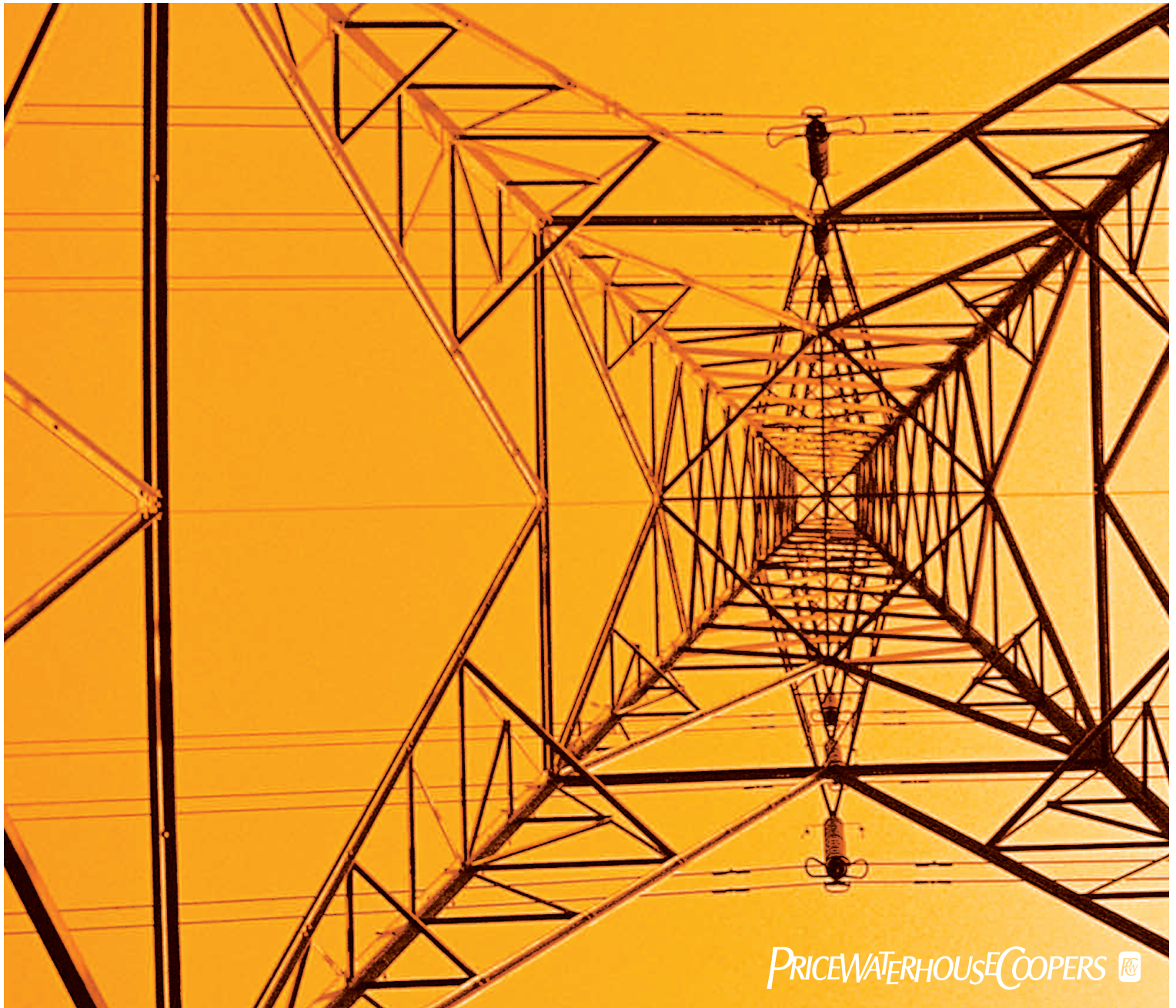


Energy, Utilities & Mining
Roundtable discussion paper

Smart from the start

Managing smart grid programmes



Smart from the start

“You need buy-in and **total**
commitment of your
whole company
before you start
because it will touch every aspect of the
operation of the utility.”

Jim Meadows, Director, SmartMeter™ Field Deployment, Pacific Gas & Electric Company

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“It's a **once in**
a lifetime
opportunity
to engage with customers
but there is a fine line
between winning their faith
or losing their faith.”

Stephen Knight, Chair of UK Smart Metering Group, PwC

“Smart grids are **fundamental to the changes that need to come** – replacement of ageing infrastructure, clean energy, electric cars, securing supply and many more challenges. All this while reducing the total cost. It seems impossible but this is where smart grids come in.”

Jon Stromsather, senior smart grid manager, Enel

Smart grids are one of the biggest developments in the power utilities industry worldwide in modern times. They offer the potential to significantly reduce grid inefficiency, enable more interactive demand management, better integrate distributed power sources into the grid, change customer experience and facilitate new uses for electric power.

However, the realisation of these benefits is not a given. Like any major project, there are the challenges of delivering on time, on budget and operating successfully. But it is not just a matter of rising to those challenges. Success also relies on a complex interplay of technological, cross-sectoral, behavioural and regulatory factors in addition to effective project implementation.

