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. At 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.

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

IEA, Renewable energy medium-term market report, 2013

Substitution

Customers will substitute the products and services provided from traditional utilities. For instance, customer owned distributed generation will substitute for grid connected generation and micro-grids will offer the potential for entire communities or businesses to move completely off-grid.

40% of capacity in Germany is from distributed generation.

Bain & Co, Distributed energy: Disrupting the utility business model

New Entrants

New business models will provide opportunities for new entrants to capture value in the market. These new entrants will seek to become intermediaries between the customer and the traditional utilities. Aggregators, internet switching sites and Energy Service Companies (ESCOs) are examples of such possibilities.

The ESCO industry in the US could reach $15billion by 2020.

Berkeley Labs, Current Size and Remaining Market Potential of the U.S. Energy Service Company Industry, 2013

Generation

Build sufficient 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.

REGULATION

Allow a rate-of-return on assets for meeting customer service standards

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

Navigant Research, Market data: Demand response, Q3 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.

By 2019 there will be 5.9 billion smart phones worldwide

Ericsson mobility report, November 2013

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.

From 2003 to 2012 the levelised cost of PV has dropped by nearly 50%

World Energy Council, World energy perspective cost of energy technologies 2013

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.

Bulk Generation

> Large scale intermittent and renewable facilities replacing carbon intensive capacity.

Transmission

> Demand management and storage become key to system balancing.

Distribution

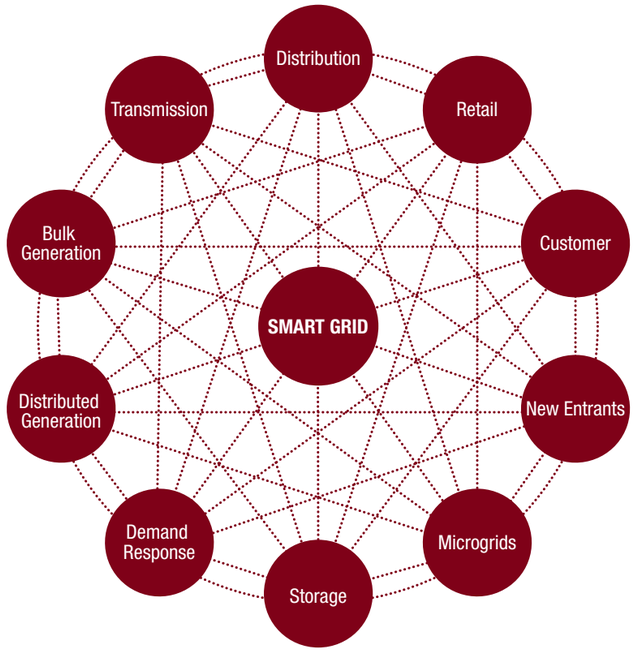
> Increased levels of innovation, visibility, automation and control.

Retail

> High levels of customer interaction and data driven products and services

Customer

> Conscious, engaged and actively seeking the best deal.



Regulation
Support technical innovation and new commercial arrangements

Distributed Generation

> Customers increasingly becoming producers

Demand Response

> Customer demand managed through pricing and contracts for direct control

Storage

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

Microgrids

> Increasing numbers of off-grid communities, campuses and businesses

New Entrants

> New entrants providing new services to end customers and existing participants

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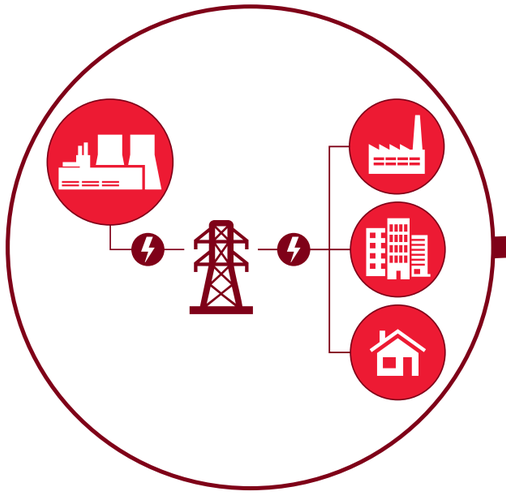
The migration to a smart grid presents a number of challenges and opportunities...



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 too 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?

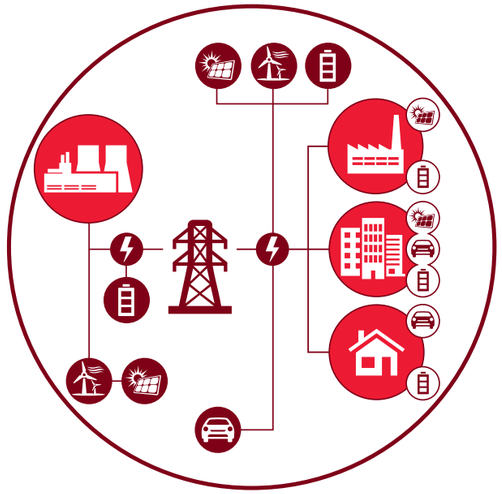
Smart grid solutions work differently from the traditional grid, have a different lifecycle, involve different commercial arrangements and carry a different risk profile. They therefore require different financing and regulatory models that allow utilities to make a trade-off between OPEX and CAPEX and 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 weighed 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 comparison of demand response against network reinforcement. Regulators need to make sure they encourage innovation while still protecting the consumer.



How to exploit new market opportunities?

Smart Grid is disruptive and creates new business opportunities not only within the value chain but also for grid technology and service providers. For instance, in some markets demand response aggregators are becoming intermediaries between the utility and their customers. In others, grid technology companies are considering becoming micro-grid operators, a role that puts them in competition with the distribution companies. Utilities and their technology and service providers need a clear view of the opportunities smart grid presents and the culture and organisation to turn these opportunities in to reality.

How to make lasting changes to customer behaviour?

Many benefits from smart assume that customer demand patterns will change in a lasting manner. For instance, time-of-use rates are justified on the basis of shifting customers' consumption from peak to off peak. However, if customers revert back to their original behaviour then the value is lost. Policy makers and utilities need to consider how to engage with customers to realise long-term changes to behaviour that ensure a continuous return on the smart grid investment. The utility industry needs to look at leading examples from other sectors and refresh its approach to interacting with its customers.

How to turn pilots into reality?

Many utility companies have successfully executed smart grid and smart meter pilots. However fewer 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 metering pilots are, from their inception, considered as business transformation pilots. This means focusing 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 to be created. Gaining operational efficiencies and insights will require new approaches to analysing big data in order to yield insight that will improve operating efficiencies or deliver competitive advantage.

How to manage risks?

Smart grids and metering pose risks to the ongoing operation of the electricity system and to 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 interactions between participants. 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.

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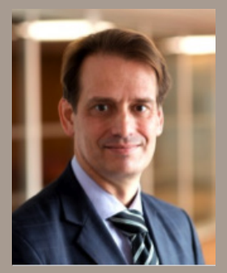
The era of smart grids is set to deliver real improvements. A range of technological innovations are, together, expected to make possible a step change in grid efficiency, facilitate automation to reduce cost and improve quality, enable the integrated and optimal use of distributed and renewable generation, and promote interaction between supply and demand technologies and between the consumer and the utility that will provide benefits for both. But this future comes at a cost. 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



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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.

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