

A comprehensive view of
the strategies, priorities,
drivers and challenges for
Great Britain's smart grid
adoption



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FOREWORD

Smart grid challenges for electricity distribution businesses

This report is based on an in-depth survey carried out by Logica consultants with key executives within the network businesses in Britain. The study is not a vision of how smart grids should be implemented in Britain. Neither does it provide new insights into the benefits or business case (real or otherwise) for the smart grid. Uniquely, this study focuses on the current maturity of thinking, organisation and capabilities in our electricity networks businesses. How ready are they for the smart grid? And how do they feel about the challenges ahead?

The key questions addressed by the survey are:

- What is the smart grid strategy for key players in the UK?
- What are the drivers for investing in smart grids, now and in the medium to long term?
- What are the key challenges in relation to smart grids?

Competitive markets around the world have delivered lower costs to customers and efficiencies across the energy industries. In many of these markets Logica has led the way in the development of deregulation strategy, business IT strategy, systems development, systems integration and managed service operation for the energy sector. Our involvement in British energy market deregulation began over 20 years ago. Today we remain at the heart of this market, providing new solutions and mission critical services.

Our track record in delivery and as a thought leader gives Logica a unique position to drive the smart grid debate forward. The increasing activity in the sector in the US and globally will soon be ready to be replicated in Britain. We need to be poised to make sure that Britain can realise the maximum benefit of this exciting new development.

To do this we need to understand the lessons learnt so far and the challenges we need to tackle in the future to execute the smart grid vision for Britain. To fulfil this need Logica went to the experts - the industry leaders charged with delivering the advantages of a smart grid to Britain. Each participant company offered one or more interviewees who gave a series of views directly relevant to their own business. While many of the participants also add their considerable knowledge to respected industry bodies such as the Electricity Networks Strategy Group (ENSG), this survey reflects a different view – that of the individual electricity networks businesses, not the collective vision of a strategy group. As such, opinions recorded sometimes align with published industry views, but equally often diverge.



Six of the eight major electricity transmission and distribution network businesses in Britain participated in the survey. We would like to take this opportunity to thank the executives from the following companies for their time and views that helped us put this survey together:

CE Electric UK

E.ON Central Networks

EDF Energy Networks

Electricity North West Limited

National Grid

Scottish Power

How do we define smart grids?

For a definition of smart grids from a British context we will consider the smart grid work from ENSG (Electricity Networks Strategy Group), DECC (Department of Energy and Climate Change) and Ofgem (Office of Gas and Electricity Markets) have asked the ENSG to produce a high level vision of what a UK smart grid might look like; the challenges it would help address, and a route map for delivery of this vision. According to the terms of reference for the ENSG smart grid working group:

'Smart grid' is not a precisely defined concept - it is unclear what it practically means to have 'smart grid' capability in Britain. The European Technology Platform for smart grids has published a definition that is focused on the benefits that a smart grid is expected to deliver. This is as follows:

A smart grid is an electricity network that can intelligently integrate the actions of all users connected to it - generators, consumers and those that do both - in order to efficiently deliver sustainable, economic and secure electricity supplies.

A smart grid employs innovative products and services together with intelligent monitoring, control, communication, and self-healing technologies to:

- better facilitate the connection and operation of generators of all sizes and technologies
- allow electricity consumers to play a part in optimising the operation of the system; provide consumers with greater information and choice of supply
- significantly reduce the environmental impact of the total electricity supply system
- deliver enhanced levels of reliability and security of supply.



EXECUTIVE SUMMARY

Globally, the energy and utilities industry is experiencing the most significant period of investment it has ever known. This is fuelled not only by the rapid rise of the developing nations, where energy infrastructure development has become a priority to support the booming economy, but also by the need to replace now aging infrastructure in the developed world.

The British energy sector is poised for a quantum leap within the medium to long term. The imminent introduction of smart metering has initiated a wave of reforms across the industry and, following on from similar developments worldwide, the network businesses in Britain are now considering the forthcoming development of smart grids.

This survey was undertaken to assess the current maturity of smart grids (or, more accurately, smart grid strategies) in the British electricity distribution sector and the drivers and challenges faced in its development. The survey highlighted 3 key elements of the smart grid evolution in the UK:

The regulatory environment is the single biggest driver for influencing any transformation. The electricity distribution businesses are regulated natural monopolies owned by investors who consider them a source of safe long-term returns. In such an environment, real

business change will not happen by itself. It must be driven by catalytic measures from the regulator and even then, should lead to a safe, predictable ROI. The respondents to the survey were keen to emphasise the amount of influence the regulator has over their businesses and how an appropriate regulatory regime is essential to influence the development of their strategies and investment decisions towards smart grids.

Smart metering and smart grid programmes are inseparable. It is true that smart metering has been the initial driver for industry change here, if not in other countries. As a concept, in Britain smart grid has been very much the latecomer to the party. Most of the respondents recognised this but echoed the interdependency of both projects. The key message from this discussion was the significant overlap across the programmes and the need to carefully orchestrate resources and plans in order to harness the maximum possible benefit for Britain.

The current **key drivers** that respondents believe will influence the business case for smart grids include capital avoidance, reducing network operating costs and better planning and management of load. Their view of the future drivers shows that demand side management, management of capacity change and management of

load from new technologies like renewables and electric vehicles will take the majority of attention. The responses show the opinion that only in the medium to long term will there be genuinely new drivers dictating the evolution of the grid.

We believe that this survey will help establish a baseline for smart grid readiness in Britain and will provide food for thought to key stakeholders towards ensuring continued development and transformation of the energy networks sector.



SURVEY FRAMEWORK

1. Describe your organisation's smart grid strategy? Would you say you have one?
2. What are the common drivers that will influence/have influenced the business case for the smart grid – or smart grid technologies? Rate each one in importance for your business where 1 is least important and 5 is most important. Indicate their importance in years to come.
3. What are your expectations of smart grids in terms of addressing your key drivers? Do you think they will improve - and by how much?
4. What do you see as the key challenges in relation to smart grids?
5. What investment do you think needs to be made for your organisation's smart grid strategy?
6. Do you have any current regulatory allocations for smart grid?
7. Do you have an overall budget for smart grid? If yes, what?
8. Which of your smart grid projects do you have funding for? e.g. Pilots?
9. How will your organisation be structured to undertake the smart grid evolution?
10. Have you considered KPIs regarding moving towards the development of a smart grid? If yes, what are they?
11. Do you have an overall smart grid timeline and project plan or timelines for individual projects?
12. What projects are being undertaken first to move towards a smart grid and what is their maturity?
13. Do you see smart metering and smart grids as independent projects?
14. Are you looking internationally for guidance and advice? If so, where? List other companies you are drawing advice from?
15. Have you seen any examples of demonstrable business case benefits through the implementation of any smart grid projects – including smart metering?
16. Have you seen anything in the market at the moment that has impressed you regarding smart grids, such as demos, presentations, papers etc?
17. How important is it for your company to include business case benefits in your smart grid strategy? On a scale of 1-5 where 5 is the most important.



