Example 2 – Smart Grids facilitate energy efficiency, demand response and thus save energy

Goal and means

Energy efficiency is one of the most cost-effective ways of reducing greenhouse gas emissions. *Smart Grids* can *reduce the need for costly new generation, transmission and distribution capacity* by *cutting energy usage and peak demand* in a number of direct and indirect ways:

- Optimising grid operation and usage will *directly reduce energy consumption by reducing losses,* and will enhance *voltage quality, reliability and operational securit*y.
- Smart Grids (relying here on smart metering solutions) can *help consumers use energy more efficiently and have more control over their energy bills*. A more active participation by consumers is not only a goal in itself, but a possible means to integrate renewable and other more energy-efficient sources of energy in the electrical network. Enabling a demand response makes retail and wholesale markets more efficient as well as helping to meet the EU's sustainability goals (e.g. shifting energy consumption away from peak times).

Problems

Energy efficiency cuts demand, hence sales and profits. Energy companies today still focus on supply (i.e. selling more energy) not on demand. They need to be encouraged to sell less (not more) energy, by making energy efficiency a fundamental market design feature.

Smart Grid Challenges and Solutions

Smart meters can have many useful applications such as providing consumers and suppliers with accurate information about actual consumption. However, smart meters in themselves do not save energy or lead to more active consumers. Raising consumer awareness of energy use, especially when used in conjunction with different tariff structures, can help consumers identify how to reduce their consumption.

A Smart Grid can also *integrate generation and storage at customer sites*. An increase in distributed generation can lead to a *more active role of consumers whereby they also act as producers*, feeding in the energy they generate whenever it is available. If *electrical vehicles are widely employed in the medium-long term then storage of energy on the distribution level would become easily available* (presuming the current technical challenges including the suitability of car batteries to many charging/discharging cycles are solved in a satisfactory and economically viable way). These new consumption technologies could also contribute to reducing or "leveraging" large portions of demand.

Energy Regulator's Role

Regulators control network tariffs and hence the network operators' revenue streams. *Regulators can set targets* against which network operators would be rewarded or fined *to discourage network losses* and can encourage grid operators to adopt solutions which *push energy efficiency goals.*

Energy regulators working through the newly created International Confederation of Energy Regulators (ICER) have jointly committed to play their role in overseeing efficient and climate responsible markets. One of their eight commitments in the World Energy Regulators' Statement on Climate Change is a report on regulatory best practices to promote energy efficiency to be presented to the next G8 Energy

Activities of European Energy Regulators on Smart Grid and Climate Change Issues

The European Energy Regulators act as key facilitators of Smart Grids by identifying and removing possible barriers and finding solutions that provide an appropriate balance between all stakeholders' positions. We undertake a number of activities related to smart grid including public consultations, workshops, reports and multi-stakeholder panels. *www.energy-regulators.eu*

External Activities

Regulators and the European Commission's Smart Grids Task Force
Regulators are fully involved in the European Commission's newly created Task Force on the implementation of smart grids.

Regulators and the EU Smart Grids Technology Platform
Regulators have been involved in the Advisory Council of the Smart Grids European Technology Platform since its inception in 2005. (www.smartgrids.eu)

Regulators' contribution to Standardisation
CEER/ERGEG works closely with the European Standards bodies (CEN, CENELEC and ETSI) who are mandated by the European Commission to develop an open architecture for utility meters (water, gas, electricity and heat).

Events

Regulators' Workshop on Smart Metering, 14 December 2009

Regulators' official side event at COP-15 on Smart Grids, 9 December 2009
CEER side event at the United Nation's Climate Change Conference in Copenhagen.

Regulators' Workshop on Smart Grids, 29 June 2009

Publications and Public Consultations

Regulators' Public Consultation on Smart Grids, Ref. E09-EQS-30-04, December 2009
This paper explores the drivers and opportunities for 'smarter' networks from the users' perspective. It discusses the regulatory challenges and priorities, and provides a useful reference point on EU and US experiences with Smart Grids.

Regulators' Public Consultation on the regulatory aspects of the integration of wind generation in European electricity markets, Ref. C09-SDE-TF-14-02a, December 2009
The paper considers whether the regulatory regime for wind generation facilitates barriers to its deployment and/or distorts incentives in choosing where to locate in the EU. It examines how wind generation should be integrated into the electricity market (e.g. bidding closer to real time and balancing) and network access arrangements.

Regulators' Status Review on the Regulatory Aspects of Smart Metering, Ref. E09-RMF-17-03, October 2009
This report reviews the state of play regarding the introduction of smart meters in Europe, examining the issue from a regulatory perspective: meter value management; roll-out policy; access to data and privacy issues; and functional and technical aspects.

Regulators' Status Review of Sustainable Development in the Energy Sector, Ref: C09-SDE-10-03, April 2009
The report assesses Europe's progress in working towards sustainable development against the 2020 targets. It also illustrates some of the different low carbon diets (in terms of carbon abatement, air quality, renewables and efficiency) of different EU Member States in an effort to manage the transition to a low carbon economy in the energy sector.