In Autumn 2010, we brought together around 40 people in a roundtable of senior executives from the US, Europe and the Middle East, as well as PwC smart grid experts, to gain first-hand insight into the rollout of smart grids. Participants in the roundtable included major utility companies, network operators, suppliers, regulators and PwC specialists working on smart grid projects in different parts of the world. The event benefited from the insight of companies in a variety of markets and a variety of different rollout stages.

Key presenters of the roundtable included Pacific Gas & Electric Company (PG&E), one of the largest combined natural gas and electric utilities in the United States, and ENEL, Italy's largest power company and Europe's second largest listed utility by installed capacity. Both companies are at an advanced stage in smart meter installation and smart grid development.

This report draws on the experience of these and other companies at different stages of smart meter and smart grid implementation. The overriding lesson from the participants in our smart grid roundtable is ‘don't underestimate the scale and reach of smart grid projects.’ They need to be planned on the basis of a large capital project.

They also need have a very strong and robust focus on the concerns of customers and the wider public right from the start and be accompanied by a realisation that the move to smart metering and smart grids has implications for the whole organisation. Companies that view smart grid projects in narrow technological terms are likely to fail to realise the benefits of smart grids at best and run into major cost and reputation damage at worse.

02 The extent of change

Today's global picture

By its nature the development of smart grid infrastructure is evolutionary. Different parts of the smart grid jigsaw, such as smart metering and high voltage direct current (HVDC) and energy storage, are being rolled out at different speeds. The rollout of the smart meter element of smart grids is furthest advanced in North America and Europe.

Within North America, Pacific Gas & Electric Company (PG&E) in California has embarked on an ambitious US\$2.2bn programme to install 10 million smart meters by 2012. It is firmly on track with over 6.2 million in place by mid 2010. Elsewhere in the US, smart meter programmes are being rolled out in a number of other states, including Texas and Florida. In Canada, smart meters are being rolled out to all small businesses and households in Ontario by 2010.

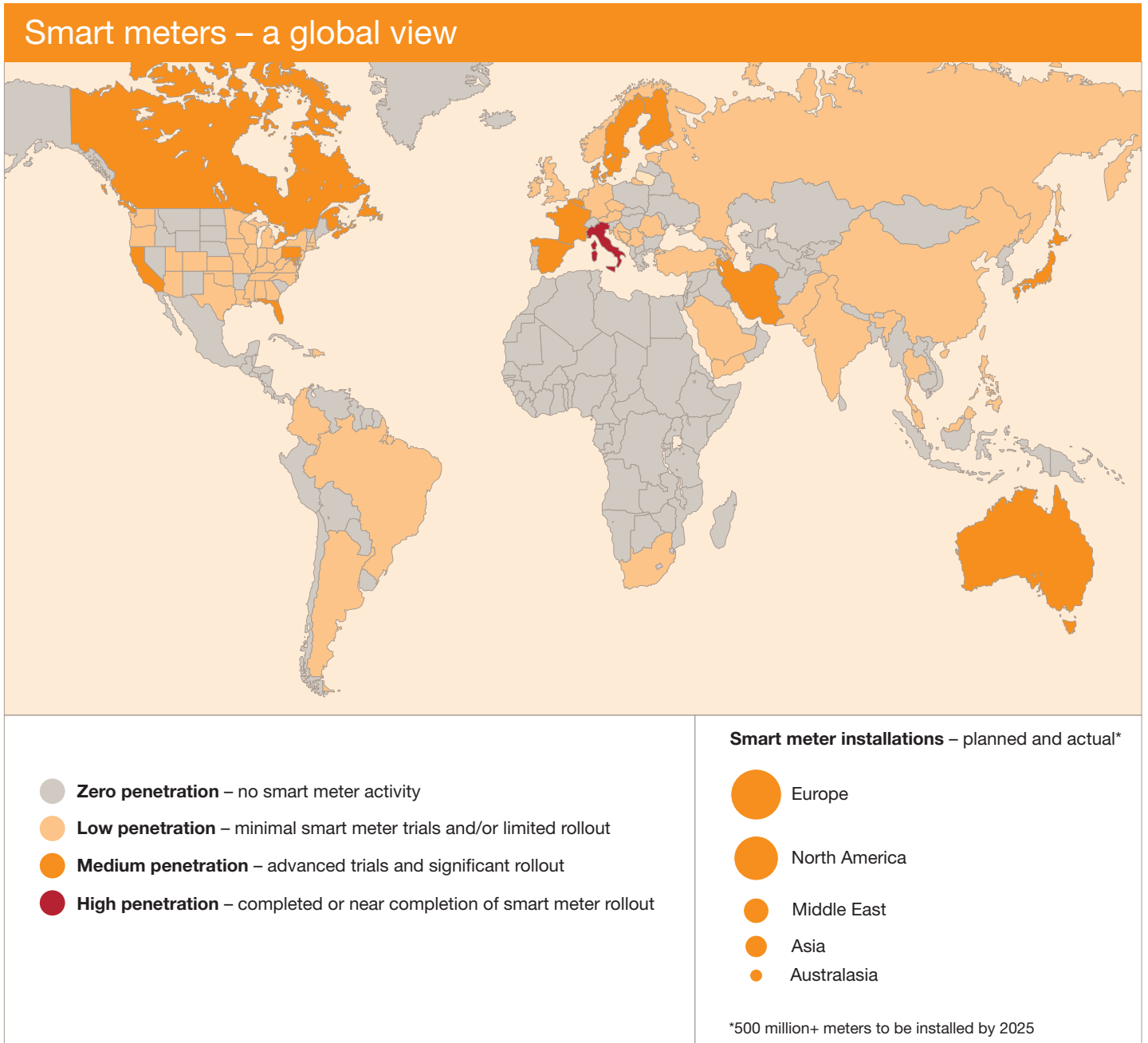
In Europe, Italy has the world's largest smart meter deployment. Enel became a global first mover by installing smart meters from 2001 onwards and now has 32 million in place. By 2011 all 36 million electricity customers in Italy are expected to be covered by smart metering. Spain and France will see the next biggest smart meter deployment with Enel-owned Endesa, Iberdrola and EDF announcing programmes that will total 50 million meters.

