The Challenge of Powering the Future: An End-to-End Approach Towards the Next Generation Utility

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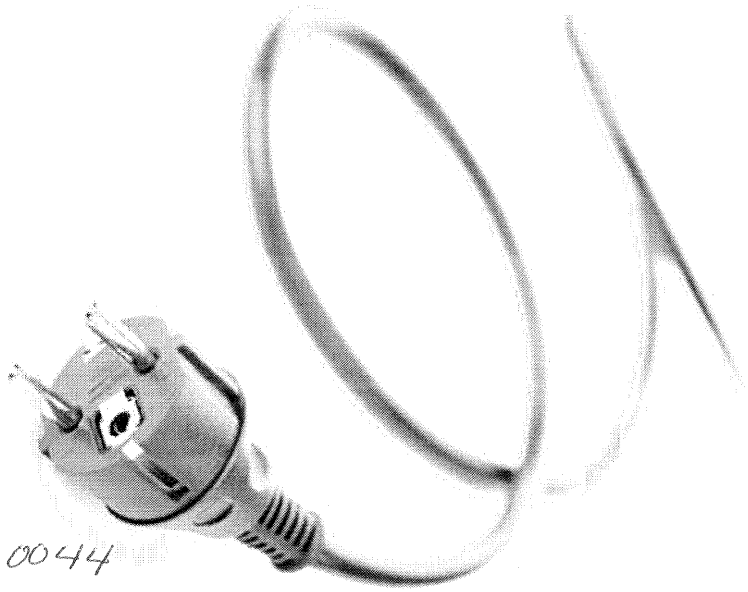

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The challenge ahead

The regulated utility industry in the United States faces an unprecedented dilemma as it is caught between the conflicting demands of a triple bottom line to address the requirements of its shareholders, the environment and society.

While environmental and societal pressure on the industry will continue to intensify, the targets remain uncertain and the methods with which to meet these requirements and finance them remain less than clear. The only thing that is clear is the magnitude of the challenge ahead. The United States is facing massive requirements for investment in its electric system—from generation to distribution. Our future investment requirements are estimated to be between $400 billion and $1 trillion over the next 20 years to upgrade our electrical infrastructure. The rate impact to the average retail customer would be between $75 and $200 per year and this does not even consider any additional cost resulting from stricter environmental legislation. Needless to say rate increases of this magnitude are untenable.

The current credit crisis also complicates the challenge of powering the future. Not only will this have an immediate impact on bad debt and revenue recovery but like many other businesses, a utility needs financing to build and upgrade its asset base. What is unique about this industry however, is that within the current regulatory construct, the deployment of capital is the most prominent avenue for growth. The credit crisis could result in delays to any proposed infrastructure investments and thus reduce rate base growth and, with that, earnings per share (EPS) growth.

In addition, the utility must also prepare for an inevitable decline in energy sales as societal demand for energy efficiency mounts. We believe that the consumer will move from being a price-taker to being a price-setter. Consumer awareness of energy consumption is increasing and, as a result, an empowered consumer will demand more services (from their utility or other providers) that will allow them to effectively curtail peak loads and manage consumption.

In light of the above challenges, utilities are faced with an unprecedented and conflicting set of demands:

- Be a significant part of the carbon solution.
- Solve the asset infrastructure challenge economically.
- Identify & steward sustainable, economically viable energy resources through the next decades.
- Proactively assist customers' efforts to manage their energy costs.
- Renew their organization's skills and talent base to achieve the above.
- Continue to provide reasonably predictable earnings growth.

While many utilities have embarked upon efforts to define a path towards the "next-generation utility" we find that these efforts are often siloed initiatives driven by the generation, transmission & distribution (T&D) or customer segments of the organization. Addressing the upcoming challenge will require a coordinated and integrated set of decisions so as not to suboptimize the end-to-end value chain. In this article we intend to explore a set of eight critical "themes" across the generation, T&D and customer elements of the value chain that, in our opinion, will shape the future of our industry.

