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Smart Grids Briefing

A briefing by the Institution of **Engineering & Technology**

12th July 2010



www.theiet.org

What is a smart grid?

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.

(Reference EU SmartGrid Platform)

Smart Grid is not a single technology but an umbrella term that covers a multitude of different elements that together create a new vision for more intelligent and responsive energy systems.

Why will smart grids be needed?

Smart Grids are a key element in achieving a sustainable energy system. For example, by 2020 there is expected to be **increased demand** for electricity for electric transport and space heating from heat pumps. At the same time the traditional base-load electricity generation will have been replaced by variable renewable energy in order to meet carbon reduction targets. **Balancing** supply and demand on a minute by minute basis and strengthening the electricity system without a smarter grid would require very substantial investment in additional generation capacity and network reinforcement. Smart grids will enable the challenges for clean energy to be met in a more cost-effective way and bring wider benefits through greater customer engagement. Smart Grids will allow customers to participate and be rewarded, for example, by varying the time of day when they use devices that consume the most energy.

What parts of the infrastructure will be involved in smart grid?

Smart grid will need to integrate all parts of the electricity network and all users, including those who also generate and feed surplus electricity in to the local network.

Parts of the UK energy supply chain that have previously been quite separate will need to integrate seamlessly in a smart grid in order to achieve the benefits of secure, clean and affordable supply. To ensure the best use of a smart grid, close collaboration will be required not only between the different players in the energy system but also with IT and telecommunications providers, manufacturers of **electric vehicles** and white goods, and operators of car parks providing electric vehicle charging.

What are the timescales?

In most developed countries smart **grids** need to be deployed rapidly post 2020 if their decarbonisation and energy security objectives are to be achieved.

In the UK, it is planned to roll out smart **meters** to all homes during the period 2012–2017. Timescales are unavoidably long for achieving change in this sector (particularly as existing services cannot be interrupted) and Smart Grid functionality is expected to be trialled between now and 2015 with increasing wide area deployment being evident towards 2020.

What will consumers' interaction with smart grids feel like?

The aim of a smart grid is to enable low carbon energy to be used efficiently and best use to be made of available network capacity. In a world where the availability of generation may be **limited**, especially at peak times, the aim is for smart grids to **avoid an adverse impact** on the **lifestyle** of consumers and indeed offer attractive new choices and services. Home automation, for example, will pick up signals indicating the times when items such as dishwashers or electric vehicle charging can benefit from the best prices for energy. They will also enable home micro-generation, such as from solar panels, to be exported into the local network and for customers to be paid for it.

Once smart grids become more commonplace from around 2020 onwards, some customers are likely to want to take close control of their energy consumption (or production) while others will welcome automated systems or the services of third party providers. In all cases there will be much more information available about our energy use than we have today. This will be up to date and easily accessible so that informed choices can be made. Early smart grid developments taking place now, especially in the area of smart metering, recognise the importance of a **good experience** for customers including matters such as **data privacy** and **security**.

How does UK thinking on smart grids compare with the rest of Europe?

The UK electricity industry is active in its thinking on smart grids and the regulator, Ofgem, has recently introduced new incentives in this area. However, at present there is more concrete progress evident in continental Europe and **EU energy policy** is beginning to be shaped by **ambitious plans** for a future smart grid. This thinking has been led by the EU SmartGrid Platform, with active inputs from the UK, which has produced a series of accessible reports. The European Electricity Grid Initiative, launched by the Spanish presidency in Madrid in June 2010, demonstrates the commitment to roll-out smart grid technology across continental Europe.

There is much to be done to bring smart grid capability to the UK energy system. Most of our **distribution networks** were installed between the 1930s and 1970s and significant technological change is needed, combined with radically new approaches by our Network companies. In the UK, the electricity supply chain was split at privatisation into more separate companies than the model adopted on the continent. This creates an additional challenge to achieving joined up thinking and ensuring that the parties that have to make new investments also receive due rewards.

What is the relationship between smart grids and smart metering?

