Realizing the Full Potential of Smart Metering

Accenture’s Digitally Enabled Grid program

High performance. Delivered.
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Introduction

Smart metering deployment represents a common first step into smart grid solutions at scale for many utilities. The 10 largest national deployments worldwide are expected to add 500 million new smart meters by 2020, approximately tripling the 2012 global installed base, and the locus of growth shifting from North America to Europe, then Latin America and Asia. Despite the ongoing rollouts, many utilities are still unclear about the optimal route to extracting value from these large investments. Whether utilities are at the stage of planning, preparation or actual deployment, the blanket term “smart” masks a more complex reality. Smart metering means different things to different utilities, given the variety of prevailing industry structures, legal frameworks, regulatory mandates, availability of technology, network infrastructure stability and the operational environments. There is a wide array of possible approaches to deploying smart technologies and benefit areas on which to focus most aggressively.

Against this backdrop, Accenture recommends focusing on five areas to help support strong, ongoing benefits realization from smart metering across the full breadth of the business:

1. Putting the consumer and the community at the heart of the design
2. Managing the complexities of deployment
3. Focusing on the people and process change
4. Future proofing the technology
5. Releasing further value from analytics
Smart metering: A diverse and challenging deployment
A broad, diverse set of value levers

Smart metering deployment has the potential to deliver value across the entire value chain. Results from Accenture’s recent utilities executive survey, conducted as part of Accenture’s Digitally Enabled Grid program on insights from smart grid and smart metering, confirms that utilities are focused on different benefits from their deployments (see Figure 1). For North American respondents, the role of smart metering as a means to support outage management and increasing grid reliability are clear priorities. In contrast, European utilities are much more focused on consumer-related capabilities and meeting regulatory mandates. These smart metering priorities reflect the macro challenges countries face and whether the deployment is mandated or not.

Varying degrees of clarity on business models and the business case

Although deployments are proceeding in a large number of markets worldwide, the survey also indicates that some utilities still feel they face uncertainty in both the business model and business case for smart metering (see Figures 2 and 3). Overall, North American utilities seem to feel more secure than the European respondents about how smart metering will impact their businesses, which is likely a result of being further along in the deployment cycle than most European utilities. It is clear that many European utilities and regulators have more work to do to provide the necessary clarity in business model and business case areas, if their aggressive deployment schedules are to be maintained and expected value delivered to consumers.

Accenture’s Digitally Enabled Grid program: 2013 executive survey methodology

Accenture conducted an executive survey among utilities executives worldwide involved in the decision-making process for smart grid-related matters in their company. The survey results are based on questionnaire-led interviews with 54 utilities executives in 13 countries, conducted via telephone in 2013 for Accenture by Kadence.*

Figure 1. Benefits expected from smart metering deployment.

What are the largest benefits that your company expects from smart metering deployment?

Select three

- Improved outage management and outage restoration
- Reduced meter reading costs
- Improved grid reliability
- Enhanced network planning and asset management
- Drive energy efficiency and demand response through new tariffs and greater information
- Meet regulatory mandate
- Reduced energy theft
- Improved retail operations efficiency
- Enable the integration of distributed generation and electric vehicles
- Enable beyond-the-meter load applications

Base: All respondents, smart metering section.
Source: Accenture’s Digitally Enabled Grid program, 2013 executive survey.
Is the business model in your company well defined for smart metering (e.g., understanding of the impact on the day-to-day operations, clear process ownership, visibility on costs and revenue flows, clarity on data governance, etc.)?

Yes, and it is already in operation

Yes, the future business model is fully articulated and agreed

Yes, to a large extent: the business model is largely defined but there are still some areas of uncertainty

No, the business model is not defined yet

Base: All respondents, smart metering section.
Source: Accenture’s Digitally Enabled Grid program, 2013 executive survey.

Figure 2. Degree of business model clarity for smart metering deployments.

Is the business case for smart metering articulated and agreed between key players (e.g., regulator, distribution company, retailer, municipality, consumer advocates, etc.)?

Yes

No

Base: All respondents, smart metering section.
Source: Accenture’s Digitally Enabled Grid program, 2013 executive survey.

Figure 3. Degree of business case clarity for smart metering deployments.
Deployment challenges

Utilities face a broad set of challenges to confirm effective deployment of smart metering. As would be expected, European survey respondents identify an undefined business model and a lack of supporting policy/regulation as the two largest challenges to deployment (see Figure 4). In contrast, while some North American respondents also seem to have concerns about the degree of regulatory support, other more practical deployment considerations are also highlighted, such as data management and analytics, and lack of consumer acceptance.

Learning from other smart metering deployments

The extensive range of deployment experience around the world provides a tremendous learning opportunity for utilities. Although the temptation for utilities may be to look to learn from deployments that are very similar to their own, the contrasting deployments might yield even more valuable insights. For example, the United Kingdom smart metering deployment program (see the UK case study on page 8) looks highly unusual at a high level, but it will most likely yield interesting solutions in areas of value to all deployments, such as data management, consumer behavior change and technology interoperability.

Figure 4. Challenges to successful full-scale smart metering deployment.

What is the biggest challenge to successful full-scale smart metering deployment in your company?

