Briefing

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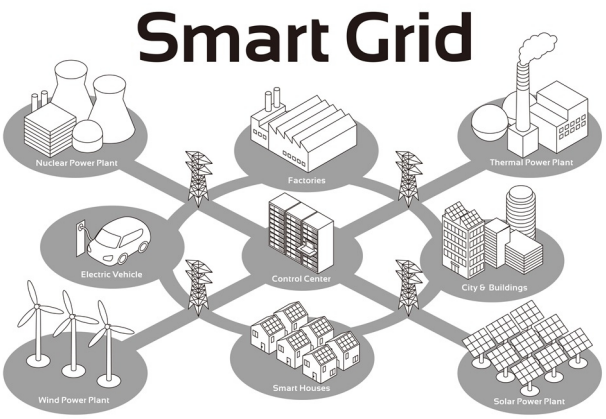
European Parliament

Smart electricity grids and meters in the EU Member States

SUMMARY

Smart electricity grids feature in the European Commission's Energy Union package and constitute a priority for the EU in the energy field. Proponents of smart grids argue they can contribute to a more efficient use of energy, increasing the share of renewables in the energy mix, reducing the infrastructure required to supply electricity, and curbing overall energy consumption. Smart grids can also empower consumers, making them more aware of their energy use and able to adjust it in response to price signals. To facilitate the development of smart grids, the Commission encourages the deployment of smart metering across EU Member States, in line with the recommendations of the 2009 gas and electricity packages.

Yet in practice significant variations exist among Member States in their deployment of smart metering, the precise energy cost savings are uncertain and there remain concerns about security and data protection. Energy producers tend to be most supportive of smart metering, and have successfully pushed for full-scale deployment in several member states. The European Parliament is generally supportive of the development of smart grids and metering, but asks that this process takes full account of consumer concerns, particularly in terms of costs and security.



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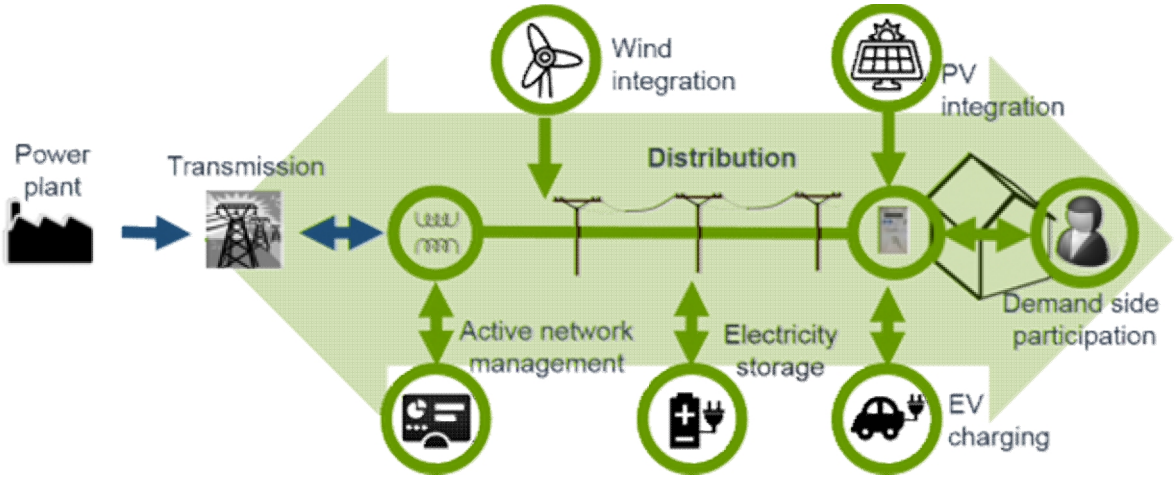
What are smart grids and meters?

The International Energy Agency (IEA) defines the smart grid as 'an electricity network that uses digital and other advanced technologies to monitor and manage the transport of electricity from all generation sources to meet the varying electricity demands of end-users' (2011 IEA report). Smart grids allow renewable energy sources, whose contribution to power generation is intermittent (wind, solar), to be more easily compensated by conventional forms of energy when user demand is high or the energy supply from renewables is low. A 2011 OECD paper notes that smart grids reduce demand peaks for energy, by sending price signals that encourage consumers to adjust their energy use to off-peak periods, and so spread electricity use more evenly over the day and night. Smart grids can also allow consumers to sell surplus energy they generate, for example through solar panels, to the electricity grid at a defined price.

