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REPORT FROM THE COMMISSION

Benchmarking smart metering deployment in the EU-27 with a focus on electricity

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Objective

The aim of this report is to measure progress on the deployment of intelligent metering in EU Member States in line with the provisions of the Third Energy Package¹. Subject to the outcome of a possible economic assessment of long-term costs and benefits, Member States are required to prepare a timescale (of up to 10 years in the case of electricity) for the deployment of intelligent metering systems². This report looks at progress in the EU-27³ to date and frames recommendations for the way forward.

There are two Staff Working Documents accompanying this report. They present the state-of-play of smart metering implementation in the EU, and include an overview of the cost-benefit analyses conducted by Member States along with related country-specific data.

Smart metering in EU legislation

The Third Energy Package requires Member States to ensure implementation of intelligent metering systems for the long-term benefit of consumers. This implementation may be conditional on a positive economic assessment of the long-term costs and benefits (cost-benefit analysis – CBA) to be completed by 3 September 2012. For electricity, there is a target of rolling out at least 80% by 2020, of the positively assessed cases.

Furthermore, in line with the spirit, and complementing the provisions of the Third Package, the Energy Efficiency Directive⁴ supports the development of energy services based on data from smart meters, demand response⁵ and dynamic prices. It does that while respecting and promoting individuals' right to the protection of personal data as enshrined in Article 8 of the Charter of Fundamental Rights of the European Union (the Charter), as well as ensuring a high level of consumer protection (Article 38 of the Charter).

The Third Energy Package does not set a specific implementation target for smart metering in the gas sector, but the Retail Markets Interpretative Note⁶ states that it should be achieved in a 'reasonable period of time'.

Progress on smart metering deployment in the EU-27

Analysis shows that appreciable progress has been made. Following positive CBAs for electricity in over two thirds of cases, Member States are now committed to proceeding with (or have already completed) the roll-out of smart metering. There are close to 45 million smart meters already installed in three Member States (Finland, Italy and Sweden),

¹ Annex I.2 to the Electricity Directive (2009/72/EC) and the Gas Directive (2009/73/EC).

² 'Smart metering system' or 'intelligent metering system' means an electronic system that can measure energy, consumption, providing more information than a conventional meter, and can transmit and receive data using a form of electronic communication — definition from Article 2, point 28 of the Energy Efficiency Directive (2012/27/EU), OJ L315, 14.11.2012, p.1.

³ EU-27: Austria, Belgium, Bulgaria, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and the United Kingdom. Croatia was not covered in the analysis as the main data collection was carried out before its accession.

⁴ Energy Efficiency Directive (2012/27/EU).

⁵ 'Demand response' is to be understood as voluntary changes by end-consumers of their usual electricity use patterns - in response to market signals (such as time-variable electricity prices or incentive payments) or following the acceptance of consumers' bids (on their own or through aggregation) to sell in organised energy electricity markets their will to change their demand for electricity at a given point in time. Accordingly, demand response should be neither involuntary nor unremunerated. (Staff Working Document 05.11.2013).

⁶ Interpretative Note on Directive 2009/72/EC concerning common rules for the internal market in electricity and Directive 2009/73/EC concerning common rules for the internal market in natural gas, Staff Working Paper, 22.01.2010.

representing 23% of envisaged installation in the EU by 2020. According to our estimates, the roll-out commitments amount to an investment of around €45 billion for the installation by 2020 of close to 200 million smart meters for electricity (representing approximately 72% of all European consumers) and 45 million meters (around 40% of consumers) for gas. These figures are encouraging. They demonstrate that where roll-out of smart metering is positively assessed, the expected penetration rate for electricity in these Member States exceeds the Third Energy Package target of 80% but falls short of an EU-wide penetration rate of 80%. This also indicates that the business case for rolling out smart metering is not yet overwhelming throughout Europe, and this is something more of a challenge in the case of gas.

Overview of the benchmarking results

The results of Member States' cost-benefit analyses are as follows:

Electricity

- 16 Member States (Austria, Denmark, Estonia, Finland, France, Greece, Ireland, Italy, Luxembourg, Malta, Netherlands, Poland, Romania, Spain, Sweden and the UK⁷) will proceed with large-scale roll-out of smart meters by 2020 or earlier, or have already done so. In two of them, namely in Poland and Romania, the CBAs yielded positive results but official decisions on roll-out are still pending;
- In seven Member States (Belgium, the Czech Republic, Germany, Latvia, Lithuania, Portugal, and Slovakia), the CBAs for large-scale roll-out by 2020 were negative or inconclusive, but in Germany, Latvia and Slovakia smart metering was found to be economically justified for particular groups of customers;
- For four Member States (Bulgaria, Cyprus, Hungary and Slovenia), the CBAs or roll-out plans were not available at the time of writing⁸; and
- Legislation for electricity smart meters is in place in the majority of Member States, providing for a legal framework for deployment and/or regulating specific matters such as timeline of the roll-out, or setting technical specifications for the meters, etc. Only five Member States (Belgium, Bulgaria, Hungary, Latvia and Lithuania), have no such legislation in place.