Select one

<table>
<thead>
<tr>
<th>Challenge</th>
<th>Europe</th>
<th>North America</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of supporting policy/regulation</td>
<td>25%</td>
<td>2</td>
</tr>
<tr>
<td>Complexity in terms of data management and analytics</td>
<td>24%</td>
<td>3</td>
</tr>
<tr>
<td>Lack of consumer acceptance</td>
<td>12%</td>
<td>2</td>
</tr>
<tr>
<td>Undefined business model</td>
<td>10%</td>
<td>2</td>
</tr>
<tr>
<td>Undefined business case</td>
<td>8%</td>
<td>1</td>
</tr>
<tr>
<td>Lack of clarity on the best technology/ optimal architecture development</td>
<td>6%</td>
<td>4</td>
</tr>
<tr>
<td>Concerns about security</td>
<td>6%</td>
<td>2</td>
</tr>
<tr>
<td>Concerns about scalability of the solution</td>
<td>4%</td>
<td>2</td>
</tr>
<tr>
<td>Lack of industry standards</td>
<td>4%</td>
<td>2</td>
</tr>
<tr>
<td>Lack of clarity regarding deployment approach</td>
<td>2%</td>
<td>2</td>
</tr>
</tbody>
</table>

Base: All respondents, smart metering section.
Source: Accenture's Digitally Enabled Grid program, 2013 executive survey.
The United Kingdom is embarking on a substantial deployment of smart meters, with more than 50 million electricity and gas meters due to be deployed, costing close to £12 billion. Although the UK smart metering rollout differs markedly from every other global deployment, it could end up providing a wealth of insights for all deployment programs. Its most fundamental characteristic is that it is retailer-led within a competitive retail market. As a result, the deployment approach taken by each utility will need to take into account both the optimization of installation and the potential to improve its retail position, particularly with its most valuable consumers. Beyond the potential efficiencies in meter operations, there is value in attracting and retaining the best consumers. Given this background, utilities around the world may learn some valuable lessons from the way the retail product set in the United Kingdom evolves—helping to answer questions such as: What do consumers want, and will beyond-the-meter services be part of the solution? For example, one utility has already raised the possibility of offering free electricity on Saturdays in return for customers switching more of their usage away from the working weekdays.

In the United Kingdom, meters generally sit inside people’s homes, meaning most installations require appointments and a well-trained, consumer-aware workforce. While the need to enter homes increases the brand risks from poor delivery, it also opens up the potential for training consumers on solutions offered by the meter and in-home devices. So varying approaches by the utilities involved could easily lead to different outcomes in energy conservation and in the uptake of additional products and services.

Given the relatively high level of UK consumer switching, interoperability will be key. Considerable effort will be invested in verifying that expensive assets need not be replaced when consumers change retailers or sign up for new products. Also, the approaches the United Kingdom adopts for managing consumer data will provide useful comparisons for many utilities in other markets.

Another distinctive characteristic of the United Kingdom is that prepayment is likely to be a significant component of the offered solutions. Already, about 15 percent of UK electricity meters use prepayment—a higher proportion than in most other developed countries, and the number of consumers with prepayment meters has been growing in recent years. The potential to provide prepay solutions at a lower cost than using traditional prepayment meters could result in growth of the prepay approach and its extension into new consumer segments, mirroring the use of prepay in mobile phone services.

While smart meters have significant potential to improve the service levels provided to prepayment consumers, they also open opportunities for new tariffs and demand-response products to help manage grid constraints and renewables integration. Unlike with many rollouts, the UK deployment will enable consumers to retain ownership of their energy data. Utilities would only have the rights to the basic data required to deliver against their statutory commitments. This separation limits utilities to providing services such as basic billing and last-gasp alerts signaling an outage, unless the consumer explicitly agrees. This situation opens up the prospect of a type of market developing for consumer data—in turn, raising the question of how much utilities would have to pay to gain additional access to that data. It would also be instructive to see if the UK model of consumer data ownership helps to improve consumer acceptance of smart meters, and whether this approach is adopted by other countries.
Accenture has identified five critical success factors to help confirm sustainable benefits realization from smart metering across the full breadth of the business, from design through deployment:

1. Putting the consumer and the community at the heart of the design
2. Managing the complexities of deployment
3. Focusing on the people and process change
4. Future proofing the technology
5. Releasing further value from analytics

1. Putting the consumer and the community at the heart of the design

One of the key lessons that has emerged is that deployment success is dependent on developing and communicating a compelling consumer value proposition. Consumers need to feel the solution has been designed for their benefit if it is to achieve behavioral change. During smart meter rollouts, consumers want to be engaged and educated and, once in place, they expect providers to leverage the technology to offer a new energy experience—one that is more personalized and proactive, particularly when it comes to saving money. A sound smart metering program can be delayed for years or even canceled if it fails to engage consumers and win buy-in. For example, after early experiences with some public backlash in the United States, energy providers and other organizations have exhibited a consistent focus on engaging and educating consumers on the benefits of smart metering as part of their deployment and post-deployment programs (see sidebar on page 11). Lack of consumer acceptance was identified as the second-most common deployment barrier by North American respondents in our executive survey.

Figure 5. Consumer expectations for education about new smart meters.

If your energy provider was installing a smart meter at your home, what would you want to know about the smart meter?

<table>
<thead>
<tr>
<th>Information</th>
<th>I would not care about this information</th>
<th>I would like this information but will be fine if I do not have it</th>
<th>I would require this information</th>
</tr>
</thead>
<tbody>
<tr>
<td>How will it impact my bill</td>
<td>5%</td>
<td>14%</td>
<td>81%</td>
</tr>
<tr>
<td>How much it will cost to install and maintain</td>
<td>6%</td>
<td>13%</td>
<td>81%</td>
</tr>
<tr>
<td>How will it work</td>
<td>7%</td>
<td>21%</td>
<td>72%</td>
</tr>
<tr>
<td>When it will be installed and if I have to be home for the installation</td>
<td>10%</td>
<td>25%</td>
<td>65%</td>
</tr>
<tr>
<td>If there are any health and safety concerns</td>
<td>11%</td>
<td>25%</td>
<td>64%</td>
</tr>
<tr>
<td>If the power will go out while the smart meter is being installed and for how long</td>
<td>12%</td>
<td>26%</td>
<td>62%</td>
</tr>
<tr>
<td>If there are any privacy concerns</td>
<td>14%</td>
<td>27%</td>
<td>59%</td>
</tr>
<tr>
<td>How it will help me reduce my impact on the environment</td>
<td>10%</td>
<td>35%</td>
<td>55%</td>
</tr>
<tr>
<td>If I can choose to keep my old meter (i.e., not have a smart meter installed)</td>
<td>16%</td>
<td>31%</td>
<td>53%</td>
</tr>
<tr>
<td>What extra products and services my provider can offer along with the smart meter</td>
<td>13%</td>
<td>38%</td>
<td>49%</td>
</tr>
</tbody>
</table>

