White Paper

Future of IT Infrastructure: The New Infrastructure of IT at Utilities

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IN THIS WHITE PAPER

This IDC Energy Insights White Paper examines the business challenges faced by today's utility and retail energy companies around the world. At the same time, information and telecommunications technology is changing at a rapid pace and making its way into businesses of all kinds – utilities are no exception. We examine the implications of these challenges on IT and provide utilities with guidance on the use of services to help manage the impending transformation.

SITUATION OVERVIEW

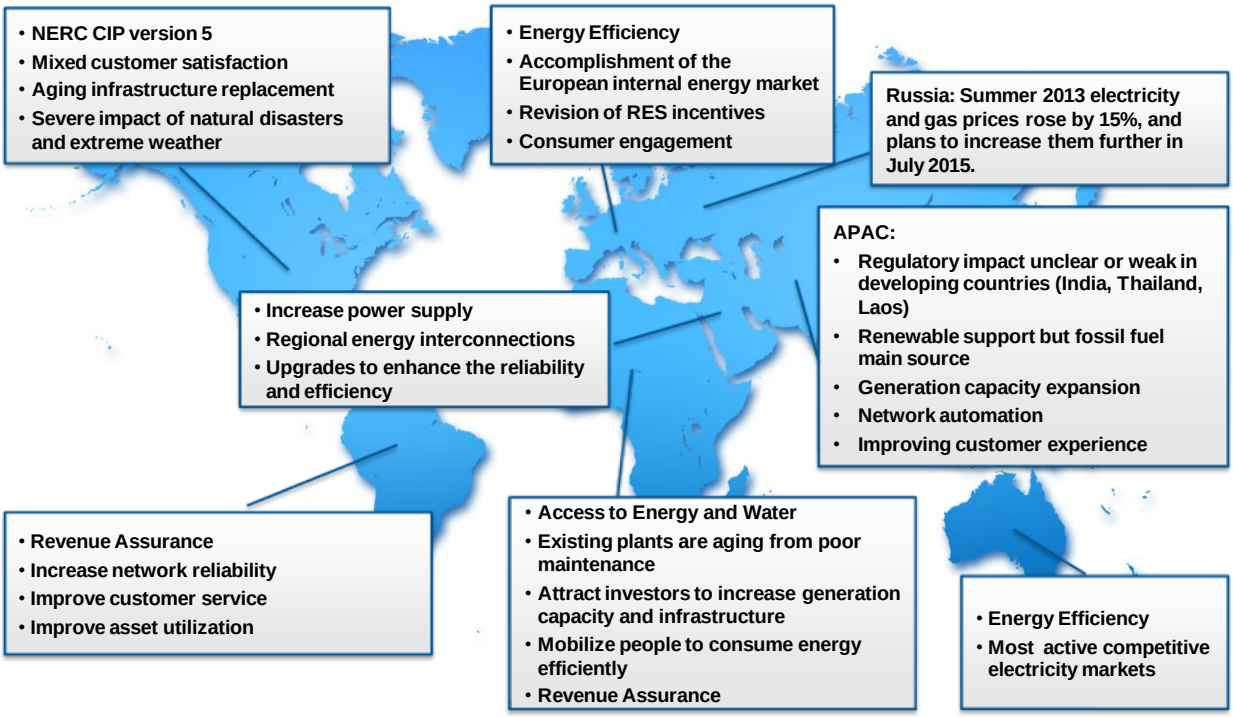
Business and Regulatory Environment

The utilities industry continues to be under pressure. Each region has its own pressures, policies and priorities as illustrated in Figure 1.

That said, all regions face cost pressure. Utilities are looking for cost reductions throughout the organization, including savings that can be achieved in IT. At the same time, the introduction of new information and communications such as cloud, mobility, Big Data and analytics and social business are forcing IT departments to rethink how they deliver IT. Utilities are no exception.