1 FINDINGS SUMMARY

- There were several key challenges identified by the respondents in relation to smart grids. The most important was the development of an appropriate regulatory regime and commercial framework. Other challenges included agreeing the technological standards, operational challenges and concerns over skills and resourcing.
- The study found British DNOs distributed across a wide spectrum of strategy development with respect to smart grids. More often than not, the DNO's current status was a reflection of the activities going on in their associated businesses across the corporate parent. Most respondents had started developing smart grid strategy in some shape or form.
- Current key drivers that will influence the business case for smart grids include capital avoidance, reducing network operating costs, and better planning and management of load.
- The respondents' view of the future drivers was the key towards understanding expectations from smart grids in the future where demand side management, management of capacity change and management of load from new technologies like renewables and electric vehicles will take the majority of their attention. This signals how the participants felt the grid will evolve and how there will be new drivers dictating the evolution of the grid to better serve the needs of Britain in 2020.
- The responses to the investment needed echoed the status of various strategies. Some organisations had clearer ideas of the gaps and the investments needed to fill them. There were some DNOs looking to identify the gaps and being mindful of them in their current investments. The other end of the spectrum also saw DNOs predicting no immediate funding requirement in the current price control period.
- With smart grid being in a fledgling state currently, most organisations surveyed had different views on their future organisation structure. This was also influenced by their current structure and approach towards embracing new and innovative technologies.
- Most organisations have not yet made budgetary provisions for the development of smart grids and associated technologies. The organisations surveyed were keenly anticipating LCNF funding and some organisations indicated that the LCN funds would help them set up dedicated teams for smart grid related projects.
- Most respondents opined that smart metering and smart grids should not be separate projects as there is a huge amount of interdependency. Most of them however did recognise that their development so far has been disjointed, but that a big opportunity will be missed if these programmes are not aligned and better coordinated.
- Most respondents have been looking out for, and have come across several business cases for smart grid development. The majority of the respondents doubted if the business cases were compelling enough to proceed with investment without (further) significant regulatory intervention. It was also argued that often the qualitative benefits like social and environmental benefits are not included in the business case.
- Most respondents have not seen anything in the world of smart grids that has been truly impressive.



2 RESPONSES

2.1 Strategy

Q1. Describe your organisation's smart grid strategy? Would you say you have one?

A key observation was that the smart grid strategies of the organisations surveyed were heavily influenced by the evolving regulatory and industry landscape. Those organisations that are part of global utility giants were at times ahead of the others with respect to their understanding and reaction to the emergence of the smart grid. Several organisations have already been undertaking aspects of what might be considered 'smart' for some time now. These disparate pieces coupled with the maturing strategies, market and regulatory framework will in time lead to organisations well placed to develop and deliver the smart grid revolution.

The study found British DNOs distributed across a wide spectrum of strategy development. More often than not, a DNO's current state was a reflection of the activities going on in their associated businesses across the corporate parent.

One of the key drivers in Britain for companies to be considering a smart grid strategy has been the announcement of the LCNF. In the final proposals of the Distribution Price Control Review (DPCR5), Ofgem proposed a £500m Low Carbon Networks Fund (LCNF) to encourage the network operators to use the DPCR5 period (1 April 2010 to 31 March 2015) to deploy new technology, operating and commercial arrangements to facilitate low carbon energy.

The most advanced organisation on the spectrum mentioned having an "evolving strategy, quite advanced but not a completely finished product yet". This organisation has been actively involved with development of the ENSG's report on the smart grid road map. They have also been monitoring the regulatory developments and believe they have a fair view of how the LCN funding will further influence their smart grid strategy and decisions for the future.

Another organisation was satisfied with their strategic position with regards to smart grids and claimed to have "lots of pieces in place" to develop a roadmap for their organisation. They have been working to put together ideas on the definition of functionality required and have brainstormed lighthouse projects and their characteristics. They also had a clear timetable for these processes to be introduced into the business for the ultimate benefit of their customers. They also said a lot of technical work had been done in preparation of actual groundwork and they were in key discussions with partners for a route to implementation of these lighthouse projects.

One DNO mentioned that key elements of 'smart grid', as we know it today have been in place in their strategies and roadmaps for a while now. This also implied that whilst the strategy existed disparately within the business, renewed focus should be able to bring these together to form a clear and concise smart grid strategy and road map for the organisation. The key driver for them was to 'connect and manage'. The key question being can the network effectively control and manage generation and load?

"Our Network Controllable Points programme has been a clear strategy for 4-5 years, improving QoS and CI / CML. We participate in the RPZs. We've installed a prototype dynamic thermal rating project."

One DNO was a bit sceptical about the smart grid revolution. Their opinion was that between 2010 and 2020 there will be a tremendous increase in distributed generation connected to the grid – but that this can be managed by technological innovation and developing engineering standards already underway on the current network. For transformation towards utopian smart grids, they stated that there were conflicting drivers, particularly due to the current market structure. These coupled with the (apparent) lack of incentives, provision of coherent set of regulations and drivers, was making the business case for smart grids very challenging.



“In other parts of the world with a government-led single company, things are a lot easier. One major blocker in this country - our split businesses - mean that drivers are external. There are 3 areas to consider: technical, operational (i.e. who is balancing?), and commercial.”

Supporting the conflicting drivers mentioned above, one of the smaller DNO organisations admitted a lack of smart grid strategy. They did recognise the challenges posed by this new technology but had not yet come to a suitable definition and identity for the task at hand. They clearly recognised the leading driver for smart grid innovation as the need to reduce carbon emissions. They also mentioned that smart customers and smart grid went hand in hand and supply and demand needed to be balanced right across the grid. They were looking for regulatory intervention and guidelines so that consensus could be reached on techniques and technologies to ensure effective industry and customer participation. It was also mentioned that

the network in its current state is capable of handling the impact of the forecasted take-up in electric vehicles in the short and perhaps the medium term. The long term prospects were also still debatable, as much is still unclear, especially around customer behaviour to understand predicted demand.

“There’s a challenge in Britain as customer demands are relatively modest on a world scale. We don’t have the large heating or aircon demand that other countries have. And we’re probably a good 10 years away from [significant levels of] electric cars.”

