EUROPEAN COMMISSION

Brussels, 9.3.2012
C(2012) 1342 final

COMMISSION RECOMMENDATION

of 9.3.2012

on preparations for the roll-out of smart metering systems

COMMISSION RECOMMENDATION

of 9.3.2012

on preparations for the roll-out of smart metering systems

THE EUROPEAN COMMISSION,

Having regard to the Treaty on the Functioning of the European Union, and in particular Article 292 thereof,

Whereas:

(1) Smart grids mark a new development on the path towards greater consumer empowerment, greater integration of renewable energy sources into the grid and higher energy efficiency and make a considerable contribution to reducing greenhouse gas emissions and to job creation and technological development in the Union.

(2) In accordance with Directive 2009/72/EC of the European Parliament and of the Council of 13 July 2009 concerning common rules for the internal market in electricity and repealing Directive 2003/54/EC[1] and Directive 2009/73/EC of the European Parliament and of the Council of 13 July 2009 concerning common rules for the internal market in natural gas and repealing Directive 2003/55/EC[2], Member States are required to ensure the implementation of smart metering systems that assist the active participation of consumers in the electricity supply and gas supply markets and implementation of those metering systems may be subject to an economic assessment of all the long-term costs and benefits to the market and the individual consumer or which form of smart metering is economically reasonable and cost-effective and which timeframe is feasible for their deployment.

(3) The Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions of 12 April 2011 on 'Smart Grids: from innovation to deployment'[3] announces a number of measures, including monitoring Member States' progress, establishing guidelines on key performance indicators and guidelines to define a methodology for the Member States' plans for implementation of smart metering systems, along with cost-benefit analyses.

(4) The Digital Agenda for Europe lists a set of appropriate measures, in particular on data protection in the Union, on network and information security, on cyber-attacks and on

---

1 OJ L 211, 14.8.2009, p. 55.
2 OJ L 211, 14.8.2009, p. 94.
3 COM(2011) 202 final.

functionalities for smart grids and metering. Member States, in collaboration with industry, the Commission and other stakeholders, should take appropriate measures to ensure a coherent approach.

(5) One of the key tasks and preconditions for using smart metering systems is to find appropriate technical and legal solutions which safeguard protection of personal data as a fundamental right under Article8 of the Charter of Fundamental Rights of the European Union and Article 16 of the Treaty on the Functioning of the European Union. Member States and stakeholders should ensure, especially in the initial phase of the roll-out of smart meters, that smart metering system applications are monitored and that fundamental rights and freedoms of individuals are respected.

(6) Smart metering systems allow processing of data, including predominantly personal data. Moreover, the deployment of smart grids and smart metering systems should allow suppliers and network operators to evolve from a broad view of energy behaviour to detailed information on the energy behaviour of individual end-consumers.

(7) The rights and obligations provided for by Directive 95/46/EC of the European Parliament and of the Council of 24 October 1995 on the protection of individuals with regard to the processing of personal data and on the free movement of such data[4] and by Directive 2002/58/EC of the European Parliament and of the Council of 12 July 2002 concerning the processing of personal data and the protection of privacy in the electronic communications sector[5] are fully applicable to smart metering which processes personal data, in particular in the use of publicly available electronic communications services for contractual and commercial relations with customers..

(8) The opinions of the Working Party on the protection of individuals with regard to the processing of personal data set up in accordance Article 29 of Directive 95/46/EC provide guidance for identifying and developing 'best available techniques' to safeguard personal data and guarantee data security when data are processed in smart metering systems and smart grids.

(9) In the light of the potential for deployment of smart grids, particular attention should be paid to security and protection of the personal data processed by smart metering systems. In this respect, data protection impact assessments should make it possible to identify from the start data protection risks in smart grid developments.

(10) Data protection and information security features should be built into smart metering systems before they are rolled out and used extensively. Such features can effectively improve consumers' control over the processing of personal data.

(11) Member States should cooperate with industry and civil society stakeholders, in particular with national data protection authorities, to stimulate and support introduction of the 'security and data protection by design' principle at an early stage in the development of smart grids, particularly for the roll-out of smart metering systems.

---

4 OJ L 281, 23.11.1995, p. 31.

5 OJ L 201, 31.7.2002, p. 37.

(12) Any party processing personal data in the context of smart metering systems should take all reasonable steps to ensure that data cannot be traced to an identified or identifiable person by any means likely to be used by either the network operator or any other third party, unless the data are processed in compliance with the applicable principles and legal rules on data protection.

(13) The Commission Communication of 2 May 2007 on 'Promoting data protection by privacy enhancing technologies (PETs)'[6] sets out clear measures to achieve the goals of minimising the processing of personal data and using anonymous or pseudonymous data wherever possible by supporting the development of PETs and use thereof by data controllers and individuals.

(14) A template developed at Union level for conducting data protection impact assessments will ensure that the provisions of this Recommendation are followed coherently across Member States.

