Welcome to the smart future
Utilities must determine their strategies for thriving in a sector transformed by smart.

Innovate to build customer relationships
A shift in mindset is critical to meet customer needs in a smart world.

The deployment dilemma
Rollouts that deliver on time, on budget and on message.
“Threat or opportunity? Smart will transform the utility business model. I believe that utilities are best placed to lead the smart transformation – if they are ready to change almost every facet of their business.”

Alain Bollack, Director, Global Power & Utilities Center
Contents

02 Welcome to the smart future
While long anticipated, a “perfect storm” of diverse factors has dramatically hastened the arrival of the smart transformation.

06 The smart state of play
A global snapshot of smart meter progress, rollout hot spots and likely challenges ahead.

10 Innovate to build customer relationships
Power and utilities companies will need to shift their thinking to drive innovation and redefine the customer relationship.

14 Case study: Tshwane pioneers Africa’s smart future
A world-first, off-balance-sheet funded smart meter rollout may lead the way to a brighter future for Africa.

16 Optimizing the grid
As renewable and distributed energy place new demands on the grid, smart technology can help ensure efficiency, reliability and resiliency.

20 Beyond the meter: a spotlight on the US
Utilities in the US are already exploring the “beyond the meter” opportunities offered by smart. What lessons can be learned?

24 Case study: npower’s smart journey
A whole-of-business approach to smart meters ensures this leading UK energy retailer is positioned for future innovation.

26 Managing the smart transformation
A clear strategy, strong business case and rigorous project management will derive maximum value, even from mandated smart meter rollouts.

30 The deployment dilemma
A strategic approach to smart meter installations is essential to managing costs, mitigating risks and delivering business objectives.
The long-awaited smart transformation of the utilities sector has reached a tipping point – the future is now. Power and utilities companies must determine their smart strategies to ensure they are best positioned to stay relevant amid rapid change.

Alain Bollack reports

Welcome to the smart future

Digital technology is transforming the electricity grid into an interactive, intelligent smart system that uses real-time information to manage supply and demand efficiently, sustainably and economically. This transformation is the most fundamental change ever seen by the world’s power and utilities (P&U) sector.

While the smart transformation has been long anticipated, a “perfect storm” of diverse factors (see inset box on page 5) has dramatically hastened its arrival, and several disruptive elements highlight the need to act now.
Grid game-changers

The world’s use of energy generated through renewable sources, including solar, wind, hydropower and biomass fuels, is increasing at a pace few could have predicted. While carbon abatement targets have been key drivers, rapidly declining costs strengthen the economic argument behind renewables – the price of solar PV panels, for example, has fallen 75% since 2006. Predictions of future growth see renewable generation set to challenge coal as the primary source of electricity by 2035. This will mean the addition of a staggering 7,000TWh of renewable energy into the electricity grid.

The game-changing potential of renewables is magnified by advances in microgrids and energy storage. In 2014, microgrid installations generate about 866MW of electricity worldwide, but this output is expected to climb to more than 4,100MW by 2020. While North America currently dominates the market, expect Asia-Pacific to emerge as the global leader in microgrid deployments by 2030 or 2035 due to the region’s huge need for power, growing populations and lack of traditional grid infrastructure.

Energy storage – long considered the sector’s “holy grail” – could soon become affordable and widely available as battery reliability improves and prices drop. Tesla’s investment in manufacturing lithium-ion batteries will double global production and aim to cut prices by a third in three years and halve them by 2020. Energy storage is expected to rise to see annual installations reach 6GW by 2017 and a whopping 40GW by 2022. The US, Germany and Japan are set to lead the way.

Better batteries will also help accelerate adoption of electric vehicles (EVs) by overcoming the “range anxiety” that has hampered the industry to date. By 2022, more than 35 million EVs will be on roads worldwide. Increased numbers of EVs will have big implications for utilities – charging a plug-in car can increase a home’s power consumption by 50% or more. The issue will be heightened in EV hot spots such as London, San Francisco and Paris and make the use of smart technology to manage electricity flow and incentivize off-peak use increasingly important for utilities.
Avoiding the Kodak trap

These factors are transforming the way power is generated, transported and consumed and putting huge pressure on the P&U industry to adopt smart technology. Staying relevant requires reinvention – not an easy task for a sector unused to rapid change. But early adaption is possible, and necessary, if utilities are to lead the way into the future.

Cautionary tales from other industries show the danger of denying the need for change. Film pioneer Kodak invented digital photography but failed to adapt its business to this new technology, leaving others to beat it at its own game. Similarly, Sony, which first made music portable, let Apple win its market, and a lack of vision saw video rental chain Blockbuster turn down an option to buy Netflix.

These companies could have led the transformations of their respective industries, yet complacency and a reluctance to innovate saw them outmaneuvered by more nimble rivals. Will we someday say the same about some of the world’s biggest P&U companies?

I believe that this does not have to be the case. Indeed, many utilities are in an excellent position to fend off new market entrants and lead the smart transformation – but they will need to be prepared to change almost every part of their business.

Prime position to lead

What can P&U companies do differently? And how should business models change? There is no single “right” answer to these questions. Answering them begins with each company’s challenges and opportunities.

1. Capital constraints

Already pressured by tighter revenue, many utilities are struggling to attract the investment needed to upgrade existing assets and fund the development of the more complex infrastructure demanded by smart. Current estimates show that a US$17t investment is needed in global power infrastructure through 2035.

2. Skills crunch

Utilities’ workforces are facing a global capability and capacity crunch. Smart alters the staff profile by requiring fewer people in roles such as call center operator but demanding more people in other existing roles such as fieldforce as well as entirely new roles such as data analyst and digital media professional. At the same time, the sector’s workforce is aging. As reported in EY’s Talent at the table: index of women in power and utilities, approximately 60% of the global utility industry workforce is over 40 years of age, with many expected to retire in the next 10 to 15 years.

3. Cultural inertia

Not used to change, utilities risk being held back by being too slow to adapt. Innovation must become a priority. According to the pan-European electricity industry association Eurelectric, faster innovation by utilities could be worth €70b to the European Union (EU) economy alone in 2030.

4. Customer relationships

Today’s empowered customers demand more choice, different products and better service. But an EY survey found that only 20% of customers trust their utility provider. Will poor relationships limit the ability of P&U companies to capitalize on the opportunities presented by smart?