Base: All respondents, excludes Italy and Sweden.
According to Accenture’s 2013 research, *Delivering the New Energy Consumer Experience*, conducted among more than 10,000 residential end consumers, most respondents reported they would want to learn more about smart meters (see Figure 5), particularly: how a smart meter will affect their bill, how it will work and the costs to install and maintain. It is vital to determine from the very start of the program what consumers want from a smart meter and build a good understanding of consumers’ fears over issues such as privacy, health and cyber security. Likewise, consumers must be educated about what a smart meter can and cannot do—unrealistic expectations about reductions in bills without having to change consumption behavior can undermine the program and damage consumer relations.

The communications methods developed should be viewed as part of a consistent, comprehensive approach that spans the full project all the way through post deployment (see Figure 6).

2. Managing the complexities of deployment

Get the delivery leadership and team right and aligned

The deployment of smart meters is a transformational change for many parts of the utility business, and cannot be achieved without the appropriate leadership and coordination from the delivery team. Leadership needs to articulate a shared vision for smart metering and verify there is alignment across roles, responsibilities and metrics.

A vital task for the core team is internal communications with employees. Smart metering deployment can cause considerable concern to employees; they must be engaged throughout the project duration for it to be successful. Maintaining employee engagement throughout a long, complex deployment program is challenging, particularly confirming that the employees drive and own the changes to ways of working.

Developing and executing a comprehensive internal stakeholder communication plan can help verify support for the program and readiness for the new processes.

Successfully deploying a smart metering capability requires the development of new, often scarce skillsets within the core delivery team. For example, by its nature, any smart meter deployment program is highly complex; it is important to use planners experienced in large-scale planning and dedicated to the project. As a result, high-quality, experienced personnel with deployment delivery experience would be at a premium for utilities and deployment partners. Verifying sufficient access to these personnel would require long-term talent management.

Figure 6. Accenture’s high-level communications approach for smart meter deployment.
From the initial stages of the program, it is important to perform a comprehensive end-to-end testing of the solution: meter and communications technology, systems, volumes, installations in all environments and the scope for scalability. However, it is equally vital to stay focused on the overall business goals and not just technical testing. For example, testing consumer concerns and the reasons for refusal of a smart meter can allow the deployment team to build a tiered response process that addresses refusals in a sympathetic but consistent, efficient manner.

In the midst of the complexity of the deployment stage, it can be easy to lose focus on benefits realization. The program management team needs to validate that the business case is front and center of every part of the program; for example, taken into account in every process design session.

Australian utilities Jemena and United Energy used business intelligence to create a deployment tracking dashboard, which combined key rollout and safety performance indicators and exceptions to present a consolidated view of meter rollout progress. This dashboard was instrumental in managing rollout contractor performance and payment, including supporting required regulatory reporting. The underlying data was additionally used to provide spatial visualization of the rollout progress on a map of the network area.

Putting consumers first: Leading practices from the United States

Consumer engagement is a critical component of successful deployment and adoption of smart meters and technologies. Engaging consumers at every phase of the smart meter deployment process can generate sustainable benefits for both utilities and consumers. Following are examples from the Smart Grid Consumer Collaborative’s report, Smart Grid Customer Engagement Success Stories, of strategies used by four US utilities to successfully engage consumers at various phases of deployments, and to help increase consumer awareness, acceptance and adoption of smart technologies and programs.

During San Diego Gas & Electric’s (SDG&E) smart meter deployment, the utility performed consumer outreach at 90-, 60- and 30-day intervals prior to meter installation and, out of approximately 2.3 million installations, received complaints from less than 2 percent of consumers.

SDG&E also provides home area network (HAN) devices for purchase, integrated with consumers’ smart meters, enabling them to manage their usage, determine energy usage of home appliances and make smarter energy decisions to reduce overall usage and costs. The utility also held a Biggest Energy Saver contest (run by Simple Energy), which awarded consumers for specific usage reduction compared to the prior year.

On its journey to deploy 2.2 million smart meters, CenterPoint Energy communicated with consumers prior to key touchpoints through various channels, including door hangers, small billboards and cinema advertisements, and enabled consumers to track the deployment progress of their neighborhood online. The utility also created an annual Biggest Energy Saver contest, to encourage consumers to reduce monthly energy usage compared to similar periods in the prior year. As a result of its engagement efforts, a 2011 survey of CenterPoint Energy’s consumers indicated 80 percent approved of the utility’s smart grid, 70 percent were interested in smart appliances/thermostats and 89 percent valued energy savings enabled by smart meters.

During Southern California Edison’s (SCE) smart meter deployment of 5 million residential and small business accounts, the utility proactively engaged consumers by posting 68 FAQs organized in four categories—smart meters, privacy, home and business area networks, and opting out—and providing a consumer portal as part of a My Account program to track energy usage by hour, day, month or year. My Account also provides easy-to-read reports that include insights to help shift usage to evenings and weekends. SCE also created the Budget Assistant smart meter-enabled tool to help consumers set monthly spending goals, track progress and get automated alerts to stay in control and on budget each month.