Regulators' Status Review of Renewable and Energy Efficiency Support Schemes in the EU, Ref. C08-SDE-05-03, December 2008
This report examines the support schemes (e.g. feed-in tariffs, quotas with tradable certificates etc.) in place across Europe. It identifies barriers to the further deployment of renewables and assesses the extent to which renewables have been successful in replacing conventional generation in the fuel mix.

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FS-09-03, December 2009

Council of European Energy Regulators

ERGEG – European Regulators Group for Electricity & Gas

Smart Grids and smart energy regulation can help implement climate change objectives

*The development of zero and low-carbon emitting electricity generation will play a key role in meeting climate change objectives. But today's electricity transmission and distribution networks were not built to properly integrate the large amounts of this new generation or the demand (customer) response needed. Instead, new network technologies will need to be deployed which provide electricity grids with the intelligence to deliver this enhanced level of system performance and efficiency – in short, they must evolve into **Smart Grids**.*

These smart grids need to be more efficient and customer-oriented than ever before.

A Fact Sheet by the European Energy Regulators on how electricity "smart grids" and regulators are key to implementing climate change objectives

The European Regulators' Group for Electricity and Gas (ERGEG) was created by the European Commission as its advisory body on energy issues. The Council of European Energy Regulators (CEER) was set up by the regulators on their own initiative and acts as a preparatory body for ERGEG. www.energy-regulators.eu.

Role of Smart Grids in climate change

Smart Grids are key to reducing carbon emissions and improving energy efficiency by:

- *reducing network losses;*
- *facilitating higher penetration of renewable and distributed generation* in compliance with operational security, power system and electricity market efficiency;
- *supporting efficient end-use of electricity*, for example of plug-in electricity vehicles.

See the two examples on (1) integrating more renewables and (2) driving energy savings.

What is the Smart Grid?

Although there is no standard global definition, the EU's Smart Grids Technology Platform defines Smart Grids as "*electricity networks 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.* (www.smartgrids.eu)

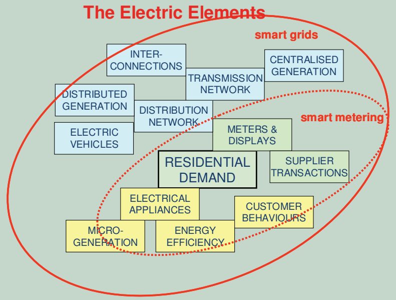
But what does this "smartness" mean?

The "smartness" is manifested in making *better use of technologies and solutions* to better *plan and run* existing electricity grids, to *intelligently control generation* (including low-carbon) and to enable *new energy services* and *energy efficiency* improvements.

Smart Grids are about *building, expanding, operating and maintaining the electricity networks of the future* in a way which will also help meet the EU's 20/20/20 climate change objectives. These ambitious targets for the year 2020 include 20% reduction in greenhouse gas emissions, 20% EU renewables share and 20% savings in consumption by improving energy efficiency.

What the Smart Grid does not mean?

- The Smart Grid relates to the *electricity network only* (not gas) – it concerns both distribution and transmission levels.
- Smart Grids are not new "super grids". They will *not look significantly different to today's "conventional" electricity grids* transporting and distributing power over "copper and iron". However, *Smart Grids will lead to improved cost-efficiency and effectiveness*.
- The Smart Grid *is no revolution* but rather an *evolution* or a process within which electricity grids are being continuously improved to meet the needs of current and future customers.
- The Smart Grid is *not covering 100% of all networks* in all European Union (EU) Member States – that would be both unnecessary and impossible, at least on a realistic timescale. Moreover, roadmaps for deployment of Smart Grids differ between Member States. What Europe needs is one integrated EU grid at transmission level and activation or intelligence at distribution level.
- There *will not (and cannot) be any "roll-out" of Smart Grids*, since such a "roll-out" is continuously occurring.
- Although the concepts are sometimes



confused, the *Smart Grid is not smart metering* – the smart grid is a much broader set of technologies and solutions (see diagram).

- While many utilities have put their focus on smart metering, *smart metering does not provide a Smart Grid*. Indeed, it is possible to have smarter electricity grids (i.e. distribution and transmission networks) without smart metering. But, there are several benefits to smart metering which can reinforce other policy actions on climate change. For example, when used with other parameters (such as differential tariffs and information) smart meters can encourage consumers to reduce their demand (load) when prices are high or when system reliability or power quality is at risk.

Benefits of Smart Grids

For regulators, it is important to understand what they are intended to solve and what types of functions or value they can provide for users of the transmission or distribution grids.

Smart Grids employ innovative products and services together with intelligent monitoring, control, communication, and self-healing technologies in order to:

- Better facilitate the connection and operation of generators of all sizes and technologies (e.g. renewables);
- Optimise grid operation and usage (e.g. reducing losses) and grid infrastructure;
- Allow consumers to play a part in optimising the operation of the system;
- Provide consumers with greater information and options for choice of supply;
- Significantly reduce the environmental impact of the whole electricity supply system;
- Maintain or even improve the existing high levels of system reliability, quality and security of supply;
- Maintain and improve the existing network services efficiently (e.g. adequate short-circuit power at point of grid connection, efficient and reliable alarm and fault management for self-healing procedures in distribution networks, adequate (bi-directional) protection concepts for distributed generation etc);
- Foster market integration towards an integrated market on electricity.