A system operator organisation in Britain admitted to being ‘extremely interested observers’ of the progress of the smart grid. They said their strategy could not be classed as a smart strategy but their overall business strategy had elements that could come under the smart umbrella. Their interest in the evolution of grid was due to the direct impacts on their business:

- Market balancing - how effectively will market participants self balance
- System operator access to balancing services through demand side management
- Dealing with more active distribution networks, plus more variables from more active parties
- Network optimisation - how to utilise assets to best balance primary asset investment with automation and complexity to drive assets harder e.g. use of FACTS
- New technologies that could affect system and demand behaviour e.g. electric vehicles and heat pumps
- Efficient and secure integration of intermittent and distribution connected generation into the UKs generation mix.

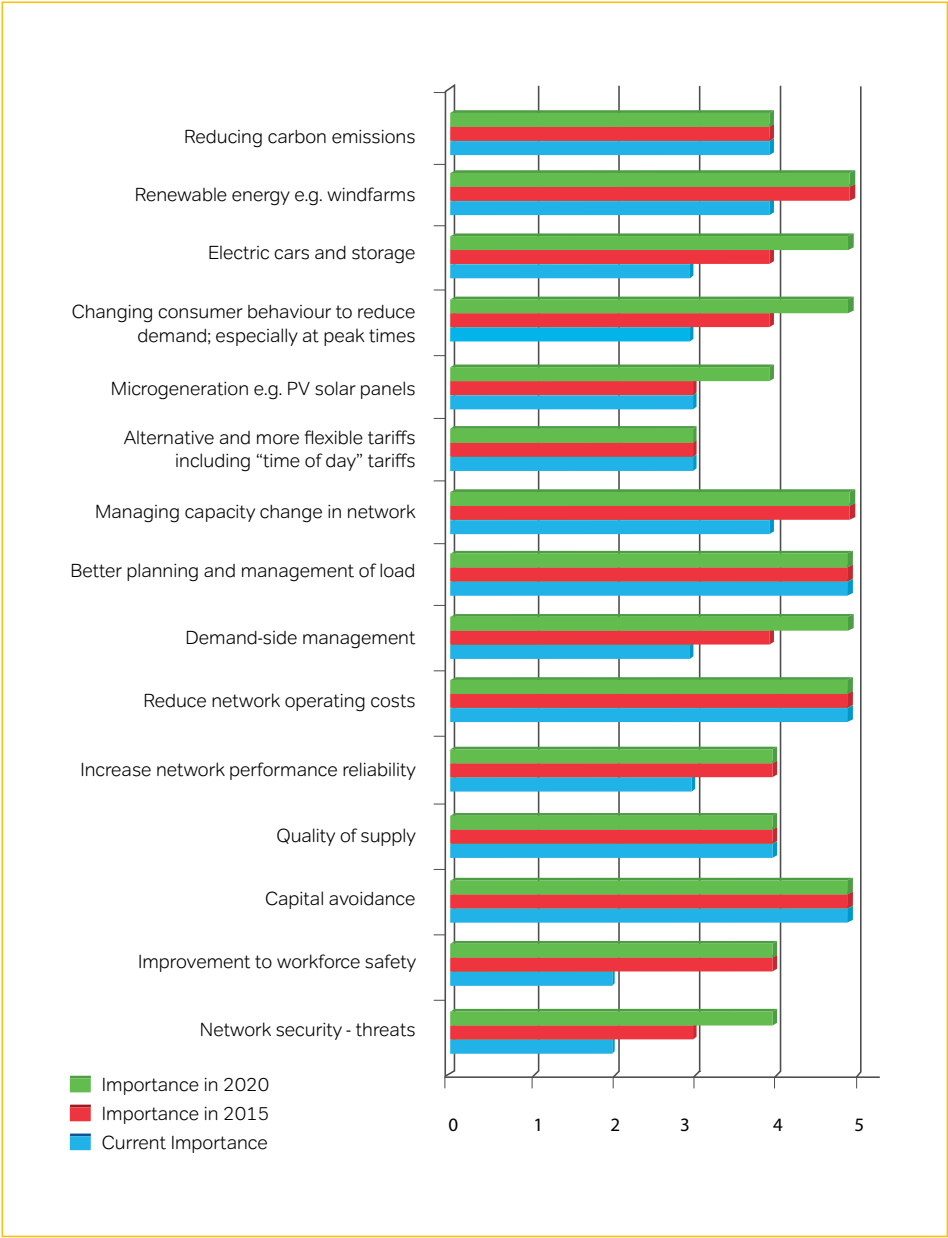
“From a smart perspective, our main challenge is: how do we operate in an intermittent world?”



2.2 Drivers

Q2. What are the common drivers that will influence/have influenced the business case for the smart grid – or smart grid technologies? Rate each one in importance for your business where 1 is least important and 5 is most important. Indicate their importance in years to come.

A selection of criteria were given to respondents and they were asked to rate them on a numerical basis from zero to five, with five being most important. The following graph shows their rated importance in the current time frame and projected out to the year 2020.



Network security – threats

The response to this driver was fairly split across the respondents. Whilst the majority of them scored this low, some of them acknowledged that it is an active point of discussion and might acquire greater prominence in the future.

Improvement to workforce safety

It was widely stated that workforce safety is paramount to the network businesses currently. Safety therefore, was considered as less of a driver for smart grids specifically. Like the previous driver, this one was scored low by the majority of the respondents except one who admitted this being a high priority due to their current, higher than usual focus on workforce safety.

Capital avoidance

This particular driver scored 'high' with almost all of the respondents. The key message we received included the fact that there is always a drive to outperform the regulatory settlement for the DNO businesses. But while a real focus area, not every respondent agreed that capital avoidance was a given.

"[There is] always a drive to outperform the regulatory settlement. But we can deliver real benefits via smart meters, not just take a cynical view."

"If we try to look at the economics, how much can be avoided by shifting demand? Also, capital avoidance business cases fail to take into account the needs of matching minute by minute. This could need more network rather than less. Broadly speaking, we could still be avoiding building new generation. It's much cheaper to reinforce than build generation."

Quality of supply

This driver was a relatively immediate and high priority for some DNOs and the others perceived it as a medium to fairly important driver for influencing the business case for a smart grid.

Increase network performance reliability

This driver scored modestly among most respondents. One key DNO organisation however pointed out that this driver was immediate and high in influencing their business for a smart grid business case.

Reduce network operating costs

The influence of this particular driver is illustrated by the quote we received from a respondent who described it as *"a close second to safety as a major focus."*

This was echoed by almost all respondents who stated that this was an immediate and highly influential driver towards any potential smart grid adoption.

Demand-side management

The general consensus amongst the respondents was that although this is not a very strong driver today, it will increase in prominence with time and could become the most important driver for smart grids and future network developments.