(15) An assessment of the data protection impact carried out by the operator and stakeholders prior to the roll-out of smart metering systems will provide the information necessary in order to take appropriate protective measures. Such measures should be monitored and reviewed throughout the lifetime of the smart meter.

(16) In accordance with Directive 2009/72/EC, Member States are expected to complete, by 3 September 2012, a cost-benefit assessment of the roll-out of smart metering systems. Pursuant to the Communication from the Commission of 12 April 2011, the Commission considers it important to lay down criteria, a template and more general guidelines that would improve the depth and comparability of analyses. As suggested by the Smart Grid Task Force[7], the criteria should use quantifiable indicators.

(17) Member States, in collaboration with industry, the Commission and other stakeholders, should take appropriate measures to disseminate information about and raise awareness of the potential benefits and risks associated with use of smart metering technology.

(18) In this respect, Member States, in collaboration with industry, civil society associations and other stakeholders, should identify and disseminate examples of good practice in smart metering applications and take appropriate measures — such as large-scale pilot projects — to increase public awareness, as a prerequisite for wider take-up of this technology.

(19) Establishment of a set of recommended functional requirements would enable Member States to achieve an optimum level of cost-efficiency in their roll-out plans more easily and simultaneously. Setting the same requirements would also provide regulators, the metering industry, network operators and suppliers with some indication of the approaches most likely to be taken in this sector.

---

[6] COM(2007) 228 final.

[7] http://ec.europa.eu/energy/gas_electricity/smartgrids/taskforce_en.htm

(20) Based on the guidelines of good practice defined by the European Regulators' Group for Electricity and Gas (hereinafter referred to as the 'ERGEG')[8] and on the analysis of the first cost-benefit assessments communicated by Member States, the Commission sees benefit in recommending to Member States and regulators a set of common minimum functionalities for smart meters.

(21) After consulting the European Data Protection Supervisor,

HAS ADOPTED THIS RECOMMENDATION:

I. DATA PROTECTION AND SECURITY CONSIDERATIONS

1. This Section provides guidance to Member States on the design and operation of smart grids and smart metering systems ensuring the fundamental right to protection of personal data.

2. This Section also provides guidance on measures to be taken for the deployment of smart metering applications in order to ensure that national legislation implementing Directive 95/46/EC is, where applicable, respected when such technologies are deployed.

Definitions

3. Member States are invited to take note of the following definitions:

   (a) 'Smart grid'[9] means an upgraded energy network to which two-way digital communication between the supplier and consumer, smart metering and monitoring and control systems have been added.

   (b) 'Smart metering system' means an electronic system that can measure energy consumption, adding more information than a conventional meter, and can transmit and receive data using a form of electronic communication[10].

   (c) 'Data protection impact assessment' means a systematic process for evaluating the potential impact of risks where processing operations are likely to present specific risks to the rights and freedoms of data subjects by virtue of their nature, their scope or their purposes to be to carried by the controller or processor or the processor acting on the controller's behalf.

   (d) 'Data protection by design' requires to implement, having regard to the state of the art and the cost of implementation, both at the time of the determination of

---

8 ERGEG Guidelines of Good Practice (GGP) on regulatory aspects of smart meters for electricity and gas (Ref. E10-RMF-29-05).

9 The European Smart Grid Task Force defines smart grids as energy networks that can efficiently integrate the behaviour of all users connected to them 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.

10 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 – Retail markets, p. 7.

the means for processing and at the time of the processing itself, appropriate technical and organisational measures and procedures in such a way that the processing will meet the requirements of Directive 95/46/EC and ensure the protection of the rights of the data subject.

(e) ‘Data protection by default’ requires to implement mechanisms for ensuring that, by default, only those personal data are processed which are necessary for each specific purpose of the processing and are especially not collected or retained beyond the minimum necessary for those purposes, both in terms of the amount of the data and the time of their storage.

(f) 'Best available techniques' refer to the most effective and advanced stage in the development of activities and their methods of operation, which indicate the practical suitability of particular techniques for providing in principle the basis for complying with the EU data protection framework. They are designed to prevent or mitigate risks on privacy, personal data and security.

Data protection impact assessments

4. The data protection impact assessment should describe the envisaged processing operations, an assessment of the risks to the rights and freedoms of data subjects, the measures envisaged to address the risks, safeguards, security measures and mechanisms to ensure the protection of personal data and to demonstrate compliance with Directive 95/46/EC, taking into account the rights and legitimate interests of data subjects and persons concerned.

5. In order to guarantee protection of personal data throughout the Union, Member States should adopt and apply the data protection impact assessment template to be developed by the Commission and submitted to the Working Party on the protection of individuals with regard to the processing of personal data for its opinion within twelve months of publication of this Recommendation in the *Official Journal of the European Union*.

6. When implementing this template, Member States should take into account the advice of the Working Party on the protection of individuals with regard to the processing of personal data.

7. Member States should ensure that network operators and operators of smart metering systems, in line with their other obligations under Directive 95/46/EC, take the appropriate technical and organisational measures to ensure protection of personal data.