The generation dilemma

With the elections behind us, we are clearly on a path towards a significant shift in our energy and environmental policy. Whilst we are likely to gain much needed certainty through greenhouse-gas (GHG) legislation, the path forward remains complex as the government will attempt to balance environmental demands whilst managing a significant budget deficit and an economic recession that leaves little room to increase rates. This dilemma was illustrated in the way multiple renewable portfolio standard (RPS) initiatives were defeated in the ballots including Proposition 7 in California. What is clear, is that the industry will have fewer degrees of freedom in shaping their generation portfolio as regulation and legislation plays an increasing role in mandating standards and fuel types (in some cases defying fundamental technological constraints).

In the short term, energy efficiency and conservation provide the most cost-efficient and highest-impact solution to addressing the environmental challenge. In the medium to long term we see a gradual evolution of our generation portfolio with coal, gas, nuclear and renewables all playing a significant role in powering the nation.

Theme 1: We will see a significant increase in renewable energy sources. "Winning" utilities will need to be at the forefront of shaping the renewable generation landscape.

With the new administration pledging more than $150 billion in investment in clean technology over the next 10 years, there is little doubt that renewables will become a core part of the energy landscape. The question facing the utility industry is not whether this will have a significant impact but rather how a utility should position itself to reap the benefits from one of the most promising growth driver for the US economy. The clean tech industry will reshape the energy industry in the same way the internet reshaped the IT industry and "winning" utilities cannot afford to remain in the "mainframe age" as new entrants reap the benefit from clean tech growth.

Utilities will need to take a proactive stance towards their renewable strategy. An analysis of R&D spending shows that while utilities represent 5.23 percent of US capital spending, it only accounts for 0.067 percent of US research and development (R&D) spending. We do not advocate that utilities should build fully fledged R&D capabilities and recognize that much of the R&D is performed by equipment manufacturers, the US Department of Energy and academic centers. Utilities will, however, need to take greater control over the evolution of technology and work with start-ups and research centers to drive and understand how to leverage new technology into their portfolio.

In additional to centralized renewable sources, we believe that customer-driven distributed generation will play a core part of our future renewable portfolio and will provide either a competitive threat or an opportunity for growth.

Theme 2: Gas is the transition fuel of choice over the next 10+ years.

While demand for power will grow at a much slower rate, we face a requirement to alleviate pressure on reserve margins and baseload capacity over the next 10 to 15 years which will be compounded as old coal and dual-fuel units continue to be retired to meet new environmental regulations. In the short to medium term, new load requirements will be filled by natural gas for a few reasons:

- It is the only option that has short enough construction lead times to meet immediate power requirements and alleviate short-term tightness in reserve margins.
- It will be needed to support renewable energy sources such as wind and solar.
- It is the only politically acceptable choice.

Theme 3: While nuclear will play a greater role in our baseload portfolio, coal plants will remain critical to meeting our future energy needs and will remain a significant source of value for their owners.

Gas alone will not alleviate the baseload challenge we will face in the coming years and while nuclear will play an increasing role in our generation portfolio, any contribution impact will not be felt for decades. Coal plants will need to remain an integral part of the generation solution for many years to come and will likely be a significant source of value for their owners. Despite increasing social and political pressures against legacy fuels and power production methods, coal is simply too cheap and readily available to ignore.

There are several reasons which support our conclusion.

1. Starting with the first Clean Air Act in the early 1970s, the United States has grandfathered existing power plants with respect to any environmental legislation.

