



The Digital Utility: Findings and Recommendations

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Executive Summary

Situation Overview

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Executive Summary

Major Findings

- Customer Satisfaction Tops Business Priorities with Reliability and Cost Reduction Close Behind
- Utilities Rate Themselves Average Compared to their Peers
- Distribution Optimization Leads Business-related IT Initiatives
- Utilities Continue to Work on Realizing Value from Smart Meter Implementations
- “Analytics” is Cited as the Trend with the Most Impact over the Next Five Years
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Executive Summary

Recommendations for Utilities

Distribution Grid Optimization

- Anticipate the impact of intermittent resources, electric vehicles and distributed energy resources from supply, storage and demand perspectives

Customer Engagement

- Consider the redesign of current business processes and systems to leverage customer information and multiple communication channels

Advanced Analytics

- Develop a strategy to address people, process, technology and data to get significant value from analytics. Recognize where analytics can provide business value and implement tools and templates to take advantage of it.

Situation Overview

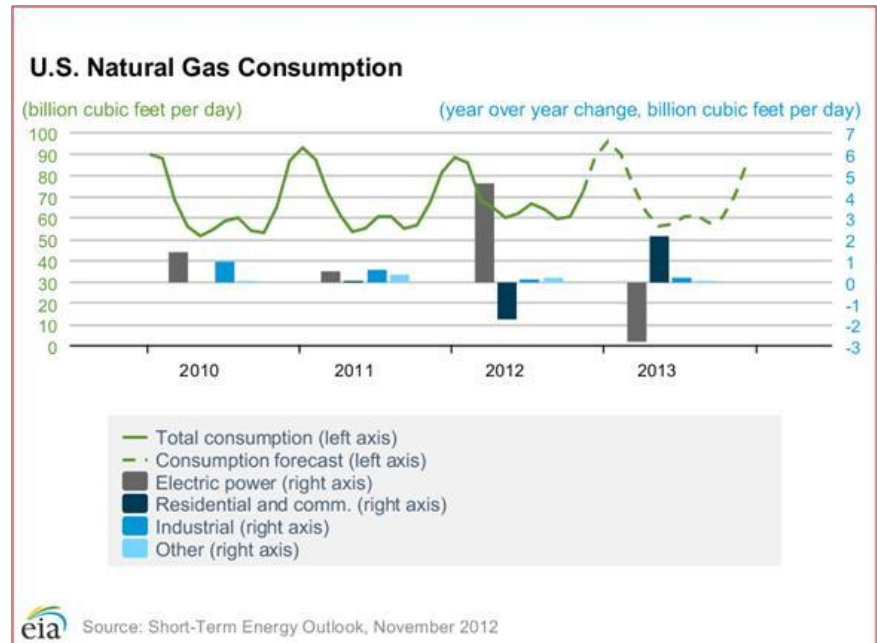
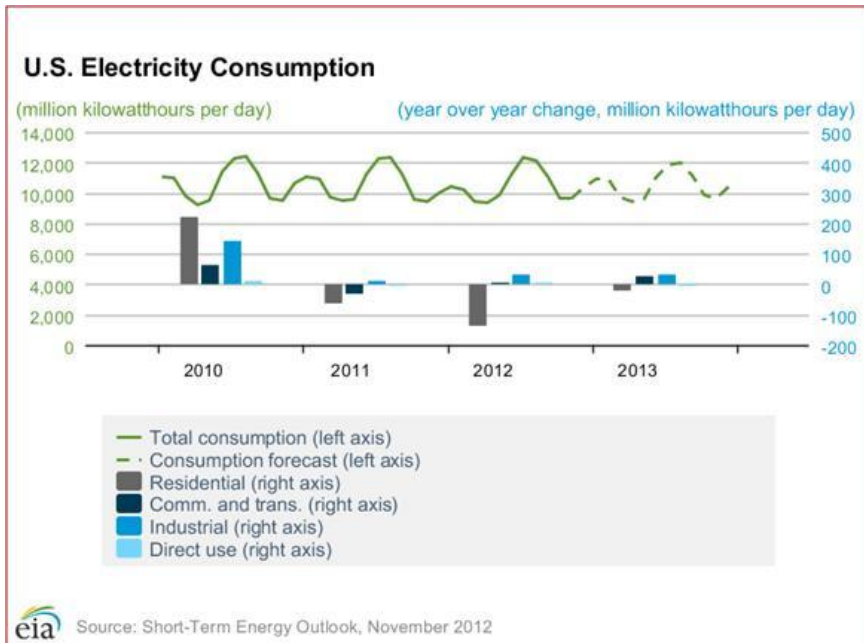
Business conditions
Regulatory conditions