8. Member States should ensure that the entity processing personal data consults the Data Protection Supervisory Authority referred to in Article 28 of Directive 95/46/ECon the data protection impact assessment, prior to processing. This should allow the Authority to assess the compliance of the processing and, in particular, the risks for the protection of personal data of the data subject and the related safeguards.

9. Member States should make sure that once the template for data protection impact assessments, as provided for in point 5, has been adopted, network operators implement the points 7 and 8 in accordance with it.

Data protection by design and data protection by default settings

10. Member States should strongly encourage network operators to incorporate data protection by design and data protection by default settings in deployment of smart grids and smart metering.

11. Data protection by design and data protection by default settings should be incorporated in the methodologies of parties involved in development of smart grids when personal data are processed.

12. Data protection by design should be implemented at legislative level (through legislation that has to be compliant with data protection laws) at technical level (by setting appropriate requirements in smart grid standards to ensure that infrastructure is fully consistent with the data protection laws) and organisational level (relating to processing).

13. Data protection by default should be implemented so that the most data protection friendly option is provided to the customer as a default configuration.

14. Member States should encourage European standardisation organisations to give preference to smart grid reference architectures based on data protection by design and on data protection by default.

15. For the purposes of optimising transparency and the individual's trust, Member States should encourage use of appropriate privacy certification mechanisms and data protection seals and marks, provided by independent parties.

16. Article 8 of the Charter of Fundamental Rights of the European Union and Article 8(2) of the European Convention on Human Rights require justifying any interference with the right to the protection of personal data. The legitimacy of interference must be assessed on a case-by-case basis in the light of the cumulative criteria of legality, necessity, legitimacy and proportionality. Any processing of personal data which interferes with the fundamental right to the protection of personal data within the smart grid and smart metering system therefore has to be necessary and proportional for it to be considered fully in compliance with the Charter.

17. In order to mitigate the risks on personal data and security, Members States, in collaboration with industry, the Commission and other stakeholders, should support the determination of best available techniques for each common minimum functional requirement listed in point 42 of the Recommendation.

Data protection measures

18. When deciding the range of information allowed for processing within smart grids, Member States should take all necessary measures to impose, as much as possible, use of data rendered anonymous in such a way that the individual is no longer identifiable. In cases where personal data are to be collected, processed and stored, Member States should ensure that the data are appropriate and relevant. Data collection should be limited to the minimum necessary for the purposes for which data are processed and data should be kept in a form which permits identification of

data subjects for no longer than is necessary for the purposes for which the personal data are processed.

19. Processing of personal data by or within a smart metering system should be legitimate in accordance with one or more of the grounds listed in Article 7 of Directive 95/46/EC. The opinion of the Working Party on the protection of individuals with regard to the processing of personal data on Smart Metering[11] should be taken into account.

20. The processing of personal data by third parties offering value-added energy services should also be lawful and based on one or more of the six grounds for legitimate processing listed in Article 7 of Directive 95/46/EC. Where consent is chosen as the ground for processing, the consent of the data subject should be freely given, specific, informed and explicit and be given separately for each value-added service. The data subject should have the right to withdraw his or her consent at any time. The withdrawal of consent should not affect the lawfulness of the processing based on consent before the withdrawal.

21. Member States should clearly determine the roles and responsibilities of data controllers and data processors. They should be compatible with their respective obligations set out in Directive 95/46/EC.

22. Member States should perform an analysis prior to launching processing operations, in order to determine to which extent suppliers and network operators need to store personal data for the purposes of maintaining and operating the smart grid and for billing. This analysis should allow Member States to determine, *inter alia*, if the periods for the storage of personal data currently set in national law are no longer than necessary for the purposes of operating smart grids. This must include mechanisms to ensure that the time limits set for the erasure of personal data and for a periodic review of the need to store personal data are observed.

23. For the purpose of this analysis, each Member State should particularly take into account the following principles: the principle of data minimisation, the principle of transparency - by ensuring that the end consumer is informed in a user-friendly and intelligible form using clear and plain language, of the purposes, timing, circumstances, collection, storage and all other processing of personal data, and the principle of empowerment of the individual - by ensuring that the measures taken safeguard the individual's rights.

Data security

24. Member States should ensure that personal data security is designed in at an early stage as part of the architecture of the network, within a data protection by design process. This should encompass measures to protect personal data against accidental or unlawful destruction or accidental loss and to prevent any unlawful forms of processing, in particular any unauthorised disclosure, dissemination, access to or alteration of personal data.

[11] Opinion No 183 of the Article 29 Working Party on Smart Metering, April 2011.

25. The use of encrypted channels is recommended as it is one of the most effective technical means against misuse.

26. Member States should take into account that all present and future components of smart grids ensure compliance with all the 'security-relevant' standards developed by European standardisation organisations, including the Smart Grid Information Security essential requirements in the Commission's standardisation mandate M/490. The international security standards should also be taken into account, in particular the ISO/IEC 27000 series ('ISMS family of standards').