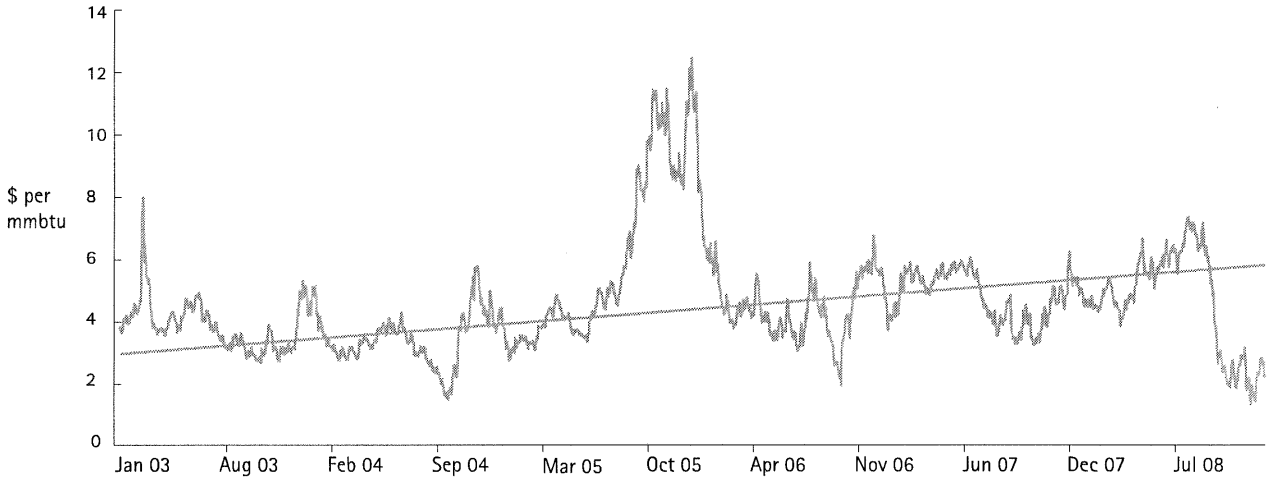
2. The US coal generation fleet is quite young, with an average age of 35 years out of a typical asset life of 50 years. Replacing these plants for more environmentally friendly technologies in a very short period—10 to 15 years – would be prohibitively expensive for rate payers.

3. Thirdly, stripping coal out of the generation mix would push other options—nuclear and natural gas—beyond their sustainable limits. Switching completely from coal to nuclear would add 300 nuclear units to the current 104 unites. When we look at current projections, we see plans for up to 40 new nuclear units. While this represents a major addition to our current nuclear fleet, it is a far cry from the number required to replace coal.

4. Finally, the underlying fundamental coal to gas spread (Figure 1) is likely to persist and possibly even increase. Greenhouse-gas emissions prices would need to be prohibitively high in order to reverse this fuel spread.

Thus, regardless of ultimate GHG emission standards, coal is unlikely to be eliminated or significantly diminished, even in the case of a nuclear renaissance. We will however see acceleration in the development of advanced clean coal technologies including but by no means limited to carbon capture and sequestration (which is 20+ years away).

Figure 1. Historical coal natural gas spread 2003-2008 (NYMEX CAPP – NYMEX Henry Hub, $/mmbtu);