Business Conditions

Energy Consumption is Down and is Expected to Remain so in the Short Term

- Electricity: Economic recession – especially for industrial customers, energy efficiency continues to affect growth
- Natural gas: Recession effects are partly offset by greater use of natural gas for power generation

The EIA's March 2013 Short-Term Energy Outlook (STEO) projects that electric retail sales will grow by ~0.7% in 2013 and 2014; in the residential sector, the corresponding growth rates will be ~0.3% and ~0.8%



Business Conditions

Customer Satisfaction is Mixed



JD Powers 2012 Gas Utility Residential Customer Satisfaction

- Satisfaction is up due to lower bills



JD Powers 2012 Electric Utility Residential Customer Satisfaction Study

- Satisfaction is down for two straight years
- Customer satisfaction on price for electricity is up due to lower bills
- Satisfaction with power quality and reliability – the most important factor in driving satisfaction – declined by 13 points from 2011

Attention Shifts to Capital Investment in Other Physical Infrastructure



Generation

- Aging plants at end of life
- Gas-fired still being built to replace retired coals plants
- Higher maintenance costs for coal plants being cycled



Transmission

- Accommodation of renewable generation sources driven by state RPS standards



Emissions

- Proactive investments in scrubbers and other technology
- More regulatory certainty and enforcement expected



Distribution

- Grid hardening for reliability
- Replacement projects for pipeline integrity
- Connection to shale gas resources

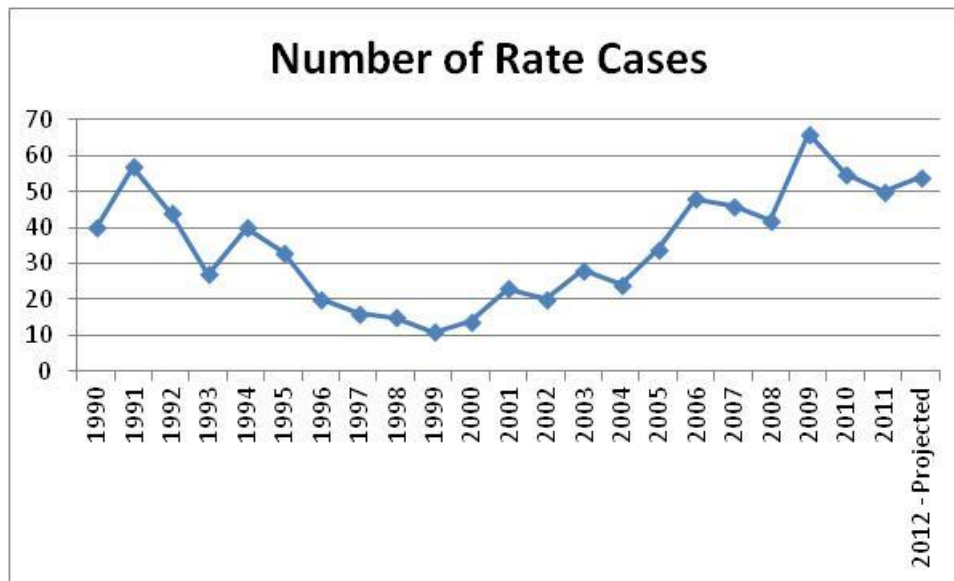
Customer-Owned Distributed Energy Resources (DER) are the New Competition

- Some states allow purchase power agreements between building owners and third parties to provide energy from third party owned roof top solar.
- In 2003, there were less than 7,000 U.S. customers on net metering. By 2010, there were 156,000 (roughly half in California)
- Universities, the U.S. Department of Defense and other “campus” like facilities are implementing micro-grids to manage costs and reliability.
- Poses some problems with intermittency, but more problems revenue loss, payouts to “prosumers” and while requiring additional investment in the grid on the part of utilities.