27. Member States should ensure that network operators identify security risks and the appropriate security measures to guarantee the adequate level of security and resilience of the smart metering systems. In this regard, network operators, in cooperation with national competent authorities and civil society organisations, should apply existing standards, guidelines and schemes and where not available develop a new one. Relevant guidelines published by the European Network Information and Security Agency (ENISA) should also be taken into account.

28. Member States should ensure that in accordance with Article 4 of Directive 2002/58/EC, in the event of a personal data breach, the controller notifies without undue delay (preferably not later than 24 hours after the breach has been established) the supervisory authority and the data subject, if the breach is likely to have an adverse effect on protection of his or her personal data.

Information and transparency on smart metering

29. Without prejudice to the obligations of data controllers, in accordance with Directive 95/46/EC Member States should require that network operators develop and publish an accurate and clear information policy for each of their applications. The policy should include at least the items mentioned in Articles 10 and 11 of Directive 95/46/EC.

Where personal data relating to a data subject are collected, the controller should also provide the data subject with at least the following information:

(a) the identity and the contact details of the controller and of the controller's representative and of the data protection officer, if any;

(b) the purposes of the processing for which the personal data are intended, including the terms and general conditions and the legitimate interests pursued by the controller if the processing is based on Article 7 of Directive 95/46/EC;

(c) the period for which the personal data will be stored;

(d) the right to ask the controller for access to and rectification or erasure of the personal data concerning the data subject or to object to the processing of such personal data;

(e) the right to lodge a complaint with the supervisory authority referred to in Article 28 of Directive 95/46/EC and the contact details of the supervisory authority;

(f) the recipients or categories of recipients of the personal data;

(g) any further information necessary to guarantee fair processing in respect of the data subject, having regard to the specific circumstances in which the personal data are collected.

II. METHODOLOGY FOR THE ECONOMIC ASSESSMENT OF THE LONG-TERM COSTS AND BENEFITS FOR THE ROLL-OUT OF SMART METERING SYSTEMS

30. This Section provides guidance to Member States along with a framework for cost-benefit analysis as a foundation for conducting a consistent, credible and transparent economic assessment of the long-term costs and benefits of the roll-out of smart metering.

31. The economic assessment should follow the guidelines set out in the Annex and should always include the following four steps:

- tailoring to local conditions;
- cost-benefit analysis (hereinafter referred to as 'CBA');
- sensitivity analysis;
- performance assessment, externalities and social impact.

Tailoring to local conditions

32. When carrying out the economic assessment of the roll-out of smart metering, Member States or any competent authority that they designate should examine and take into consideration, where available, appropriate pilot programmes that have already implemented smart metering systems. They should also consult, where possible, actual field performance data and pertinent 'real-life' experience, in order to fine-tune their assumptions on technology choices and to optimise the associated costs and benefits and consumer engagement, both in terms of public awareness and use of smart metering systems.

33. In order to perform the cost-benefit analysis, Member States or any competent authority they designate should ensure that a minimum of two forecast scenarios are considered, one of them being 'business as usual' ('do nothing and nothing happens'). In the case of electricity, the second scenario should be in line with the obligation imposed in Directive 2009/72/EC of an 80 % roll-out of smart metering by 2020 and should consider the set of common minimum functionalities laid down in Section III of this Recommendation. It is recommended to explore additional alternative scenarios. Such scenarios should also take into account synergies between existing and future energy-saving measures along with other forms of feedback and advice to consumers, especially the introduction of frequent billing or cost statements based on actual consumption rather than flat rates or estimated consumption. Member States should consider in their alternative scenarios the positive role that clear consumer information and price transparency, as well as competition on the manufacturers' and providers' side may have in the roll-out of smart metering.

34. When setting the conditions and deciding on the hypotheses for running the different scenarios, the Member States or any competent authority they designate should ensure that they conduct timely consultations on this subject with the national regulatory authorities and with promoters and enforcers of the roll-out of smart metering — which in most Member States are the distribution system operators — and with the owners of relevant pilot projects, where available.

35. As regards, and during, the process of setting the framework conditions, Member States or any competent authority they designate should ensure that all the appropriate communication infrastructure technologies, architectures and measures needed to guarantee interoperability and compliance with the available Union's or international standards and best practices are taken into consideration. Furthermore, Member States or any competent authority that they designate should ensure that the assumptions underpinning the analysis are adapted to local circumstances, bearing in mind parameters such as geographical coverage, electricity demand, peak load and micro- and macro-economic conditions. Section 2 of the Annex to this Recommendation contains a list of the parameters which the Member States should ensure are used in this operation.

Cost-benefit analysis (CBA)

36. The Member States or any competent authority they designate should ensure that the CBA follows the supporting guidelines and the step-by-step methodological framework (the 'seven CBA steps') laid down in the Annex to this Recommendation. Furthermore, Member States or any competent authority they designate should ensure a reasonable, transparent and well-documented calculation of all the expected costs and benefits in accordance with the logical sequential process proposed for estimating them. Costs that might potentially be incurred by the consumer through the roll-out of smart metering systems should be explicitly indicated in the CBA and set into comparison with long-term potential benefits for the consumers. In Annex I tables 4 and 5 propose a non-exhaustive list of elements to be included in the CBA.