Cost of Smart Grids - regulators require value for consumers and society

Investment in grids needs to be carried out introducing cost efficient intelligent technologies that will also help to meet the climate change targets.

However, this *should not be a case of regulators writing a blank cheque for network operators*. Regulators (who control network tariffs and hence the revenue stream of network operators) must consider the public interest implications of these investments.

Smartness should ultimately result in reduced costs, improved efficiency and customer benefits.

Smart Grids requires Smart Regulation

Regulators are not the main actors in the deployment of smart grids – however they have a central role to play in *encouraging electricity network operators to re-invent how they manage demand and supply by deploying innovative and smart grid technologies.*

Key regulatory challenges of smart grids:

1. Regulators must find ways to encourage network companies to be more innovative.

2. Regulators must enable network companies to *identify and prioritise specific Smart Grid solutions* that can more efficiently meet network users' needs and incentivise them to be deployed. There should be clearly defined and agreed criteria for selection of projects for network operators and follow-up.

3. A major challenge for regulators is to find ways of *encouraging an adequate level and scope for more radical innovation* while providing an appropriate degree of protection of customers' interests and economically effective development of the network (given that network operators are monopolies).

4. Regulators must act as *key facilitators of smart grids* by identifying and removing possible barriers and finding solutions that provide an appropriate balance between all stakeholders' positions.

Europe's national energy regulators meeting through CEER and ERGEG share best practice at EU level and are facilitators of smart grids.

At international level, regulatory cooperation happens through the *International Confederation of Energy Regulators (ICER)*, a virtual confederation of the world's energy regulators (11 regional associations representing more than 200 national regulators) which was created in October 2009 (www.icer-regulators.net) and is chaired by CEER President/ERGEG Chair, Lord Mogg. CEER also heads up ICER's Climate Change Working Group.

ICER's first output was the World Regulators' Statement on Climate Change (October 2009) which commits regulators worldwide to eight concrete actions on climate change including *inter alia*: reports on (a) regulatory best practices to promote energy efficiency and (b) the integration of renewable and distributed generation into the overall energy supply and their effect on the grid and competition.

Example 1 – Smart Grids can better integrate more renewable energy sources

Goal and means

The integration of low-carbon generation technologies that use renewable energy sources (RES) or that use primary energy more efficiently e.g. combined heat and power (CHP) help meet sustainability objectives.

These generation units can be divided into *large scale* (connected to the transmission grid e.g. large wind or solar parks, large hydro plants) and *small scale* (connected to distribution grids, e.g. individual wind mills or solar cells, small hydro plants or micro-CHP).

This *small-scale generation, or distributed generation (DG)*, can, depending on its location and penetration level, contribute to energy efficiency by reducing losses in the distribution networks. An increase in DG can also lead to a more active role of consumers, in which they act also as producers (*production-side user participation*).

Problems

Today's conventional grids were not built to be able to cope with large scale zero and low-carbon electricity generation including an effective demand response.

Ageing networks will need to be *replaced or reinforced* to connect new forms of generation.

Without smart grid solutions, there is a real *risk* that the renewal of the grid will result *in "like-for-like" replacement* of copper and iron, based on conventional technologies, *without any efficiency gains*.

Smart Grid Challenges and Solutions

For large scale renewable and distributed generation, cost-effective connection solutions need to be developed, particularly as renewable resources are often distant from the load (demand) centres.

Because of the intermittent character of wind energy (today's most mature RES technology in terms of deployment and installation), *monitoring and balancing* on the transmission level will become more challenging and measures to maintain balance (e.g. management of supply, maximising interconnection capacity by soft measures like coordinated phase-shifters operation, etc.) need to be enhanced. Furthermore, new smart technologies are required in particular to *connect the massive capacity of the additional off-shore wind in the years to come*.

The grid must be able to cope with more *small scale or distributed generation* (DG) e.g. windmill, small hydro plants or micro-CHP. If the network operator can no longer guarantee quality and reliability for the network users, additional measures ranging from changes in protection settings (bidirectional instead of unidirectional), operational control practices (real-time supervision, data acquisition and security analysis) to massive network investments (e.g. high voltage DC lines to "collect" the off-shore wind and bring it to the demand centres in continental Europe are needed.

Energy Regulator's Role

Smart Grids can *effectively integrate renewables* and *dynamically manage the mismatch between intermittent renewables* (e.g. wind) *and consumer demand*.

Regulators have a key role to play in *incentivising network operators* to adopt Smart Grid solutions and integrate new and best technologies. Regulators too can *change the market rules* such as balancing systems and markets (e.g. moving from traditional day-ahead electricity bidding closer to a real-time one) to help the network better manage the wind intermittency (which would in turn help renewables better compete with fossil fuels).