Regulatory Conditions

Public Utilities Commissions are Seeing More Applications for Rate Increases

- Reasons for filings: infrastructure investment, rising operation and maintenance costs, new rate mechanisms, replace loss in revenue
- Some recovery done without a rate case. At least 18 states have approved recovery pipeline integrity costs through rate adjustment



- Utilities are asking for less ROE and getting less
 - Drop in the rate of return on equity from 11.5 in 2000 to just over 9.5% in Q2 and Q3 2012
 - Due to lower interest rates, commission reluctance to approve increases in times of economic hardship

Source: SNL Energy, 2012, as cited in EEI monthly rate case report.

Regulatory Conditions

Regulatory mandates for dynamic rates and demand response vary regionally.

- Regulatory suggestions are not the same as mandates.
- Timetables, if any, vary by state, especially where there is overcapacity.
- Very few North American utilities are billing based on interval metering.

Type of Program	Programs in 2012	Programs Expected 2013-2017
Programs with Critical Peak Pricing & Controls	3	3
Demand Response (Emergency, Demand Bidding and Buyback)	13	8
Time of Use	40	45
Critical Peak Pricing	8	21
Real-time Pricing	3	11
Peak time Rebate	7	6

Reference: FERC Assessment of Demand Response & Advanced Metering <http://www.ferc.gov/legal/staff-reports/12-20-12-demand-response.pdf>

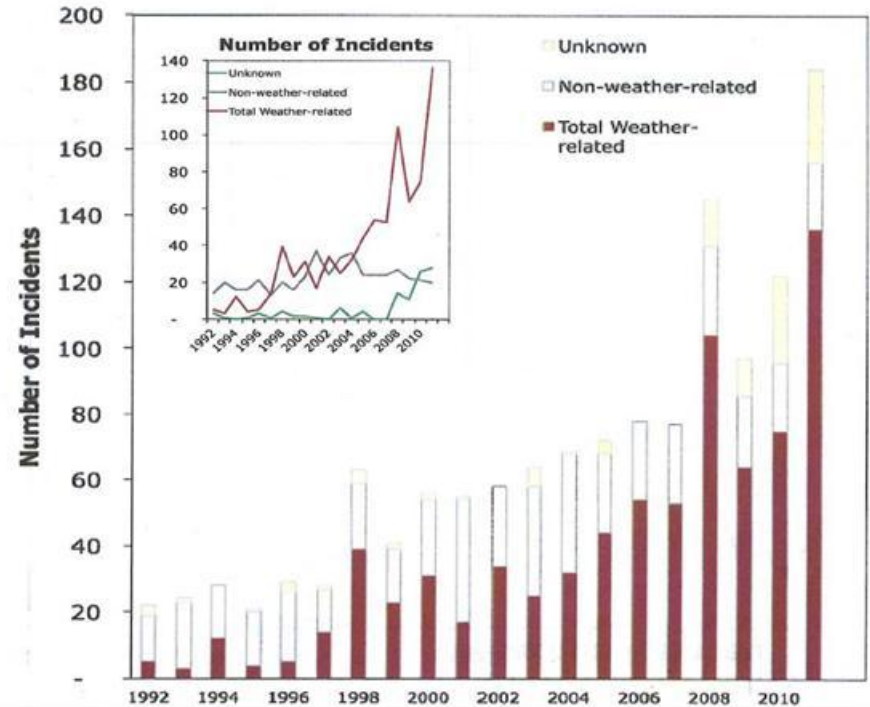
Regulatory Conditions

Natural Disasters and Extreme Weather Put Pressure on Utilities

- Hurricane Sandy: 8.7 million customers were without power and gas distribution shut off due to flooding
- Tropical Storm Irene: “[Utility] performance in the aftermath of the 2011 storms was deficient and inadequate in the areas of outage and service restoration preparation,” according to the Connecticut Public Utilities Regulatory Authority

Significant U.S. Grid Weather-Related Grid Disturbances

With Inset of Non-Weather- vs. Weather-Related Outage Comparison



Source: *Electric Grid Disruptions and Extreme Weather*. See <http://evanmills.lbl.gov/presentations/Mills-Grid-Disruptions-NCDC-3May2012.pdf>. Notes: Historical “Grid Disturbance” data from the U.S. Department of Energy, Energy Information Administration. Form OE-417, “Electric Emergency Incident and Disturbance Report” (and before 1978 from the National Electric Reliability Council, Disturbance Analysis Working Group).

