Smart Meters Executive Paper

Smart infrastructure overview

The ever growing global demand for energy, combined with increasing scarcity of resources and the threat of climate change, have prompted governments and regulators to push towards clean, renewable energy sources and higher energy efficiency.

Smart grids involve the application of information, communication and other technologies to the electricity grid in order to actively manage the network in a holistic way including the interactions between suppliers and consumers.

The EU’s smart grid vision

The development of smart grids, and the associated roll-out of smart meters, is widely considered to be a key enabler of the transition towards a low carbon economy. Smart grids involve the application of information, communication and other technologies to the electricity grid in order to actively manage the network in a holistic way including the interactions between suppliers and consumers.

Smart grids are expected to bring a number of benefits, including:

- Facilitating a change in the generation mix from a few, large, predictable sources to a larger number of more widely distributed generators with more volatile and less predictable output (e.g. renewables, including microgeneration)

- Accommodating more electricity storage facilities

- Optimising operation of the system to minimise cost and carbon whilst improving reliability, flexibility, quality and security of supply

- Identifying network issues earlier and re-routing power when necessary

- Improving theft and tampering detection and prevention

- Enabling the demand side to play a part in balancing supply and demand. For example through tariff structures that more accurately reflect the expected supply / demand balance in each time period and smart appliances which can be turned on and off remotely to respond to the actual supply / demand balance in real time

- Reducing overall consumption of electricity through improved information and awareness

However, the cost of building smart grids infrastructure is enormous. Eurelectric, representing Europe’s power generation industry, estimated that the sector needs to invest €1.8 trillion between 2010 and 2030 to replace aging plants, develop smart grids, meet surging demand and deliver the environmental targets. European utilities will need to double their ICT spending to a total of €350 billion over the same period to achieve the smart grid transformation, including the roll-out of smart meters.

The European Commission has set up a task force on smart grids to facilitate and support the process of EU-wide smart grid implementation. It has already produced a report entitled “Roles and Responsibilities of Actors involved in the Smart Grids Deployment” (April 2011) and will shortly produce a set of regulatory recommendations.
Although a number of high level route maps have been published, there is significant uncertainty as to how exactly to develop smart grids. The UK’s Electricity Networks Strategy Group recognised that “there is no single smart grid solution. Specific solutions will often be defined by local and circuit level context – legacy infrastructure and challenges and opportunities”. A number of government sponsored funds have been established to finance the trial of new technologies which could play a role in smart grids. Examples include the German E-Energy Programme and the UK Low Carbon Networks Fund.

Smart meters will be a critical component of the smart grids and are expected to account for roughly a fifth of the total smart grid infrastructure investment. Smart meters combine a number of functions including interval or time-of-use measurement and communication of consumption, real-time or near real-time sensors, power outage notification, and power quality monitoring. Meters that include one-way communications are often referred to as Automated Meter Reading (AMR) whereas two-way communications are referred to as Advanced Metering Infrastructure (AMI).

The plans for implementing smart meters are much further developed than for the other parts of the smart grid. A mass roll-out of smart meters across North America and Europe is planned to be completed by 2020.

**Rapid roll-out of smart meters by 2020**

The total market potential in Europe amounts to c.230m AMI meters and c.45m AMR (on top of c.120m standard meters) to be installed between 2010 and 2019. Half of these are expected to be electricity meters, with gas and water accounting for a quarter each. AMI’s high share compared to AMR can be explained by regulators’ and utilities’ concern around future proofing, particularly for electricity.

The rapid roll-out of smart meters is being driven by governments and regulators. For the EU member states, the fundamental piece of regulation is the Directive on Internal Markets (2009/72/EC), which is part of the Third Energy Package. It establishes:

- An obligation for member states to produce cost-benefit assessments for the rollout of smart metering before 3 September 2012
- Where rollout of smart meters is assessed positively, at least 80% of consumers are to be equipped with intelligent electricity metering systems by 2020
- Further directives encourage bi-directional communication capability, monthly meter reading and implementation of the same standards for gas in a reasonable period of time. They also require smart meters in all new or reconstructed buildings

Of the eleven countries that have conducted an electricity smart meter cost benefit analysis to date, seven have reported positive net benefits, while four have reported negative benefits. This suggests that the business case for smart meters roll-out is relatively finely balanced.