With a smaller customer base, Sweden was the first country to achieve 100% coverage. Elsewhere, European governments are adopting targets for smart meter deployment with the UK, for example, aiming for 100% coverage by 2020. Other parts of the world have seen more limited deployments with testing and partial rollouts in countries such as Japan, Australia and New Zealand.

"Smart grids are a massive development for utilities companies in all different parts of the globe, accounting for a large slice of the already substantial capital investment programmes planned by the industry," observes Steve Randle, UK energy, utilities and mining consulting leader with PwC.

The challenge goes well beyond the task of successfully implementing major smart grid programmes. Randle points out that smart grids herald a change or role and way of working for companies: "Utilities are also forming alliances and working closely with companies outside of their industry as part of the transformation of the power grid. In doing so, they are sharing the growing financial and operational burdens as well as taking on added responsibility in a new, widened role of systems integrator."

62% of utilities in a recent global survey cited smart grid initiatives as the reason for increasing capital expenditure in 2010, and 64% said the same for 2011.*



Smart metering provides the bedrock for many of the other elements of the smart grid future.

04 The extent of change

Tomorrow's potential

Smart meter programmes form the building blocks of a future where active and interactive management of demand and load control is possible, new energy sources can be fully and safely integrated into the grid and new uses of electricity for transportation can be supported. However, many technological and business case questions remain. It is not a future that will automatically evolve.

The necessary 'glue' to ensure system cohesion is still the subject of debate and development. Many governments and regulators are still deliberating over the right policy frameworks. Technology is evolving and the market for 'smart enabled' products for customers, such as 'smart' domestic appliances, is yet to emerge.

Smart metering typically has a strong business case with return on investment in the form of workforce savings, billing accuracy and automation. However, for other smart grid initiatives such as e-mobility, the business case might work at a 'whole system' level but is not sufficient at a 'single player' level. Michael Hurley, PwC's global energy and utilities advisory leader, observes: "Many smart grid projects have benefits for the whole energy system and wider markets and society that don't accrue just to the company making the investment. Frameworks have to be devised so that this investment is appropriately rewarded."

Hurley's point is taken up by Jon Stromsather, Enel's senior smart grid manager: "The business case isn't there as a DSO to do this by ourselves so it won't be possible without the active involvement of the regulators. If not, we are going to be here in 10 years and talking about pilots again." His views are echoed by PG&E's Jim Meadows: "Smart grid is a challenging business case. Smart metering is easy enough because there are a lot of operational savings and a lot of programmes that can now be offered to customers. After that it will be much more of an incremental approach because it is not so obvious how you grow it from here without a more holistic approach. But the backbone is in place – the base to start from."

An area of significant uncertainty is communications and standards. There is great variance in choice of communications technology between Europe and North America. In competitive markets such as the UK, companies face additional risk.

A senior executive from a leading UK utility company in our roundtable commented: "What we are building the meters to withstand is not in our hands because of the competitive nature of the market. It poses a lot of risks and challenges for us. The communications technology will ultimately be decided by the regulator through the creation of a data communications company but, in the meantime, we have to make assumptions."

Mark Coyle of Bglobal, a smart energy infrastructure and information services company, says: "The key thing we realised when rolling out meters is to separate out communications from the meter and make them extensible through easy upgrades without having to change the meter. If you look back at communications 10 years ago, it was a completely different world and it will be a completely different world in a decade from now or even two or three years' time. It is vital to make sure you don't rollout something that would have to be redeployed or even disposed of."

As the smart grid develops, the presence of companies and brands from outside the utilities market is likely to become more visible. Luk Sterckx, CEO of SPE-Luminus, Belgium's second largest gas and electricity utility, says: "If you look at the horizontal level there are very strong interests from the telecoms and online/IT sectors and, potentially, from appliance manufacturers. These parties and interests are going to play a role in a very big battlefield which we have not really seen the beginning of yet." Both Google and Microsoft are active in looking at what can be done with the data, how best to present it and enhance the customer experience.

Stephen Knight, chair of PwC's UK smart metering group, points out: "Smart metering reduces barriers to entry because it simplifies the energy market. This provides an opportunity for specific offers of the kind we are seeing from Google with its energy monitoring tool and, potentially, for actual home energy retailing offers. Brands who have built up trust with customers may be attracted to an energy retail space which will be more automated."