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Despite these issues, and the entrance of new players, three major strengths mean utilities are still in an excellent position to lead the smart transformation.

The first obvious advantage is that utilities own the energy networks and possess the technical capability to operate them. Simply put: who can run the grid better than its owner?

Another strength is that utilities pioneered many of the disruptive elements that are behind the current transformation, including smart meters, microgrids and, of course, renewable generation. They have invested heavily in these technologies and have the people and programs in place to make them succeed.

Finally, and importantly, utilities hold a vast wealth of customer data. The onset of smart will only increase the volume and value of customer insights, if utilities are prepared to think differently about using data to drive new growth.

But harnessing these strengths will not be easy. Utilities will need to do more if they are to survive, and thrive, in a sector transformed by smart.

The work starts now

Rather than be left behind by the smart transformation, P&U companies are in a prime position to lead it. But it will not be easy. With no single “right” smart strategy, P&U companies must take a considered, individual approach to determining just how, when and where they should transition from their traditional mode of operations. Some will seek out partnerships. Others will buy new businesses. And some may choose to remain a “pipes and wires” engineering-led company. Whatever the decision, the work begins now. This special edition of Plug in explores the next steps for utilities. We believe these steps can help you in your own smart journey, and we welcome your feedback on this issue.

The quickening pace of smart

The smart transformation of the P&U sector is happening much more quickly than most in the industry foresaw. The rapid change has been driven by:

- **Political and regulatory pressure**
  Governments and regulators are demanding utilities do more to reduce consumers’ energy bills and help meet carbon abatement targets. In the US, for example, utilities have been instructed to shrink electricity bills by around 8%. In almost all regions of the world, regulatory mandates have been the key drivers of smart meter rollouts.

- **Technological change**
  The digital revolution has defined the last 25 years. The technology behind the smart devices that have transformed all of our lives is now transforming all aspects of the P&U sector.

- **New competition**
  New entrants, such as Google Nest, Toshiba and Honeywell, are entering the energy sector and using their superior customer service skills to challenge the dominance of traditional utilities.

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Alain leads our smart metering and smart grid advisory center and has worked in performance improvement, business case, strategy and transformation and supply chain procurement across Europe and Africa. Alain enjoys bringing lessons learned from successful projects across the globe to current client issues: “I like using real-life experiences from other countries to help clients feel that they’re not alone in their smart program implementation.”
Smart meters are rapidly transforming the global power and utilities (P&U) sector. **Knut Haukenes** and **Shubhanshi Gupta** explain progress to date, highlight the world’s next rollout hot spots and point to key challenges ahead.

Smart meters are a global phenomenon. Their rollout to all corners of the globe is changing the way the world uses and values electricity, gas and water – and transforming all aspects of the P&U sector.

The sheer numbers behind this global smart deployment are breathtaking. Global revenue from annual smart meter shipments is expected to grow from US$4.4b in 2013 to US$6.6b in 2023, and the number of worldwide smart meter shipments is anticipated to climb from 94 million annually in 2014 to 116 million annually in 2023.
Key drivers behind global progress

Smart metering is utilities’ common answer to a broad range of specific challenges faced by a sector in transformation:

- Customer expectations of improved service and new products
- Rapid rise in distributed energy resources (DER)
- The need to improve cash collection and reduce theft
- Substantial increase in peak demand for emerging markets
- Ambitious energy efficiency targets set by governments and regulators
- The need to optimize network performance

The potential of smart meters to drive down operational costs, increase energy efficiency, shift peak demand, introduce new products and services, integrate DER into the grid and reduce leakage in meter-to-cash processes is behind their rapidly expanding global footprint.

In South Korea, the Korea Electric Power Company (KEPCO) has awarded contracts worth $US1.3b to install 10m smart meters by 2016 and aims to achieve 100% smart meter coverage by 2020.

In North America, Brazil leads the way with almost 38m smart electricity meters to be installed by 2020. In Brazil the need to update outdated distribution systems and improve reliability ahead of the 2014 FIFA World Cup were perhaps equal in importance to regulatory mandates.

In South America, Brazil leads the way with almost 38m smart electricity meters to be installed by 2020. In Brazil the need to update outdated distribution systems and improve reliability ahead of the 2014 FIFA World Cup were perhaps equal in importance to regulatory mandates.

In Asia-Pacific, elsewhere in the region, Japan, while still at the beginning of its smart meter journey, could quickly become one of the world’s smart leaders, with plans to roll out 78m by 2025.

More than 435m devices are expected to be installed in China by 2020.

An aggressive smart policy in China will see that country dominate global smart meter deployment in the next 10 years.

Europe, The UK is on track to meet ambitious 2020 targets with 53m electric and gas meters set for installation by this deadline.

We expect smart meter installations in the US to make steady progress over the next decade, reaching 91% penetration by 2022.

The US saw an initial flurry of smart meter rollouts between 2009 and 2012 as a result of the recovery act that pumped US$3.4b into smart grids.

As funding has dwindled, so have implementation efforts.

195m meters will be installed by 2020 at a cost of €35b (US$46b).

While initiated by early movers Italy and the Nordic countries, installation is being driven forward by massive regulatory targets in the UK and France.

France is also making excellent progress, working toward an ambitious target of 90% smart meter penetration (equating to 35m meters) through 2020.
The importance of stable regulation

In most markets, regulatory push has been the biggest driver of the smart meter rollout. In the EU, for example, the 2012 EU Energy Efficiency Directive (requiring all Member States to complete a cost-benefit analysis by 2012 and deploy smart metering systems to 80% of consumers by 2020) has spurred Europe to lead the world in smart meter deployment.

A regulator-led smart meter rollout brings both advantages and disadvantages. In an increasingly unbundled power market, where the smart metering investment may fall on a different player from the one realizing its benefits, the regulator's holistic view across the entire value chain is essential to drive deployment. On the downside, the slow pace of regulatory change can sometimes fail to properly incentivize smart investments. An example of the latter is seen in Italy, where the leading utility, Enel, embarked on the smart meter journey before the regulatory framework was in place. Only in response to this rollout did the regulator (AEEG) gradually adapt its regulation and mandate complete deployment.