The purpose of the meter at the customer premises is to make measurements of the energy supply. The main measurement traditionally has been the amount of electricity used and this data has been manually collected. The degree of “smartness” of a meter relates to the amount of **communication** applied to it, the range of **measurements** it can make and their granularity, and its ability to provide **information** locally to the customer.

Increased information from customers is also important to the smarter operation of the wider energy system and will enable network companies to track the quality of supply to customers and respond more promptly when for example, there is a loss of supply.

What is required for smart meters to enable a future smart grid?

The requirements of the smart meters need to be specified as a component in a future smart grid system.

Meters have long lives and this field is moving quickly. Therefore the key to establishing a smart grid in the future is to agree a specification for smart **meters** that enables them to be operated as part of a **smart grid system** in the future. It is important that smart meters are designed with the capability to measure real time consumption and key network parameters and transmit this information in near real time via a range of communications options. It is also important that they can link to future home energy management systems.

What needs to be in place to ensure security?

The smart metering/smart grid system needs to be designed with security and data protection built in from the outset and as the default position. The IET has called for a **technically competent Design Authority** to be responsible for design of the system as a whole in order to ensure **end to end security**. In the UK, the **Data Commissioner** will need to be satisfied that the whole system has data protection as an inherent design feature.

What needs to be done?

Generating companies, the transmission companies, the distribution companies, metering companies and electricity supply companies are currently separate commercial entities whose interaction is closely regulated through licences. The existing **regulatory regime** is currently under review by the Energy Market Regulator, Ofgem, and the recommendations are expected to be published for comment this summer. **Leadership** of a high order will be needed at all levels so that implementation can be driven in a way that allows all stakeholders to play their part in realising the vision for smart grids.

What are the criteria by which the IET will judge the “Prospectus for smart metering” when it is published?

- Implementation of smart metering that is designed to **enable** (or at the very least not create barriers to) the development of future Smart Grids. Without these the government’s energy policies, involving a significant amount of variable renewable generation, will not be achieved
- **Operational security** of the national energy infrastructure
- Full regard for security and personal **data protection**
- Recognition of the **interdependency** of energy policy with other UK infrastructure by involvement of the Department for Transport and the electric vehicles community (re EV charging and potential vehicle to grid (V2G) storage options, and Ofcom (for potential synergies with the Digital Britain strategy)
- a “**systems engineering**” approach needs to be taken. In other words, the whole needs to be seen as an interconnected system requiring **engineering rigour** in its design. It requires power, communications and IT professionals to work together to determine a robust way forward
- Full regard for **best practice** in the design and implementation of large IT-enabled business change projects
- Cost effectiveness
- Public engagement.

Advice to journalists (and others)

The words smart grid, smart metering, automatic meter reading (AMR) and supergrid are frequently used with **imprecise or inconsistent meanings**. ICT experts and power engineers tend to use the terms with a different meaning or emphasis. We recommend a check on terminology before quoting or comparing, especially between examples from different countries. The IET will be pleased to assist here.

Further Information

- “The Future of Britain’s Electricity Networks” Report of the Energy and Climate Change Select Committee, 23 February 2010
- “PRASEG Inquiry Renewables and the Grid: access and management” Report of the Parliamentary Renewable and Sustainable Energy Group, March 2010
- EU Smart Grids Platform <http://www.smartgrids.eu/>
- “Electric vehicles: charged with potential”, Royal Academy of Engineering, May 2010.



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About the Institution of Engineering and Technology

The IET is Europe's largest professional society for the engineering and technology community, with more than 150,000 members in 127 countries and offices in Europe, North America and Asia-Pacific. Its membership includes Power, IT, Electronics, Communications and Manufacturing engineers.

As a charity, the IET is technically informed but independent of energy industry, equipment supplier or service provider interests. The IET regards it as part of its professional duty to provide expert and impartial information in the public interest.

Images (clockwise from top left)

- Wind farm
- Solar panels on UK house
- Energy efficient washing machine
- Electric vehicle charging station (kind permission of Elektromotive Limited)

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