FIGURE 1

Global Policies and Priorities



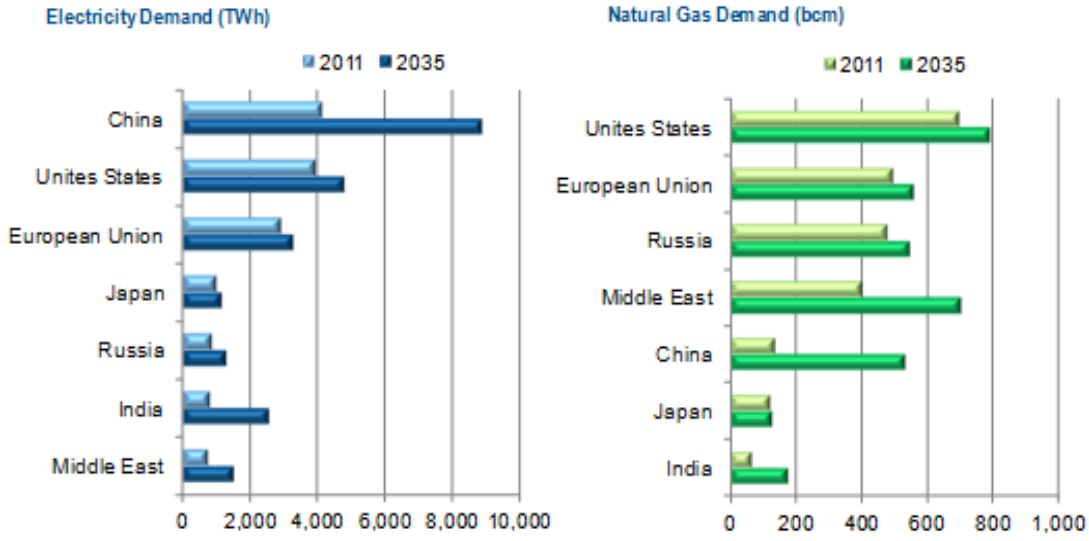
Source: IDC Energy Insights, 2014

Economic Growth Increases Demand and Need for Infrastructure

The past several years have seen a general increase in demand for energy and water from the emerging economies and a build out of new infrastructure to meet growing needs (see Figure 2). In Asia/Pacific and the Middle East, utilities struggle to keep up with surging demand for electricity, gas and water in areas of new development. Africa, which only accounts for 3% of global electricity consumption while housing 15% of the world's population, will see electricity consumption increase by 60% by 2020.