But regulatory stability and certainty are as important as incentivized investment. The German experience offers a cautionary tale of how uncertainty can derail progress. Germany should be a world leader in smart technology, given that country’s surge in renewables, which make up almost 30% of the energy mix. But instead, it plays a frustrating waiting game, due to the lack of a nationwide smart meter mandate and the delay of an implementation framework, now not expected until 2014-15. The lesson is clear: a stable regulatory framework must be put in place at an early stage to drive the investment needed to initiate rollout.

There are, however, important exceptions to the regulation-driven approach taken in Europe and the US. For example, Africa tells a different smart meter story altogether. Here, the urgent need for electrification rather than a regulatory push is driving utilities and municipalities...

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Figure 1. EY smart metering benefits matrix

<table>
<thead>
<tr>
<th>Impact</th>
<th>Effort</th>
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<tbody>
<tr>
<td>Low</td>
<td>Reduce opex</td>
</tr>
<tr>
<td>Medium</td>
<td>Manage capex</td>
</tr>
<tr>
<td>High</td>
<td>No pain, no gain</td>
</tr>
</tbody>
</table>

- **Quick wins**
  1. Reduction in costs of manual meter reading
  2. Reduced costs of billing operations

- **Customer operations enhancements**
  3. Reduction in call center costs
  4. Reduced operational costs of prepayment metering

- **Outage management**
  5. Reduced costs of outage resolution
  6. Improved reliability of supply (e.g. CAIDI/SAIDI)

- **Analytics (grid and customer)**
  7. Reduction in non-technical losses
  8. Provision of new services

- **Beyond the meter/tariff programs**
  9. Deferred distribution capacity investments
  10. Reduce CO2 emissions

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**Selected smart meter benefits**

<table>
<thead>
<tr>
<th>Base case smart meter benefits*</th>
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<tbody>
<tr>
<td>1. Reduction in costs of manual meter reading</td>
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<tr>
<td>2. Reduced costs of billing operations</td>
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<td>3. Reduction in call center costs</td>
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</tr>
<tr>
<td>10. Reduce CO2 emissions</td>
</tr>
</tbody>
</table>

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* From core smart meter functionalities built into most implementations. Not all benefits listed here.
to roll out smart technology using interesting new ways of financing. As a case in point, EY worked with the City of Tshwane (see page 14) in South Africa to roll out prepaid smart meters using a world-first off-balance-sheet funding model. We expect this model of smart metering deployment to be adopted more widely across Africa and other emerging markets.

Broaden the business case

In our extensive work conducting national and utility-level cost-benefit analyses (CBAs), EY has identified more than 40 benefits of smart metering across the power sector value chain – from improving generation efficiency to optimizing consumer energy usage (see Figure 1). But, interestingly, we see most countries basing their national business case around the achievement of one main benefit, which is determined by their own priorities. In the UK, for example, energy efficiency was the key benefit-driver of the CBA, while in France, network optimization was prioritized. In some Eastern European countries, including Romania and Hungary, the focus was on reducing non-technical losses, mostly theft, as well as operational efficiency. This “benefit specialization” has produced a range of benefits per meter point in the EU that vary from as low as €18 (US$24) in Latvia to €654 (US$860) in Austria, with €309 (US$406) as an average.

But, while it is understandable that countries have different motivations for deploying smart meters, a more holistic view of the smart metering benefits may yield broader stakeholder engagement for rollout across the value chain.

Different delivery models for different markets

In our successful delivery of more than 35 smart meter projects around the world, we see countries organizing their rollouts around one of three different models:

► Competitive.
  As in the UK, the competitive model sees the smart meter rollout carried out by suppliers, which should drive down prices for consumers.

► Collaborative.
  The collaborative model, which is seen in Norway, involves the creation of alliances of distribution system operators (DSOs) to roll out smart meters.

► Single utility deployment.
  This model, as seen, for example, in China, Japan, Ireland and France, sees one electricity distributor rolling out all the smart meters for a particular region.

Deciding which deployment model to use is generally determined by the interaction of a country’s market structure, its regulatory environment and the particular issues facing its power sector. In the UK, the selection of a competitive model was a natural result of the very advanced unbundling of the domestic energy market.

Next steps

As the push toward smart gathers momentum, the installation of smart meters will continue with hot spots of activity occurring across both mature and emerging markets. Watch for China to lead a surge of activity in Asia-Pacific while the continuing rollout across Western Europe and the US will also lead the global march toward smart meters.

As these markets work toward successful deployment, business models will evolve, and it will become increasingly valuable for utilities to proactively influence the regulatory framework toward the best-practice experience of regulation-driven rollout. We expect that the lessons learned from advanced regulatory reform in Italy, Norway, France and the UK will help set a benchmark for regulatory models that achieve the right mix of incentives and stability for smart metering investments.

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Knut understands the drivers of global smart meter rollout, particularly how innovative regulation can influence the business models of utilities. Working within our Advisory Center for Smart Metering and Smart Grid, Knut uses this knowledge to help P&U companies plan and manage their smart programs and adapt their businesses to the transformation currently taking place within the sector.

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Shubhanshi has her finger on the pulse of P&U. Her role within our energy team sees her researching and analyzing the most pressing issues within the sector, including smart technology. Shubhanshi has supported major client engagements in this field, as well as in the areas of capital programs and customer relationships.
Innovate to build customer relationships
Innovation across almost all aspects of the business will be essential if utilities are to use smart technology to build positive and profitable relationships with customers.

Cornelius Anger reports

Let’s start with the bad news: most utilities do not have good customer relationships – they have billing relationships. Particularly in regulated markets, power and utility (P&U) companies have historically viewed the customer as a one-dimensional meter reading rather than a multidimensional person whose needs evolve. This lack of a real relationship means that utilities have little knowledge of what customers want or need from their utility providers.

Now for the good news: no one else in the energy sector understands this either. And, while we’ve heard plenty about new market entrants swooping in and stealing utilities’ customers, I think this overstates the case for nontraditional players in the P&U sector. We’ve seen many new entrants underestimate the complexity of the energy market in terms of supply and demand, the variable cost of electricity and the layers of regulations. Even Google failed in its first attempt to enter the P&U space with a consumption visualization and energy-saving advice solution, and retired the PowerMeter Service at the end of 2011.

Utilities are still best positioned to lead the provision of new products and services to customers – but they will need to be prepared to leave their comfort zone. Here are my key messages for P&U companies about how a shift in thinking can drive innovation and redefine the customer relationship:
It is not hard to understand how the traditional mindset of utilities developed to see customer relationships as a low priority. Throughout its history, the sector’s key objective has been to operate with 100% reliability. Times have changed, however, and for some households, the 24-hour availability of power is becoming less critical.