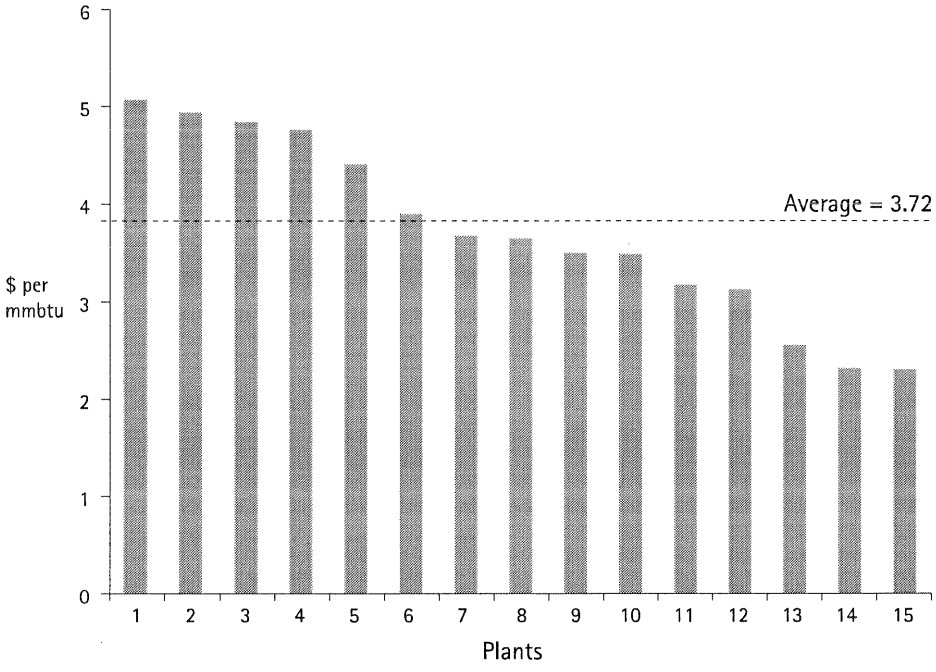


Theme 4: Given the increasing difficulty in siting and getting environmental and regulatory approvals for infrastructure investments in generation, utilities must focus on operational excellence to extend the life of assets and extract more value.

Historically, our generation fleet has exhibited significant variability in performance and we believe there are significant opportunities to improve operating performance. In our benchmarking analyses, we commonly see 40 percent deviations in performance around the mean (see Figure 2) across units of identical make and similar vintage. In addition, and as revealing, we commonly see 1 to 5 percent gaps in performance across the same unit when operated by different operators within an organization (normalized for weather other conditions outside of the operator's control).

This gap and the value, both financial and environmental, associated with closing the gap in performance is significant and we see numerous utilities adopting lean manufacturing techniques and other operational excellence techniques as a core part of their strategy to drive revenue growth through operational improvements.

Figure 2. Total non-fuel O&M regional comparable coal power plants



The coming conundrum for transmission and distribution

The challenges on the generation part of the value chain are intimately tied to those found in T&D. Utilities are struggling to determine how to upgrade the existing grid, understand the threat of demand destruction so that they can dimension the system for peak demand, expand and adapt the grid to cater for distributed generation and renewables, and enable evolving customer needs and expectations.

Theme 5: We believe that an integrated perspective on smart grid will drive the future for T&D despite untested financial benefits and large technological uncertainty in the distribution system.

The US electrical grid was built during the middle of the 20th century. Now more than 50 years later, infrastructure components are operating well beyond their designed lives. The past decades have been characterized by massive underinvestment in the electrical grid. What is clear, is that system upgrades are inevitable and overdue, and this is where Smart technologies enter the equation.

While many utilities refer to their advanced metering infrastructure (AMI)/smart meter programs as smart grid programs, we believe smart grid encompasses three major components: smart metering, smart grid and smart in-house technology (see Figure 3):

1. Smart metering technology:

Smart metering is the starting point for any smart grid strategy. In the past few years the technology has reached a point where the business case for action is clear and supported by a broad range of benefits including improved data collection, remote connect/disconnect, better theft detection, more accurate load forecasting, improved power-quality monitoring and outage management, and superior customer service. In addition, smart meters support real-time pricing which will allow for peak-load shaving and will alleviate strain on the utility grid, thus improving reliability and decreasing outages frequency.

2. Smart grid technology:

Smart grid technologies are broad ranging and include distributed sensors, remote control devices, smart substations, power stabilization software and pattern recognition software to name a few. The business case for smart grid technology is not yet as attractive as that for smart meters due to the longer term and unproven nature of the benefits and uncertainty surrounding technology costs. We do however see numerous utilities, driven by a core belief in smart grid within the C-suite, undertake deployment pilots supported by a well founded, albeit long term financial business case. Xcel Energy's Boulder City SmartGridCity™ pilot is one of the more significant examples today. In most of these early deployments, the projected benefits are tied to automatic detection and response to network problems and faults, reduced outage frequency and duration, decreased energy loss and theft, improvements in power quality monitoring and rectification and reliability, and reduced expenditure through condition-based maintenance.

3. Smart in-house technology:

In house technology is still in early stages of maturity and includes Pprogrammable controllable thermostat, smart appliances (e.g., plug-in hybrid electric vehicle/PHEV controller), communications hubs and home area networks. While we are in early pilot stages the benefits contemplated further reinforce those attained through smart metering by driving the next level of automated demand response.

Smart technologies will allow the customer to have a better understanding of their electricity usage which will translate into a reduction in the information asymmetry between the utility and customers. This will lead to a reduction in consumption which we estimate to be approximately 10 percent. Reduction in electricity requirements will ripple through transmission, distribution as well as generation. An end to end approach to any strategy and business case is therefore critical.

