with the bill or just recording outages as in the past.*
- *New sensors and controls are being added to the grid: Newer and more advanced technologies such as FLISR (Fault Location, Isolation and Service Restoration), VVO (Volt-VAR optimization), and so on are being added to the network many of which are capable of functioning in an automated manner.*
  - *So What: Field and operational personnel need to be (1) aware of and (2) ready for these automatic devices in the field and understand when/why they activate and if they do, (1) how to understand the symptoms of action/inaction and (2) what do they need to do about it.*
- *Existing Electro-mechanical devices are being replaced by electronic devices: starting with old electro-mechanical meters being replaced by Smart Meters to a future with Solid-State Transformers (SST) which are demonstrating the capability to replace existing transformers, utilities are seeing an influx of electronics and power electronics on the grid.*
  - *So What: While the core characteristics of these devices are the same as the device they are replacing, their behavior is different, they are able to do more and deliver more information to operations and field personnel, a significant aspect of this change that utilities and regulators need to keep in mind is that – their lifespan is going to be lower than the 40-50 years that was the utility plan for before. Regulators must also be ready for this change because equipment may need to be replaced more often.*
- *New additions to the grid: Additions of components such as DERs (Distributed Energy Resources), Electric cars, electric storage, and others, some implemented by the utility and some by the customer, some in transmission and some in distribution – all have the potential to disrupt utility operations in ways that we have not seen before.*
  - *So What: With the change in the behavior of the grid, with these new devices being added, virtually all aspects of the utility operations will change forever. As the New York state REV process has confirmed, everything from planning, system operations, field services, and customer services will all change possibly in ways that we have not yet figured out.*


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- *Regulatory changes: The two major initiatives in New York (REV) and California (Better than Smart) [PGI] have identified major changes to their state's direction. If RPS was a major move in the right direction, these have shown the ability to make dramatic changes for their respective states and all the states in the US are watching these two initiatives.*
  - *So What: As the regulatory directions change, utilities and their employees will need to keep pace and change along with it, requiring a level of nimbleness that has eluded this industry until now.*
- *Retail Choice – New competitors: As the electric utility becomes more automated, and as more information becomes available to the utility, and if states such as New York have anything to impart to the rest of the country, it is possible that new participants will come into our industry and provide services. It is easy to see other service companies such as telecom, security, and so on offering bundled services to their customers.*
  - *So What: Depending upon how the utility chooses to respond, they will need to become much more customer-friendly and get ready to also offer bundled services to their customers.*

**So, how does all of this impact the electric utility of the future?**

*New roles: Utilities are already identifying and implementing new roles within their organization and more will come in the future. While the subset identified here appears to be roles that already exist, it is important to understand the differences between what they do now versus what would be expected of them in the new future.*


- *Chief Customer Officer: PG&E had taken one of the first steps forward in this direction by hiring a Chief Customer Officer whose primary focus was to improve customer intimacy with the utility. This represents the first step in the move towards customer intimacy and more responsiveness to the customer and their needs.*
- *Chief Technology Officer: Utilities are being exposed to new technologies in ways that have never happened before. They need to be able to understand the impact of the technologies, their applicability to their unique environments, and the potential for benefits to their customers.*
- *Business Architect: Going forward, defining a business architecture is no longer the purview of consulting companies. Utilities need to transform themselves, and if they do not, they run the risk of reducing the benefits of technology implementations. The business architect owns the 'business roadmap, anticipates future turns in the business, and assists the organization in getting ready for it.*
- *Technology Architect: The biggest change hitting the utility in the technology area is the co-mingling of IT and OT. The role of the technology architect is changing from a pure IT architect to someone who understands all aspects of IT and OT, their impact on the organization, and owns the technology roadmap for the utility.*
- *New Chief Information Officer: Until the recent past, the utility CIO was more of a large system (with the core being the CIS system) owner. Many of the operational systems such as EMS, OMS, and so on were on the periphery of their vision. This is now changing – the new systems such as OMS, AMI, and DMS are all much more integrated and impacting each other thereby blurring the boundaries between IT and OT systems and the new CIO needs to be ready for them all.*

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## **New training:**

*Like many other businesses, utilities will need to do more with fewer people through increased automation, controls, and improved business processes. For this to happen, the workforce of the future must not only be better trained in technology, but they must also feel comfortable with integrated business processes, which are currently siloed in various operating departments*