But while customers begin to value choice, flexibility and transparent pricing as much as, or even more than, 100% availability, utilities are still focused on reliability above all else. Of course, safety and reliability will always be important, but without broadening priorities, utilities will find it difficult to even consider, let alone implement, innovative products and services. It is hard to think about opportunities when the topic of discussion is always threats.

How can you build a relationship with someone you don’t even know? Most utilities, motivated by reducing risk and costs, have cut customer interactions to the minimum — often just sending the bill.

The rollout of smart meters is a chance to think differently about customer interactions. Every part of the deployment process is an opportunity to interact with customers in a positive way. For example, if call center agents will have to be trained to answer questions about smart meters, why not also train them to offer helpful recommendations regarding energy use? If fieldforce staff must learn how to install smart meters, why not also help them improve their level of professionalism while working within customers’ homes?

Using innovation to make small changes during the rollout of smart meters will have a big impact on the ability of utilities to leverage smart to build better customer relationships.

Today’s connected customers live in an omni-channel world. And while there is still a place for communication via telephone and post, more and more customers want to interact with utilities through digital means, including apps, email, websites and social media. Smart metering means utilities have no choice but to enter, and master, this digital domain as well. They must become more professional in their use of social media and other digital platforms and use the insights delivered by smart technology to create the omni-channel experience that customers demand.

For example, other industries have used customer segmentation to develop online games that can encourage customers to benchmark against their neighbors and communities, driving energy-efficient behavior and creating customer loyalty along the way.
Regulation around data privacy has improved significantly since the early days of smart meter rollouts. I am convinced that we now have sound data security and data privacy regulation that provide a robust basis for doing business. Instead of feeling limited by data privacy issues, P&U companies should focus on the benefit of new products and services enabled by the responsible use of customer data.

We see with applications like Facebook that people are prepared to share data if they think they will get value from doing so. We are already seeing examples of this in the P&U industry: Google’s Nest division has entered into agreements with third parties such as Mercedes cars and Jawbone Up wristbands that allow users to control their home thermostats from remote locations.

As with companies in other industries with a primarily local or regional focus, utilities typically struggle to have either the speed or the scale to compete with new market entrants that can leverage the latest technologies at a national or even global level.

Separating innovation business units from the main utility allows for this broader platform while adding the agility and flexibility needed to foster an entrepreneurial spirit. As separate units, these businesses can attract and hire new people, develop and try out different products and make quick decisions, all without being tied to traditional utility planning cycles.

Let’s remember that smart technology is still in its early stages – no one really knows what the “killer” applications will be in the future. Being successful in this field means being flexible enough to invest in multiple opportunities. Of course, some will fail, but a nimble business structure will avoid burning too much money. Others will be successful.

E.ON SE recently launched a program called “Agile,” as well as a “Digital Transformation Unit,” to explore and grow new businesses quickly and independently from the existing core. This is a concept I believe we will start to see more of in the sector.

Just as the innovative technology of smart metering transforms how utilities interact with the customer, innovative thinking and actions will hold the key to making the most of this relationship to grow new products and services, particularly in the “beyond the meter” space. We are already seeing excellent examples of this in the P&U sector, such as the customer analytics software and services company Opower engaging with customers in new ways to reap significant rewards. Opower is working on behalf of its P&U clients – but I am confident that we will see similar success stories from utilities themselves, if they are bold enough to shift their thinking.

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Cornelius understands how technology can transform a business. His knowledge of the impact of smart technology on the P&U sector is complemented by diverse experience helping other industries, including infrastructure and telecommunications, adapt to changes in digital technology. Cornelius enjoys using his knowledge to support the world’s leading utilities in strengthening their market position and growing beyond their core business.
The City of Tshwane is South Africa’s administrative capital city and is responsible for supplying electricity to about 500,000 customers. Throughout its history, Tshwane’s electricity sector has experienced endemic problems with late payments, long-term debtors and electricity theft.

In 2012, Tshwane Executive Mayor Kgosietsio Ramokgopa attempted to address these issues with a groundbreaking initiative to implement prepaid smart metering for all consumers. As Ramokgopa explained at the time, “Once in full swing, the project will help overcome problems of inaccurate billing and loss of revenue … and secure the financial position of the city. This is a game-changing project and will most likely redefine local government’s financial management.”

In a world first, an off-balance-sheet funding model has enabled the South African City of Tshwane and Total Utilities Management Services (TUMS) to use smart meters to secure city revenues, modernize infrastructure and provide scope for future capital expenditure. Paul Renshall, Chief Operating Officer of TUMS, explains the project.
**Innovative funding model**

The city appointed TUMS to build, own and operate the new smart system in Tshwane in return for a service fee. Peu Capital, an investment holding company belonging to the same parent company (Peu Group) as TUMS, created an off-balance-sheet funding proposal to ensure that the smart metering program could be implemented with no recourse to the city. The model included deploying prepaid meters in a staggered rollout that first targeted the highest consumers of electricity while blocking consumers in arrears until debts were paid.

We believe that the project's off-balance-sheet funding model is a world first. In straight capital investment terms, Tshwane would have needed to raise an estimated ZAR6b (US$0.61b) to fund the program. Instead, TUMS' highly innovative concept would provide funding in a manner structured to ensure that the customer tariffs would not need to be raised, as well as enable an accelerated rollout to maximize cost savings for implementation. The off-balance-sheet arrangement would also strengthen Tshwane's financial position going forward and provide financial flexibility for future capital expenditure.

Peu Capital engaged EY for this project because of its proven knowledge of the smart field and its depth in the local African market. The EY team included people with extensive experience in similar projects in India and Italy. Specifically, the role of EY’s team was to:

1. **Create the business case.**
   Time pressure was tight – the team had less than four weeks to compile information from consumer sources and build the business case for what we believe is the largest deployment of smart meters in Africa and an pioneering funding approach.

2. **Design the new smart metering operating business, TUMS**
   The off-balance-sheet nature of this initiative meant that, in essence, a new utility company, TUMS, needed to be set up to operate these assets. A new structure and operating model had to be designed and created from scratch, complete with C-suite and supporting workforce of up to 85 members. This was an unprecedented move that required a fundamental shift in mindset away from the typical implementation model for smart metering systems.