Project Description and Findings

Project Description

Methodology

In-depth interviews conducted with North American utilities

- 14 in-depth interviews completed
- Representing 12 different companies
- Respondents are executives from distribution and IT

Analysts draw on experience working with utilities in North America

Secondary research was conducted to supplement findings and recommendations

Profile of Companies Represented

Utility ownership

IOU: 9

Municipal: 1

Privately Held: 1

Government: 1

Utility type

Combined
electric and gas: 5

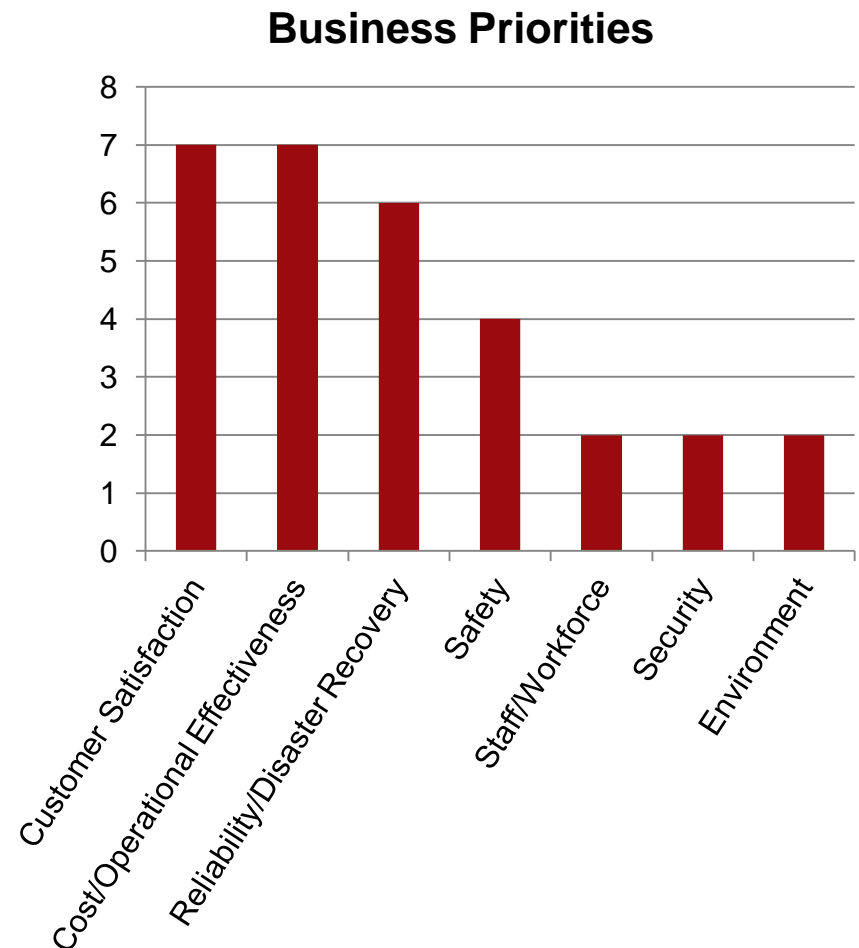
Electric only: 7

Profile of Companies Represented

	Revenues	Assets	Electric Customers	Gas Customers	Total Customers
Median	\$10,000,000,000	\$33,749,500,000	1,900,000	980,000	2,080,000
Average	\$10,441,076,923	\$37,309,413,357	2,870,754	1,224,395	5,503,158

Customer Satisfaction Tops Business Priorities with Reliability and Cost Reduction Close Behind

- Customer satisfaction is a corporate priority for utility respondents.
- Reliability is important to all respondents, but particularly to those utilities that have experienced extreme weather events.
- Interviews re-enforced JD Edwards findings that customer satisfaction is tied to reliability.
- Utilities look to reduction in operational costs, given the unfavorable regulatory climate for rate increases.



Distribution Optimization Leads Business-related IT Initiatives

- Reliability, resiliency, and grid efficiency are driving investment.
- Initiatives include smart grid implementations, distribution automation and distribution management system (DMS) implementations/upgrades
- Looking ahead, investments will also be driven by the need to accommodate a more dynamic grid:
 - At least one utility is considering voltage conservation for demand response, rather than grid efficiency
 - Another utility is investing \$110 million in distribution and expects investment will accommodate a more dynamic grid
- Other business-related IT initiatives included CIS upgrade replacement, work and asset management, mobile workforce, ERP upgrades.