Reducing the frequency and scale of demand peaks can improve energy efficiency, reduce the use of fossil fuels needed for back-up power generation, and ultimately require fewer power plants and less transmission capacity to supply electricity. Yet in order to respond effectively to price signals, consumers need real-time information on their energy use or generation. This can be provided by advanced metering systems ('smart meters') which use the latest digital technologies, update information regularly and provide two-way electronic communication between consumers and the grid.

Figure 1: How a smart grid works



Source: European Distribution System Operator's Association (EDSO) for Smart Grids.

Smart Grids and Energy Union

Commissioner Maroš Šefčovič (Vice-President for Energy Union) **considers** that smart grids could have a similar effect on the EU economy as shale gas had on the US economy: increasing energy independence, reducing reliance on energy imports, and providing substantial savings to consumers. Commissioner Miguel Arias Cañete (Climate and Energy) **considers** them central to the vision of an Energy Union primarily because they encourage demand-side response by consumers, and in the long run reduce the infrastructure needed to supply electricity. The Energy Union package proposed by the European Commission encourages smart grids because they can benefit consumers through more transparent and flexible pricing, foster greater use of renewable energy in power generation systems, increase technological innovation in the energy sector and provide 'green jobs' in EU Member States. Smart grids are expected to contribute

towards the long-term goals set by the European Council (October 2014): improve EU energy efficiency by 27%, attain a 27% EU share of renewable energy by 2030 and reduce greenhouse gas emissions. The Commission has placed particular emphasis on the large-scale roll-out of smart electricity metering across EU Member States, as foreseen by the 2009 Electricity Directive, in order to 'assist the active participation of consumers in the electricity supply market' (Annex 1).

EU policies on smart grids

In 2009 the Commission set up a Smart Grids Task Force to develop common standards and technical requirements for smart grids. The Commission sees smart grids as necessary 'to ensure an economically efficient, sustainable power system with low losses and high quality and security of supply and safety', and its 2011 Communication on the subject noted that €5.5 billion was invested in about 300 Smart Grid projects across EU Member States, with €300 million coming from the EU budget. The Commission suggests that smart grids can improve energy efficiency and curb CO_2 emissions, yet also notes that government support for deployment of smart grids in the EU is rather limited when compared to other parts of the developed world (notably the USA). The Commission's Joint Research Centre keeps a detailed inventory of all smart grid and metering projects in Europe and has carried out its own research on the subject.

The Connecting Europe Facility foresees transnational projects of common interest (PCIs) to develop infrastructure in the energy sector, using public funds to leverage further private investment. Yet the first round of PCIs in energy infrastructure (248 projects were chosen in October 2013) saw only two smart grid projects selected for funding (see box). Smart grid projects tend to focus on improving the efficiency and integration of national (or even local) power generation and transmission, so do not necessarily have a transnational dimension, which is usually a requirement for EU funding. Nevertheless, standards and requirements for smart grids are being designed to be inter-operable between different suppliers and national systems, paving the way for greater cross-border transmission in future. Energy infrastructure, including smart grids, is expected to account for several projects financed by the European Fund for Strategic Investments.

Smart grids as projects of common interest (PCIs)

Two smart grid PCIs have been selected for EU funding by the Connecting Europe Facility. North Atlantic Green Zone will deliver a technologically advanced cross-border smart grid between the UK and Ireland, with increased capability and high speed communication. Green-Me project finances the feasibility study and design phase of a smart grid interconnection that aims to improve integration of renewable energy and storage capacity across several regions of France and Italy.

The 2009 Electricity Directive recommended the roll-out of smart metering systems across the EU but without a binding target date for Member States to comply. The Commission later specified a minimum set of ten functionality requirements to ensure system interoperability and the possibility of technological upgrades. Yet the final decision on deployment is to be taken by individual Member States, who can make implementation conditional on a positive economic assessment of costs and benefits. These national cost-benefit analyses (CBA) were to be completed by September 2012 and sent for scrutiny to the Commission, which used them as the basis for its

2014 benchmarking report on smart metering deployment. If the CBA findings prove positive then Member States are expected to ensure 80% of consumers receive smart meters by 2020. Member States can also proceed to full-scale deployment without a detailed CBA, an option pursued by Italy and Spain.