FIGURE 2

Energy Demand Trends – 2011 to 2035

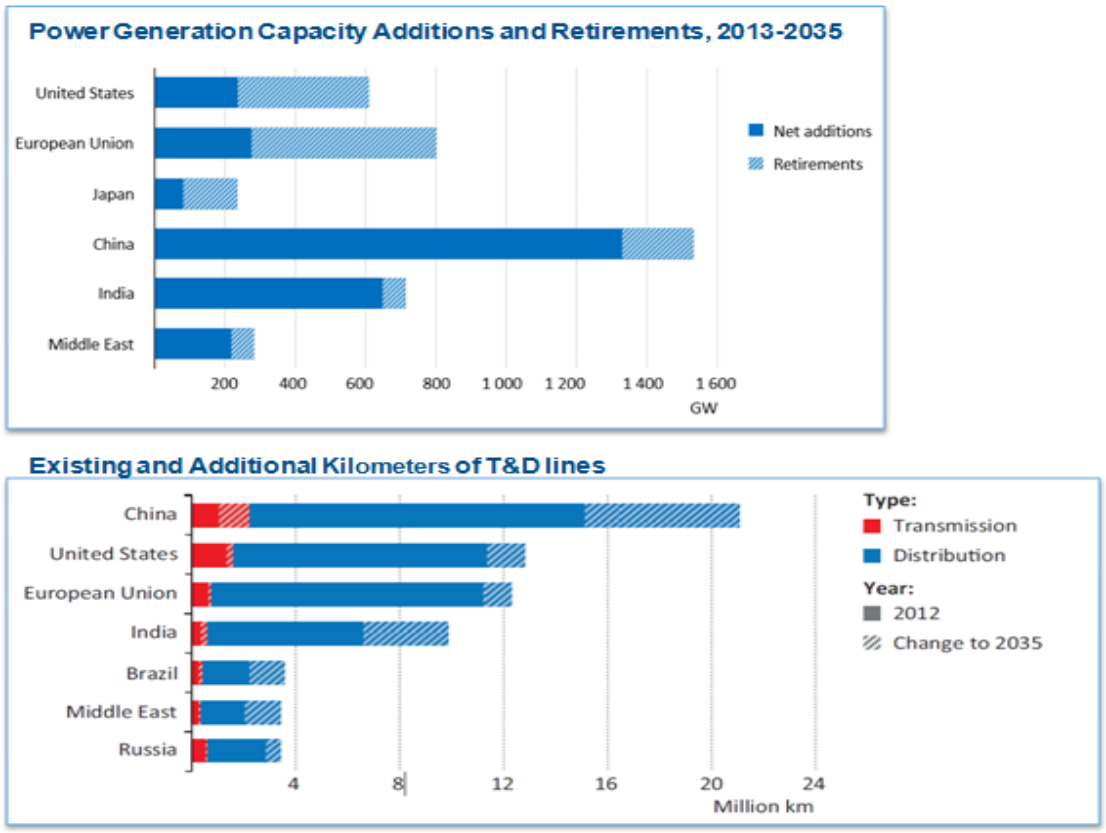


Source: International Energy Agency (IEA), World Energy Outlook, 2013, New Policy Scenario

Where there is new growth in demand, new infrastructure needs to be built to deliver electricity, gas and water (see Figure 3). For example, China and India are expected to build almost 40% of the world's new generation capacity to meet growing demand. For electricity, the infrastructure includes new generation, transmission lines and substations, distribution lines, substations and transformers. For gas, storage and pipelines to new locations are required. For water, there are new treatment plants, pipelines and pump stations.

FIGURE 3

Additions to Electricity Infrastructure



Source: International Energy Agency (IEA), World Energy Outlook, 2013, New Policy Scenario

Where Demand is Lagging Capital Investment is Still Needed

In the developed world, utilities are still plagued with the repercussions of the late-2008 financial crisis and an overall reduction in revenue. In North America, energy consumption, and therefore utility revenues, is down. In Europe, where some countries are still coping with severe economic crisis, renewable incentives are disrupting the generation business. The more difficult conditions on capital and borrowing markets, and more importantly, uncertainty about medium- and long-term return on investments are negatively impacting access to capital for investment.

Utilities in the developed economies need to make large capital investments in infrastructure. Water utilities are faced with aging infrastructure leading to potential water quality issues, leakage and increased maintenance costs, while at the same time have limited capital to replace infrastructure at the scale needed. Recent incidents with gas pipeline explosions point to the need to replace aging gas infrastructure. For electric utilities, infrastructure is aging and there is a need to build new non-carbonized generation to meet renewable standards, build new infrastructure to serve new energy or power sources, and add emissions control equipment per regulation.

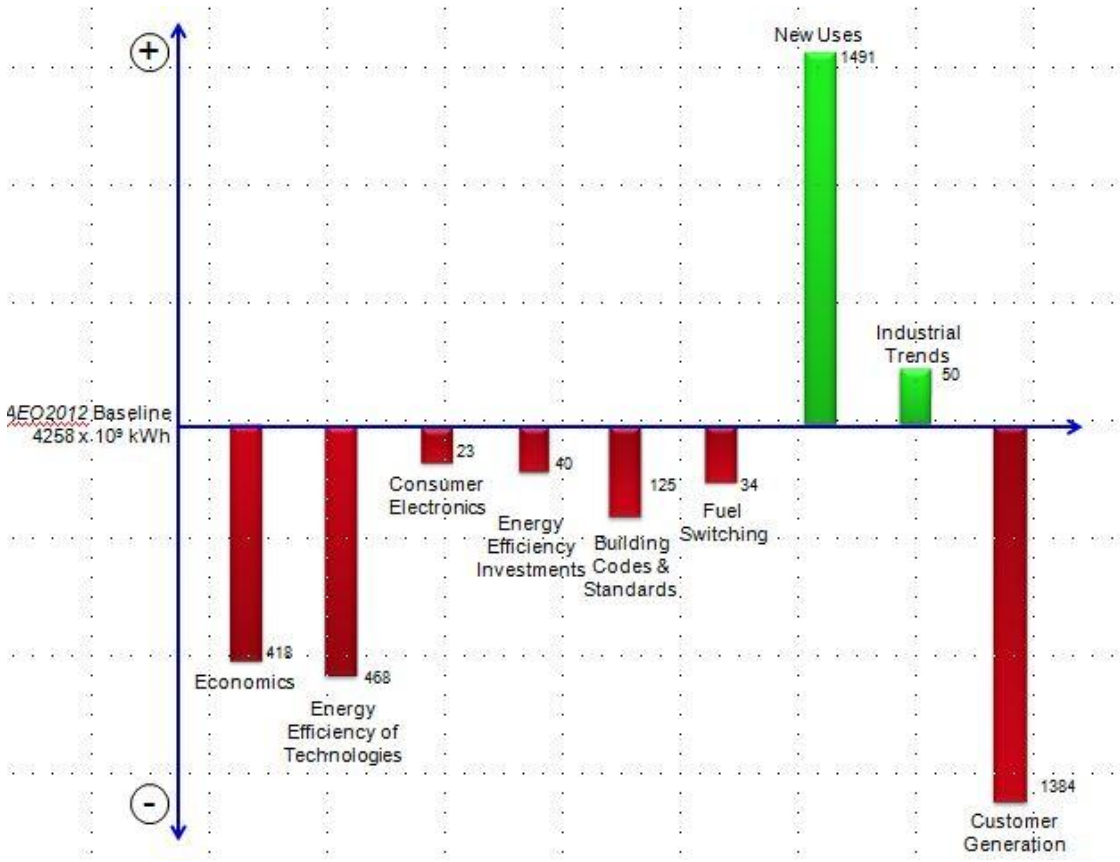
Electric Utilities are Facing Disruptive Forces