Through the installation of 823,000 smart meters and creation of the SmartHours program, Oklahoma Gas & Electric (OG&E) was able to reduce its load by 70 megawatts. SmartHours provides participating consumers with notice of the next day’s peak price via phone, text or e-mail. Consumers could then take action to shift their usage out of the peak period. The goal for 2014 is to reduce its load by 210 MW by lowering peak demand. In conjunction with SmartHours, OG&E offered state-of-the-art programmable thermostats to consumers, enabling them to adjust temperature settings to coincide with peak hours and take advantage of time-based pricing. The thermostat automatically adjusts the temperature to match consumers’ personalized settings as it receives price signals through the smart grid system.
3. Focusing on the people and process change

Recognize the scale of business change

Smart metering deployment is far more than an asset replacement and IT program and the change approach must reflect this. Operating the change management program in a manner that emphasizes the new capability requirements and ways of working would support benefit realization. Talent management is critical to providing the new skills and behaviors required. Managing the coordination of new capability development while balancing operational priorities is a key challenge and requires detailed scheduling to verify that the business maintains high service levels. Throughout the transition to smart metering, effective change management would be required to manage the changeover effectively, both within the business and with consumers.

Accenture analysis estimates more than half of utilities' business processes can be impacted by the deployment of smart meters and the accompanying premise-side technologies, programs and services.

The most impacted network and retail processes include:

- Core customer operations.
- Customer interaction and advocacy.
- Operational support services.
- Customer strategy.
- Customer field operations.
- Integrated analytics.
- Network analysis and long-term planning.
- Asset network needs management.
- System capacity and demand analysis.
- System operations governance.
- Communications networks.
- Regulatory management.

The extent of process change provides a major business challenge to organizational readiness, such as managing the cross-business implications of unplanned outages. One starting point is to drive the change requirements from the desired business outcomes and design the new capabilities to meet them. Each work group in a utility would be affected differently and require different levels of readiness (see Figure 7).

4. Future proofing the solution

Developing a sustainable technology solution

While the concept of smart metering for consumer billing purposes is relatively mature, the technology is still evolving. So too are some of the uses of smart metering, with utilities, consumers and third parties all exploring new solutions to extract further value from their investments. Preferred communications technologies are changing, meter asset life is uncertain and some smart metering products are constantly evolving.

Concerns over these broad, rapid changes can stall smart metering programs in their early stages, as utilities pursue the objective of a future-proof solution. The ongoing evolution of the smart metering solution landscape should not prevent utilities from pressing ahead with their smart metering plans.

Figure 7. High-level summary of the impact of smart metering on key utility work groups.

<table>
<thead>
<tr>
<th>Work groups</th>
<th>Change in nature of job</th>
<th>Work volume</th>
<th>New skills/competencies</th>
<th>New behaviors required</th>
<th>Overall impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid operations</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Field operations (Construction and maintenance)</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Field operations (Meter reading and home services)</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Consumer solutions (Call center)</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Consumer solutions back office (Billing and collections)</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Information technology/operational technology (IT/OT)</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Consumers/external</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Significant change  Moderate change  Minor or no change
Implications for future proofing the technology solution

Accenture's perspective is that there are three specific actions a utility can take to mitigate the risk of obsolescence and make deployments of the technology more future-proof:

- Where timelines and market maturity permit, select products that are able to integrate via open standards.
- Define a flexible architecture that will put a baseline in place and allow the solution to evolve as products mature—and then manage expectations aligned to this capability.
- Select advanced metering infrastructure (AMI) and communications that can be efficiently upgraded remotely, as these can commonly be incorrect the first time. Consider, in detail, any aspect that cannot be remotely upgraded.

Overall, while the standards for smart metering are still evolving, this fluid situation does not necessarily compromise the potential for mass deployment. As standards evolve, cooperation and integration between the meter and communications providers are critical; even when standards are specified, in many cases they can be interpreted in different ways by different parties. This cooperation will not happen by default; it will need to be made to happen through strong architectural oversight. The requirements for system performance and availability will be driven by the very high data volumes and industry obligations on data collection performance.

Buy, build or borrow?

To date, the trend in Western markets has been to implement smart metering using packaged solutions. In the Asia-Pacific region, the larger utilities have shown stronger interest in custom-built solutions due to the perceived uniqueness of their market and their often strong internal information technology (IT) engineering capabilities. In general, Accenture expects most utilities to be able to successfully deploy packaged solutions.

In the past two years, the prospect of smart metering as a managed service has emerged. According to Pike Research, it is unlikely that large state-owned utilities such as those in China and India will be willing to use a “standard, non-customized offering” for their solutions. However, it is likely that smaller or financially constrained utilities would find such an offering attractive. Based on this research, the territories in which smart-metering-as-a-service is more likely to be adopted are the United States, the Nordic countries, Germany, Latin America, Asia and Australasia. For example, a relatively small utility co-op in Denmark, EnergiMidt, is using a cloud-based solution to provide billing and operational support services for its 170,000 meters.

Trends for smart metering applications

Smart metering applications are needed to support the introduction of smart metering capability across three dimensions:

- The implementation of new technologies to enable remote collection and processing of significantly larger volumes of meter data.
- Modifications to existing systems to support remote meter functionality, management of new asset classes, new billing options, and interaction with operational systems such as outage management.
- The implementation of new “value-add” capabilities such as analytics and additional integration to optimize the benefits and returns from smart metering investments.

Table 1 outlines global trends observed for the smart metering application landscape.