The wider interest in smart meters was evidenced in Spring 2010 when Google joined with 46 other signatories in a letter to urge President Obama to adopt a goal of providing every household with real time information about their electricity use¹. The list of companies signing the letter was dominated by big names from outside the immediate utilities sector including General Electric, Hewlett Packard, Intel, Nokia, Verizon and Whirlpool.

¹ A letter to the President of the United States, The Climate Group, April 2, 2010.

“It doesn’t take that many people to do the right thing on a hot day to make the peak shaving business case pay off.”

Spotlight: California and Italy – smart metering in action



In California, a major part of the drive to rollout smart metering came from the experience of rolling blackouts in 2000 and 2001. Blackouts occurred on summer days when peak load was at its highest and demand exceeded supply. There were ways to interact with commercial customers who drew the heaviest loads by offering them demand programmes but, without smart meters, it was not possible to have a more dynamic way of managing demand from small commercial and residential customers.

The goal of shaving demand on peak days is already being achieved. SmartRate is a tariff that accompanies PG&E’s SmartMeter™ programme. Already there are 25,000 people active in the programme resulting in 16% peak demand savings on critical summer days. Jim Meadows, PG&E’s director, SmartMeter™ field deployment, heads the project management office responsible for delivering the company’s seven year smart meter installation programme. He explains: “SmartRate customers get an energy saving the rest of the time if they can cut their consumption on critical peak days. They get a text, e-mail or phone call a day ahead and know that, if they can find a way to turn the air con off, maybe get out of the house, make it to a movie or the beach, then they will save money.”

The numbers sound small but Meadows points out that “it doesn’t take that many people to do the right thing on a hot day to make the business case pay off. You only need 15% to 20% of people to make it a winning business case.” Peak load shaving is just part of the picture for PG&E’s smart meter rollout. The full implementation will bring substantial savings in meter reading and management costs as well as losses arising from older inaccurate meters. “The operational end game is US\$170 million of savings. Before smart meters, we had a 1,000 strong meter field force and we read every account each month for billing purposes.”

In Italy, Enel is reaping similar substantial rewards from its first mover investment in smart meters and associated network innovations. The company’s investment was made on pure business grounds without any regulatory prompting. Jon Stromsather, Enel’s senior smart grid manager, says: “It has brought huge benefits. We have achieved a dramatic quality of service improvement and a reduction in operating expenditure. On an investment of Euro 2.1 billion we have had estimated annual savings of around Euro 500 million – a payback time of little more than four years.”

Like PG&E, Enel’s opex savings have come from workforce savings. Paolo Scuro, smart grid project manager at Enel, says: “We had 19 million remote activities in 2009 – things such as contract changes, connections, disconnections, reconnections etc. Previously, all of these would have needed a worker in the field if we didn’t have the smart meter system and associated automation. We went from an operational cost of about Euro 80 per customer in 2001 to Euro 49 in 2008, in large part thanks to the Telegestore automatic meter management.” Another benefit has been that smart meters have enabled a more flexible tariff structure, with bi-hourly or flexible tariffs, day and night, peak and non-peak, etc. so that customers can save money and adapt their energy usage to fit supply circumstances.

Enel’s smart meter rollout has been accompanied by parallel programmes covering network automation, workforce management, including all workers with hand-held tablet communications devices, and asset management. Around a quarter of all the company’s secondary substations are now remotely controlled, enabling much earlier interventions to correct faults. Stromsather points to “supply interruptions being cut from 128 minutes in 2001 to 50 minutes in 2008 which, while it is still not comparable with some other countries, is quite good given the state of the network in Italy.”

06 Getting it right

Managing project scale and breadth

The sheer size and complexity of developing smart grids should not be underestimated. It involves integrating renewable energy, enabling distributed energy and planning infrastructure around electric vehicles, to name a few of the elements. The challenges utilities are encountering, if not properly managed, could potentially hobble or derail ambitious, multiyear smart infrastructure build-outs, some estimated at hundreds of millions of dollars.

The challenge for utility companies of managing smart grids is all the greater as, in most cases, smart grid capital expenditures are layered on top of already-expanding capital expenditure budgets. In the US, for example, overall capital investment by the utilities industry is estimated to reach US\$75 billion in 2010, more than double that in 2004 (US\$36 billion), according to one recent survey².

Just the smart meter component of smart grids is a massive undertaking on its own, typically requiring the replacement of many millions of meters. It requires complex technology, supply chain, stakeholder management and organisational change choices along the way. Daryl Walcroft, partner with PwC in San Francisco, is a major capital project management expert. He says “it is so important to treat a smart meter project as a large capital project, with all its attendant governance, supply, stakeholder and public risk, and not just as a technological rollout. There is no doubt that smart meter projects are mega projects. In our experience projects of this size need a different level of control to other projects.”

One participant in our roundtable observed: “it was easy to fall into the trap of it seeming like a meter install project when we first started – worrying about the labour, worrying about the supply chain and the quality of equipment – but you quickly realise there is much, much more. Our project management office (PMO) started off with about 20 people but quadrupled in size to take account of all the controls you need covering things from vendor management to change management.”

In this particular company’s case the PMO is focused on all aspects of the delivery of the capital project – procurement, quality assurance, workforce etc – while wider corporate ownership of the project, and all the attendant implications for organisational change, customer and stakeholder relations, are managed through an operational steering committee. Again, ensuring the scale of change is understood and appreciated at the corporate level as well as the project management level is key to programme success.