Sensitivity analysis

37. The Member States or any competent authority they designate should identify critical variables for the sensitivity analysis and report the magnitude of the variable range (minimum and maximum values of the critical variables identified) for the positive roll-out conditions where benefits exceed costs, as obtained from the sensitivity analyses they have performed. In addition, their analysis might also include the volatility responsiveness and possible control measures to keep the value of the variable within the desired range.

Performance assessment, externalities and social impact

38. When assessing the merits of deployment, externalities (such as on environment or health), the impact of public policy measures and social benefits expected from the roll-out of smart metering, the Member States or any competent authority they designate should ensure that appropriate weighting factors, complementing the quantitative results of the previous steps of the CBA, are taken into account.

The Annex to this Recommendation provides a list of references for other related benefits.

III. COMMON MINIMUM FUNCTIONAL REQUIREMENTS FOR SMART METERING SYSTEMS FOR ELECTRICITY

39. This Section is based on best practice from early CBAs for smart metering of electricity carried out in 11 Member States. It provides guidance on measures to be taken to ensure that Member States make due use of appropriate interoperability and standards for smart metering systems currently being developed under Mandates M/441, M/468 and M/490 and of best practice.

40. Member States are provided with guidance on a set of common minimum functional requirements for smart metering of electricity that would enable them to identify common means of achieving cost-efficiencies in their roll-out plans. This could in turn serve Member States, metering suppliers and network operators as a common basis for their own cost-benefit analyses and investments to facilitate the procurement associated with roll-out and provide regulators with European reference definitions.

41. This Section also provides guidance on provisions to secure consumer benefits and contribute to increases in energy efficiency. It should facilitate the linking of smart metering systems with standardized interfaces equipped with consumer oriented tools that combine consumption data and cost information, encouraging consumer interest in energy saving actions and response to demand. This approach should be fully taken into account when analysing the costs and benefits of the roll-out of smart metering of electricity in line with Union legislation.

Common minimum functional requirements

42. Every smart metering system for electricity should offer at least all the functionalities listed below:

For the customer:

(a) **Provide readings directly to the customer and any third party designated by the consumer.** This functionality is essential in a smart metering system, as direct consumer feedback is essential to ensure energy savings on the demand side. There is a significant consensus on provision of standardised interfaces which would enable energy management solutions in ‘real time’, such as home automation, and different demand response schemes and facilitate secure delivery of data directly to the customer. Accurate, user-friendly and timely readings provided directly from the interface of customer's choice to the customer and any third party designated by the consumer are strongly recommended since they are the key to running demand response services, taking ‘on-line’ energy-saving decisions and effective integration of distributed energy resources. In order to stimulate energy saving, Member States are strongly recommended to ensure that final customers using smart metering systems are equipped with a standardised interface which provides visualised individual consumption data to the consumer.

(b) **Update the readings referred to in point (a) frequently enough to allow the information to be used to achieve energy savings.** This functionality relates purely to the demand side, namely the end customer. If consumers are to rely

on the information provided by the system, they need to see the information responding to their action. The rate has to be adapted to the response time of the energy-consuming or energy-producing products. The general consensus is that an update rate of every 15 minutes is needed at least. Further developments and new energy services are likely to lead to faster communications. It is also recommended that the smart metering system should be able to store customer consumption data for a reasonable time in order to allow the customer and any third party designated by the consumer to consult and retrieve data on past consumption. This should make it possible to calculate costs related to consumption.

For the metering operator:

(c) **Allow remote reading of meters by the operator.** This functionality relates to the supply side (metering operators). There is a broad consensus that this is a key functionality.

(d) **Provide two-way communication between the smart metering system and external networks for maintenance and control of the metering system**. This functionality relates to metering. There is a broad consensus that this is a key functionality.

(e) **Allow readings to be taken frequently enough for the information to be used for network planning**. This functionality relates to both the demand side and the supply side.

For commercial aspects of energy supply:

(f) **Support advanced tariff systems.** This functionality relates to both the demand side and the supply side. Smart metering systems should include advance tariff structures, time-of-use registers and remote tariff control. This should help consumers and network operators to achieve energy efficiencies and save costs by reducing the peaks in energy demand. This functionality, together with functionalities referred to in points (a) and (b), is a key driving force for empowering the consumer and for improving the energy efficiency of the supply system. It is strongly recommended that the smart metering system allows automatic transfer of information about advanced tariffs options to the final customers e.g. via standardised interface mentioned under a).

(g) **Allow remote on/off control of the supply and/or flow or power limitation.** This functionality relates to both the demand side and the supply side. It provides additional protection for the consumer by allowing grading in the limitations. It speeds up processes such as when moving home — the old supply can be disconnected and the new supply connected quickly and simply. It is needed for handling technical grid emergencies. It may, however, introduce additional security risks which need to be minimised.