<table>
<thead>
<tr>
<th>Application</th>
<th>Current position</th>
<th>Future trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>The head end</td>
<td>• Relatively immature technology that has historically been structured around proprietary network solutions</td>
<td>• Move to nonproprietary networks will drive head-end solutions to increasingly support standardized protocols across multiple communications technologies</td>
</tr>
<tr>
<td>Meter data management systems (MDMS)</td>
<td>• Relatively mature core solution&lt;br&gt;• Packages provide strong performance on most functions, though some utility-specific analysis requirements can cause problems if not managed carefully</td>
<td>• Packaged solutions will dominate rollouts&lt;br&gt;• Extension of MDMS to support complex analytics solutions to increase benefits proposition&lt;br&gt;• MDMS will scale to more than 20 million to 30 million meters</td>
</tr>
<tr>
<td>Application integration</td>
<td>• Driving increased value from integration of meter data with outage management systems, asset analytics and customer systems</td>
<td>• Extension of integration to third-party systems, such as to transmission operators for load forecasting, and to potential providers of in-home solutions, such as energy management companies</td>
</tr>
<tr>
<td>Analytics</td>
<td>• Largely an underutilized area of value for existing deployments, though becoming recognized as a key next step for many utilities with AMI&lt;br&gt;• Application of existing business intelligence approaches to meter data is starting to demonstrate the scale of benefits available</td>
<td>• Increasing demand for real-time analytics will drive the use of cloud-scale computing and integration with nonstandard, unstructured data sources</td>
</tr>
<tr>
<td>Portals</td>
<td>• Smart meter data generally being incorporated into existing utility portals</td>
<td>• Increasing requirements to access real-time data, support for smart devices and integration with social sites</td>
</tr>
</tbody>
</table>
Trends for smart metering communications

While the pace of change for utilities is now faster than ever across virtually all areas of their business, this acceleration is especially evident in their communication needs. Communications for AMI has been one of the most significant developments for utilities in recent years, and continues to be of strategic importance. In this context, key global utility trends are impacting the AMI network, as detailed in Table 2.

Table 2. Trends in communications.

<table>
<thead>
<tr>
<th>Comm. network</th>
<th>Current position</th>
<th>Future trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wide area network (WAN)</td>
<td>• Strong focus on capacity planning and data prioritization to make most-effective use of limited bandwidth&lt;br&gt;• Requirements for increased security of consumer data on network&lt;br&gt;• Interoperability constraints with different types of FAN&lt;br&gt;• Leveraging existing corporate WAN to support grid operations</td>
<td>• Growing importance of reliable, lower-latency networks to support real-time control&lt;br&gt;• Extension of Internet protocol (IP) support to the end points in the field&lt;br&gt;• Increased interest in partnerships for dedicated high-bandwidth networks</td>
</tr>
<tr>
<td>Field area network (FAN)</td>
<td>• Dominated by proprietary networks such as mesh radio and power line communications (PLC)&lt;br&gt;• Security of consumer data supported by proprietary network&lt;br&gt;• Greater importance for network reliability&lt;br&gt;• Interoperability between field area networks is driving the use of IP</td>
<td>• More flexible networks to support different types of data traffic and allowing sharing of data with multiple applications&lt;br&gt;• Leveraging of AMI technologies to support other smart grid technologies such as distribution automation&lt;br&gt;• Extension to support other end points other than smart meters, such as switches, transformer sensors, etc.</td>
</tr>
<tr>
<td>Home area network (HAN)</td>
<td>• Limited communication beyond the meter to household smart devices&lt;br&gt;• ZigBee® and Wi-Fi HAN are the dominant communication technologies</td>
<td>• Increasing pressure for open standards and the usage of IP as opposed to proprietary protocols&lt;br&gt;• Growth of IPv6 to support increased security&lt;br&gt;• Increased device control capabilities where electric vehicles or solar photovoltaic deployments become very high</td>
</tr>
</tbody>
</table>

Trends for smart meters and premise-side equipment

The technologies for metering of electricity, gas and water are relatively mature. However, key challenges remain around the interface with communications to enable remote functionality, both with the utility and with the HAN (see Table 3). For this reason, it is critical that the meter and communications vendors work together closely to avoid gaps in the design and implementation of the meter-to-communications interface.

Table 3. Trends in smart meters and premise-side equipment.

<table>
<thead>
<tr>
<th>Meter/device</th>
<th>Current position</th>
<th>Future trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>The smart meter</td>
<td>• Asset lives considerably shorter than previous meter generation (five to 15 years)&lt;br&gt;• Modular design for communications and other components likely to evolve quickly</td>
<td>• Reducing smart meter costs leading to lower use of modular design—replace the whole meter&lt;br&gt;• Increasingly specified to actively support smart grid operation</td>
</tr>
<tr>
<td>Beyond-the-meter devices</td>
<td>• Currently limited in scope and capabilities—dominated by in-home displays to provide energy information to consumers and direct load control devices&lt;br&gt;• Security concerns common among householders</td>
<td>• Growing interoperability and open standards&lt;br&gt;• Rapid and diverse growth of end-consumer energy solutions&lt;br&gt;• Growth of set-and-forget technologies to support energy management&lt;br&gt;• Embedded devices in appliances to support grid stability (no consumer interaction)</td>
</tr>
</tbody>
</table>

This coordination is typically most effectively managed via an overarching AMI solution architecture function. While contractual arrangements with each party are important, success also requires careful selection of parties that can work well together to deliver an overall solution.
The role of power line communications in European smart metering rollouts

Two-way communication plays a major role in building the modern metering platform, with communication solutions potentially achieving an optimal trade-off between system costs and performance. Despite perceived reliability issues during its early deployment, power line communications (PLC) presents an attractive transmission solution to some utilities. New, open orthogonal frequency division multiplexing (OFDM)-based PLC systems developed and tested in a number of international field trials have rehabilitated PLC’s early image, and OFDM-based PLC systems are now seen to offer reliability, higher throughput and support for a range of smart grid applications.