Better planning and management of load

The response to this driver was a reflection of the current capability and expectations from future with respect to planning and load management. Whilst the majority of respondents acknowledged this driver as being of more importance in the medium to long term, one key DNO reflected that they were very happy with their current modelling and planning / management ability which could be interpreted as this not being such an important driver for them.

Managing capacity change in network

This driver was universally recognised as being at the top of the agenda whilst talking about any new development with the grid. It was also pointed out that this driver will be very much key in the medium to long term future.

Alternative and more flexible tariffs including 'time of day' tariffs

It was generally appreciated that according to the current evolutionary roadmap for the industry, DNOs will have a greater interaction with electricity suppliers (and their customers). Therefore, the commercial needs of the supply businesses and the network performance needs of the DNO businesses will need to be managed amicably to ensure that there are no conflicts. However, from a purely DNO point of view it was argued that the emphasis was on demand side management rather than tariffs.

"From the DNO view, [it is] more about taking consumers out of the equation and interacting with devices."

Microgeneration e.g. PV solar panels

The advent of microgeneration devices and their impact on future decisions relating to the grid were not understood to be very high. The majority of respondents were happy with their ability to cope with the current demand and some increased demand in the future. It was also noted that the regulator's decision on feed-in tariffs might give a boost to microgeneration installations to the extent that in future microgeneration could become an 'interesting' driver.

Changing consumer behaviour to reduce demand; especially at peak times

This driver was scored in line with demand side management. There was consensus amongst the respondents that this driver will increase in importance with time. An interesting observation was made by a respondent who said that this needs to be made easier and that currently there is no conscious effort by the customer to achieve demand reduction.

Another key observation was the differentiation between tariffs and demand side management. Whilst both are aimed at altering customer energy consumption, DNOs recognise that traditional supplier and DNO requirements could conflict and that this is something that must be considered and resolved.

Electric cars and storage

The respondents acknowledged the growing trend towards electric vehicles (though not necessarily in the short-term).

There were some key behavioural questions around charging times etc, that will need to be answered when these cars become a reality. The respondents therefore rated this trend as one having increasing importance in the medium to long term.

Renewable energy, e.g. wind farms

Depending on their locations, the DNOs rated this driver as high or very high. Almost all respondents agreed that this was a driver that will only grow in its importance with the passage of time.

Reducing carbon emissions

Barring one exception, all the respondents said that their respective organisations were very passionate about reducing carbon emissions and that this priority was filtered right down across the organisation. They also opined that this driver will maintain its strength over time.

Key drivers summary

The current key drivers that respondents believe will influence the business case for smart grids include capital avoidance, reducing network operating costs and better planning and management of load.

The respondents' view of future drivers shows that demand side management, management of capacity change and management of load from new technologies like renewables and electric vehicles will take the majority of their attention. This signals how the participants felt the drivers for the smart grid will evolve, from a relatively traditional base of doing things better / cheaper in the short term to genuinely responding to new challenges later. Responses show the opinion that only in the medium to long term will there be genuinely new drivers dictating the evolution of the grid.



2.3 Expectations

Q3. What are your expectations of smart grids in terms of addressing your key drivers? Do you think they will improve and by how much?

The responses to this question provided useful insights into the current drivers for the electricity networks businesses and how (or indeed if) they see the advent of the smart grid helping to address these. One key factor understood was that by their very nature, these businesses are heavily reliant on regulatory influences to drive investment and innovations. As such, their current business drivers are

becoming, and will continue to become, inextricably linked with smart grids, if regulation drives them to this conclusion.

In the short term most DNOs opined that there were no expectations of smart grids helping to address their current drivers.

“In DPCR5 overall it depends on what the incentives are. If it were not for the funds Ofgem have allocated, we would have focused on maximising what we got from the existing incentives.”

In the medium to long term however, several key measures/drivers were indicated by a few key DNO respondents,

which can be addressed by implementation of smart grids. These drivers were:

- Maintaining network performance while optimising reinforcement
- Managing the impact of microgeneration and feed-in tariffs
- Reduction of carbon emissions
- Security of supply
- Network diagnostics.



2.4 Key challenges

Q4. What do you see as the key challenges in relation to smart grids?

As expected this question received significant input from the respondents and it laid out the tests facing smart grid development and adoption in Britain. There were clear themes emerging from the responses, which have been grouped below to provide clarity on these important issues.

Regulatory and commercial frameworks:

One of the first things to be brought up in the conversation was the regulatory and commercial framework. Some respondents were concerned whether the current industry structure was the right one to encourage innovation and development of smart grids. Many considered that existing licence defined roles within the industry will evolve in response to the challenges of greater demand side participation, increased level of distribution network connected generation, changes to electricity demand (e.g. from heat pumps and electric vehicles) and large scale intermittent generation. The role of the distribution networks is likely to change and their interface with suppliers, ESCOs and the system operator will need to become stronger. The majority of the respondents opined that there was not enough clarity on the long term commercial drivers for smart grids. There were questions raised around the (lack of) incentives in place to encourage development - and some respondents doubted the effectiveness of LCNF, suggesting that it could be a barrier and instead of encouraging collaboration might encourage competitive behaviour.

“Defining and agreeing the basics – we need to define the role for suppliers, DNOs, generators, ESCOs and system operators.”

“Things won’t happen until the right incentives are in place.”

“Extremely competitive businesses (such as in energy supply) just don’t have the money to innovate.”

Customer involvement:

A number of participants discussed the fact that the smart grid is a difficult concept for customers and one that, if represented inappropriately, could be seen as an expensive and unnecessary investment.

“What is it that will make people want smart grids?”

“There is a big danger that we leave them [customers] behind. We have got to win hearts and minds!”

Technical aspects:

The need to agree technical standards was considered paramount before even talking about major roll outs. The majority felt that standards needed to be defined for meters, integration, interoperability and data sets. Some respondents also pointed out the need to agree standards for a communications backbone that took into account all requirements for accessibility for network businesses.

Operational aspects:

Managing the network is an operational business and many concerns were raised around the operational aspects of the smart grid, particularly around demand side management and system balancing. Concerns were raised about the lack of clarity around the future role of system operators around the network operations of the smart grid.

“How will intermittency in the system be managed? Who will be responsible for transactions? It’s hard to say what

ordinary economic activity will do to network needs.”

“What if there is real penetration of battery vehicles in 10-15 years’ time? It’s reasonable to consider demand side response to manage these [charging needs].”

“What is National Grid’s system operator role?”

“Does the current transmission SO extend its system operation down (ultimately down to the end customer)? We’re trying to find the right answer, not protect our interests.”

The nature and likely increase in volume of distribution connected generation and flexible demand are likely to drive the emergence of the distribution system operator and require the system operator and distribution network roles to be considered in the context of delivering the required network infrastructure and control to underpin the energy needs of the UK in an affordable, secure and sustainable way. The need, timing and extent of any changes are uncertain given the uncertainty over many of the driving factors.

