Get Smart with Smart Grids A new paradigm

The adoption of smart grid technologies by utilities will result in a seismic transformation for the industry. New technologies and ways of working will be required. New players will enter the industry and the industry's relationships with their customers will be forever changed. Smart grids will challenge the utilities to think outside the box and look for new solutions. The stable nature of the traditional utility business will become a thing of the past.

Grids of yesterday... were designed to deliver electricity along a linear supply chain from large scale dispatchable generation through the transmission and distribution networks to end customers. Customer demand was predictable and the system was balanced by adjusting supply to meet demand. The distribution level the grid was designed with high safety margins so that it could be configured and left to run without intervention. Regulation focused on allowing the utility to earn a rate-of-return on assets in return for meeting customer service targets. While this model has existed for many years it is now under pressure from forces that will result in a transformation of the energy delivery supply chain.

Grids of tomorrow... The supply chain will become networked and non-linear both physically (with power flowing bi-directionally) and commercially (with new market participants and new commercial arrangements between participants). In this new world, the smart grid will play a key role in ensuring that demand and supply is balanced through smart systems that merge consideration of grid technical constraints with customer preference and activity while allowing industry participants to manage risk and make a fair return.

### Decarbonisation
Targets for carbon reduction will see changes to both the supply and demand side. On the supply side there will be an increase in renewable generation connected to the system. While on the demand side new uses of electricity such as transportation and heating along with demand response will disrupt the well-understood demand profiles that industry has used.

*25% of global capacity will come from renewable generation by 2018*  
(Bain & Co. Distributed energy: Disrupting the utility business model, 2013)

### Generation
Build sustainable grid connected, large and controllable generation to meet demand.

### Transmission
Balance the system by adjusting generation output to meet demand.

### Distribution
Over build and then operate blind.

### Retail
Deliver and bill with as little customer interaction as possible.

### Customer
Little knowledge of how electricity is consumed. No incentive to use electricity at different times of the day.

### New Entrants
Customer
Conscious, engaged and actively seeking the best deal.

### Bulk Generation
Large scale intermittent and renewable facilities replacing carbon intensive capacity.

### Transmission
Demand management and storage become key to system balancing.

### Distribution
Increased levels of innovation, visibility, automation and control.

### Retail
High levels of customer interaction and data driven products and services

### Technology
Technologies for alternative generation, storage, communications and sensors are, or have reached, a tipping point that allows their economic deployment. New grid equipment now comes with a multitude of sensors and measurement points that previously would have been expensive to obtain but now come as standard.

### Changing demand patterns
As customers find new uses for electricity, build their own generation and engage in demand response then customer demand will become ever more difficult to predict and as a result the traditional method of varying supply to meet a predictable demand will become progressively less viable. In addition, new uses of electricity and, in developing countries, increased electrification will lead to increases in peak demand.

*By 2020, global demand response capacity is expected to reach 140 GW*

*By 2019 there will be 5 billion smart phones worldwide*  
(Natural News, Smart phone market will surge, 2013)

### Customer Expectations
Customers of today demand immediacy and accuracy of information. The utility model of telling customers months after the fact how much they consumed and the cost is an outlier in terms of customers’ experience with other service providers where immediate feedback on mobile platforms is available.

### Distribution
Increased use of distributed and grid connected storage to balance the system and manage the grid

### Distribution
Increasing numbers of off-grid communities, campuses and businesses

### New Entrants
New entrants providing new services to end customers and existing participants
The migration to a smart grid presents a number of challenges and opportunities...

How to improve customer retention and satisfaction?
In today's digital world customer expectations for accuracy, immediacy and flexibility are rising. Utilities that don't provide a first class service to their customers will be punished as a result. Forward thinking utilities are looking at how to engage customers with new technologies and social media, how to deliver new products and services that are underpinned by smart meters and smart grids, and how to gain customer insight from the 'big data' collected from smart meters and the grid.

How to develop a solid business case?
Costs and benefits for smart grid and smart meter projects are often not aligned. Costs can fall on one participant in the value chain with benefits falling to others. Understanding how benefits and costs aggregate to a societal level is important but so is understanding the individual case for each organisation. A rigorous evaluation is required to fully understand the cost and benefit impacts of smart grid projects across the value chain.