In developed economies, utility revenue is eroding, not just due to economic conditions but with implementation of energy efficiency, better appliance standards, demand response and the increase in the penetration of self generation or customer-owned generation. Going forward, one of the biggest contributors to revenue erosion will be distributed or self generation. While generators and distribution system operators (DSOs) lose revenues and delivery fees, self generators are making use of the DSO grids to distribute power that they sell back to the grid. As a result, DSOs face higher management costs as well as greater wear and tear on grid equipment for a system that was designed for central, not distributed generation.

Figure 4 illustrates the potential impact of various "puts" and "takes" from energy demand in the United States by the year 2013. The Electric Power Research Institute (EPRI) analyzed the U.S. Department of Energy's Energy Information Agency (EIA) Annual Energy Outlook 2012. The EIA Annual Energy Outlook forecasts several different scenarios of future demand. Working from the base case scenario, EPRI estimates the relative impact of various trends on consumption in the U.S. While new trends such as more computerization and use of electronics, electric vehicles, and so forth add to demand along with trends in industrial usage, distributed energy, energy efficiency and standards subtract from demand.

FIGURE 4

Changing Electricity Demand (Year 2030)



Source: Electric Power Research Institute (EPRI), Program on Technology Innovation: Tracking the, Demand for Electricity from Grid Services, 2013

Globally the way electricity is generated and delivered is changing as well. There is a growing trend toward implementation of microgrids, virtual power plants, and a different role assigned to networks. Bio-villages and community-led energy initiatives are flourishing in Europe, where about three million citizens are now generating their own electricity.

Water, Gas and Electric Utilities Face More Demanding Customers

Competitive liberalized markets in Europe, Australia and some U.S. states have altered the traditional utility relationship with the customer. Retail energy providers in these markets have been working to attract and retain customers since the 1990s. Customers in these markets have more choice, and they are exercising that choice more often, especially commercial and industrial customers.

What has also changed in recent years is customers' expectations of their service providers. Customers want their utility to be more responsive and reliable. Armed with mobile phones, iPads and personal computers, customers are coming to expect their utility to deliver the omni-channel experience that they get from their bank or retailer.

A Smarter Grid

Smart grid initiatives are at various stages throughout the world. The United States saw a bump up of investment stimulated by federal government in the last several years. Europe is expected to increase investment in the next few years. Smart grid installations are being considered for Greenfield applications in China and India. IDC Energy Insights forecasts that worldwide spending on smart grid specialty hardware, IT hardware, software and services will grow from US$27.7 billion to US$40.6 billion by 2017.

Smart grid implementations are not exclusive to the electric industry. Smart "grid" efforts are also being undertaken in water and gas utilities. For example, the industry is starting to examine how smart pipeline infrastructure can help water utilities detect leaks or potential leaks and prioritize capital investment. Smart water spending globally is expected to grow to US$3.3 billion by 2016. Smart grid investments deliver efficiencies through advanced control and automation, and optimization technologies that can on-ramp distributed energy resources. Efficiencies can be gained independent of smart meter installation. With smart meters, efficiencies come as consumers become more aware of their consumption patterns and act to reduce their bills.