DECC expects the roll-out of gas and electricity smart meters in the UK to cost £11.3bn but deliver benefits of £18.7bn, both in present value terms. Consumer energy savings are expected to account for a third of the total benefits.

### Impact assessment for UK smart meter roll-out (£bn)

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<td><strong>Network benefits</strong></td>
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National regulations are used to force or encourage smart meter implementation in many countries. The smart meters roll-out programme for major European countries is summarised below.
In 2003, Sweden became the first EU country to mandate smart meters. The initial regulations were only for larger users in the electricity sector but by the time government had mandated monthly invoicing for all electricity users in July 2009, electricity smart meters had already been deployed to nearly all final customers in the country.

Italy was also an early adopter of electricity smart meters. Approximately €2.1bn was invested over a time-frame of five years with expected annual savings of €500m. ENEL, the formerly state-owned Italian utility company, claims that the investment has already paid off through the increase in revenue from energy theft detection and prevention.

Denmark is an interesting case study. In 2008 there was a proposal to roll-out smart meters to all electricity customers but studies concluded that the implementation costs would exceed the benefits. Nevertheless, network operators have either already installed, or are planning to install, electricity smart meters for 50% of their end customers. Most of the network operators are owned by their customers.

Finland introduced regulation in March 2009 which requires a minimum penetration of smart meters of 80% by 2014. Utilities have responded quickly and have already installed over 1 million smart meters (leaving 2 million still to be installed). The legislation in Finland, like that in Sweden and Norway, only covers electricity. There are no country-wide plans for the roll-out of gas, heat or water smart meters.

Although the commitment to a rapid roll-out of smart meters is high in most of the main European markets, there is a significant risk of the roll-out targets not being fully achieved by 2020 given the current state of progress and the ambitious nature of the targets for the larger countries. The countries with the greatest uncertainty appear to be Germany and the Netherlands. In Germany, the regulation is currently relatively vague with respect to technical requirements and timing. Smart meter regulation was postponed in the Netherlands after parliament rejected the draft bill due to privacy issues - a revised bill allows consumers to opt out of smart meters.

**Smart meters value chain**

In most European countries the utility network operators are responsible for the roll-out of smart meters to their customers. The main exception to this is the UK where the roles of network operations and energy retailing are separate. The energy retailers are responsible for the UK smart meters roll-out. The split of responsibilities in the UK could create an opportunity for infrastructure funds as energy retailers are unlikely to want to fund all of the capex required for a rapid roll-out of smart meters.

The overall smart meters value chain extends from provision of hardware through to a range of systems and services. The majority of the cost of rolling out smart
sensitive

Smart meter value chain

Overview of the value chain steps:

- **Equipment:** Smart meters combine an electricity, gas or water meter with a communication module which enables communication over a network with the utility / energy service provider. The meter market is dominated by a few large, long established, international groups such as Itron, Elster and Landis+Gyr. Some smaller specialised companies are active in the network equipment market. The network infrastructure is likely to differ significantly across Europe.

- **Deployment services:** Smart meter deployment services are often outsourced to specialised project management companies or system integrators.

- **AMI head and MDM:** The smart meter data flows to the AMI head which carries out meter data collection, network management and monitoring. The raw data is then passed to the meter data management (MDM) system for processing. Companies offering MDM systems include large software houses (e.g., Oracle), integrated meter manufacturers (e.g., Itron) and smaller specialised software companies (e.g., eMeter).

- **System integration:** The integration of smart meter systems into the operating systems of the utilities (or energy retailers) is mainly done by large international system integrators.

- **Operation / outsource:** Network operations are traditionally carried out by utilities, however some activities are often outsourced.