Costs and benefits of smart metering

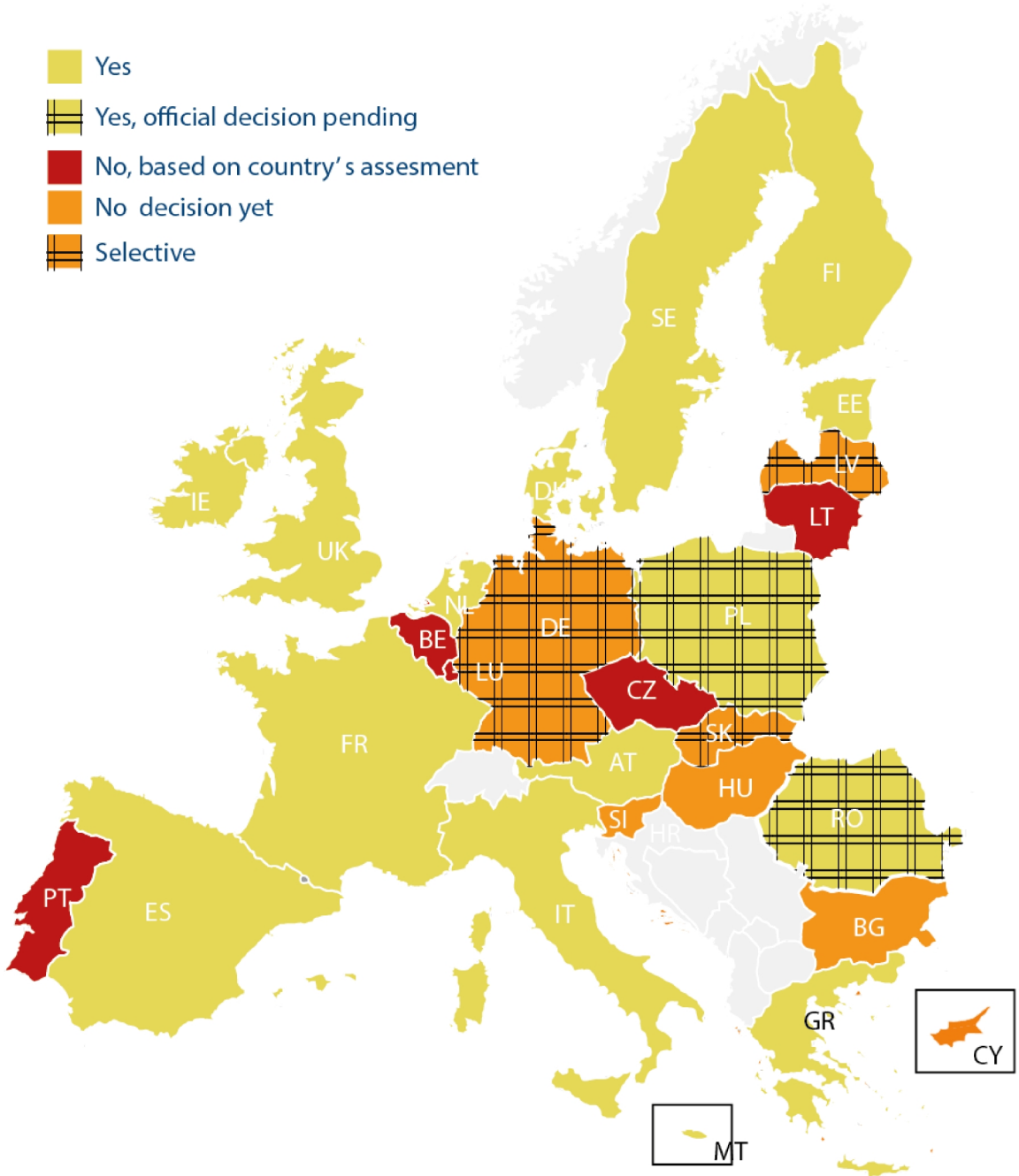
Variations across Member States

The 2014 Commission Benchmarking Report reflected on progress in the roll-out of smart metering across the EU and found a mixed picture (see figure 1). Three Member States were advanced in their roll-out plans (Finland, Italy, Sweden), installing close to 45 million meters. Another thirteen Member States declared their intention to proceed with large-scale roll-out of smart meters by 2020, although they are at different stages of the process: Poland and Romania have not made an official decision on roll-out, Spain has proceeded even without the full CBA and the UK has encountered serious technical problems that have significantly delayed the process. In seven Member States, the CBAs proved negative or inconclusive (Belgium, Czech Republic, Germany, Latvia, Lithuania, Portugal, Slovakia). In Germany, Latvia and Slovakia, smart metering was found to be economically justified only for particular groups of customers. These countries now expect to roll out smart meters to around 23% of household consumers. Four Member States (Bulgaria, Cyprus, Hungary, Slovenia) did not produce CBAs or roll-out plans at all. Although enthusiasm for smart electricity metering is not uniform across the EU, a majority of Member States still intend to proceed with large-scale deployment by 2020. The picture is more negative concerning the deployment of gas meters (see box below), likely to take place on a more limited scale across the EU.

Smart gas meters

The large-scale roll-out of smart gas meters is foreseen in the 2009 Gas Directive. Yet only five Member States have made binding decisions on the roll-out of smart gas metering by 2020 (Ireland, Italy, Luxembourg, Netherlands, UK). Austria and France are expected to develop roll-out plans and other states may do so after new CBAs are conducted. Twelve Member States concluded that, for now, the costs outweighed the benefits. Others will install smart metering systems only for selected groups of consumers or have reached no binding decisions. In its 2014 benchmarking report, the European Commission concludes that 'making the business case for gas smart metering is more of a challenge, given that the expected benefits are either less significant than for electricity or do not apply'. Gas can be held in storage while the supply and prices of gas do not vary much over short time periods, so the expected advantages of smart metering are more modest than for electricity. Installation costs can be reduced where smart gas and electricity meters are rolled out together, as proposed in the Netherlands and the UK.

Figure 2 - Deployment of smart electricity meters in EU Member States by 2020



Source: European Commission (2014 benchmarking report on smart metering)