Thus, although we believe that the business case for smart grid is viable it requires (a) continued improvements in technology, specifically around interoperability, (b) an end-to-end perspective—from generation to retail, (c) a long term investment horizon and (d) most importantly, a shift in the regulatory framework to ensure shareholders are adequately rewarded for the investment. The business case will vary dramatically from one utility to the next and the sensible way forward, in our opinion, lies in a large scale pilot approach where technology is deployed at a city or municipal level and tested under real-world conditions.

Theme 6: Regardless of which smart technologies are selected, we believe that utilities will need to proactively reshape the regulatory compact.

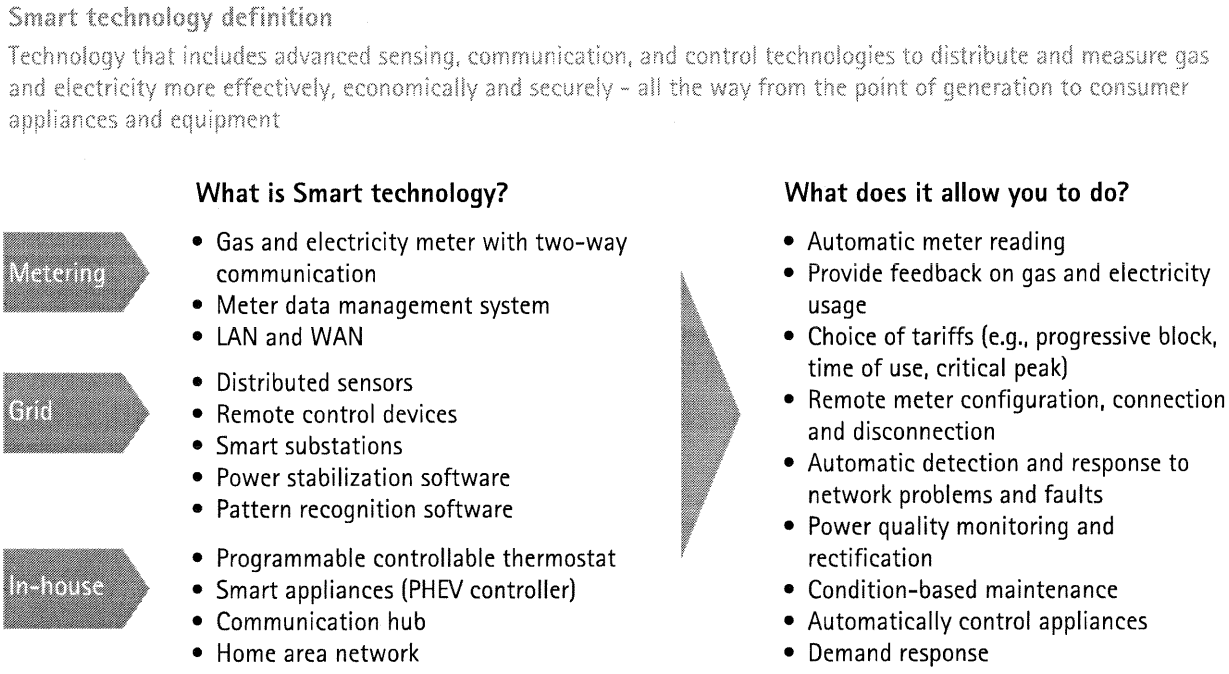
Created at the beginning of the 20th century with the goal of spurring the construction of a complete and operational electrical grid, the current regulatory compact guarantees a rate of return for every dollar of capital investment as well as reimbursement for reasonable expenses associated with operating the infrastructure.

While the societal benefits of reduced energy consumption are clear, utilities will experience a compounding decline in power sales and revenue. Furthermore, a reduction in peak load will reduce both the wear and tear on existing equipment as well as the need for new infrastructure.