3. **Run the TUMS project management office (PMO)**
   The EY team currently runs the PMO and will also be responsible for ongoing commercial and risk management. The first meter was switched on in October 2013, with all existing meters set to be replaced with prepaid smart meters within three years of this go-live date. The EY team is coordinating the work of all service providers, monitoring and reporting on the progress of the project, and defining and mapping the business requirements and processes.

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**A new model for smart – a new future for Africa**

Once rolled out, Tshwane will have the most advanced smart metering system on the continent. In addition to improving consumers' awareness of their consumption patterns, the smart functionality will improve customer service, enable more accurate billing and allow for early detection of faults to speed up response times. The initiative is also expected to generate opportunities for local businesses, create jobs and help develop new worker skills.

But the impact of this project extends far beyond Tshwane. The thinking behind the project's business case and the operational model is likely to influence the way smart metering evolves across Africa. The Executive Mayor was right – this project has been a true game-changer, proving that transformational change can be achieved with no cost to the city itself, without raising customer tariffs and with built-in flexibility to upgrade to time-of-use tariffs further down the line. In a continent with an urgent need for electrification, the TUMS project helps show Africa the way to a brighter future.

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“We chose EY for its proven knowledge of the smart field and its depth in the local Africa market. Their team included people who had experience of projects similar to ours in India and Italy.”

Busi Tshili, CEO, TUMS
For almost 100 years, the electricity grid was a largely static network whose role — to transport electricity from centralized power plants along transmission and distribution lines to homes and businesses — remained much the same. Modernization through a series of technological advances has created a smart grid that uses digital technology, most notably smart meters, to provide energy usage information to both customers and utilities in real time to help manage and optimize the efficient use of power.

Mike Elzey reports.
Improving capabilities, cutting costs
Smart helps electricity companies optimize their grids to achieve three overriding aims: efficiency, reliability and resiliency.

**Efficiency**
Smart meters and the digitization of the grid allow for better management of supply and demand. Electricity is deployed when and where it is needed and different sources of power – such as that generated via renewables or distributed energy – are integrated into the network. Smart meters also allow today’s empowered customer to play a bigger role in improving efficiency, encouraging behavioral changes that have benefits for both consumer and utility.

**Reliability**
A smart grid allows for the optimum control of electricity voltage and frequency, which can impact the performance and life expectancy of more sensitive devices, such as televisions and computers. This is significant not just for the householder but also for commercial clients such as those in Silicon Valley and other high-tech hot spots where poor power quality can have a huge economic impact.

**Resiliency**
Disruption of supply by extreme weather or manmade events is an increasing risk for utilities around the world. In the US, Superstorm Sandy in 2012 exposed the fragility of the traditional grid, as well as the fact that restoring power in the digital age is not just a “pipes and wires” issue. Integration across utilities’ systems, processes and workforces is needed to restore both the electricity and the data behind it. A smart grid – when backed with a collaborative sector-wide approach – can prevent some outages and minimize the impact of others by reducing the time without power, cutting the costs of restoring it and allowing for better communication of progress to customers, the media and regulators.

Integrating different energy sources
Renewable and DER are a growing market force expected to completely transform the electricity sector. In fact, many predict that, by 2020, power from rooftop solar photovoltaic will become cheaper than power from the grid in most parts of the US.

The intermittent nature of DER and its multiple, disparate sources of generation create new, unprecedented demands on electricity flow management. A smart grid that enables two-way communication between customer locations and the utility can allow utilities to use real-time data regarding DER to efficiently use multiple sources of generation while maintaining a reliable source of power and avoiding blackouts.

And as adoption of electric vehicles (EVs) increases, smart grids will help utilities manage the resulting demand by providing the ability to identify where and when customers are charging EVs.

An optimized smart grid not only allows utilities to manage energy more efficiently now, it also positions them to take advantage of future developments and compete with new market entrants. Smart grids, and the usage information they provide, allow utilities to create new products and services to meet customer needs today and into the future. The opportunity to generate these additional revenue streams is valuable when electricity demand in many markets remains flat.

Aligning the business
But while optimizing the grid through smart technology offers numerous benefits, ensuring successful smart grid implementation requires a holistic approach that extends far beyond IT. This is about the business, as much as the technology, and may require a large-scale change program.

We are working with many clients to help them determine their own approach to grid modernization and then manage the risk and maximize the benefits of optimizing the grid. Our capabilities span the entire process, from building a strong business case to selecting vendors and deploying, integrating and aligning all business processes. Other articles in this issue of Plug in describe in more detail our approach to the deployment of smart programs (see page 30) and to major program transformation (see page 26).
How smart grids can save transformers

A grid optimized with smart technology can better manage electricity flow through transformers, extending the life of these high-cost assets.

Transformers go unnoticed in most neighborhood streets, but the role of these silver boxes – to adjust voltage as it enters homes and businesses – is critical to delivering a safe and reliable power supply. But transformers are vulnerable to failure due to extreme temperatures and dramatic load changes and are expensive to replace.

In Phoenix, Arizona, where summer temperatures soar into the hundreds, the hot days and only slightly cooler nights were causing transformers to fail at a rate of about 5,000 per year within a network of one million customers. The cost to Arizona Public Service Company – the state’s largest electricity utility – was enormous. But environmental factors are only part of the problem. Big electricity load changes caused by simultaneous charging of electric vehicles within the same area, for example, can also vastly increase the wear and tear on transformers and reduce their useful life.

While the smart grid can’t do much about those sizzling Southwest US summers, its ability to levelize and control the flow of electricity through the system will enhance and expand the life of transformers, significantly reducing the operation and maintenance expenses of many utilities.

However a utility approaches grid optimization, communicating the resulting changes to stakeholders will be crucial to the success of the program, as well as enhancing brand and reputation in the longer term. Regulators and shareholders will need to be convinced that the benefits of an optimized grid justify increased rates of return. These increases must be clearly communicated to consumers and the media, who will also require assurances regarding privacy and data security.