Skills and resourcing:

One of the biggest challenges facing the entire utilities industry was also dominant in discussions around smart grid. The key skill gaps were identified in the traditional area of engineering, but also in areas such as commercial relationships, customer interaction and regulation and legal. One respondent echoed the general consensus by stating that DNOs have a huge challenge in succession planning and the current age profile of staff meant that the industry will be rapidly losing the services of key personnel, making the skills gap even bigger in times to come.

2.5 Investment

Q5. What investment do you think needs to be made for your organisation's smart grid strategy?

The responses to the investment needed echoed the state of various strategies as discussed during Q1. Some organisations had clearer ideas of the gaps and the investments needed to fill them. There were some network businesses looking to identify the gaps and being mindful of them in their current investments. The other end of the spectrum also saw DNOs predicting no immediate funding requirements (over LCNF) in the next 5 years.

One organisation with satisfactory strategic positioning in terms of smart grid identified key investments needed in **people and skills**. They emphasised that this needed to happen outside of the current regulatory incentive scheme. They also had an understanding of certain gaps that needed to be filled via partnerships. Their view was that such developments should be aimed at design, control, asset management and GIS needs for the organisation in 2025. They also opined that network control and design would need to come together.

“There isn't the critical mass left in the industry to create these clever solutions.”

Another key electricity distribution business within Britain, whose parent is actively involved in several lighthouse projects in smart grid across the continent, identified the need for investment in full-scale trials. Some examples included:

- Sophisticated voltage control
- Commercial models e.g. demand side management contracts
- Storage on the network
- Virtual power plants (commercial and technical).

A business pointed out that back office systems must interface with the smart grid. This is not part of the current economic model for the smart meter rollout and these discrepancies needed to be sorted out. A key mention was reserved for the development, implementation and sharing of a nationwide communications backbone. They pointed out the need for ‘actuator’ devices which would make switchgear capable of switching. They also pointed out that the current scope of the home area network (HAN) was creating the wrong impression and an in-premise control and monitoring system was needed to effectively control the load in a smarter grid.

A couple of comparatively smaller network businesses did not see any immediate investment requirements. One organisation mentioned waiting for standards and definitions to take place before any serious investment would gather pace. The other one did not expect any need for real investment in the next 5 years, but suggested that DPCR6 negotiations will help crystallise the shape of smart grid development and hence will influence the investment needs.

A key system operator stakeholder said that from their perspective there will be interface arrangements with many more active parties and the ability to process the associated data will be critical.

“Smart meters mean the TSO will have to process an awful lot more data. ENSG highlighted a significant volume of investment in transmission assets. Many of these could be consolidated under the smart grids banner.”



2.6 Regulatory allocations

Q6. Do you have any current regulatory allocations for smart grid?

Most respondents confirmed having a desire to secure LCN funding. Some respondents also discussed funding received under IFI (Innovation Funding Incentive) put to use on some projects that might be classified as smart lighthouse projects. A key observation made was that no allocation of funds towards smart grids was requested as part of DPCR5 submissions by the DNO businesses across Britain.

2.7 Budget

Q7. Do you have an overall budget for smart grid? If yes, what?

Generally, as was the case with the previous question, there was no indication of any budget being set aside for smart grid specifically. However, many of these businesses are carrying out trials and project implementations that could be considered part of a wider smart grid strategy. Funding for these has typically come from IFI or business-as-usual budgets.

One DNO organisation had a very frank answer to the budget allocation for smart grid:

“The IFI encourages research, but not design & development. There is just no incentive to take risks. It’s less risky to reinforce the network AND you get your money back.”

It was noted that the LCNF has the capability to change this position. One network business stated:

“Now that we have the LCNF, we can justify having our team. Until now, it was very much a risk.”

2.8 Pilots

Q8. Which of your smart grid projects do you have funding for? E.g. Pilots?

The response to this question was varied and in line with the variations seen in the strategies of the surveyed organisations around smart grids. Whilst some organisations did not have any funding or pilots running that could be classified as smart grid pilots, some early adopters and organisations with more evolved strategies had some examples of projects being undertaken. Some of the projects mentioned included:

- Demand side management (DSM) contracts
- European Framework 7 projects on aggregating demand and DSM
- Storage on the network
- European Framework 6 project - the virtual power plant concept
- A superconducting fault current limiter
- Applying dynamic line ratings / Dynamic thermal rating
- Active network control.

2.9 Organisation structure

Q9. How will your organisation be structured to undertake the smart grid evolution?

With smart grid being in a fledgling state currently, most participants had different, and less than fully formed views on the organisation structure for the future.

One organisation made it clear that they did not view smart grid as a bolt-on to the existing business. They intend to start with a small catalytic energy projects team and with continued evolution transform their organisation from the current to a smart future, establishing



smart grid as business as usual.

Another business said it was in the early stages of mobilisation to deal with the developments resulting from the onset of LCNF. They too echoed the earlier view that these should not be viewed as standalone and confirmed having a programme in place dealing with basics, such as productivity, asset management, safety, and customer service. They also acknowledged that they had yet to put in place a structure to take their business into the future.

Another organisation said that the smart grid developments will not have any impact on their organisational structure. There might be some changes at the corporate level but they expected the transformation from ‘dumb’ to smart network to be incorporated into their current business model.

One respondent stated that depending on the regulatory developments, they will need to develop new relationships with customers, which could lead to an entirely new organisation.

One DNO confirmed having created a new department considering sustainability and that smart grids was initially part of this department’s remit.

2.10 KPIs

Q10. Have you considered KPIs regarding moving towards the development of a smart grid? If yes, what are they?

Most respondents indicated that they had not yet reached a stage for considering KPIs regarding smart grid developments. Some acknowledged that they needed KPIs but opined that KPIs come in much later in the development stage. At the present moment they were engaged in building solid foundations.

2.11 Timeline and project plan

Q11. Do you have an overall smart grid timeline and project plan or timelines for individual projects?

There was an expected variance in the responses received. These variances can be attributed to a host of factors including:

- Maturity of smart grid strategy
- Corporate ownership
- Understanding of industry trends and projections for the future.

One DNO confirmed that they had built an S curve of key expectations of where they might be at certain times in the future. They did however mention that this was “fairly crude but a good place to start”.

One organisation made a very important observation around their timeline and how the industry is poised today. They said that they only had a very high level timeline/plan for smart grid and only expected early investments to begin in 2016 onwards with actual rollouts of

technology around 2020s. This was also with the caveat that if CC&S (carbon capture and storage) and new nuclear took off in a big way then that might present a case for maintaining the status quo rather than going for smart grid.