Security is Top Priority

Security has always been a concern for utilities, though the traditional focus was on physical security and the restriction of access to critical facilities. Today, utility security encompasses not only physical security but the interconnected network of systems that touch almost all operational aspects of an electric, gas or water utility. With the introduction of IP-addressable devices, including smart metering for electric power utilities, utilities are rightly concerned with vulnerabilities that could be introduced into their systems and infrastructure.

The threat landscape is ever changing; malware such as Stuxnet – which targeted control system functionality – came on the scene in 2010, quickly followed by Duqu, Flame and similar advanced exploits. Recently, gas pipeline companies have been victims of cyberattacks that went undetected for long periods of time, sometimes years. There has been an uptick in cyberattacks from foreign actors that seek to disrupt operations or hacktivists who oppose utility practices. In North America, the North American Reliability Council's Critical Infrastructure Protection is in the fifth cycle of security regulations to protect bulk electric power.

IDC Energy Insights estimates that worldwide utility spending on security software alone will increase from US$783.9 million in 2012 to US$1.2 billion in 2016, a four-year CAGR of 9.3%. These numbers do not even include security services or other security that may be embedded in software applications.

In summary, utilities are facing a number of challenges although these may vary across regions. Table 1 summarizes the salient challenges specific to the type of utilities, along with IDC Energy Insights forecast of global IT spending levels in each utilities segment by 2017. IT spending includes hardware, software and services. Of course, regardless of whether the utility provides water, gas or power, customer demands for better service are increasing.

TABLE 1

Utility Challenges and Expected Investment in IT

Type of Utility	Challenges	Global IT Spending by 2017
Water	▪ Aging infrastructure leading to water leakages ▪ Shrinking water resources in some regions and need to support water conservation ▪ Need to improve water quality ▪ Lack of capital to invest in need infrastructure	US$8.2 billion
Gas	▪ Aging infrastructure leading to gas explosions ▪ New infrastructure needed to connect new resources or meet new demand	US$11.9 billion

Electric	▪ Power generation
	  ▪ New generation to meet new demand or renewable requirements
	  ▪ Aging plants lead to costly repairs or potential unplanned outages
	  ▪ Volatile costs of generation fuel
	  ▪ Regulations require investment in emissions control
	▪ Power transmission
	  ▪ Need to connect new resources, like wind and solar farms or meet new demands
	▪ Power distribution
	  ▪ Aging infrastructure leading to outages
	  ▪ Disruptive technologies and new competition
	▪ Lack of capital to invest in need infrastructure
		US$42.5 billion*

Note: * Includes electric utility plus combined electric and gas utility spending.

Source: IDC Energy Insights, 2014

APPROACH

IT Driven to Reduce Costs

In the face of demand, loss of revenue and the need to make capital investments, utilities are faced with a dilemma. Regulated investor-owned utilities in the United States, for the most part, have a rate-making process that incentivizes utilities by allowing a fixed profit on top of capital expenditures: operating expense reduction has traditionally not been a focus on the rate-making process. Countries such as the United Kingdom have a rate-making process that incentivizes cost reduction. For regulated utilities in other regions, cost reduction is not so clear. For government-owned utilities such as municipals or state-owned utilities, the need to reduce costs is a given as government-owned utilities seek lower costs for their citizens.

Still, around the globe utility IT departments are facing reduced budgets and CIOs are looking at ways to reduce cost. For example, reducing IT costs was one of the top five priorities of 119 utilities in Europe, according to an IDC study conducted in 2013. Even if budgets are increasing, the CIO who is an innovator will want to free up budget by reducing the cost of IT needed to run the business, in favor of IT that can help transfer the business.

Services to Achieve Cost Reduction

Utility CIOs have been deploying alternatives to in-house staffing by outsourcing IT and business functions to third party providers, especially for commodity functions such as desktop support and email management. Providers that can provide innovation, such as virtualization strategies, while supporting the infrastructure can offer an extra value-add to their utility customers.

For regulated utilities that are incented based on capex and not opex, service providers will need to work on alternative pricing strategies. This challenge could be solved through construction of managed service contracts to have a "leasing" component that allows for capitalization – a win for both managed service providers and utilities.

IT Pressed to Deliver More Data

With greater instrumentation on the grid, including IP-addressable devices, such as distribution line sensors, phasor measurement units and smart meters, utilities have to access more data than ever before. Smart meter data is time series, often in 15 minute intervals, but data from sensors on the grid can be in increments as small as seconds. Even without smart grid investments, utilities struggle with managing data volume from existing systems: SCADA systems, grid sensors, data historians, outage management systems, weather monitoring systems and market data.