Exciting times ahead

The challenges posed by a smart grid can no doubt appear daunting to a sector already facing issues such as slowing electricity demand, aging infrastructure and regulatory changes. But I believe the benefits of an optimized grid – increased efficiency, reliability and resiliency, as well as the capability to offer new products and services – will far outweigh the temporary pain. At EY, we look forward to working with clients to help implement their grid optimization strategy and harness the opportunities of the smart transformation.
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Mike has always been at the cutting edge of energy technology. He began his career of almost 35 years in the US Navy nuclear submarine services, attracted by the opportunity to work with nuclear, and has since worked across all aspects of the industry, including generation, transmission, distribution and retail. Based in EY’s Atlanta office, Mike is now focused on smart grid, which he believes offers some of the industry’s most exciting challenges to date. He explains: “I understand the issues our clients are facing and enjoy helping them navigate these in what may seem like a very difficult and confusing time. I have a vision of the end result of our industry transformation and want to help P&U clients see this too – it may seem difficult now, but, with the right strategy in place, we will all be better off with a smarter, more integrated grid.”

Four steps to a successful grid optimization strategy

While every grid optimization program will differ, depending on the goals of each individual utility, Mike says that four factors are key to successful deployment:

1. Build the business case
   Know where the project capital is coming from and why it is best invested in your grid infrastructure rather than in other opportunities.

2. Manage the program
   Ensure you have adequate capabilities in-house to execute the optimization program on-time and on-budget – or be prepared to bring in the appropriate skills. In our experience, many utilities overestimate their management capabilities, realizing their skill gaps only when the program overruns or expensive mistakes are made.

3. Understand vendor capabilities
   Be wary of technology vendors, many of whom are still at the beginning of their journey in this field. Not all products will be equally valuable, and not all vendors will be equally capable of deploying them within your organization. Pilot programs are essential.

4. Align the organization
   Recognize that grid optimization is a whole-of-business change program that may challenge utilities to break down the silos that currently hinder the ability of different business functions to work together. All work streams and business processes must be aligned to the change to avoid cost overruns, equipment failure, vendor issues and other problems that occur due to a lack of oversight across the entire organization.

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Smart technology enables utilities to offer customers a wide range of new products. Some of these are “close to home,” such as surge protection and advice on energy efficiency, while others represent a huge departure from traditional utility services, from home maintenance to insurance. (See Figure 1, on page 22).
Early adoption of smart meters in the US means that many utilities have dabbled in these products and services since the early 2000s. However, a lack of a clear strategy has seen many of these early attempts at BTM fail to deliver on their potential. In fact, they often had to be torn down completely and rebuilt to derive real value.

**Determine the strategic fit**

Avoiding these false starts means first identifying BTM objectives to make sure that strategy and execution align. Utilities must ask why they are pursuing BTM opportunities. Is the main objective to improve customer satisfaction? Find new sources of revenue as energy efficiency drives down overall demand? Strengthen the brand? Or protect against new market entrants?

The answers will determine how smart should be leveraged to build the customer relationship and offer new products and services. For example, some additional services, such as SMS alerts regarding high bills, may actually be a cost to the business, but if they improve customer satisfaction, the overall net value may be positive. Appliance warranties tend to be profitable programs, but if they also create customer goodwill, they add even more value.
Once utilities have identified which BTM opportunities are the best strategic fit, it is time to make some operational decisions. Should a utility build the new business, buy an existing business or partner with a third party? This decision is a complex one, heavily influenced by each company's strategic mandate around growth, its current ability to deliver and its willingness to invest in building a new type of business.

For example, many utilities may be able to leverage internal skills and knowledge to offer energy management advice and use existing forces in the field to carry out maintenance services. For other services that sit outside their investment profile, such as insurance or home heating and cooling, utilities can use their brand and customer channels to go to market while engaging a third-party partner to execute the offering.

Once a path to market is set, utilities must develop an implementation strategy that includes target customers, partners, product messages, distribution, prices and brand.

Learn from US lessons

In the US, utilities are reporting annual return-on-investment rates from BTM services in the range of 12% to 23%. As the global smart rollout continues, expect to see more of the world's utilities – driven by slowing energy demand and changing customer needs. But doing so will require taking a strategic approach to identifying appropriate opportunities, determining the path to market and then making it happen.
While none of this is easy, the experience of US utilities yields valuable lessons for the rest of the world. And from this experience, we have the benchmarking data and frameworks to help clients launch successful BTM initiatives.

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Based in our Boston office, Mark has been in the P&U industry for more than 20 years. Mark has worked across all aspects of the sector but now specializes in helping utilities better understand and meet the needs of their customers. As smart transforms the customer relationship, Mark works with clients to leverage knowledge of customer behavior to improve operations and uncover new drivers of growth.
npower’s smart journey

Chris Thewlis, Director of Metering, npower

The smart metering rollout is one of the UK’s biggest energy infrastructure initiatives since mains gas was laid down in the late 1960s. As a big six energy retailer, npower is tasked with about 6 million of the 53 million mandated meter installations.

The UK’s smart meter rollout is one of the world’s most ambitious, requiring energy retailers to install electricity and gas smart meters in every home and business by 2020. For npower, achieving this requires the complete renewal of our energy infrastructure from a metering perspective – and securing the engagement of our staff and customers.
More than a mandate
Despite the regulatory push, we were determined to derive maximum value from smart. Yes, the Government has mandated the industry to install smart meters, but we wanted the organization, as well as our customers, to understand the benefit of what we were doing, rather than just the cost.

We brought in EY to work with us across our entire smart metering program. EY first helped our team address some key questions about our smart meter strategy, which then guided the development of a robust, fit-for-purpose business case model. This model, which has been reviewed, refreshed and updated during the life of the program, helps us accurately forecast the costs and benefits of smart metering. It is also a useful tool to guide informed communications with government about timelines and constraints.

Engagement with customers and business
Since EY came on board, I think we have really progressed in terms of organizing our smart program, getting it to focus on delivery, and crucially been successful in getting the whole business more engaged with the transformational change that is coming.

This business engagement has been critical to ensuring that npower’s smart program will maximize return on investment. We know smart will transform our business. It will change the conversations we have with customers. Instead of answering questions about a bill, we will be advising customers on how to be more energy efficient through insulation, a new heating systems or Nest, or any number of new products and services. In short, npower can move from being an energy provider to a company that offers the kinds of products and services our customers want.

The challenge is getting our team to embrace this transformation as an opportunity, not a threat. Doing this meant bringing stakeholders together to secure agreement on our project scope and delivery approach. We want our company to see this as an opportunity, bringing stakeholders together to secure agreement on our project scope and delivery approach.