An organisation with foreign ownership was expecting the smart grid timeline and project pipeline to be dictated by the corporate parent as their initial feelings were that as a group there were significant synergies to be realised in back-office systems.

A few businesses had no overall smart grid timeline or project plans in place yet.

Most organisations surveyed were of the opinion that during the DPCR6 negotiations, timelines for smart grids and associated innovations will gather momentum. It was generally appreciated that the learnings from current developments, like projects from LCN funding, discussions around RPI-X replacement and development of new regulatory regimes, will lead towards a more informed industry during DPCR6 negotiations and that will help drive timelines for smart grid for Britain.

2.12 Existing projects

As could be expected, respondents did not indicate a significant number of projects (as opposed to pilots, discussed earlier) being undertaken in the smart grid arena. Smart grid as an idea is in its fledgling state and even the lighthouse projects commissioned or planned so far are strictly oriented towards enhancing network monitoring and performance.

There was, however, an appreciable amount of work being carried out within the DNO organisations surveyed that could be classified as being under the wider smart umbrella. These projects have typically not been organisationally separated, but could still become the foundations for future LCNF and other true smart grid projects. The projects mentioned so far include network automation, fault current limiters, and new applications of ENMAC (the near-monopoly incumbent network control system in UK electricity distribution) or related products.



2.13 Smart metering and smart grids

Q13. Do you see smart metering and smart grids as independent projects?

Most respondents, except one, opined that smart metering and smart grids **should not** be separate projects as there is a huge amount of interdependency. Most of them however did recognise that their development so far has been disjointed but a big opportunity will be missed if these programmes are not aligned. The following quotes illustrate the point:

“They have been [independent]. Smart metering is going to go ahead, but it's independent AND an element of smart grids. If they end up separate, it's an opportunity missed. Key for DECC and the industry to ensure that doesn't happen.”

“[They are] hugely interdependent. True to say they are separate strategy workstreams. But they must be seen as interdependent.”

“Last week would have said they're part of the same thing. But in timing terms, they're probably different. It'll be close to 2020 or later before the benefits for the DNOs appear.”

“Ideally, no. A lot of smart grid functionality can be derived from smart metering – but if we mess it up, we will end up delivering a second platform [for the network needs].”

2.14 International guidance

Q14. Are you looking internationally for guidance and advice? If so, where? List other companies you are drawing advice from?

Most organisations surveyed were keeping a keen watch on smart grid developments across the globe. They were following the developments by either getting information through their corporate parents, at trade and industry conferences or by following the more renowned publicly available success stories.

The key companies / projects mentioned included:

- Projects around the globe
 - Xcel Energy, Boulder, USA
 - EDP, Portugal – InovGrid project
- Corporate group initiatives
 - E.ON group initiatives
 - EDF group initiatives
 - Iberdrola group initiatives
- Regulatory and Industry bodies
 - CIREN - Centre International de Recherche sur l'Environnement et le Développement, France
 - EPRI(Telegrid) - Electric Power Research Institute
 - ENSG – Energy Networks Strategy Group.

2.15 Business case benefits

Q15. Have you seen any examples of demonstrable business case benefits through the implementation of any smart grid projects – including smart metering?

Most respondents have been looking out for, and have come across several business cases. Most, however, doubted if the business cases were compelling enough to proceed with investment without (further) significant regulatory intervention. It was also argued that often

the qualitative benefits like social benefits / societal evaluation are not included in the business case. It was generally agreed that even on a project basis these business cases were not yet stacking up. In spite of this the demonstrable opinion was that this does not mean there is not a case for smart grids. In fact the respondents urged the regulator to take a lead with the business case, understand the qualitative benefits and then if necessary mandate the smart grid investment.

“I think DECC are struggling to invent the business case. They've had to do so because we don't yet know how to factor everything in. If we accept global warming and the impact of carbon, there should be a business case for the smart grid.”

A few examples of business cases mentioned included:

- Internal business cases developed by the DNOs themselves
- Current (US)
- Accenture (UK)
- DECC
- Barringa
- KEMA.

2.16 Current solutions in the market

Q16. Have you seen anything in the market at the moment that has impressed you regarding smart grids, such as demos; presentations; papers etc?

Most respondents have not seen anything in the market that has been truly impressive. They also have concerns with some products / projects, which have been very successful overseas, and their suitability for the British market.

“No, nothing that would work in Britain. There’s potentially a lot of benefit in there for the customer but it’s difficult to see a successful business case (how we’re going to make money out of it).”

“No. Most of the things people are demonstrating are disappointing. I’m surprised at how disappointed I’ve been (for example with Boulder Colorado). It’s not that innovative.”

A lot of organisations were impressed by the early results of their own trials or lighthouse projects as they were demonstrable proof of these technologies performing in a UK context. One interesting point to note was that there were some key projects like Boulder, Colorado and EDP that were being observed by a number of participants across the British industry. There were several projects of similar maturity and relevance that were not quoted by the respondents.

2.17 Benefits and strategy

Q17. How important is it for your company to include business case benefits in your smart grid strategy? On a scale of 1-5 where 5 is the most important.

The respondents were fairly spread on this scale. A few DNOs came out at 5 and said in the long term business case benefits were very important and as the case evolved, the delivery will be adapted to fit the business case. One important point made was that this business case

did not need to be a totally financial one. It should include other (intangible and qualitative) factors like benefits for society and political benefits.

“This is a very live discussion! We need to be able to see that it generates a positive financial benefit for us, fast or slow. It’s a hurdle that has to be got over – then with it comes the other societal benefits.”



3 LOGICA CONCLUSIONS

This survey provided us with a unique opportunity to understand how ready our electricity networks businesses are for the forthcoming smart grid. Many of the contributors to the study are members of, or contributors to, industry bodies: the Energy Networks Association (ENA), the Electricity Networks Strategy Group (ENSG) and the Energy Networks Future Group (ENFG) to name a few. But while publications from these bodies provide a collective opinion and shared vision, our study focuses on what each individual business' position is. This is unique. And, though no individual business is explicitly identified with any remark or position, the study reveals many things about the real state of smart grid maturity in Britain that are not always clear when studying the collective views published so far.

The conclusions we have drawn from our study reflect the responses gathered, as well as Logica's own observations on the industry.

Regulated businesses do what they're incentivised to do

Regulation is the foundation for natural monopolies like DNOs. And in Britain, the regulatory regime is the single biggest influence in the development of their business strategy and investment decisions. In such an environment, it is not enough for regulators to issue a new edict to "develop the smart grid" or indeed to put in place some small measures to kick start the revolution in the hope that market forces will take us down a path to the smart grid. Undoubtedly, the Low Carbon Network Fund is a fabulous catalyst for progress in smart grids, and Ofgem should be congratulated for it. But it's not enough. Regulated businesses need more. Time and again we see that regulated businesses do what they're incentivised to do and little else. Not for them the speculative investment or risky new strategy. Rather: meet the incentivisation targets; get the solid return; keep the lights on; repeat. It's worked so far.