Both will reduce the need for capital investment and inhibit the utility's main avenue for growth. Under the current compact, utilities cannot satisfy their responsibility to shareholders' to generate growth while simultaneously embarking on energy efficiency and demand response programs that destroy demand. In an industry that is accustomed to 1 to 2 percent annual growth, the impact from energy efficiency programs that could potentially reduce consumption from existing customers by 10 percent (albeit compensated by new customer growth) will be significant.

To many, the answer is decoupling which has already been enacted in many states. We believe that decoupling alone will be insufficient as this does not completely address the threat of demand destruction and capital deferral. Therefore, along with any decoupling of rates, a provision is also needed that allows the utility to recover some of the revenue that it stands to lose. Utilities under such a compact would be kept financially whole while being able to aggressively promote measures that address societal demands. It is important to note that this regulatory compact could not last forever because the revenue requirement associated with deferred capital investments is an escalating cost that the consumer should not have to bear in perpetuity. Accordingly, we believe that this regulatory compact should have a clear expiration which would provide utilities time to transform their operations. Utilities will need to be proactive in shaping the regulatory agenda. While a departure from the current, fairly safe, regulatory compact creates risks and uncertainty, we believe that a stalling or delay strategy will create significantly greater risk and be disadvantageous to shareholders.

Figure 3. Definition of smart technologies



The evolving customer proposition—the customer as a price setter

Theme 7: We believe that the implementation of energy efficiency and smart technologies will change the role of the customer from being a price taker to a price setter requiring very different capabilities from the utility.

We believe that three shifts in consumer behavior will take place:

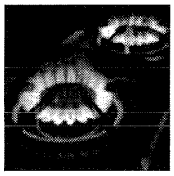
- Firstly, the customer will demand more accurate billing. This means eliminating estimated meter reads, increasing the consumers' trust in meter read accuracy, and improving the accuracy of bill forecasting.

- Secondly, as consumer awareness increases and as new technologies – including newer distributed generation and PHEVs—continue to mature, the customer will require power that is more reliable than what can be provided by today's grid. Specifically, this means fewer outages, more accurate outage restoration estimates, and a reduction in the cost of outages due to either more proactive identification and restoration or implementation of new battery or backup technologies.

- Thirdly, customers will demand the ability to manage their energy consumption through real time view of energy prices. Eventually the smart grid will reach into the home and manage demand by directly controlling appliances and HVAC equipment.

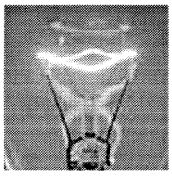
So, what does an empowered customer really mean for the utility? Consumption will be driven by customers and influenced by externalities such as their desire to reduce energy expenditures or carbon emissions (see Figure 4). Furthermore, consumption patterns will no longer be as clear as they once were and this will make load forecasting more difficult. In other words, utilities will be in yet another difficult position where they must maximize shareholder value while simultaneously accepting more risk without any corresponding financial reward.

Figure 4. Customer requirements



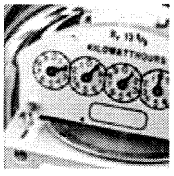
Ability to manage and reduce costs

- Lower bills by changing when electricity is used from the grid
- Manage costs by viewing real time consumption changes based on appliance changes
- Lower bills by allowing the Smart grid automatically adjust appliance settings
- Lower bills by participating by voluntarily conserving during extreme peak demand



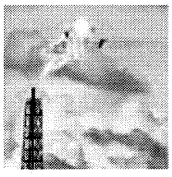
Supply reliable power

- Less power outages
- More trust in the accuracy of restoration estimates during outages
- Reduced impact of outages with battery/backup equipment that takes advantage of Time-of-use pricing



More accurate bills

- No more estimated reads
- More trust in meter read accuracy
- Accurate bill forecasts



Reduce environmental impact

- Quantify carbon emission savings due to changes in behavior

Theme 8: Utilities will need to fundamentally change their customer facing capabilities if they are to become key players in the provision of "green" solutions to their customers.

While many utilities are focused on improving customer service/J.D. Power scores for current basic energy services, winning utilities will need to adopt a game changing strategy and not only provide great customer service on current products but aggressively position themselves to provide a much broader set of services (see Figure 5) around energy efficiency, sustainability and demand response such as time of use tariffs, micro-generation leasing, HVAC leasing, energy audits, energy monitoring, carbon offsetting and large scale property portfolio efficiency management, to name a few.