Although storage is relatively inexpensive compared to a decade ago, many utilities are revisiting their storage strategy to take into account regulatory and business requirements for access to the data. For example, meter data may have to be archived for a defined period of time – typically seven years - if it is used as the basis of billing. Even without the regulatory considerations, utilities are keeping data accessible for at least two years. Utilities want to be able to utilize this data, because they believe that

there is business value in doing so. They want their employees to get access for functions such as load forecasting, asset management and outage management.

Storage and Datacenter Services

Storage solutions are a priority for utilities in Western Europe. According to an IDC Energy Insights Survey conducted in October 2013 for Western Europe, 91% of respondents stated that they would be investing in storage solutions in 2014.

Datacenter strategies are under consideration and not just for disaster recovery or redundancy. In some regions, utilities have in-house datacenters, but are looking for datacenter management services as a way to reduce costs. In other regions, utilities are going outside the enterprise for datacenters and related services.

IT Delivering Secure Communications

As there are more IP-addressable devices on the grid, IT is increasingly involved in helping to secure physical assets that have traditionally been protected by operations groups, such as transmission operations, pipeline operations and generation operations. In the United States, a 2012 survey conducted by IDC Energy Insights revealed that 65% of IT departments hold some or all of the utility security budget. That is not a surprise since IT has more experience in identity and access management, network security, end point security, web security, maintaining surveillance and deploying vulnerability services.

Security and Network Operations Centers

The first requirement of IT is to provide and manage a secure communications infrastructure to connect to smart devices on the grid. Setting up and managing secure communications becomes more important as more "smart" devices are deployed with Greenfield installations or grid and pipeline infrastructure modernization.

Network Operations Center

The network operations center (NOC) is a location dedicated to remotely monitor and control a communication network infrastructure, typically for a utility's multiple communication network environments. The functions of a NOC include monitoring and managing alarms for data transmission errors and failed equipment, analyzing network performance issues, managing trouble ticketing, and bringing problems to resolution. Resolving issues may pass through several levels of technical expertise.

NOCs are most often found in investor-owned utilities and large municipal utilities and operated facilities needing systems integration support. In these cases, utilities may historically operate a NOC and desire to upgrade to the latest capabilities available in the marketplace. For example, utility interest in converged communication network infrastructure leads to implementation of smart grid network management system (NMS). NOC managed services uptake will increase as smart grid communication networks (AMI networks, distribution-area networks, home area networks, etc.) infrastructure becomes more pervasive and more complex to manage and operate. Medium and small

utilities will benefit from NOCs, largely due to lack of in-house skills. Still larger utilities will realize definitive value from NOC managed services as well.

NOC managed services will be attractive to utilities because smart grid communications networks (advanced meter infrastructure, distribution/local/home area networks) are large, complex and use relatively new technology. Utilities will benefit from NOC services to centralize management and 24 x 7 monitoring of critical systems. Edge-device proliferation, distributed energy integration, consumer energy services, Web service architectures, and a dynamic and fast-reacting infrastructure define the future grid. NOC coordinates the myriad of demands that impact converged network performance while maintaining high levels of system reliability.

Security Operations Center

The security operations center (SOC) is a collection of services put together in a standalone or a bundled fashion. Typically, a SOC is similar to a network operations center but built specifically to provide network security, data protection, endpoint security and threat intelligence. Utility companies are showing greater interest in traditional services like intrusion prevention, malware protection, identity management and threat intelligence, as well as unique capabilities like SCADA system monitoring, meter data encryption, log management and NERC CIP consulting. Security services are offered either in a packaged fashion such as a SOC or in a standalone format and are quite attractive for the IT and operations professionals in the utility companies because these services can reduce capital outlays and deployment costs, may require incident response and forensic capabilities that are hard to find in the typical utility organization, and because these services can be quickly implemented.

FUTURE OUTLOOK

The Third Platform will Define Strategy

For the past five years, IDC has predicted and chronicled the IT industry's massive and disruptive shift to its "3rd Platform" for innovation and growth – built on the four technology pillars of cloud, mobile, Big Data/analytics and social technologies. The 3rd Platform will obviously disrupt every industry, including the utilities industry. Utility CIOs will evaluate how to leverage at least one dimension of the 3rd Platform better (i.e., mobile apps, Big Data/analytics, social networking) in the coming year. The areas that have most potential for managed services are Big Data/analytics, cloud and mobile.