The survey signalled that the British industry believes that there is no credible business case yet, that can encourage DNOs to invest in smart grids. A move to smart grids will only gather momentum if the Government and the regulator provide sufficient impetus. **The right regulatory regime, with the right incentives to invest, is paramount.**

End-to-end industry change is inevitable

DNOs recognise that to deliver the benefits of smart grids (particularly the carbon reduction we all believe to be a key driver) the industry needs to change. A glib answer that has occasionally been heard in hushed tones might be to take us back to before privatisation, when the elements of the electricity supply chain were allowed to interact freely. But this is no answer. The arguments for the benefits to consumers of a disaggregated industry have been won.

However, it is clear that to make demand side management work, or to deliver generation instead of reinforcement, or indeed to do so many of the things that constitute a smart grid as we are beginning to understand it, DNOs need to be able to interact with suppliers, with generators and with other parties we are yet to understand. To do so means big change - the kind of change that can only happen with a root-and-branch review of Regulation. Perhaps we could call it RPI-X@20?

But technology-driven change isn't the answer

One of the more striking revelations of the survey has been the technological focus of the smart grid community. This is something of a paradox. As discussed above, many businesses are slowly recognising that fundamental industry change is the only route to the smart grid. As such, they are at least beginning to talk the talk of process and commercial change as critical enablers. But at the same time, talk of pilots and existing projects too often focus on technology

and not on new ways of working. It will be all too easy for our electricity networks businesses then to fall back into a comfort zone of new gadgets on the network or new algorithms for smart control systems. We cannot let this happen. We strongly believe that focusing on technology will not yield the real benefits of the smart grid, which can only come from genuine industry transformation. Technological developments are needed, yes. But they are just a beginning. Entirely new business processes, practices, collaborations and relationships are as important to facilitate a move towards a smarter grid. We must ensure that there is as much emphasis on creating and optimising the new business models for our industry as we currently see on technology. Without it, the smart grid will fail.

Smart grids might not be just around the corner after all

The British electricity market has been contemplating, if not exactly poised for, a paradigm shift for some time now. The early transformation focus was led by smart metering and industry debate was almost exclusively focused around the benefits, models and technological choices for metering. Honourable exceptions such as the Ofgem Long Term Energy Network Scenarios (LENS) did blaze a trail to some extent, but outputs were inconclusive to say the least. Greater debate on the operations and logistics of benefits realisation from smart metering eventually gave momentum to wider thoughts on smart grids and slowly, the network businesses entered the discussions. This development was unfortunately too late to really inform investment strategies for DPCR5 submissions to any significance - meaning there's little or no funding allocated in DNO budgets for smart grid investments in the forthcoming 5 year period. While the LCNF has given the sector a timely boost, our respondents often remind us that they consider many smart grid developments to be the realm of DPCR6, not today or tomorrow. This might be at



odds with public understanding which, while still relatively low, is on the rise. Not a lot happening, then not a lot continuing to happen for a number of years may prove quite a turn-off.

The smart metering / smart grid conundrum

It is generally acknowledged that smart metering was the first to gather pace in Britain. As such, the wider area of smart grids is perceived differently in Britain as compared to most other countries, where smart metering is simply one aspect of the overall smart grid. In Britain, this has led to what is probably a lack of understanding of the inextricability of the two. Our survey signalled that the majority of participants echoed the interdependency of both projects. They opined that smart metering and smart grids could be nominally independent programmes, but that there is tremendous overlap and interdependence. We believe that these programmes are strongly related and there are technological, logistical and economical overlaps that need to be considered more carefully than is currently the case. Even the benefits are interdependent. We strongly believe that smart grids and smart metering are two sides of the same

coin and, although the vision for these transformations has been undertaken separately, the delivery of benefits and success will largely depend on how closely these two initiatives work together.

A parochial view?

While being asked to list the projects that caught attention of the leaders of the smart grid evolution, we were surprised to see that Xcel Energy's smart grid project in Boulder, Colorado and EDP's project in Portugal were the only ones mentioned, unless the respondent cited their own parent company's international projects. While it is true that the British industry is different to elsewhere in the world, have we become too blinkered in our views, missing the learning available from overseas? Or was it simply the case that other projects were of insufficient quality to warrant a mention?

There are many live smart grid projects around the world, at various stages of completion. We strongly believe that following these developments more closely will provide useful learning for Britain, helping to empower us to make the right investment and technology decisions for the benefit of customers.

And finally...

It is a reasonable assumption to state that most in the industry would agree smart grid development in Britain is immature. We didn't need a survey to come to that conclusion. However, our survey clearly shows that even smart grid thinking in Britain is immature. This is with no disrespect to those in the networks businesses charged with responsibility for moving things forward. Without doubt, there are brilliant minds at work, applied to delivering a new electricity network capable of supporting Britain's smart aspirations. And we thank them profusely for their contribution. But our survey shows that their thinking is, for the

moment, hampered by too many unknowns, and too few sure-fire reasons for investing.

We can take some encouragement from the developing business strategies, pilot projects and ideas so many of our respondents talked about; and from the variety of smart grid developments seen elsewhere in the world. But there is no irrefutable business case for the smart grid yet. And there isn't a set of regulatory incentives to encourage natural monopolies like electricity distribution businesses to invest in smart grids.

We believe that the industry is at the start of a journey that will in time create suitable conditions for growth of smart grids. However, there is a tremendous amount of work that still needs to be done.

To achieve success, all Britain's smart grid stakeholders will need to understand, agree and communicate the mutual benefits that can be derived from smart grids. We'll need to involve the end customer. And we must encourage the debate on incentives for investment. In short, development of a stronger, more credible business case under the careful guidance of the regulator will be pivotal to any success. Without it, we may flounder for a decade. Once we have it, the smart grid will be on its way.

4 LOGICA CASE STUDIES

4.1 InovGrid, EDP, Portugal

With six million customers, Energias de Portugal (EDP) ranks among Europe's major electricity operators, as well as being one of Portugal's largest business groups.

Logica is the systems integrator in the InovGrid consortium, which also includes the Portuguese government and EDP. The project encompasses smart metering, electricity distribution management and integration of microgeneration (solar and wind) and Logica's role is to develop the infrastructure and services, to enable smart grid management for EDP's electricity distribution network.

The infrastructure under development comprises of three levels:

- At the client delivery point level – deployment of energy boxes (EB)
- At the medium voltage to low voltage electricity distribution

transformer level - deployment of the electricity distribution transformer controller (DTC)

- At the central backend systems - implementation of central management and supervision system integrated with legacy systems.