And, because smart success will always depend on customer engagement, EY has used insights from other major rollouts to help us build a positive experience for customers. Our multiphase approach to customer engagement begins with raising awareness of the program, and it ends with “settling in” post-installation. Key to the success of this strategy is the tailoring of messages and channel choices to individual customers’ behaviors and attitudes toward smart.

Positioned for the future
Throughout the smart program, the EY team has acted as true partners to npower. We feel they are definitely “in it with us.” Every smart program will have its issues – certainly, we have faced resource constraints and technology delays. Each time, the EY team’s “can do” culture has seen us overcome these. Their ability to bring a wider industry perspective to the program, as well as their experience and level of professionalism, gives us more confidence that what we are going to deliver is fit for purpose.

In 2014, npower’s smart program is still work in progress, but we have already reaped significant benefits. Installations of smart meters have increased every week, exceeding expectations, and the percentage of “no access” or “refused” installations has decreased significantly. Customer feedback has been positive, and npower’s progress has also been noted by regulators.

I see npower’s smart journey as just getting started. Getting deployment right is paramount, but, beyond putting meters on walls, our smart program is about positioning the company for future innovation. Think of the early days of iPhones – it wasn’t until the App Store opened that everyone realized their potential. And now everyone has a smartphone.

Smart meters are similar. Who knows what sort of products will be enabled by smart in the future? Laying down a reliable metering infrastructure for our customers now will allow npower to innovate and build success on top of this innovation.
Successful smart meter rollout begins long before a single device is installed and continues well after the last fieldforce engineer has gone home. Richard Sudlow explains the importance of a business-led approach to smart project management.

Managing the smart transformation

If you read no further in this article, remember this: smart project management is not about IT. Of course, technology is a big part of the smart metering rollout, but it is an enabler, not the endgame. Smart metering will impact nearly all of a utility’s operations and processes and completely change the way it does business. With so much at stake, careful preparation, a business-led approach and end-to-end management is critical to the success of smart at “go live” and beyond.
Start as you mean to go on

Successful smart meter rollout starts with strategy. Setting a strategy early is critical to realizing the benefits of the rollout and ensuring the project stays on track over what is usually a protracted timeline. Developing a rollout strategy will vary depending on each utility’s business case, which will be determined by a range of drivers, including the company’s own goals and, to a large extent, the regulatory framework around smart within its region of operation. For some utilities, the business case is built around energy efficiency or network optimization; for others, the focus is improving the customer relationship or reducing non-technical losses, particularly theft.

For many utilities, though, the smart rollout is driven less from a positive business case and more by a regulatory mandate. Mandated rollouts still offer opportunities to realize benefits as long as the rollout strategy is aligned to overall corporate objectives and includes cost-effectiveness as a key driver. This does not mean doing the project as cheaply as possible, but directing investment where it will deliver the most value. For example, investment in a marketing campaign that creates awareness and a “buzz” around smart may help lower the overall cost of the program if it increases the likelihood that customers will be at home when installers arrive for their appointments.

Whatever the reason behind the rollout, embedding the business case into every phase of the project will help guide key decisions and help ensure that high-level objectives are met. This is especially important given the long timeline of most smart meter rollouts. Even rollouts that begin well can run into challenges a year or even a number of years into the project. Keeping the business drivers front of mind when addressing these challenges will help utilities develop solutions or make changes to the project that do not compromise the overall business case.
The digital connectivity of smart has changed every aspect of electricity metering. Installing, maintaining, interacting with and protecting smart meters will require utilities to develop completely new capabilities.

Why managing smart is so complex

All major projects are difficult to manage, but the characteristics of a smart rollout combine to create particular challenges:

**Capacity**

In most regions, the window for smart meter rollout is much smaller than the usual timeline of meter replacement. France, for example, set a rollout schedule of 35 million meters in seven years. The intensity of these timelines is significantly increasing the workload of fieldforces.

**Capability**

The digital connectivity of smart has changed every aspect of electricity metering. Installing, maintaining, interacting with and protecting smart meters will require utilities to develop completely new capabilities.

**Technology**

Determining the appropriate meter technologies and ensuring these are available, compliant, proven and compatible are perhaps among the biggest challenges of smart and an area where we frequently draw upon our global experience to advise clients.

**Security**

While utilities are experienced in managing the safety and security of their infrastructure, smart meters take security requirements to a whole new level. Ensuring customer data is kept safe and that meters are protected from cyber attacks add another layer of complexity to the smart rollout.

**Unchartered territory**

The nature of smart rollouts means that they are often the first project of their kind in a particular region. In these situations, we help utilities draw upon global “lessons learned” and our knowledge of the local regulatory environment to help them overcome the challenges of being a smart pioneer.
See the bigger picture

If the smart rollout was not challenging enough, it is complicated by its place within an already packed corporate agenda. Utilities around the world are facing the triple challenge of improving environmental performance, keeping consumers’ costs down and maintaining system reliability. The impact of renewables, rise of distributed generation, competition from new entrants, aging infrastructure and the increasing complexity of regulations are completely transforming our sector at an unprecedented rate.

All of these transformative changes will be impacted or enabled by smart. It is important then that the smart rollout not be seen as a standalone project, but as part of a pipeline of organizational change. Its processes, milestones and measures of success are interdependent on those of other major programs and highlight the importance of a business case that considers the company’s overall business goals, as well as rigorous project management.

Structure the project

The complexity of smart means that the structure of the rollout is just as important as its strategy. Even with a strong business case, running a smart meter rollout can feel a bit like juggling a large number of balls. With no “one-stop shop” for smart meters, managing many vendors and third-party providers can present one of the greatest challenges – and risks – of the rollout.

Putting in place an appropriate governance and project structure is critical to effectively manage vendors and measure progress. We work with many clients to put together a collaborative hub that uses clearly defined responsibilities and outcome-focused contracts to ensure all players have “skin in the game” and are working toward common goals.

Think beyond “go live”

Managing the process from end-to-end through rigorous tracking and measurement is critical to avoid leaking value over what is often a multiyear timeline. One of the biggest mistakes we see is stopping this project management at go live. In many ways, go live is just the beginning, particularly if a utility’s business case includes leveraging smart to begin a digital journey for both the organization and customers. Continuing to track and measure progress post-rollout will protect the business case from poor practices and also identify areas where tweaking may add value over the long term.