It is essential that risk is not just dealt with at the project level but also at the enterprise level. Something that goes wrong with the project could actually affect the whole enterprise. It is essential to flow key project risks up into the enterprise and, if necessary, enterprise level project risks can flow down into the project. Many companies struggle with this. Conceptually it is easy but to actually do it for real can be tough. PwC sees companies that are great at identifying lots and lots of risks but are not so adept at knowing which ones are key and getting the right flows to happen.

² “Capital Expenditure Update”, SNL Energy, Financial Focus, March 25, 2010.

“Organisations that underestimate the scale of these projects risk being in trouble from the start.”

Roundtable take-outs



Project scale and breadth

- Smart meter projects are ‘mega projects’.
- Increased level of complexity and scale requires an enhanced level of control.
- Regulatory environment and public awareness require careful management and consideration.
- Best practice examples and lessons learned can be taken from other sectors (e.g. energy, mining, transportation).
- Think about integrating systems with cost and risk management data, allowing probabilistic analysis, resource analysis and in some cases earned value analysis.
- Consider sophisticated estimate to completion (ETC) models that account for escalation factors and probabilistic inputs, giving realistic upper and lower time and budget forecasts.
- Get the basics right – apply controls and contingency management clearly and consistency across all aspects of the programme.
- Minimise technology risks by making communications extensible, this enables remote upgrades.

08 Getting it right

Thinking about customers from the start

Two way communication lies at the heart of smart grid technology. Its effectiveness, though, relies on such communication translating into behaviour change. Smart grid technology is for nothing if customers do not adopt it and respond to it by consuming electricity in different ways. Future smart devices may enable consumption to be optimised automatically but, even with such technology in place, customers have to be won over and there are many trust and other barriers to overcome along the way.

Indeed, in a media environment where issues such as data privacy and technology malfunctions can grab big headlines, smart grid rollouts have the potential to make or break reputations. The importance of the customer's buy-in to smart metering and the risk of potential reputation impacts mean a strong emphasis must be placed on customer communications right from the start of the project.

The very nature of a smart grid rollout offers a unique customer relationship opportunity as Stephen Knight, chair of PwC's UK smart metering group, observes: "It is a once in a lifetime opportunity to engage with customers but there is a fine line between winning their faith or losing their faith. It provides a face to face communications opportunity that will virtually disappear after that." Q&A and scripts for meter installers plus back-up information materials and dedicated telephone support for customers feature among the steps taken to optimise this opportunity by companies in our roundtable discussion.

It doesn't take a lot of customer complaints or public concern to cause problems. For example, in the Netherlands it didn't take many people to get involved in data privacy issues in a way that has delayed smart grid development by a number of years. As a result, the Netherlands is still facing uncertainty with regards to a full smart meter rollout in the near future.

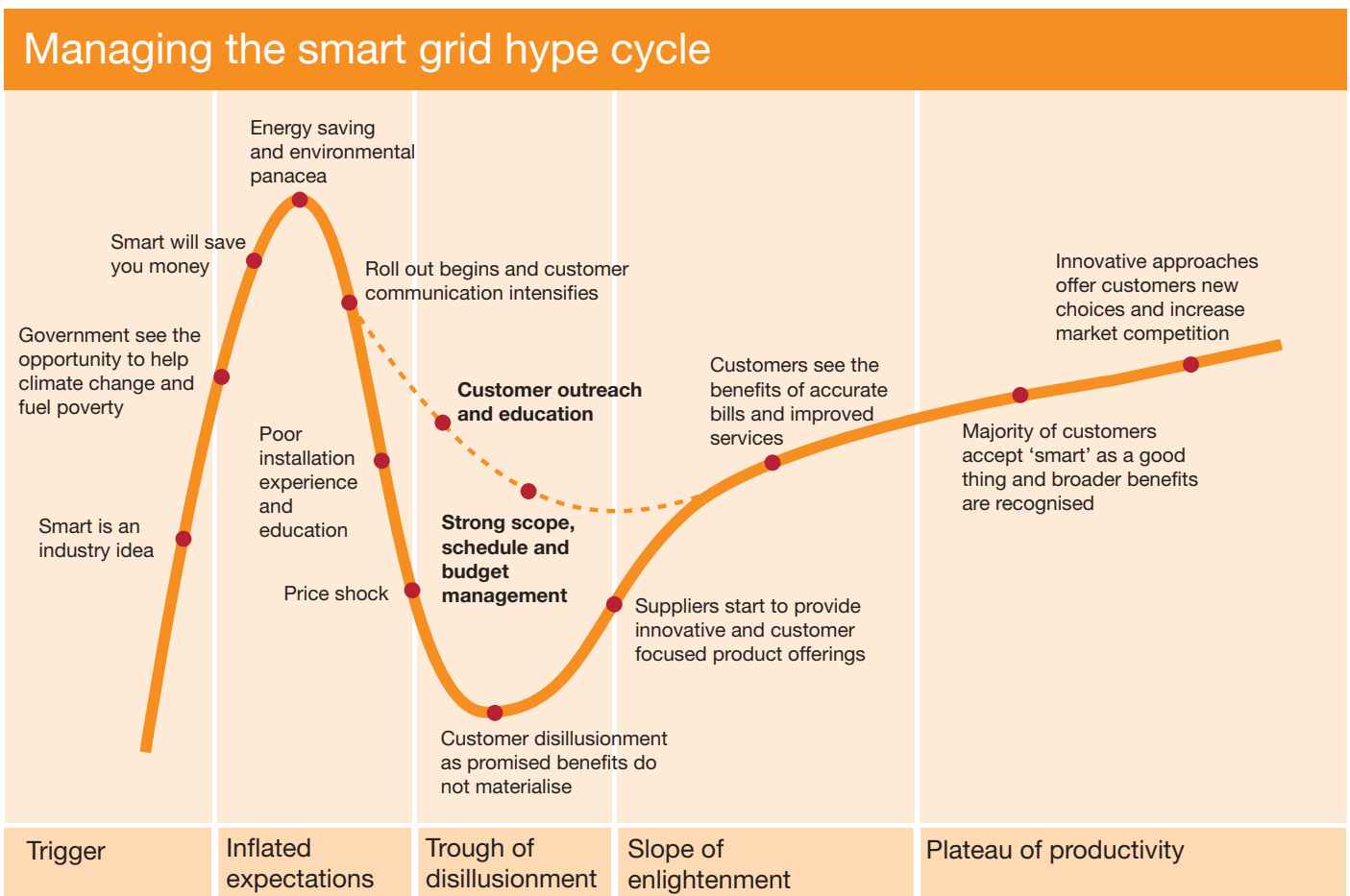
Following pressure group activity and review by the Dutch Data Protection Agency, a law enforcing the rollout of smart meters has been dramatically modified and remains delayed. Law makers and industry found themselves responding to public and political debates on data privacy rather than engaging with such concerns from the start.