The use of PLC has tended to be particularly popular in many European countries (see Figure 8). This choice has reflected a broad set of considerations, both local, such as meter numbers per transformer and general, such as attitudes to service discontinuation risks. Some of the Nordic countries and Italy have already completed the deployment of smart meters based on PLC, although other projects are still under consideration. Spain and France, which have some of the largest distribution service operations (DSOs) in Europe, have also managed large-scale pilot rollouts. Germany and United Kingdom have numerous medium-size rollouts, largely because of the higher number of DSOs.

Figure 8. Status of power line communications metering deployment in Europe.

Note: Map based on Accenture perception and might not represent the completeness of European projects.
Source: The Role of Communication Technology in Europe’s Advanced Metering Infrastructure, Accenture, 2013.
5. Releasing further value from analytics

Identifying the full breadth of smart metering benefits

The smart metering business case is broad and complex, as the technology has the potential to impact the entire electricity system, from generation investment and dispatch, through network optimization, all the way to retail operations and beyond into the home (see Figure 9). The most commonly pursued benefits, however, have tended to be focused on the retail area, particularly the core areas of meter reads and consumer service support. While the benefits are becoming well characterized in the retail area, it is clear that many of the potential benefits from distribution optimization and capital efficiencies are commonly discounted or ignored. Similarly, while the scale of potential benefits from areas such as theft prevention are clear, the deployment of solutions that can provide ongoing delivery of these benefits is still at an early stage.

Analytics as a key capability in smart metering value realization

The step change in availability of accurate load and power quality data from millions of end points offers enormous potential value in managing the network, generation and consumer relationships. Accenture’s executive survey results support this view, with analytics solutions representing the highest-priority smart grid solution, particularly for North American respondents (see Figure 10). However, delivering these solutions will require an advanced analytics capability that enables integration and examination of large quantities of data.

Figure 9. Key potential benefit areas of the smart metering business case and their levels of certainty.

<table>
<thead>
<tr>
<th>Benefit areas</th>
<th>Degree of certainty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Core metering</td>
<td></td>
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<tr>
<td>Meter reading</td>
<td>Commonly achieved</td>
</tr>
<tr>
<td>Meter services</td>
<td></td>
</tr>
<tr>
<td>Contact center call</td>
<td>Initial success at most utilities</td>
</tr>
<tr>
<td>Back office</td>
<td></td>
</tr>
<tr>
<td>Under metering</td>
<td>Under exploration</td>
</tr>
<tr>
<td>Bad debt costs</td>
<td>Strategy phase</td>
</tr>
<tr>
<td>Tempering and theft costs</td>
<td></td>
</tr>
<tr>
<td>Disconnect non-pay</td>
<td></td>
</tr>
<tr>
<td>Estimated meter - move in/out</td>
<td></td>
</tr>
<tr>
<td>Pre-pay</td>
<td></td>
</tr>
<tr>
<td>Retail revenue protection</td>
<td></td>
</tr>
<tr>
<td>Distribution optimization</td>
<td></td>
</tr>
<tr>
<td>Predictive maintenance costs</td>
<td></td>
</tr>
<tr>
<td>Outage (FLISR)</td>
<td></td>
</tr>
<tr>
<td>Network optimization and technical losses</td>
<td></td>
</tr>
<tr>
<td>Power quality and Volt/VAR management</td>
<td></td>
</tr>
<tr>
<td>Capital efficiencies</td>
<td></td>
</tr>
<tr>
<td>Replacement deferral</td>
<td></td>
</tr>
<tr>
<td>Reinforcement deferral</td>
<td></td>
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<tr>
<td>System-wide system optimization</td>
<td></td>
</tr>
<tr>
<td>Demand response</td>
<td></td>
</tr>
<tr>
<td>Energy efficiency</td>
<td></td>
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<tr>
<td>Remote load control</td>
<td></td>
</tr>
</tbody>
</table>
Reducing distribution costs through capital efficiencies

Traditionally, the lack of granularity of consumption data has meant that engineers have had to add significant margins onto asset designs and operations to account for unknown asset loading and power quality levels. Smart metering provides a potential step change in the accuracy with which loads can be monitored and forecast. This possibility opens up a broad range of potential areas of value for asset managers such as peak load forecasting, power quality assessments and asset loading monitoring. Prioritization of replacement or reinforcement capital spend can reduce overall investment as well as improve network reliability. In addition, such data can help utilities articulate to regulators the true cost of reinforcement activities resulting from distributed generation deployment, potentially supporting new approaches to manage network disruption resulting from large-scale embedded generator growth.

Enhancing the renewables hosting capacity through improved network optimization and demand response

Many distribution utilities are starting to experience the impacts of increased levels of distributed renewables in their networks, without the necessary data to understand when the altering power flow characteristics will cause network instability. Smart metering data can enable improved projection models, which bring together historical data and weather forecasts, allowing a utility to accurately forecast supply of renewable resources. Forecasting demand requires insight into consumer electricity consumption, maximum demand (value and time), seasonal variability and demographics. This detailed data also allows utilities to develop solutions, such as demand response, that are targeted specifically to support localized distribution network operations, rather than generation or transmission.

Figure 10. Priority smart grid solutions in the short term.

Which smart solutions do you expect to be the highest priority for your company by 2020?