Concentrating on Analytics

In the next 12 to 18 months, utilities will address analytics. The utility industry is a ready-made market for analytics. In fact, transmission operators already use sophisticated analytics to manage the electric grid called state estimators. Utilities have a need to make use of data to provide a return on smart grid investment. Utilities are looking to analytics to aid in business objectives such as outage mitigation and restoration, theft and fraud detection, predictive maintenance, and water leakage, among others. In Europe and Australia, retail energy providers are looking at analytics to forecast demand and segment customers for new service offerings. Big Data will eventually be implemented, but implementation will be dependent on the development of a two-way distribution grid with increased penetration of distributed generation.

Infrastructure Services to Support Big Data and Analytics Infrastructure

Utilities will require help building and managing what is needed to support analytics and eventually Big Data and analytics. This includes infrastructure, data organization and management, analytics and discovery and decision support and automation interface. The infrastructure layer includes industry standard servers, networks, storage and clustering software. In the future, third party service providers that offer infrastructure services will have a role to play in Big Data and analytics.

The Move to Cloud

Utilities are already starting to adopt cloud computing. For example, in the United States, the 2013 IDC U.S. Vertical Communications and IT Survey found that 23.7% of utility respondents already deploy private cloud and 18% are using public cloud. Private cloud is preferred over public cloud because of the perception that it is more secure than public cloud. Both private and public clouds are being used to reduce hardware and software costs, reduce outside maintenance costs, and decrease pressure on internal IT resources. The utility industry is willing to use cloud for software as a service (SaaS) applications now and, within the next 18 to 36 months, will start to accept cloud for storage of data. Smaller municipal or government utilities will be moving to the cloud sooner.

Services Must Be Secure

One of the biggest barriers to adoption of public cloud is security. That said, cloud adoption will continue to increase in utilities based on the lower costs of services and speed of deployment. Concern about security and critical infrastructure protection means that service providers have to prove that the services they offer are secure and will meet service level requirements (SLAs) such as customized utility security SLAs and cloud services vendor offers public responsibility and financial indemnification for security breaches.

Going Mobile

Bring your own device (BYOD) has been a topic of interest to utilities starting first in North America, South America and Europe and is now moving to the Middle East and Asia/Pacific. The push for BYOD has been led primarily by executives and office workers. The enterprise needs to develop a corporate policy on BYOD. It is up to IT to manage that policy, security for the mobile devices and, depending on the policy, support for the employees' own mobile devices.

The use of mobile devices in the field will rise with advances in mobile technology. Depending on the region, utilities have likely already deployed ruggedized devices in the field that are fit for purpose. The migration to tablet and smartphone use is still evolving. Probably the most prevalent use of mobility in the field is for recording inspections and work order completions. The expectation is that the new generation of workers will come to view their mobile device not only as a means for data collection and GPS tracking, but also to provide data and information needed to perform the job. They will depend on the mobile phone to provide mobile apps that make their jobs easier.

Smartphones have ushered in a new era of mobile apps. However, this poses a challenge for the utility. The utility needs to have a discipline around the development and use of mobile apps for their workers. This is especially critical if the mobile apps are to draw on or feed to enterprise applications through mobile workforce connections. IT needs to be able to provide a development platform, plus manage mobile app delivery and integration.

Mobile Device and Application Management

In the future, utilities that do not have resources in-house will look to third party managed services. The services most likely to be outsourced to managed service providers are mobile device enablement and mobile application management.

CONCLUSIONS

CIOs will need to enlarge their role, shifting their primary focus from IT operations and business services to business innovation and flexibility. In two to three years, at least 60% of CIOs will be asked to reduce the cost of infrastructure and operations to focus on business innovation and value. This calls for CIOs in utilities to look to infrastructure outsourcing and cloud services as a means of reducing costs.

New service offerings, combined with new technologies, can help utilities meet cost reduction objectives while helping generation, transmission, distribution and retail achieve business value. Upon review of available services on the market, IDC has selected the following services that utilities and energy retailers should consider first:

- Managed infrastructure services to support corporate infrastructure and Big Data and analytics
- Storage and datacenter services
- Security and network operations centers
- Software as a service and cloud data storage
- Mobile device and application management

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