How to finance a smart grid transition?
Smart grid solutions work differently from the traditional grid, have a different lifecycle, involve different commercial arrangements and carry a different risk profile. They therefore require different financing and regulatory models that allow utilities to make a trade-off between OPEX and CAPEX and take account of the different risk. Utilities, their investors and regulators need to be able to compare smart grid approaches against traditional grid reinforcement or construction.

How to integrate new smart grid technologies?
Technology must be integrated not just between the traditionally separate realms of Information and Operational Technology but also between different organisations in the supply chain and also to customers themselves. The task is made harder by the reality that Smart Grid standards are emerging, overlapping and incomplete. The risk of integration and security problems occurring is high and requires careful control and management of vendors and the overall architecture.

How to regulate for the smart grid?
Current regulation may not allow smart grid investments to be fairly weighted against traditional investments. Smart grid solutions may have a different risk profile and require different commercial arrangements that make their consideration as a traditional utility regulatory investment problematic. Regulators need to encourage innovation and allow trade-offs between OPEX and CAPEX such as allowing the companies of demand response against network reinforcement. Regulators need to make sure they encourage innovation while still protecting the consumer.

How to make lasting changes to customer behaviour?
Many benefits from smart grid will never be fully realised unless customers change their traditional ways of using energy. The task is made harder by the reality that Smart Grid solutions are complex and many customers will need support from their utility companies to understand how to use and benefit from them.

How to make pilots into reality?
Many utility companies have successfully executed smart grid and smart meter pilots. However, few companies have fully translated their pilots into full-scale rollouts. We believe that this is because many pilots are constructed as technical trials whereas a full deployment requires a complete business transformation. It is important therefore that smart grid and smart meter pilots are, from inception, considered as business transformation pilots. The mean focuses on proving the business outcomes that the technology will enable rather than just that the technology works.

How to turn pilots into reality?
Many utility companies have successfully executed smart grid and smart meter pilots. However, few companies have fully translated their pilots into full-scale rollouts. We believe that this is because many pilots are constructed as technical trials whereas a full deployment requires a complete business transformation. It is important therefore that smart grid and smart meter pilots are, from inception, considered as business transformation pilots. The mean focuses on proving the business outcomes that the technology will enable rather than just that the technology works.

How to make sense of all the data?
Smart Grid technology has the potential to generate large volumes of data. Utilities must be able to exchange data between each other, process the data and obtain insights from it. Exchanging data securely may require new functions such as data hubs from it. Re-examining data security may require new functions such as data hubs to be created. Ensuring operational efficiencies and insights will require new approaches to analysing big data in order to yield insight that will improve operational efficiencies or deliver competitive advantage.

How to manage risks?
Smart grids and metering pose risks to the ongoing operation of the electricity system and the business operations of utility companies. Because of the interconnections between participants in the new smart world there are new risks to be considered around interdependencies. These risks range from cyber security, to supply chain integrity through to customer acceptance. A comprehensive and thorough approach to identifying and managing these risks is required.

The era of smart grids is set to deliver real improvements. A range of technological innovations are, together, expected to make possible a step change in grid efficiency, facilitate automation to reduce cost and improve quality, enable the integrated and optimal use of distributed and renewable generation, and promote interaction between supply and demand technologies and between the consumer and the utility that will provide benefits for both. It requires substantial capital investment and it means transforming the grid from an electromechanical system to a fully digital system.

This fundamental transformation raises many challenges and opportunities some of which are noted above. PwC can help bring effective rigour to the decisions that companies need to make at all stages of smart grid development and implementation and help companies meet the challenges and exploit the opportunities. We have extensive experience of smart grid programmes in all the major power markets around the world. Our goal is to help our clients deliver on their smart grid ambitions in a way that provides them with maximum value and competitive advantage.

Contact
Steve Mullins
Global Lead Smart Energy
Steve has worked in the utilities sector for over 20 years and in the area of smart metering and grids for over ten years. At PwC Steve is responsible for ensuring that the best experience of our international network is brought to bear for our clients. His experience of smart energy spans projects in Europe, Asia and North America. Prior to joining PwC Steve worked in a global business development role for Siemens Smart Grid Division.

To find out more email steve.mullins@uk.pwc.com