Select three

| Analytics solutions (i.e., predictive and control analytics using data from intelligent electronic devices) | 60% |
| Distribution sensing and automation | 58% |
| Advanced metering infrastructure (AMI) | 56% |
| Outage management | 48% |
| Distribution management systems (DMS) | 46% |
| Beyond-the-meter solutions (e.g., customer displays, HVAC controls, etc.) | 23% |

Base = Respondents who selected "discrete implementation" or "comprehensive rollout" as their short-term (to 2020) smart solution rollout plan. Source: Accenture’s Digitally Enabled Grid program, 2013 executive survey.
To grid operations, a smart metering system looks like a distribution grid sensor network with fine, though uneven, granularity. The data can provide inputs to myriad areas, such as voltage sensing to assist power flow monitoring, equipment loading and load distribution data, and operational effectiveness monitoring.

Applying smart meter data to support outage management

Many utilities are looking to fault location, isolation and system restoration (FLISR) solutions to help reduce outage durations and improve safety. Smart meter outage notifications (last-gasp and restoration signals) can be combined with data from sectionalizing and reclosing systems to provide improved visibility of outage locations and the restoration progress. A critical requirement to allow smart metering to support outage management activities is the presence of good connectivity models (meter-to-transformer, transformer-to-phase). For many distribution companies, the quality of these models is patchy at best, with limited accuracy and commonly missing the phase information altogether. When connectivity models are incorrect, meter voltage readings become much less valuable or even useless. Leading utilities will look to improve their connectivity models during the smart metering deployment. For instance, meter-to-phase information can be captured via devices using GPS timing during the meter rollout. Once established, the connectivity data must be kept accurate. This synchronization is one of many smart grid meta-data management issues requiring a transformation of utility business processes.

Reducing theft

Theft or diversion detection provides a substantial benefit area for some utilities, although this varies markedly across geographies. By combining data from premise meters and feeder meters, it is possible to create a comprehensive diversion-detection solution. Feeder meters measure power flow into and out of a feeder segment and premise meters measure the metered consumption in the same segment. The application of analytics can indicate diversion amounts as well as total segment technical losses.

A key consideration for these solutions is that once smart metering has been deployed, constant adaption to verify ongoing benefits delivery will be the norm, including addressing emerging risks. For example, smart meters can help reduce theft, but they can also introduce new ways to steal electricity. In the United States alone, electricity theft is estimated at $6 billion.1 Also, energy thieves will continue to become more sophisticated as they respond to new utility tools to identify fraud, meaning that utilities will need to review and update their theft algorithms regularly to stay ahead.

The capabilities enabled by detailed consumption analysis provide a valuable, low-risk first step beyond the core metering solutions. None of these solutions entail a wholesale modification of the business processes to start providing significant value. This is because the solutions are predominantly based on monitoring and offline analysis and do not require operation of an active grid with the new capabilities. However, they do require integration with other data sources as well as significant analytics capabilities.

Smart metering as an initial step in improving grid intelligence

Smart metering can provide a significant improvement in a distribution company’s ability to monitor the grid, for the first time providing pervasive information on the volumes and quality of power being consumed to network operations, workforce management and asset management teams. The value of this data, however, will be enhanced further if data capture is extended further into the grid through feeder meters and smart line sensing. Leading companies should assess how to incorporate the potential from increased grid intelligence into their investment management processes. For many utilities, this investment may be limited to opportunistic inclusion of sensing capabilities during replacement or reinforcement activities, but in some locations the benefits may warrant retrofitting of sensing equipment.
Smart metering has the potential to provide transformative levels of information and control to utilities, but there is no simple solution that ensures benefits delivery. Utilities must endeavor to gain full control over the critical components:

• Design and deploy with the consumer at the heart of solution.
• Verify that you have developed the most effective delivery team possible to manage the program.
• Perform end-to-end testing of everything—technology, processes, benefits areas, consumer attitudes, etc.
• Do not underestimate the scale of the business change.
• Future proof the technology solution where feasible through use of open standards and flexible architectures.
• Extend the breadth of the business case across the value chain and deliver these benefits through advanced analytics.

Smart meters may be a revolutionary technology, but the process of achieving ongoing value is more likely to be evolutionary in nature. Building in business and technical flexibility will be critical for seizing opportunities as the uses of smart metering evolve.

Conclusion: Extracting value from smart metering
Appendix

Global perspectives: The shifting geographical focus of smart metering rollouts

Smart metering has emerged as the dominant entry point into the smart grid journey for most distribution utilities. The 10 largest deployments worldwide are forecast to add 500 million smart meters by 2020,12 approximately tripling the current installed base. Together, these 10 countries are expected to spend an aggregate total of between US$150 billion and US$220 billion on the initial deployment.13 The UK deployment alone—of about 50 million electricity and gas smart meters—is expected to cost about £12 billion (around $19 billion, or $380 per deployed meter) over five years,14 requiring a five-fold increase in meter fittings per year across the country.

Around the world, most smart meter deployments are being driven by governmental mandates, including in China, driven in part by the country’s current Five-Year Plan,15 US states such as California and Texas, and the European Union directive for 80 percent of EU meters to be smart by 2020.16 However, there are also some notable deployments being planned that have considered a market-driven approach. Uncertainties about the costs of deployment and the ability to monetize the benefits have resulted in some national cost/benefit analysis exercises producing negative or marginal outcomes. Despite sometimes negative assessments, some utilities are proceeding with deployments as the business case has become clearer; for example, Sweden mandated its rollout despite the original negative benefits case.

Looking around the world, the geographical focus of smart meter deployments is shifting from West to East, with the Asia Pacific region, specifically China, set to dominate overall global deployment by 2020 (see Figure 11).

Figure 11. Existing and forecast smart electricity meter deployments by country—2012 to 2020.

![Figure 11: Existing and forecast smart electricity meter deployments by country—2012 to 2020.](source: Accenture analysis, 2013.)
Smart metering deployments in the United States and Canada

The deployment of smart meters in the United States and Canada is expected to steadily increase by 2020, representing a penetration rate of about 80 percent. During that time frame, the United States is forecast to add close to 90 million meters to the current population of 43 million, while Canada is estimated to grow its installed smart meter base from 6 million to between 15 million and 20 million (see Figure 12).