Paul van Engelen, senior manager at PwC in the Netherlands, says: "The privacy discussion had a major impact on the smart meter rollout. Currently there are around 300,000 meters in pilot programmes in the field but we could have had a million or more in place by now if privacy had not been an issue. Since the privacy concerns became apparent Dutch grid companies have taken initiatives to develop data privacy and protection policies, a code of conduct and have started open discussions with different stakeholders. If these initiatives had taken place from the inception of the law back in 2005, there would have been a good chance of avoiding the legislative setbacks."

With issues such as data privacy and technology malfunctions able to grab big headlines, smart grid rollouts have the potential to make or break reputations.

Elsewhere, smart meter rollouts have been hindered by some clear 'own goals'. In Australia, for example, critical peak pricing was introduced but information for customers was overlooked with the result that unexpected high bills were then blamed on the smart meter. A similar association of smart meters with high bills occurred in Canada when a new rate plan was introduced at the same time as a smart meter rollout.

Companies need to plan ahead and be mindful of the likelihood that attitudes to smart meters will follow the course of what Knight describes as the 'smart meter hype cycle' (see graph below). They need to balance the need to make customers fully appreciative of the potential that smart meters can offer while also managing expectations, mindful that not all features will be available or accessible immediately. "Seeing things from a customer point of view is essential to getting through the hype cycle as fast as possible and avoiding slipping into a trough where negative issues set in. If that trough delays the upturn by three or four years the benefit case is pretty shot," says Knight



10 Getting it right

Thinking about customers from the start

Once negative attitudes start to appear, they gather momentum and the smart meter can fast become an easy target to blame for all sorts of unrelated things. Participants in our roundtable recounted instances of house fires being blamed on smart meters and customers blaming the meter for being too accurate compared to their previous old meters which might have under-recorded actual consumption. Harmful effects from smart meter radio frequency (RF) emissions were another common scare story even though expert studies showed radio waves from a smart meter, at a distance of 10 feet, are only about one one-thousandth as much as a typical cell phone³.

The intensity of the debate around smart meters in California was such that the California Public Utilities Commission (CPUC) ordered an independent, third-party assessment of PG&E's SmartMeter™ programme. The assessment, published in September 2010, stated that the new meters are recording customer electric usage accurately. It also found that issues that arose early in the programme were limited in scope, were being "appropriately addressed by PG&E" and often reflected factors unrelated to the meters, including higher-than-normal energy usage caused by a heat wave.

The report for the CPUC was the second expert third-party evaluation of advanced metering devices in the US. The previous assessment, conducted for the Texas Public Utilities Commission, concluded that similar utility smart meters were also accurate.

The potential for pressure group activities or a small number of vocal complaints to hinder smart meter rollouts highlights the need for utility companies to have very pro-active communications strategies at the heart of their smart meter programmes. A clear view should be established on how the customer smart meter journey is to be managed. Tight control on the programme and tracking early benefits can be used to build confidence by communicating how well the programme is progressing.

Systems for monitoring customer enquiries and complaints need to be aligned with the rollout so that any emerging problems can be nipped in the bud. Customer and public information programmes should be designed to prevent and counter 'smart meter myths.' Companies that downplay such communications and see such projects in purely operational or technical terms are not only unlikely to gain the full benefits of smart meter consumer behaviour change but also risk reputation damage.

“Companies need to have very pro-active communications strategies at the heart of their smart meter programmes.”