“We’re seeing an influx of a distributed generation, we need to be thinking about what the impact on the performance of the grid is going to be and how we can manage that and leverage that to everybody’s advantage.”

Utilities Continue to Work on Realizing Value from Smart Meter Implementations

- Benefits realization for smart meters has been limited due to lack of IT infrastructure.
 - Utility respondents report a preference for building operational data stores, citing limits of using Meter Data Management (MDM) applications alone to meet analytical needs
 - Deficiencies in CIS have limited benefits realization in customer engagement and rate design for at least one utility.
- Utilities acknowledge that opportunities to be realized through analysis of smart meter data

Analytics Initiatives Utilizing Smart Meter Data

- Transformer loading for capital planning
- Theft and fraud detection
- Using smart meter data as input into the outage management system (OMS)
- Smart meter voltage data used to inform volt/var optimization
- Analyzing AMI operations performance

Source: IDC Energy Insights, 2013

“Analytics” is Cited as the Trend with the Most Impact over the Next Five Years

- Utilities see analytics as essential to their business.
 - Utilities cite potential value from analysis of time series data (smart meter, SCADA, sensor).
- Use cases for analytics mentioned by utilities:
 - Transformer loading
 - Target marketing for energy efficiency and/or demand response programs
- Speed of delivery of information is important for demand response verification, outage management (identification, restoration), and optimizing power flow.
- Despite the common agreement that analytics will create value for utility operations and utility customers, utility respondents do not have a well-developed analytics strategy.

“If we could leverage the metering infrastructure and start bringing back real-time load information and let’s factor that into the DMS model, then we could really start to squeeze out that extra overhead that’s in the system and really optimize the performance of what we’re doing and have confidence that what we’re doing is good.”

“we are just starting with some initiatives to define some potential use cases around business analytics and get a better handle for what technologies are out there, what type of capabilities they provide, and how we might utilize those to realize some benefits.”

Utilities Acknowledge the Need to Adapt to Social Media and Multiple Communications Channels

- Utilities continue to provide information to their customers through web portals and enabling self-service.
 - One utility has a customer portal that displays energy consumption.
- Social media is on the radar for most respondents.
 - One utility has a dedicated e-Channel's group for understanding social media and how customers interact with the utility.
- There is activity in the area of mobile phone app development for customers and field workers.
 - One respondent mentioned development of an outage app that can be used by customers to report outages
 - Two other companies mentioned mobile app development for customers
- Utilities have experienced benefits from notifying customers about outages and managing their expectations using social media, email and text messaging.

“Facebook and Twitter... are ways to connect more strongly with the customer, rather than just seeing the utility as this kind of staid, almost government type of authority.”

...post-storm, our Twitter account almost saw 30,000 Tweets within a period of like three to four days,

Text info to customers about outages ”...turns into why can't I check my billing at the same time, why can't I get weather alerts on it. They are all perfectly reasonable requests, but implementing the technology can be a definite disruptive technology...”

Security Remains High Priority

- NERC CIP has ensured that utilities are focusing efforts on transmission, and more recently, bulk power cyber-security.
 - Considerable resources have already been expended in compliance over the last four years.
- NERC CIP gets its authority from FERC whose purview does not extend to distribution.
- Even so utilities are beginning to address security on the distribution network.
- Utilities also mentioned the importance of keeping customer data secure, which is in line with privacy protocols in place at utilities.

“When you’re talking about a control system that is monitoring, managing, and controlling the distribution grid... the cyber security concern is magnified many fold.”

A Few Forward Looking Utilities are Addressing IT/OT Convergence

- Utility leaders are reviewing governance models for bringing Operational Technology (OT) and IT together.
- From an organizational perspective, there is a gradual migration from a support structure to one that is engineering-centric with IT and OT in separate business units to one that brings engineering and IT together.
 - Migration is driven by having more IP addressable devices on the grid and concern about security of control and IT systems
- At least one utility has eliminated the OT group and put all control systems under the VP of IT who reports directly to the CEO.