Seize the opportunity

The size and scale of smart rollouts, as well as regulatory pressure, can create a rush to rollout. But without a clear strategy, a commitment to the business case and strong project management that embeds accountability and measures progress, a smart rollout is likely to overrun budgets and deadlines and see the business miss a rare opportunity. Smart will transform all utilities. Those that take a business-led approach to the transformation will ensure that rollouts realize their potential, add value across the business and prepare for future changes within the sector.

Richard Sudlow

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Richard sees the big picture. With almost 15 years’ experience across IT, infrastructure, business and project management, Richard takes an end-to-end approach to smart. “I like understanding how all the moving parts fit together and drawing upon people in EY with specific areas of knowledge to deliver a multi-faceted, complete solution for clients.”
What’s the biggest cost of a smart meter rollout? If you said technology, you’d be wrong. Deployment costs, specifically fieldforce expenses, make up the lion’s share of the budget and highlight the importance of a clear strategy.

Paul Micallef reports

For most utilities, deploying smart meters presents a double challenge. As well as being a huge and costly project, the rollout of smart pushes power and utility (P&U) companies into a digital space with which many are still unfamiliar. This huge investment and commitment to new technologies means that even a mandated rollout must deliver as much value to the business as possible.
Roadmap for rollout

“Just do it” may sell shoes, but it is not a wise approach to smart meter deployments. Rollout must be guided by a customer deployment strategy aimed at aligning the overall business drivers to smart and tailoring deployment to emphasize different priorities (see Figure 1). The deployment strategy can also provide insight into the cost impacts and trade-offs of different tactics, as well as help pinpoint and work around possible constraints, such as workforce capability, access to capital or the capacity of suppliers to deliver.

Figure 1. Drivers of smart deployment

<table>
<thead>
<tr>
<th>Type of utility</th>
<th>Drivers for deployment</th>
<th>Example of deployment strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Utilities with soft business cases and/or limited access to capital</td>
<td>Minimize costs</td>
<td>Extend timeline</td>
</tr>
<tr>
<td>Utilities with strong regulatory edicts or requirements</td>
<td>Achieve installation targets</td>
<td>Consolidate vendors</td>
</tr>
<tr>
<td>Utilities with high levels of non-technical line loss or prolonged outages</td>
<td>Expedite revenue recovery</td>
<td>Target high-concentration areas</td>
</tr>
<tr>
<td>Utilities in competitive retail landscapes and/or poor customer satisfaction ratings</td>
<td>Create positive customer engagement</td>
<td>Employ multiple vendors</td>
</tr>
<tr>
<td>Utilities focused on cross-brand opportunities</td>
<td>Target specific customer demographics</td>
<td>Leverage turnkey providers</td>
</tr>
</tbody>
</table>

*Note: The example deployment strategies are illustrative and may vary based on specific utility circumstances.*
Mission control

Whichever strategy is chosen, deployment success is determined by the ability to ensure the right person with the right materials is serving the right customer at the right time. Making sure these different pieces of the puzzle fit together will require establishing a deployment operations center, or mission control.

Mission control brings together all parts of the deployment process and executes contingency plans when things go wrong.

Consider these possible scenarios: if a vendor based in China cannot keep up with demand and sends its shipment three months late, what is the impact on fieldforce productivity? If a vendor supplies a product in which major faults are discovered after it is installed, how will the need to replace these meters impact the installation schedule? Will it be possible to regain customer confidence? If too many meters are ordered, will excess assets need to be stored? And how will this affect warehousing costs and the validity of meter warranties? The complexities of smart mean there are almost endless scenarios to consider, and all will impact the success of the rollout in some way.

The fieldforce factor

Installing the smart meter is crunch time for the entire rollout process. Customers must be clearly notified of the need to install smart meters in their home, be given flexibility to choose an appropriate time for the installation, and then have a professional and polite fieldforce worker show up on time to install a smart meter that works well and is easy to understand. If utilities fail to meet any of these needs, the ability of their smart rollout to deliver on its goals is greatly impacted.

And while installing the meters is the most critical part of the deployment process, many utilities face serious capacity and/or capability issues with their fieldforce installers. As fieldforce costs are the number one cost of deployment, addressing this gap by choosing the most appropriate fieldforce model is critical to maximizing value. We see most utilities adopting one of three broad models:

![Figure 2. Example of how a utility's path and decision making drive smart deployment](image-url)
A utility uses internal resources for the full deployment life cycle, training and recruiting to complement existing teams and aligning employee key performance indicators to deployment milestones.

A utility complements its own resources by outsourcing some functions of deployment to third-party vendors, depending on complexity or resource availability. Performance is measured via a combination of employee KPIs and vendor service-level agreements.

A utility uses contractors for the full deployment life cycle, with an internal team ensuring that third-party vendors are meeting targets as determined by service-level agreements.

As with determining a deployment strategy, deciding which delivery model is appropriate for each utility will depend on a variety of factors (see Figure 2).

Each delivery model has benefits and trade-offs that need to be balanced depending on each utility's own circumstances and business goals for smart.

**Rethink success**

Smart meter deployments are hugely expensive, risk-intensive and complex projects. With so much at stake, it can be easy to think that success is a rollout delivered on time and on budget. And, of course, this is important. But when I work with clients, I ask them to measure success beyond just “getting it done.” Has every element of the rollout contributed to the achievement of the overall business objectives? Have you positioned your company to achieve its goals? A strategic approach to deployment will see even a mandated rollout deliver value to the business now and position it well for future smart opportunities.
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EY is a global leader in assurance, tax, transaction and advisory services. The insights and quality services we deliver help build trust and confidence in the capital markets and in economies the world over. We develop outstanding leaders who team to deliver on our promises to all of our stakeholders. In so doing, we play a critical role in building a better working world for our people, for our clients and for our communities.

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In a world of uncertainty, changing regulatory frameworks and environmental challenges, utility companies need to maintain a secure and reliable supply, while anticipating change and reacting to it quickly. EY's Global Power & Utilities Center brings together a worldwide team of professionals to help you succeed — a team with deep technical experience in providing assurance, tax, transaction and advisory services. The Center works to anticipate market trends, identify the implications and develop points of view on relevant sector issues. Ultimately it enables us to help you meet your goals and compete more effectively.

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