³ <http://www.pge.com/myhome/edusafety/systemworks/rf/>

“Tight control on the programme and tracking early benefits can be used to build confidence by communicating how well the programme is progressing.”

Roundtable take-outs



Thinking about customers from the start

- Begin customer engagement and education early and maintain throughout the rollout.
- Develop a deep understanding of your customers.
- Engage fully with privacy concerns, seek to shape the regulatory context and develop policies that make it clear how data is used and what it can't be used for.
- Approach installation as an opportunity to improve customer engagement.
- Invest in strong project management and complaint monitoring.
- Have a clear customer journey in which expectations are managed by being explicit about the steps that need to be taken before the final destination is reached.
- Develop clear and compelling smart pricing to match smart meter capabilities.
- Examine ways to ensure that the advantages of smart meters are distinctive and don't get blurred by other market changes or events that might be taking place.
- Seek to own the communications space by ensuring that the full facts about smart meters and smart grids are pro-actively communicated and avoid the danger of letting others fill a communications vacuum.

12 Getting it right

Working through the ‘whole organisation’ implications

Harnessing the full benefits of smart meter and smart grid programmes entails significant organisational change as well as different ways of working and thinking within utility companies. Smart meters, for example, have obvious implications for the size of the field force and the way utility companies approach the customer relationship. Existing systems and data need to be cleaned up and modernised to be smart grid ready. Utility companies have to be ahead of the curve on issues such as cyber security and data processing and, as smart grids and home energy innovations develop, the very role of utility companies needs to evolve into that of a home energy and clean energy ‘systems integrator’.

PG&E’s Jim Meadows is in no doubt of the importance of working through the implications for the whole organisation of smart meters. “You need buy-in and total commitment of your whole company before you start because it will touch every aspect of the operation of the utility,” says Meadows. “There is no stone unturned. All the vice presidents that run the different divisions have a stake and are ready to support the programme. We have directors from all areas of the utility on our operational steering committee, so they know what the plan is, can input their perspective and weigh up the implications for the new programmes that need to be rolled out.”

It is important for companies to have top level project sponsorship for their smart meter programmes. If it is not from the CEO, it needs to be jointly from the range of senior executives, such as the chief customer officer, regulatory officer and chief information officer, whose involvement is mission-critical. In one sense, every single employee is involved as all employees have to understand the rollout and be ambassadors for it. More directly, in terms of the way people do their jobs, many people’s jobs will change.

Job losses are inherent to realising the business benefits of smart meters as the meter reading workforce is no longer needed. At the same time, companies will need to strengthen the workforce in certain areas, particularly information and communications technology (ICT). Enel’s Jon Stromsather says: “We had no big layoffs - it has been natural turnover or people retiring. There has also been a lot of re-educating people as we become more ICT focused and, indeed, struggle to find the right people. It is not only energy anymore, it is ICT. So it has been a big change not only in numbers but also in terms of workforce capability.”

“It has been a big change not only in numbers but also in terms of workforce capability.”

“There is no stone unturned. All the vice presidents that run the different divisions have a stake and are ready to support the programme.”

Roundtable take-outs



Working through the ‘whole organisation’ implications

- Ensure the programme sponsorship is high-level enough to gain buy-in and deliver change across the whole organisation.
- Begin planning early and set smart meter rollout in the context of the wider automation, clean energy and customer relationship journey that you see yourself on.
- Think through the implications for the part that your company plays in the marketplace and what your emerging role as an integrator of clean energy generation and home energy management systems means for business, customer and stakeholder relationships.
- Engage with the workforce and trade unions early and plan opportunities for natural wastage, redeployment and new skills development.
- Examine the implications for cultural change, particularly in how you think about the customer relationship, embrace issues such as cyber security and privacy and what real time automation will mean for your employees.
- Address skill shortages or existing data or system shortfalls early so that you are not caught out in ways that endanger your programme.

14 Getting it right

Checklist

- 1** Are you recognising the scale and reach of your smart grid rollout and matching that with an appropriate capital project planning, risk and governance framework?
- 2** How far ahead of time are you planning? Have you considered the advantages of techniques such as 'front end loading' using a stage-gate process to plan more fully and robustly early on?
- 3** Do you have strong and realistic understanding of the concerns of customers and the wider public right from the start and are you addressing this in your project plans and communications?
- 4** Are you influencing and shaping the regulatory framework in a way that will optimise smart grid development? Are you addressing the data privacy and security aspects of policy as well as the energy regulatory context?
- 5** How are you addressing technological risk? How 'future proofed' are your technological choices and have you got the right arrangements in place with suppliers and partners to maximise your smart grid benefits?
- 6** Is your customer journey clear? Are you making the most of the opportunity given by smart meter rollout?
- 7** Are you developing innovative smart pricing offers and taking particular steps to make sure your customers' early experience of smart meters is positive and not undermined by price hikes or other shocks?
- 8** Do you have a pro-active communications strategy to get the facts across about smart meters and dispel the myths?
- 9** Are you matching smart grid change with parallel 'whole organisation' change? Do you have the right mechanisms to get buy-in and deliver change across the organisation?
- 10** Are you thinking through the implications of your emerging role as an integrator of clean energy generation and home energy management systems for your business, customer and stakeholder relationships and your positioning in the marketplace?