Based on the national CBAs, the estimated cost of installing smart electricity meters was varies widely between different Member States, from €77 to €776 per customer. The Commission argues this is partly because of inconsistent methodologies in the national CBAs: Member States applied different discount rates and time horizons to assess the economic value of smart metering, while the expected lifetime of smart meters and the speed of implementing the roll-out schemes varied widely. The Commission concedes that differences between national energy transmission systems have some effect on the costs and benefits of smart metering, but remains sceptical about the results of some national CBAs, and is reflecting on ways to develop a more standardised methodology.

Demand-side response of consumers

The Commission's benchmarking report expects that smart metering will lead to substantial cost savings in the longer run: the average consumer can reduce their energy costs by around 3%, while some types of consumers could reduce them by up to 10%. The 3% figure is consistent with the findings of the Energy Demand Research Project carried out by four energy suppliers in the UK, on behalf of the Office for Gas and Electricity Markets (see House of Commons Library Briefing). Trials and roll-outs of smart meters in the USA indicate that higher cost savings of 6-12% are possible (OECD Paper). But the evidence from Member States that *have* extensively deployed smart metering in the EU would suggest savings are likely to be more modest. Finland found the average savings to be only 1-2%, while Sweden gave a range of 1-3%. No data were available for Italy. Other CBAs conducted by Member States predicted energy savings to be insignificant or as low as 1% per customer. Some therefore argue that smart meters should only be installed for consumers with high energy usage, reducing the costs of deployment while keeping the average savings higher. Germany, for example, intends to restrict mandatory smart metering to consumers with high energy usage or those living in new buildings.

The Commission argues that the extent of energy saving can depend heavily on the functionality of smart meters: those with broad functionality cost more in the short term but yield greater savings in the longer run. This is because they are able to provide a wider range of information to customers, which is more frequently updated and more easily accessible, thereby facilitating demand side response. Yet a recent Egmont paper points out that only about half of Member States proceeding with large scale roll-out have delivered the ten recommended functionalities for smart meters, some early adopters used older technology that does not deliver the full range of functionalities. A particular challenge will be whether older smart meters can cope with technological upgrades or need to be replaced at very significant cost. According to the 2014 benchmarking study by the Commission, in almost all Member States the final decisions on functionality have been delegated to national distribution system operators, which usually own the smart meters, rather than governments or energy regulators.