“IT is no longer back office – it’s now a critical operational partner to the business”

Little Future-Focused Work has been Done On Business Process

- For the most part, respondents have not examined business processes for the “digital utility”.
 - Even with traditional business processes (meter to cash, work order to completion, etc.), utilities with multiple service territories do not have consistent processes and practices.
- There are some areas where digitization has led to changing the business processes:
 - Availability of consumption data on the customer portal and remote connect/disconnect meant CSR need to be trained to handle inquiries
 - New procedures for visual inspection set up after meter readers were eliminated due to smart meters
 - One utility is re-engineering work processes to accommodate workers with mobile phones.
 - Another utility is considering the impact a new DMS and sensors on the grid will have on dispatchers in control centers.
- Extreme weather events have also driven utilities to revisit their business processes for outage response.

Utilities are Not Preparing for DER

- For both customer-deployed renewables and electric vehicles, there was concern about the need to invest to respond to customer actions, but not much actual impact as yet.
- Little support for modeling and understanding the impact of these customer-driven projects:
- New distribution infrastructure and monitoring
- New offerings to the customer incorporating DER, EV
- Adjustments to meter to cash and customer service business processes

“For the first time, customers are out way ahead of the utility...”

“The problem with typical retail electric vehicles is you don’t know where they’re going to end up and you don’t know how it’s going to affect your grid but you can pretty much guarantee that they’re going to show up exactly where you don’t want them.”

Receptivity to Cloud is Increasing, but Adoption is Far from Wide-spread

- Most utilities are willing to consider the cloud as a potential cost reduction strategy or to field test technology.
- As to be expected, there are concerns over privacy and security.
- A few utilities expressed curiosity about analytics in the cloud.

“Peripheral systems ...will continue to move up to the cloud because that’s the trend and it makes sense. I don’t see core systems like CIS or MS or GIS or financial systems moving to cloud in the near future from a data perspective.”

Recommendations for Utilities

Distribution Grid Optimization
Customer Engagement
Advanced Analytics

Recommendations – Distribution Grid Optimization

- The complexity of grid management will increase in the near future with distributed energy, demand response and increased penetration of electric vehicles. Distribution optimization provides benefits of reliability, efficiency and proactive grid management
- Utilities should evaluate their current Distribution Management Systems (DMS) for function and integration with other operational systems.
- Utilities should develop a framework for the evaluation and assessment of extensions to their DMS to support advanced analytics such as forecasting, predictive load, simulations and optimization. One specific capability that should be considered is the integration of demand information with geospatial visualization tools.
- It is increasingly important to coordinate the governance of OT and IT, including organizational structure, data management, access and security. One way to accomplish this is to combine IT into the operation business units, or by implementing other forms of governance that ensure enhanced coordination.
- From a business perspective, utilities must be able to anticipate the impact of intermittent resources, electric vehicles and distributed energy resources from supply, storage and demand perspectives.
- As utilities need to make infrastructure investments to support optimization, they will need to model the business cases for these investments, including infrastructure upgrades required and alternate revenue models.

Recommendations – Customer Engagement

- In many utilities, customer support and marketing are already using social media in a manual way to notify customers of outages and other events. These social business channels in Facebook, Twitter, YouTube, Email and Instant Messaging will become an important bi-directional way for utilities to educate, motivate and interact with their customers. These are important to achieve utility goals of reliability, efficiency and customer satisfaction.
- Utilities need to develop an understanding of the business case and roadmap for multi-channel social communication.
- Utilities should consider the best ways to integrate their existing operational systems (specifically CIS, MDM, OMS, and WAMS) with social media information and mechanisms.
- Managing communication and customer expectations during outages is especially valuable.
- Using advanced web site to enable customer service can reduce operational costs and increase customer satisfaction.
- Utilities need to understand the costs of collecting and analyzing different levels of customer information compared to the benefits of having that information available.
- To leverage customer information and communication channels, utilities need to consider the redesign of current business processes.

Recommendations – Advanced Analytics

- Currently, most analytics are project based. In the near future, there will be opportunities for utilities to capture and analyze large quantities of both structured and unstructured data.
- Utilities need to develop an effective strategy to address people, process, technology and data to get significant value from analytics. Utilities need to recognize where analytics can provide business value and implement effective tools and templates to take advantage of it.
- Analytics can help deliver the value from recent utility investments in smart meters and distribution automation equipment.
- Operational Decision Support systems should be considered to provide a platform for analytics that will not impact the function and performance of the operational systems.
- Although the quantity and velocity of utility data can require “big data” systems and techniques to manage, many benefits can be derived with advanced analytics on top of data systems using current storage technologies.