- **Smart homes:** The smart homes market comprises a range of products and services which enable home automation and energy management – for example, appliances which can be turned on and off remotely to respond to changes in the network supply / demand balance. Companies active in the smart homes market include telecoms, utilities and internet companies such as Google and Microsoft.

A wide range of companies are actively trying to build their positions in the smart metering value chain. This has led to a number of acquisitions such as GE and ABB taking minority stakes in Trilliant, Toshiba’s acquisition of Landis+Gyr, and Badger’s acquisitions of Remag and Cox.

Smart meter manufacturers

The top three global smart meter manufacturers have a combined market share of nearly 50% and the next five companies have a combined share of 20%. About 10% of the total market is made up of small local companies. Larger companies have historically used acquisitions to help grow their businesses. However more recently, large players have focused on vertical rather than horizontal acquisitions in order to extend their product offers into metering communication modules or network equipment.
**Investment considerations**

Infrastructure funds own many of the gas and electricity transmission and distribution networks across Europe. For example:

- A consortium of AXA Private Equity and Italian infrastructure fund F2i have made three acquisitions in the Italian gas sector in the last two years
- Morgan Stanley Infrastructure Partners has bought a number of gas and electricity assets in Madrid over the last three years
- EISER Infrastructure owns ESP Gas Group Ltd ("ESPGG"), the fourth largest independent distribution network operator in the UK. It owns and operates the gas supply pipelines and gas meters for over 200,000 customers

However, whilst private equity companies are already involved in a number of stages of the smart grids and smart meters value chain, including ownership of a number of the smart meter manufacturers, infrastructure funds have so far had relatively limited involvement in smart grids and meters.

Infrastructure funds seek predictable cashflows which, ideally, are protected by a well defined and stable regulatory framework. Although the roll-out of smart meters is being driven by governments and regulators, the smart meters themselves are not directly regulated and the overall regulatory, commercial and technological frameworks for the smart meters roll-out are still being defined.

As the roll-out progresses and the necessary frameworks are developed then a number of the key risks are likely to be mitigated and smart meters could become an interesting investment opportunity for infrastructure funds.

**Summary**

The development of smart grids is widely considered to be a key enabler of the transition towards a low carbon economy. However, the cost of building smart grids infrastructure is enormous – c. €350bn across Europe.

Smart meters will be a critical component of the smart grids and are expected to account for roughly a fifth of the total smart grid investment. The plans for implementing smart meters are much further developed than for the other parts of the smart grid. The EU’s Third Energy Package has mandated a roll-out of smart meters across member states by 2020.

Although infrastructure funds already own many of the utility networks across Europe, their involvement with smart meters has been limited to date. However, as the regulatory, commercial and technological frameworks required for the smart meter roll-out are developed, a number of the key risks that have deterred infrastructure fund involvement should be mitigated. This rapid roll-out of smart meters will create a significant funding challenge and this in turn will provide opportunities for infrastructure funds to own a portfolio of smart meters.

There are already a number of examples of infrastructure funds already owning portfolios of utility meters.

- Capital Meters Ltd is a special purpose company that was established by Siemens Energy Services and Macquarie Bank to own gas and electricity meters and rent them to British Gas over a period of c.25 years. Siemens manages all operational aspects of the service. Macquarie provided £11m of equity, taking an 80% stake
- M&G Investments owns Calvin Capital (Meter Fit), which in turn is the owner and supplier of gas and electricity meters to British Gas customers in the North East and North West of England, and North Wales. Calvin Capital currently owns over 3 million installed meters

The roll-out of smart meters in the UK is forecast to involve £4.3bn of investment in meters and a further £1.7bn of installation costs. Funding these costs is likely to be challenging for a number of the energy retailers. Infrastructure funds could play a major role in funding this capex.

Infrastructure funds could also be involved in financing other components of the smart grid infrastructure in due course, either through their ownership of gas and electricity transmission and distribution businesses or through more discrete components such as energy storage facilities. However, the plans for developing other parts of the smart grid infrastructure are currently much less well developed.