For security and data protection:

(h) **Provide secure data communications.** This functionality relates to both the demand side and the supply side. High levels of security are essential for all

communications between the meter and the operator. This applies both to direct communications with the meter and to any messages passed via the meter to or from any appliances or controls on the consumer's premises. For local communications within the consumer's premises, both privacy and data protection are required.

(i) **Fraud prevention and detection.** This functionality relates to the supply side: security and safety in the case of access. The strong consensus shows the importance attached to this functionality. This is necessary to protect the consumer, for example from hacking access, and not just for fraud prevention.

For distributed generation:

(j) **Provide import/export and reactive metering.** This functionality relates to both the demand side and the supply side. Most countries are providing the functionalities necessary to allow renewable and local micro-generation, thus future-proofing meter installation. It is recommended that this function should be installed by default and activated/disabled in accordance with the wishes and needs of the consumer.

Follow-up

43. Member States should take all necessary measures to follow this Recommendation and to draw it to the attention of all stakeholders involved in designing and operating smart grid applications within the Union.

44. Member States should report to the Commission by 3 September 2012 on the results of their cost-benefit analysis regarding the roll-out of smart metering systems and on the measures and plans they have adopted in relation to this Recommendation.

45. The Commission intends to assess, in the light of this Recommendation, the economic appraisals reported on the roll-out of smart metering.

Addressees

46. This Recommendation is addressed to the Member States and to any competent authority they designate to be involved in the economic assessment of smart metering systems.

Done at Brussels, 9.3.2012

For the Commission
Günther Oettinger
Member of the Commission

CERTIFIED COPY
For the Secretary - General

Jordi AYET PUIGARNAU
Director of the Registry

ANNEX

Guidelines on the methodology for the economic assessment of the long-term costs and benefits of the roll-out of smart metering in accordance with Annex I to Directives 2009/72/EC and 2009/73/EC

1. References

1.1. European Commission — Joint Research Centre Institute for Energy and Transport (2012). 'Guidelines for conducting a cost-benefit analysis of smart grid projects', available at: http://ses.jrc.ec.europa.eu/

1.2. European Commission — Joint Research Centre Institute for Energy and Transport (2012). 'Guidelines for cost-benefit analysis of smart metering deployment', available at: http://ses.jrc.ec.europa.eu/

1.3. European Regulators' Group for Electricity and Gas. 'Final Guidelines of Good Practice on Regulatory Aspects of Smart Metering for Electricity and Gas', February 2011, Ref.: E10-RMF-29-05 http://www.smartgridscre.fr/media/documents/ERGEG-_Guidelines_of_good_practice.pdf

1.4. European Commission Task Force for Smart Grids (2010), Expert Group 3: Roles and responsibilities of actors involved in smart grids deployment, 'Merit deployment matrix' available at: http://ec.europa.eu/energy/gas_electricity/smartgrids/doc/expert-_group3_annex.xls

1.5. Proposal for a Directive on energy efficiency and repealing Directives 2004/8/EC and 2006/32/EC [COM(2011) 370 final, 22.6.2011]