The energy box has several capabilities including:

- Smart metering
- Service control (circuit breaker)
- LAN communications
- Home area networks (HAN) communications. In the current phase this is not yet implemented, but in the near future the energy box will be able to communicate with home devices via Bluetooth, ZigBee, or others.

The project status so far is as follows:

- In a first phase to November 2009, 500 energy boxes have been rolled out. The next phase will see a smart city completed with 50,000 energy boxes during Q1 2010. The final roll out to six million customers will be completed by 2015
- 25,000 I&C MV and special LV customer meters deployed for automated data collection on a daily basis
- Wind farm management system for 48 wind farms deployed
- Smart grid control room deployed.



5 RELATED PUBLICATIONS

5.1 Australia overview

The infrastructure in place now in Australia was developed some time ago and is due for modernisation. As the Energy Networks Association put it in their recent smart networks position paper:

“As much of Australia’s existing \$60 billion energy infrastructure was built in the 1950s to 1970s, with an asset life of around 40 years, there is a national trend to upgrade the nation’s network over the next decade. The replacement of aging infrastructure presents an opportunity to take advantage of new technologies and ‘future-proof’ the network, not only to meet the continuing growth in peak electricity consumption, but also to cope with a fundamental change in the delivery of electricity services in a carbon constrained environment.”

Smart grids are therefore a major business transformation for the energy industry, with some respondents drawing the comparison with the internet’s impact on the telecommunications industry. However there were two distinct views on how to proceed with some respondents using smart grids as an opportunity to transform their existing business and drive even more of a consumer focus (with the view consumers will drive smart grid success), whilst others see it as business as usual in terms of upgrading their existing network to make it more intelligent.

The study revealed three key areas of focus for the industry.

1. A new regulatory framework is seen to be a key determinant of progress by the energy sector. Generators, distributors and retailers, constrained by present forward planning arrangements, will need some direction from; and flexibility on the

part of the regulatory authorities in order to support the changes demanded by them. Strategy development was driven by regulatory determinations, making the government’s role pivotal.

2. **Developing the right strategy.** 25% of the industry reported that they have already developed their corporate smart grid strategy or were in the process of refining it. The balance of the industry is working on discrete projects that fit under a smart grid umbrella and these companies have plans to develop an overall strategy. All indicated that a smart grid was a business imperative and were committed to strategy development, despite the unknowns.
3. **Investment framework.** Respondents identified investment as a crucial component in order to move forward. They expressed caution around preliminary investment, expressing their reluctance to invest in solutions without knowing the shape of the challenges they address. The disaggregation of the energy value chain was a key concern for some respondents as business case benefits would be spread amongst generators, distributors, and retailers, so therefore the question becomes “who makes the investment?”

Respondents unanimously agreed that a collaborative effort is needed between government, the energy regulators and the electrical industry to provide the correct framework for progress to a smart grid.

Many pointed out that also key to their success was engagement and empowerment of the consumer and saw the responsibility of industry as well as

government to educate and inform consumers on how they can ensure more efficient use of energy.

Respondents were also cautious about the smart grid timeline. At this stage timelines exist for specific projects, but for most, an overall roadmap and timeline had not yet been developed though many were confident of completing this work within the next six months.

Respondents have noted that education and training are going to be required across the board to handle the additional information loads that will accompany this innovation, and there is some concern as to whether the universities can turn out the skill sets needed to drive the changes home.

And there are many technical challenges ahead that will need to be addressed including managing data, integration of back-end systems, managing millions of end points (meters), and developing new technologies, and all within the context of a dynamic, changing business climate.

Much of the initial investment in smart grid preparation is prioritising:

- Research and study trips for business case development
- Smart metering (in Victoria)
- Integrating telecommunications and back-end infrastructure to support two-way data flow.

The report in full can be downloaded from our website at the following link:

<http://www.logica.com.au/we-are-logica/media-centre/case-studies/logica-smart-grid-study/>

5.2 Germany overview

The utilities sector is changing dramatically. Intelligent power supply networks represent an important factor in this radical change. The so called smart grids provide an entire range of new functions, forcing the utilities industry to face an equal number of new challenges. This whitepaper examines the significance and consequences of smart grids for the IT departments of German power suppliers, takes stock of the existing situation and provides a forecast for future development.

The white paper is based upon a survey that was conducted by the market research and consulting company IDC and the consulting services provider Logica Management Consulting in November and December 2009 among 76 top managers in the power supply sector.

Forms of liberalisation and competition in the market

The most important challenges faced by electricity, natural gas and water suppliers are increased pressure to reduce cost, increasing regulation and greater customer migration. This means the IT department has to provide greater support to facilitate the optimisation of business processes. The regulation of the power sector has had its impacts on IT as well. Unbundling is now high on its agenda. For the respondents smart metering is not of the utmost importance,

but it is gaining more and more attention among IT managers.

The focus is on distributing scarce resources effectively and keeping the costs low, while at the same time maintaining investments in new technologies, if one does not want to lose out against the competition. As the pressures of competition intensify in the future, this will become increasingly important.

Smart Grids - a vision for the utilities industry

For the majority of respondents smart grids enabled the optimisation power network controls. Intelligent supply networks are also perceived as an opportunity for communication between the power suppliers and the consumers or end devices. Even the possibility of a decentralized feed-in and a better approach to regenerative energies are being realized: an issue which is going to become more and more important in future, and describes one of the objectives of the smart grids policy. However, the percentage of respondents who equate smart grids solely with the use of intelligent metering systems is quite low.

Despite this, smart grids are still quite visionary. Many of the power suppliers who were questioned are only just beginning to grapple with this. More than half of these (54%) are currently focusing on smart metering and are waiting to see how the topic of smart grids is going to develop.

The report in full can be downloaded from our website at the following link:

<http://www.logica.de/we-are-logica/media-centre/thought-pieces/studie-smart-grids-de/>

5.3 Smart Grids for Dummies

After the resounding success of our publication Smart Metering for Dummies (<http://www.logica.co.uk/we-are-logica/media-centre/articles/smart-metering-for-dummies/>), we are happy to announce that our next thought piece is being written for smart grids and Smart Grids for Dummies will be released in summer 2010. We look forward to sharing the book with you soon.









Disclaimer

This publication is intended to provide an overview and analysis of the energy industry in the UK and is based on survey results, containing opinions voiced by industry executives given on condition of anonymity. This document is for general information purposes only and is subject to change without notice.

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Logica

250 Brook Drive
Green Park
Reading RG2 6UA
United Kingdom.

energyandutilities.uk@logica.com

www.logica.com

CODE 1154 0410

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