Benefits for energy companies

Smart metering could prove very beneficial for some national distribution system operators (DSOs), which promote their deployment through the European Distribution System Operators for Smart Grids (EDSO). The decision by ENEL (DSO in Italy) to roll out smart metering was done with a view to understanding where energy was being lost in the transmission system and how to reduce these losses. The main DSOs in Spain and France chose to proceed with a large scale roll-out of smart meters, even without detailed analysis of its impact on their customers. Commercial considerations influenced the decision-making process in Finland, where the DSO pushed for smart metering deployment to be enshrined in government legislation. Only in Sweden was smart metering promoted by government largely in response to consumer concerns. The House of Commons Public Accounts Committee in the UK argues that many of the initial benefits of smart metering deployment are likely to accrue to energy suppliers rather than consumers, especially in uncompetitive energy markets. EU consumer associations (BEUC) support smart metering in principle but believe it should be optional and consumers should not have to pay the costs of installation, while vulnerable customers should be protected from large increases in peak energy costs.

Yet according to the Commission's benchmarking report, in the vast majority of Member States where deployment of smart meters has been approved, the DSOs that install them will be allowed to recoup their costs, either partially or fully, through higher network tariffs for consumers.

Data protection

Concerns have been raised about data protection in complex smart grid systems, especially personal details of customers and information about their patterns of energy use. The Egmont paper suggests that few Member States have paid significant attention to data protection in their smart metering roll-out programme. In the Netherlands, individual consumers will be allowed to opt-out from smart meters for reasons of data confidentiality. Similar proposals are being discussed in the United Kingdom. A closely related concern is the susceptibility of smart grids and meters to cyber-hacking, as highlighted by several cases in the USA where hackers were able to access smart grids through appliances such as smart meters. The European Network for Information and Security Agency (ENISA) has outlined appropriate security measures to minimise this kind of risk in a detailed report. The European Commission and its Smart Grids Task Force, which includes industry representatives, take the view that data privacy and security issues can be adequately addressed through existing legislation.

European Parliament

The European Parliament (EP) resolution of 14 March 2013 on the 'Energy Roadmap 2050' emphasised the importance of smart grids and meters for more efficient energy use, increasing the share of renewables in the energy mix and facilitating communication between producers and consumers. The EP resolution of 10 September 2013 on 'Making the Internal Energy Market Work' sees smart technologies as necessary to develop a more consumer-oriented market and calls on the Commission to 'facilitate the deployment of... smart grids that do not place a financial burden on consumers and that take their data privacy into account', as well as making 'sufficient funding available for the distribution of smart grids'.

The EP adopted an own-initiative resolution on 4 February 2014 concerning the 'Local and Regional Consequences of Smart Grids'. The EP reiterated its support for smart grids but felt that a more ambitious EU framework of policies and targets for energy efficiency and renewable energy was needed to incentivise their development. The EP felt that new technologies, such as renewables, are still at a competitive disadvantage in traditional power grids, and called for smart energy systems to receive an exemption under the state aid modernisation rules, while the application of internal market laws should be flexible enough to allow region-specific solutions in smart energy systems. The EP emphasised that security concerns related to smart grids still need to be fully addressed, and more should be done to develop smart grids at regional and local levels, particularly in disadvantaged regions of Europe.

Next steps

Smart electricity grids and metering feature prominently in the recent Communication by the European Commission on a New Deal for Energy Consumers, part of the Summer Energy Package and linked to the broader Energy Union strategy. The Commission will continue to monitor the roll-out of smart metering in Member States where this has been approved. It has asked Member States not opting for large-scale roll-out to review the critical parameters and assumptions used in their CBAs, and for the Member States that have not produced CBAs or announced roll-out plans to do so swiftly. While continuing to strongly support the large-scale deployment of smart electricity meters, the Commission now places rather less emphasis on smart gas metering, especially as a majority of the CBAs on smart gas metering proved negative or inconclusive.

Main references

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