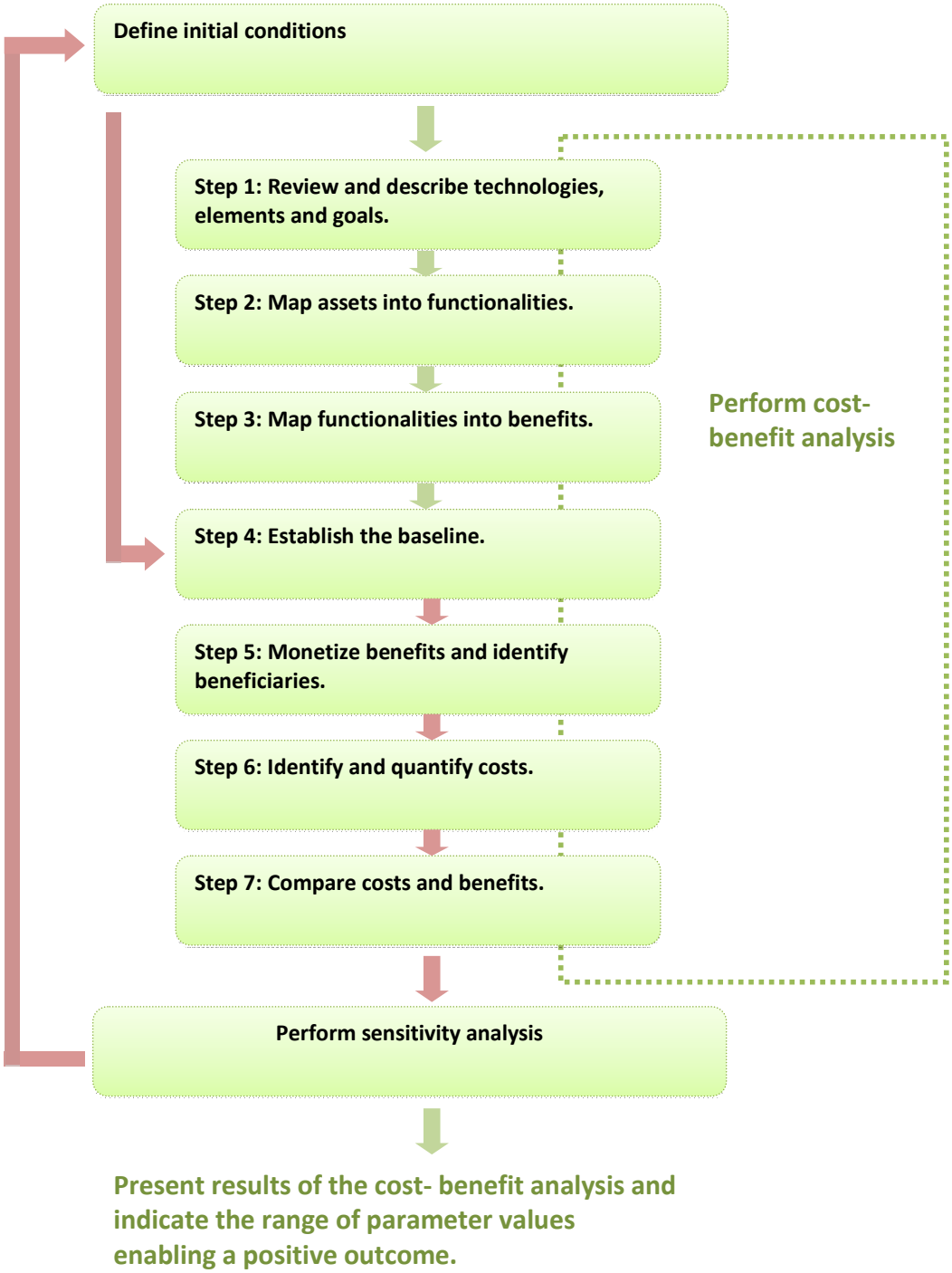
1.6. SEC(2011) 288 final — Commission Staff Working Document 'Impact Assessment' accompanying the Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, 'A roadmap for moving to a competitive low-carbon economy in 2050' (COM(2011) 112 final) (SEC(2011) 289 final)

2. Non-exhaustive list of variables/data to be set/collected in the case of electricity

Variables/data to be set/collected	Unit
Projected variation of energy consumption	%
Projected variation of energy prices	%
Peak load transfer	%
Electricity losses at transmission and distribution level	%
Estimated non-supplied minutes	Number of minutes
Value of lost load; value of supply	€/kWh
Discount rate	%
Hardware costs (e.g. smart meter, GPRS/PLC modem, etc.)	€

Number of smart metering systems to be installed	Number of smart meters
Installation costs for smart metering system	€
Life expectancy of smart metering system	Number of years
Meter reading costs	€/year
Telecommunication success rate	%
Inflation rate	%
Cost reduction associated with technology maturity	%
Implementation schedule	Number of smart meters/year
Percentage of meters placed in rural v. urban areas	%
Carbon costs	€/tonne

3. Flow-chart of steps to perform cost-benefit analysis and sensitivity analysis



Note: During the quantitative assessment, different discount rates can be used to weigh in distinct manners benefits with a social dimension and those accruing to private stakeholders. A lower discount rate should be considered to increase the present value of societal benefits and costs.

In cases where the analysis permits the calculation of costs and benefits of resulting changes to carbon emissions, it is recommended that the analysis considers the carbon prices projected both in the Commission reference and decarbonisation scenarios[12].

4. Non-exhaustive list of costs to consider for the roll-out of smart metering systems in the case of electricity

General category	Type of cost to be tracked for roll-out and to be estimated for the baseline
CAPEX	Investment in the smart metering systems
	Investment in IT
	Investment in communications
	Investment in in-home displays (if applicable)
	Generation
	Transmission
	Distribution
	Avoided investment in conventional meters (negative cost, to be added to the list of benefits)
OPEX	IT maintenance costs
	Network management and front-end costs
	Communication/data transfer costs (inc. GPRS, Radio Communications, etc)
	Scenario management costs
	Replacement/failure of smart metering systems (incremental)
	Revenue reductions (e.g. through more efficient consumption)
	Generation
	Distribution
	Transmission
	Meter reading
	Call centre/customer care
	Training costs (e.g. customer care personnel and installation personnel)
Reliability	Restoration costs

[12] Annex 7.10 to Commission Staff Working Document SEC(2011) 288 final — 'Impact Assessment': http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=SEC:2011:0288:FIN:EN:PDF.