Gas

- Five Member States (Ireland, Italy, Luxembourg, the Netherlands and the UK) have decided to roll-out smart meters by 2020 or earlier;
- Two Member States (France and Austria) have plans to proceed with a large-scale roll-out but have yet to take official decisions;
- In 12 Member States (Belgium, the Czech Republic, Denmark, Finland, Germany, Greece, Latvia, Portugal, Romania, Slovakia, Spain and Sweden), the results of the CBA were negative; while

⁷ Data on the United Kingdom-Great Britain (UK-GB) are discussed throughout the report as representative of the UK. The region of Northern Ireland (NI), in terms of overall metering points, represent a very small proportion of the overall UK figure – around 1.5% of the UK total - and therefore it is not reflective of the Member State position as a whole. Furthermore, it is rather difficult to generate data which are representative of the whole UK due to the varying methodologies as well as differences in the energy markets between NI and GB. The specific NI position is also captured as it is incorporated in the respective Country Fiches' Staff Working Document accompanying this report.

⁸ Hungary notified the Commission services of its cost-benefit-analysis in December 2013. The current report and accompanying Staff Working Documents refer to CBA data available by the end of July 2013.

- The other Member States have yet to conclude their assessment (n.b. there is no gas network in Cyprus or Malta).

Electricity meter ownership and data handling

- In 15 out of the 16 Member States that have decided to proceed with a large-scale roll-out, the distribution system operators (DSOs) are responsible for implementation and own the meters, so the operation is to be financed through network tariffs;
- In four Member States (Denmark, Estonia, Poland and the UK) data will be handled by an independent central data hub; and
- A similar picture applies in the Member States not proceeding (at least under current conditions) with large-scale roll-outs by 2020 where – with the exception of the Czech Republic, Germany and Slovakia, where alternative options for data handling are being considered – the DSOs may also be responsible for implementation, ownership and data handling.

Smart metering — of value to the consumer and to the energy system

While divergence in key roll-out parameters calls for caution (Table 1 and Table 2), available data indicate that a smart metering system could cost on average €200 to €250 per customer. Cost per metering point ranges from under €100 (€77 in Malta, €94 in Italy) to €766 in the Czech Republic.

Table 1 Summary statistics — key smart metering roll-out parameters for electricity (based on Member States' long-term economic assessments)⁹

	Range of values	Average based on data from positively assessed cases
Discount rate	3.1 to 10%	5.7% $\pm$ 1.8% (70% ¹⁰)
Lifetime	8 to 20 years	15 $\pm$ 4 years (56%)
Energy saving	0 to 5%	3% $\pm$ 1.3% (67%)
Peak load shifting	0.8 to 9.9%	n.a.
Cost per metering point	€77 to €766	€223 $\pm$ €143 (80%)
Benefit per metering point	€18 to €654	€309 $\pm$ €170 (75%)
Consumer benefits (as % of total benefits)	0.6% to 81%	n.a.

⁹ The 'discount rate' is applied to costs and benefits of smart metering investments in the respective scenarios considered. It takes into account the point in time to which the monetary values relate and the risk or uncertainty of anticipated future cash flows. The discount rate has a significant impact on the assessment of potential smart metering investments as the costs are incurred predominantly at the beginning of the scenarios considered whereas the smart intervention often produces benefits in the long-term.

'Cost per metering point' and 'benefit per metering point' statistics are based on numbers calculated using the net present value of the respective costs (CAPEX and OPEX) and benefits.

¹⁰ This percentage relates to the number of measurements (as part of the data consulted) that fall within the range of the average value quoted $\pm$ the standard deviation given. The data set considered for electricity relates to the positively assessed cost-benefit analyses from 16 countries that have already completed or will proceed with large-scale roll-out.

Table 2 Summary statistics — key smart metering roll-out parameters for gas (based on Member States' long-term economic assessments)

	Range of values	Average based on all data
Discount rate	3.1 to 10%	n.a.
Lifetime	10 to 20 years	15 - 20 years (75 %)
Energy saving	0 to 7%	1.7% $\pm$ 1% (55%)
Cost per metering point	€100 to €268	€200 $\pm$ €55 (65%)
Benefit per metering point	€140 to €1000	€160 $\pm$ €30 (80%)

Smart metering systems are expected to deliver an overall benefit per customer of €160 for gas and €309 for electricity along with assumed energy savings of 3%. The latter range from 0% in the Czech Republic to 5% in Greece and Malta. Of the countries that have completed roll-outs, Finland and Sweden have indicated energy savings of the order of 1-3%, but no data were available for Italy.