Global Contacts

Manfred Wiegand

Global Utilities Leader

+49 201 438 1517

manfred.wiegand@de.pwc.com

Michael Hurley

Global Energy, Utilities & Mining Advisory Leader

+44 20 7804 4465

michael.hurley@uk.pwc.com

Territory Contacts

Africa

Mark Ally

+27 11 797 5049

mark.ally@za.pwc.com

Jan Gey van Pittius

+27 11 797 5331

jan.gey.van.pittius@za.pwc.com

Australasia

Brian Gillespie

+61 7 3257 5656

brian.gillespie@au.pwc.com

Darren Smith

+618 9238 3240

darren.a.smith@au.pwc.com

Harry Koller

+612 8266 8761

harry.koller@au.pwc.com

Austria

Gerhard Prachner

+43 1 501 88 1800

gerhard.prachner@at.pwc.com

Erwin Smole

+43 1 501 88 2928

erwin.smole@at.pwc.com

Bernhard Haider

+43 1 501 88 2900

bernhard.haider@at.pwc.com

Belgium

Bernard Gabriels

+32 3 259 3304

bernard.gabriels@be.pwc.com

Canada

Penny Rae

+1 403 509 6371

penny.rae@ca.pwc.com

Brian Pawluck

+1 604 806 7581

brian.k.pawluck@ca.pwc.com

Janet Rieksts-Alderman

+1 506 653 9459

janet.a.rieksts-alderman@ca.pwc.com

China

Gavin Chui

+86 10 6533 2188

gavin.chui@cn.pwc.com

Hongbin Cong

+86 10 6533 2667

hongbin.cong@cn.pwc.com

Denmark

Per Timmermann

+45 3945 3945

per.timmermann@dk.pwc.com

Finland

Juha Tuomala

+358 9 22 801 451

juha.tuomala@fi.pwc.com

France

Philippe Girault

+33 1 5657 8897

philippe.girault@fr.pwc.com

Germany

Ralf Kurtz

+49 211 981 4812

ralf.kurtz@de.pwc.com

Christian Hahn

+49 30 2636 1226

christian.hahn@de.pwc.com

16 Contacts

Greece

Socrates Leptos-Bourgi
+30 210 687 4693
socrates.leptos.-bourgi@gr.pwc.com

India

Kameswara Rao
+91 40 2330 0750
kameswara.rao@in.pwc.com

Ireland

Denis O'Connor
+353 1 792 6288
denis.g.oconnor@ir.pwc.com

Italy

Giovanni Poggio
+390 6 57025 2588
giovanni.poggio@it.pwc.com

Latin America

Jorge Bacher
+54 11 5811 6952
jorge.c.bacher@ar.pwc.com

Argentina

Marcelo Iezzi
+54 11 4850 6816
marcelo.liezzi@ar.pwc.com

Brazil

Guilherme Valle
+55 11 3674 2469
guilherme.valle@br.pwc.com

Chile

Rafael Ruano
+56 2 940 0181
rafael.ruano@cl.pwc.com

Middle East

Ismail Maraqa
+962 6 585217
ismail.maraqa@jo.pwc.com

Netherlands

Jeroen van Hoof
+31 088 792 1328
jeroen.van.hoof@nl.pwc.com

New Zealand

Craig Rice
+64 9 355 8641
craig.rice@nz.pwc.com

Norway

Ole Schei Martinsen
+47 95 26 11 62
ole.martinsen@no.pwc.com

Ståle Johansen

+47 9526 0476
staale.johansen@no.pwc.com

Russia & Central and Eastern Europe

Dave Gray
+7 495 967 6311
dave.gray@ru.pwc.com

John Wilkinson

+7 495 967 6187
john.wilkinson@ru.pwc.com

Singapore

Paul Cornelius
+65 6236 3718
paul.cornelius@sg.pwc.com

Spain

Gonzalo Sanchez Martinez
+34 946 022 534
gonzalo.sanchez@es.pwc.com

Sweden

Martin Gavelius
+ 46 8 555 335 29
martin.gavelius@se.pwc.com

Switzerland

Ralf Schlaepfer
+41 58 792 1620
ralf.schlaepfer@ch.pwc.com

United Kingdom

Anthony Morgan
+44 20 7213 4178
anthony.j.morgan@uk.pwc.com

Qadir Marikar
+44 20 7213 2165
qadir.marikar@uk.pwc.com

Steve Randle
+44 20 7213 3652
steve.randle@uk.pwc.com

Duncan Michie
+44 20 7804 7394
duncan.michie@uk.pwc.com

Stephen Knight
+44 20 7212 3427
stephen.p.knight@uk.pwc.com

Dennis Mahoney
+44 (0) 20 7212 1664
dennis.mahoney@uk.pwc.com

Ross Hunter
+44 20 7804 4326
ross.hunter@uk.pwc.com

United States

Stephen Lechner
+1 415 498 6596
stephen.p.lechner@us.pwc.com

Daryl Walcroft
+1 415 498 6512
daryl.walcroft@us.pwc.com

Matthew Labovich
+1 703 918 3649
matthew.labovich@us.pwc.com

Further information

Olesya Hatop
Global Energy, Utilities & Mining Marketing
+49 201 438 1431
olesya.hatop@de.pwc.com

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