While our research shows that consumers are willing to pay for additional, environmentally focused services, and are willing to entertain offers from utilities, our research also reveals that utilities face a credibility gap relative to other organizations when it comes to the environment (see Figure 6). This is compounded by the fact that the value chain for energy services is both extremely fragmented and extremely competitive including organizations in the construction, energy provision, energy services, OEM and technology industries (e.g., Google, Microsoft, Cisco). Not only is the competition evolving but so is the target customer base. We see municipalities playing an increasingly important role and looking at their energy providers as a way to create a green proposition; often threatening municipalization.

While most utilities face a significant hurdle in terms of capability building they are also well positioned in the value chain as current owners of the customer relationship (see Figure 7). Utilities will need to drive change along two fronts: building customer service capabilities that rival those provided in other sectors and, second, proactively shaping the regulatory framework to drive a change in allowed operating scope beyond traditional services.

Figure 5. Propensity to change energy provider if they help you reduce carbon footprint

"If an energy provider was proposing products/ services that help reduce the level of carbon emissions would you be willing to switch to this provider?"

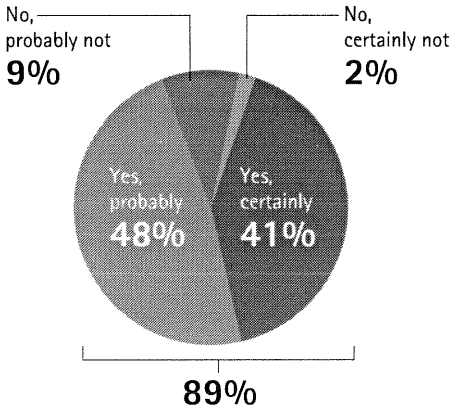


Figure 6. Trust in sources of information to address climate change concerns

"What sources of information do you trust the most to inform you on concrete actions that you can take at a personal level to address climate change?"

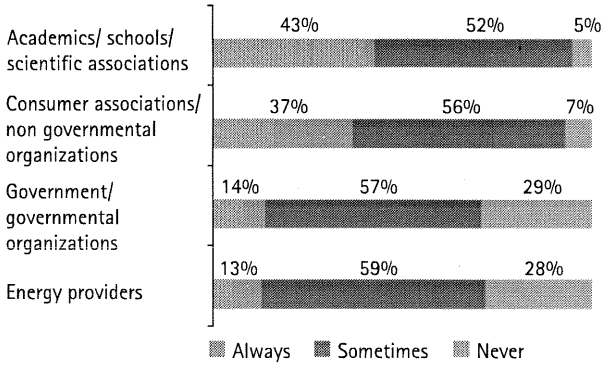
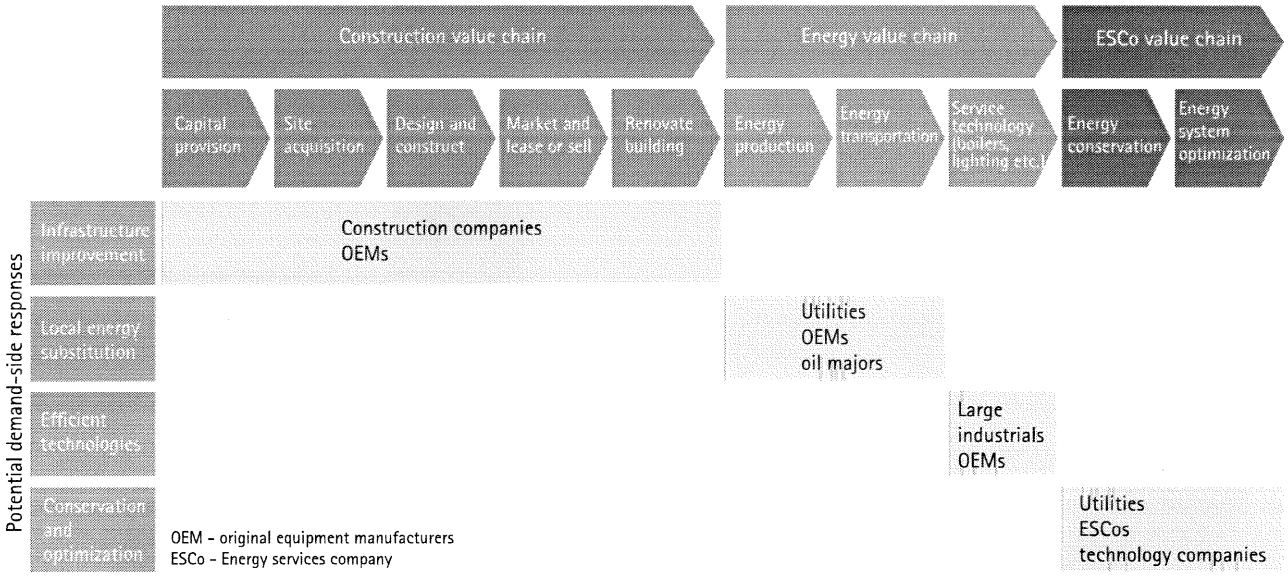