- *Understanding the basics: Everyone in the utility, the vendors providing products to them and the consultants performing work at these utilities need to understand and internalize this change. They need to understand that we are now moving into a period of change that may continue for the next several years. In addition, as the Smart Grid journey continues down the path of Grid Modernization, they need to understand the key concepts such as (1) difference between Smart Grid and Smart Meter (2) that there are different types of storage, each with its own individual characteristics (3) characteristics of different DERs and the impact they will have on different parts of the utility business (planning, operations and so on), (4) microgrids, what they mean, what they need and (5) other similar concepts.*
  - *The important part here is that everyone in the chain needs to understand the basics of what is or will be needed for a modern grid to function effectively and efficiently.*
- *Technology Training: Utilities are implementing technologies at rates we haven't seen before. New technologies such as smart meters, smartphone apps, cellular-based telecommunications, data mining and analytics, DMS/OMS, enhanced CISs, cloud-based systems, and automation systems are being brought into the utility environment at a rapid pace. This also includes systems such as GIS that are being put to new uses that were not envisaged when they were implemented. In addition, on an ongoing basis, utility employees need to bring in new data models from the GIS and upload them into operational systems such as OMS/DMS.*
  - *These systems and devices need to be installed, configured (sometimes many times), operated, and managed by utility personnel. The personnel working on them need to be fully trained in all of these technologies and their respective eccentricities.*
- *Business Training: As the technologies are coming in, utilities are transforming to take advantage of these new technologies and sometimes being moved into transformation either by their regulators or by their customers who have come to demand more. The State of New York and the REV initiative is a perfect example of a regulator's vision of bringing in retail-level markets into distribution. If this succeeds, as it is expected to, one can expect that other states who are currently following the New York effort closely will also follow suit. Business transformation is already happening at most utilities at the customer service level with more information being pushed to a smartphone app at a near-real-time pace. This will increase.*
  - *Utility personnel need to be taught business skills to be able to perform more complex tasks not all of which may have an engineering or technical basis. These tasks will get more complex as the transformation reaches other areas of the utility.*

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## **Lastly, the Regulator's Dilemma:**

*The regulator is caught between the proverbial rock and the hard place. On one side, they are supposed to represent the customer's interest and keep the costs low. On the other side, they don't want to be perceived as holding up progress and not approving anything, and on the last side, they also need to be able to help their state elected officials implement their policy objectives in a way that is not to the detriment of the existing efficient and effective functioning of the grid.*

*Some examples of the regulator's dilemma are provided below.*

- *Smart Meters and AMI: Regulators are fully aware that implementing Smart Meters will provide several other benefits to the customers and to the utility. However, they also know that the cost of implementing Smart Meters is expensive and will result in the rates going up for all the customers.*
  - *So what: Regulators need to educate themselves on how to evaluate these newer technologies and their benefits especially when they are being implemented for the greater good of the citizens in their jurisdiction.*
- *RPS and DERs: there is a general groundswell of support to bring in more distributed renewables into the grid. However, renewables such as solar and wind also bring with them key issues such as (1) 2-way power flow (2) intermittency of generation, and so on.*
  - *So What: As more distributed renewables come into the grid, the grid operator will need more tools and techniques to be able to still operate it in an efficient and effective manner. This will increase costs even as existing customers are consuming less power from the utility grid.*
- *Microgrids: Microgrids are being encouraged to be formed leading to more customers staying away from being normal utility customers and using less of the grid and power from the grid on a normal basis.*
  - *So What: The regulator needs to understand that the utility infrastructure still needs to be able to bring these microgrids back into grid control when needed under emergencies or other similar conditions thereby maintaining the same infrastructure but under a diminishing customer base. Costs go up with a customer base that may go down.*

*The key to the regulator's dilemma is that they now need to be a combination of technologist, economist, and engineer so that the solution of the problem is known to them as they navigate these troubled waters.*

## **So - What comes next?**

*This is not a technical discussion – more of a business discussion. This is also a significant change for utilities, an industry that has been resistant to change until now. As this industry evolves, it must be ready to anticipate many new dimensions such as the growth of microgrids, distributed renewables and an influx of new participants to support retail markets as well as other foundational changes – changes that over the next decade could drastically change much of what we take for granted in the utility of today. The workforce of today will also need to transform itself to handle new business, technological and regulatory changes, many of which are already here. In particular, the growing numbers of workers retiring over the next 3-5 years will quickly reach crisis level unless we react soon and proactively. We are beginning to see academia gearing up math and science programs in conjunction with some utilities to increase both the number of students they can handle and the technical skill sets that will be needed to meet these challenges. However, there is much more to be done – and the time to do it is now!*