Smart metering with retail- and consumer- friendly functionalities at the heart of consumer-centric energy systems

Intelligent metering systems to be deployed must be carefully designed, and therefore they should:

- be equipped with fit-for-purpose functionalities in line with standardisation and as proposed in Commission Recommendation 2012/148/EU¹¹ in order to ensure technical and commercial interoperability, or ensure the possibility to add functionalities at a later stage;
- guarantee data privacy and security;
- enable demand response and other energy services to evolve; and
- support retail markets that deliver full benefits to consumers and the energy system.

In eight of the Member States proceeding with large-scale roll-out of smart metering for electricity by 2020, functionalities are reported to be fully as recommended in Recommendation 2012/148/EU.

The most challenging functionality to deliver relates to the frequency at which consumption data can be updated and made available to consumers and third parties on their behalf. This functionality will support direct feedback on costs to consumers, enable consumers to make informed choices on their consumption patterns and facilitate the development of new retail services and products. Seven of the Member States proceeding with large-scale roll-out of smart metering by 2020 and three of those not intending to roll-out do not comply with this functionality. If the smart metering system is not able to deliver this functionality, Member

¹¹ Commission Recommendation 2012/148/EU, OJ L 73, 13.3.2012, p.9;
<http://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:32012H0148>.

States should ensure that this functionality can be added later, or that this functionality can be met through other arrangements.

There appears to be no direct link between the range of common minimum functionalities considered for the smart metering systems to be deployed and their overall cost. In other words, selecting fewer items from the set of common minimum functionalities does not necessarily translate into less expensive systems. In fact, the variation in ‘cost per metering point’ data across Member States indicates that the total investment is influenced far more by other parameters, including:

- starting conditions;
- local labour costs;
- geographical configurations;
- additional features beyond the minimum set of functionalities; and
- overall scenarios, discount rates and appraisal periods considered in the respective CBAs.

This makes a compelling case for adhering from the very beginning to the full set of common minimum functionalities. If the Member State’s CBA does not support this approach, it is highly recommended that the systems to be deployed are at least capable of being upgraded so as to support ‘smart’ services and products in the future. Choosing a sub-optimal, inflexible, non-upgradeable system will ultimately lead to higher costs if, for instance, substantial alteration, or even complete replacement is needed soon after installation in response to market and consumer requirements.

At present, only a few Member States have laid down guidelines on the functional requirements of smart metering systems. The others leave analysis of the options to the parties responsible for the roll-out — in the majority of cases, the distribution system operators — without setting clear incentives or requirements for functionality features that also benefit consumers.

Standards and safeguards for data protection and security — key to realising the full potential of smart metering in the EU

The internal energy market needs to ensure protection of consumer privacy when providing access to data for running business processes. It therefore needs to ensure the right to consumers’ protection of their personal data as guaranteed by Article 8 of the Charter. Work on this has so far identified the following privacy concerns:

- The risk of user profiling through high frequency data reading i.e. gathering sensitive information on the end-user’s energy footprint; and
- Protection of and access to stored data in the light of privacy and confidentiality policies.

This report and its accompanying Staff Working Documents discuss issues related to the solutions developed by the market and relevant national authorities, as well as at European

level¹² on this aspect, and highlight the key role of standardisation¹³ if the full potential of smart metering as a contribution to smart grids¹⁴ is to be realised.

Lessons learned from pilot programmes¹⁵ and operational experience

Based on experiences acquired to date from completed or on-going pilot programmes, the following aspects should be borne in mind when planning the roll-out of smart metering:

- Capitalise on the smart metering infrastructure being rolled-out:
 - o use available **standards** and the **right set of functionalities** to ensure technical and commercial interoperability, guarantee data privacy and security, and deliver full benefits to consumers and the energy system; and
 - o assess the need for a specific **data privacy and security** framework, under national and EU legislation, prior to the roll-out;
- Get the **consumer on board** from the beginning of the process:
 - o set up a communication strategy and information campaign;
 - o earn consumer trust and confidence, for which it is crucial that consumers understand what data are transmitted, and giving them access to them;
 - o use metering data to feed information back to the customer and allow the development of new products and customer-oriented services; and
 - o stimulate consumers' involvement by providing them with appropriate, user-friendly tools and mechanisms for making choices, and attractive incentives to reward their participation;
- Devise measures to **incentivise** all stakeholders to speed up the development and uptake of smart metering products and services;
- Develop and implement regulations in good time or take measures to **give confidence** to utilities and network operators **to invest** in smart metering technology and developing related services; and
- Ensure that **lessons learned and best practices** from ongoing small-scale roll-outs or pilots are taken into account in the large-scale roll-out, particularly with respect to techno-economic issues, consumer involvement and the market development of smart metering services.