Figure 7. Demand-side management value chain



Setting a course for the next-generation utility

Utilities face a shifting landscape where demand destruction and revenue loss are very real possibilities. In the face of these challenges three strategic options exist:

1. Lead the way

Proactively shaping a products and services portfolio enabling greater energy efficiency and load management while influencing the regulatory compact, embracing the carbon challenge, moving towards the smart technologies and understanding the changing nature of relationship with the customer.

2. Follow the leaders

Maximizing the current regulatory framework while laying the foundation for change by pursuing very limited forays into renewables, smart technologies and focusing on providing adequate service to the customer.

3. Resist change

Attempting to delay the advent of new regulation, focusing on short term value optimization with limited to no investment in long term capabilities or technologies.

We believe that the change outlined in this article is inevitable and while the precise timing and form could change, the end result is clear. A "lead the way" strategy while exercising investment prudence will maximize shareholder value in the medium to long term. This strategy does not require being a first mover with regards to technology deployment, which we do not think maps well to utility core strengths or the regulatory environment, but does require proactively embracing the changing landscape and the themes outlined in this document by:

1. Restructuring the asset portfolio to meet the evolving generation stack including but not limited to a clear path for the deployment of renewables and an agility to respond to technological progress.

2. Recasting the T&D network to make it intelligent, two way, and able to foster real time demand management at scale including customer premise energy network management.

3. Reinventing the customer value proposition & experience to drive demand management at scale, with customer tailored mix of commodity and energy utilization service.

4. Proactively shaping the legislative/ regulatory compact including changes in operating scope (moving beyond the meter) as well as earning structure (beyond decoupling).

Piecemeal efforts will not produce the necessary outcomes. The bold will have to drive their organization's to adopt a highly integrated, effective & efficient and extended operating model while delivering results along the way ("earning the right") so as to earn regulators' trust and support. This transformation and degree of turmoil is very much akin to that experienced within the telecoms industry over the last 15 years, which as we have seen led to a complete redefinition of the winners and losers.

Crystallizing a dramatically different future vision and shaping and executing a roadmap thereto will define the legacy of this generation of industry leaders. While the challenge ahead is more significant and fraught with more uncertainty than we have faced in the history of the industry, it is surmountable, and it all starts with that very first critical decision to lead, follow, or be left behind.

The content for this point of view is based on the article: "Building the Next Generation Utility: Fundamental changes require bold Strategies" written by Jack Azagury for the January issue of Public Utilities Fortnightly magazine.

For more information, please contact:

Jack Azagury, Senior executive
Accenture Utilities industry group
Jack.azagury@accenture.com
+1 (917) 452-3777

Tim Porter, Senior executive
Accenture Utilities industry group
Timothy.p.porter@accenture.com
+1 (678) 657-8633

Andre Begosso, Senior manager
Accenture Utilities industry group
Andre.p.begosso@accenture.com
+1 (313) 887-2249

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