The nature of the regulatory structures in the United States and Canada means that some states and provinces will delay smart meter deployment due to cost/benefit concerns. However, many of the largest population centers are covered by mandated rollouts or by approved agreements with the local regulators.

Smart metering deployments in Europe

Europe will experience a significant increase in smart meter deployments to 2020, driven by government mandates and market factors (see Figure 13). It is estimated that a total of around 200 million new smart electricity meters will be deployed across Europe, bringing the region's total smart meter population to approximately 240 million. Most European countries have adopted mandates for deployment, with a key part of the overall expected benefits being the potential to help meet their obligations under the European Union's "20-20-20" climate change targets. This set of binding legislation aims to ensure the European Union meets its ambitious climate and energy goals for 2020 through reducing greenhouse gas emissions by 20 percent compared to 1990 levels, increasing the share of renewables by 20 percent and delivering a 20 percent reduction in consumption. The only large European nation to have not mandated deployment of smart meters is Germany, but major rollouts are still expected based on the separate market assessments made by individual German utilities.

Smart metering deployment in Asia and Australia

The Asia Pacific region is set to dominate the global deployment of smart metering by 2020 (see Figure 14). China is forecast to lead the way, with an installed smart meter population that could potentially approach 400 million by that date. In contrast, it is estimated that India will deploy fewer than 18 million smart meters to its population of more than 1.2 billion people. However, the high potential in India for the deployment of smart meters to support prepayment solutions could result in strong market-led growth in installations.

Elsewhere in Asia, Japan is expected to deploy almost 60 million smart electricity meters by 2020, largely under a market-driven model. Meanwhile, South Korea is looking to position itself at the forefront of smart grid deployment globally through the government's "Green Growth" policy. As part of its broader smart grid strategy, the South Korean state utility, KEPCO, is looking to deploy between 500,000 and 1.5 million smart meters per year in homes over the next 10 years. In Australia, only the State of Victoria has made significant deployments, due to a state-level mandate. In other Australian states, concerns about the business case and adverse media coverage have delayed significant deployments. This is set to change, however, based on the recently published "Power of Choice" paper by the Australian Energy Market Commission, the national market rulemaker, which outlines the framework for a national retailer-led deployment. Further, the deployments in Victoria are starting to extend their solutions to realize value for customers and the utilities involved.

Figure 12. Estimated total number of installed smart electricity meters, North America, by 2020 (millions).

<table>
<thead>
<tr>
<th>Total number of installed smart electricity meters by 2020 (millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States</td>
</tr>
<tr>
<td>43</td>
</tr>
</tbody>
</table>

Installed electricity meters in 2013 (millions)

Additional electricity meters by 2020 (millions)

Source: Accenture analysis, 2013.
Figure 13. Estimated total number of installed smart electricity meters deployed in Europe, by country, by 2020 (millions).

Total number of installed smart electricity meters by 2020 (millions)

Government-mandate approach/Market-driven approach

- Germany: 0.3 (0.3), 32 (32)
- Austria: 0 (0), 5 (5)
- France: 0.3 (0.3), 35 (35)
- Belgium: 0 (0), 7 (7)
- Netherlands: 0.1 (0.1), 8 (8)
- Italy: 0 (0), 0 (0)
- Greece: 0 (0), 6 (6)
- Czech Republic: 0 (0), 5 (5)
- Poland: 0 (0), 16 (16)
- Sweden: 4.4 (4.4), 0 (0)
- Finland: 1.6 (1.6), 1 (1)
- Denmark: 1.7 (1.7), 1 (1)
- Spain: 1.7 (1.7), 17 (17)
- Portugal: 0.1 (0.1), 6 (6)
- United Kingdom: 0.7 (0.7), 33 (33)
- Ireland: 0 (0), 2 (2)

* Installed electricity meters in 2013
** Additional electricity meters by 2020 (realistic scenario)*
*** Additional electricity meters by 2020 (max scenario)**

* Realistic scenario: Mostly based on announced deployment by utilities
** Max scenario: Assumed 95% rollout by 2019 as required by the regulatory degree

Source: Accenture analysis, 2013.

Figure 14. Estimated total number of installed smart electricity meters deployed in Asia Pacific, by country, by 2020 (millions).

Total number of installed smart electricity meters by 2020 (millions)

Government-mandate approach/Market-driven approach

- China: 152.8 (152.8), 200-250 (200-250)
- Japan: 10.5 (10.5), 48 (48)
- South Korea: 4.9 (4.9), 16 (16)
- Australia: 2.2 (2.2), 5 (5)
- India: 1.4 (1.4), 16 (16)

* Installed electricity meters in 2013
** Additional electricity meters by 2020

Source: Accenture analysis, 2013.


13. Ibid.


19. Ibid.


* Countries in scope for Accenture’s Digitally Enabled Grid program executive survey: Argentina, Australia, Brazil, Canada, France, Germany, Italy, Japan, Netherlands, Spain, Singapore, United Kingdom, United States.
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For more information on Accenture’s Digitally Enabled Grid program, go to www.accenture.com/digitallyenabledgrid.

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Accenture Smart Grid Services focuses on delivering innovative business solutions supporting the modernization of electric, gas and water network infrastructures to improve capital efficiency and effectiveness, increase crew safety and productivity, optimize the operations of the grid and achieve the full value from advanced metering infrastructure (AMI) data and capabilities. It includes four offering areas which cover consulting, technology and managed solutions: Work, Field Resource Management; Transmission & Distribution Asset Management; Advanced Metering Infrastructure and Grid Operations.

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