Limitations of the benchmarking

Most key roll-out parameters available at this stage are based on projections and forecasts, as very few EU countries have completed their roll-outs, or got to an advanced stage. Care must

¹² European Data Protection Reform:

http://ec.europa.eu/justice/newsroom/data-protection/news/120125_en.htm.

¹³ M/490 Smart Grids standardisation; CEN/CENELEC/ETSI related smart grids work;

<http://www.cenelec.eu/standards/Sectors/SustainableEnergy/Management/SmartGrids/Pages/default.aspx>.

¹⁴ The European Smart Grid Task Force defines Smart Grids as electricity networks that can efficiently integrate the behaviour and actions of all users connected to it — generators, consumers and those that do both — in order to ensure an economically efficient, sustainable power system with low losses and high quality and security of supply and safety;

http://ec.europa.eu/energy/gas_electricity/smartgrids/doc/expert_group1.pdf.

¹⁵ Smart Grid projects in Europe: Lessons learned and current developments —2012 update European Commission, 2013; <http://ses.jrc.ec.europa.eu/jrc-scientific-and-policy-report2013>; European Smart Metering Landscape Report, Smart Regions Deliverable 2.1, Austrian Energy Agency (AEA), 2012; <http://www.smartregions.net/default.asp?sivuID=26927>.

therefore be taken in interpreting the results of the comparative analysis presented here. As shown in Table 1 and Table 2, key assumptions and values diverge. This may reflect different local realities and starting conditions, and the inclusion of additional features in the smart metering systems considered (adds-on, functionalities beyond the minimum recommended, etc.) but also methodological differences (discount rate applied, appraisal period, etc.).

The benefits for consumers, apart from more accurate billing information, are difficult to assess, as they depend on consumers' actual involvement (e.g. in demand response) and on incentives such as differentiated pricing systems.

In some cases, comprehensive data allowing for clear-cut conclusions are lacking. For instance, at the time of the present analysis and writing, four Member States had yet to communicate their CBA data. Substantial data on system functionalities are also lacking.

Next steps and way forward

The main findings of this report particularly with respect to market, key stakeholders relationships and data handling implications of smart metering will be fed into the ***Retail Energy Market Initiative*** which is currently under development.

Member State authorities considering next steps in the deployment of smart metering are advised to reflect upon a number of issues as presented below. These are largely based on lessons learned and experience acquired to date from ongoing or completed operations.

Consumers' trust and confidence

An intensive communication effort is required to help consumers understand their rights, the benefits of installing smart meters and participating in demand response programmes. Consumers should be informed about the functionalities, what data will be collected, and what these data will be used for.

An innovative energy services market

Regulation should facilitate the creation of value for consumers and the energy system as a whole through smart metering, and promote an innovative energy services market. Measures should be devised to provide incentives for all stakeholders involved to ensure the quick development of smart metering products and services so as to speed up their uptake. The Internal Energy Market (IEM) Communication¹⁶ asked Member States to produce action plans which reflect how to modernise the grid, including rules and obligations for DSOs, synergies with the ICT sector and promotion of demand response and dynamic prices.

Data protection

It is advisable, prior to roll-out, to assess the need for a specific data privacy and security framework under national and EU legislation. Furthermore, high level of personal data protection must remain a central concern in the development of smart standards.

Data handling

Particular emphasis should be placed on:

- the implications for DSOs' regulated roles, incentives and obligations;
- fostering more dynamic competition in retail through market rules allowing dynamic pricing; and
- exploring possibilities in data management and synergies with the ICT sector.

¹⁶ COM(2012)663.

Smart metering functionalities

It is strongly recommended that at least the minimum set of functionalities proposed in Commission Recommendation 2012/148/EU, which are in line with standardisation work in this field, be adhered to at EU level. This is necessary to ensure technical and commercial interoperability in smart metering, guarantee data privacy and security, and enable the creation and development of demand response and other energy services. It will enable Member States to identify common means of achieving cost efficiencies in their roll-out plans, facilitate the necessary procurement and ensure the roll-out of fit-for-purpose smart metering systems that are worth the investment. Also, Member States are advised to specify these required functionalities in good time in order to ensure clarity and coherence in the exercise, in particular for those tasked with the roll-out.

Long-term economic assessment of costs and benefits

National authorities, in particular in those Member States not opting for large-scale roll-out¹⁷ of smart metering, are recommended to consider a review of the critical parameters used and assumptions made in their current CBA scenarios using relevant information from pilot programmes and ‘real-life’ experience to refine technology choices and assumptions as to associated costs and benefits. Member States that have yet to complete their CBAs or announce roll-out plans¹⁸ are recommended to proceed swiftly with their analysis and decision-making.

¹⁷ i.e. Belgium, the Czech Republic, Germany, Hungary, Latvia, Lithuania, Portugal and Slovakia.

¹⁸ i.e. Bulgaria, Cyprus and Slovenia.