Environmental	Emission costs (CO_2 control equipment, operation and emission permits)
Energy security	Cost of fossil fuels consumed to generate power
	Cost of fossil fuels for transportation and operation
Other	Cost of consumer engagement programmes
	Sunk costs of previously installed (traditional) meters

5. Non-exhaustive list of formulae for quantification of benefits in the case of electricity

Benefit	Sub-benefit	Monetisation calculation
Reduction in meter reading and operations costs	Reduced meter operations costs	***Value (€) = [Estimated cost reductions with remote meter operations (€/year)]*** $_{Roll\text{-}out}$ ***— [Estimated cost reductions with remote meter operations (€/year) * Communications failure rate (%/100)]*** $_{Roll\text{-}out\ scenario}$
	Reduced meter reading costs	***Value (€) = [cost with local meter readings (€)]*** $_{Baseline}$ ***− [Estimated cost of obtaining local 'disperse' meter readings (€)]*** $_{Roll\text{-}out\ scenario}$ ***Where: [cost with local meter readings (€)]*** $_{Baseline}$ ***=# of clients in LV * Historical meter reading cost/client/year (€) [Estimated cost of obtaining local 'disperse' meter readings (€)]*** $_{Roll\text{-}out\ scenario}$ ***=[# of clients in LV*** [13] ****% of clients <u>not included</u> in the roll-out*Average disperse reading cost per client (€/client)]+ [# of clients in LV *% of clients <u>included</u> in the roll-out*Communications failure rate (%)*Average disperse reading cost per client (€/# clients)***
	Reduced billing costs	***Value (€) = [# of clients in LV * Billing cost/client/year (€)]*** $_{Baseline}$ ***— [# of clients in LV * Billing cost/client/year (€)]*** $_{Roll\text{-}out\ scenario}$
	Reduced call centre/customer care costs	***Value (€) = [# of clients in LV * Customer care cost/client/year (€)]*** $_{Baseline}$ ***— [# of clients in LV * Customer care cost/client/year (€)]*** $_{Roll\text{-}out\ scenario}$
Reduction in operational and maintenance costs	Reduced maintenance costs of assets	***Value (€) = [Direct costs relating to maintenance of assets(€/year)]*** $_{Baseline}$ ***— [Direct costs relating to maintenance of assets (€/year)]*** $_{Roll\text{-}out\ scenario}$
	Reduced costs of equipment breakdowns	***Value (€) = [Cost of equipment breakdowns (€/year)]*** $_{Baseline}$ ***— [Cost of equipment breakdowns (€/year)]*** $_{Roll\text{-}out\ scenario}$
Deferred/avoided distribution capacity investments	Deferred distribution capacity investments due to asset remuneration	***Value (€) = Annual investment to support growing capacity (€/year) * Time deferred (# of years) * Remuneration rate on investment (%/100)***

[13] Low voltage

	Deferred distribution capacity investments due to asset amortisation	***Value (€) = Annual investment to support growing capacity (€/year) * Time deferred (# of years) * # of years capacity asset amortisation***
Deferred/avoided transmission capacity investments	Deferred transmission capacity investments due to asset remuneration	***Value (€) = Annual investment to support growing capacity (€/year) * Time deferred (# of years) * Remuneration rate on investment (%/100)***
	Deferred transmission capacity investments due to asset amortisation	***Value (€) = Annual investment to support growing capacity (€/year) * Time deferred (# of years) * # of years capacity asset amortisation***
Deferred/avoided generation capacity investments	Deferred generation investments for peak load plants	***Value (€) = Annual investment to support peak load generation (€/year) * Time deferred (# of years)***
	Deferred generation investments for spinning reserves	***Value (€) = Annual investment to support spinning reserve generation (€/year) * Time deferred (# of years)***
Reduction of technical losses of electricity	Reduced technical losses of electricity	***Value (€) = Reduced losses via energy efficiency (€/year) + Reduced losses via voltage control (€/year) + Reduced losses at transmission level (€/year)***
Electricity cost savings	Consumption reduction	***Value (€) = Energy rate (€/MWh) * Total energy consumption at LV (MWh) * Estimated % of consumption reduction with roll-out (%/100)***
	Peak load transfer	***Value (€) = Wholesale margin difference between peak and non-peak generation margin (€/MWh) * % Peak load transfer (%/100) * Total energy consumption at LV (MWh)***
Reduction of commercial losses	Reduced electricity theft	***Value (€) = % of clients with energy theft (%/100) * Estimated average price value of energy load not recorded/client/year (€) * Total number of clients LV (# of clients)***
	Recovered revenue relating to 'contracted power' fraud	***Value (€) = % of clients with 'contracted power fraud' (%/100) * Estimated price value of contracted power not paid/client/year (€) * Total number of clients LV (# of clients)***
	Recovered revenue relating to incremental 'contracted power'	***Value (€) = % of clients requesting incremental contracted power after smart metering system installation (%/100) * Average estimated value of recovered revenue due to incremental contracted power (€) * Total number of clients LV (# of clients)***
Reduction of outage times (thanks to advanced monitoring and real-time network information)	Value of service	***Value (€) = Total energy consumed MV[14]+LV (MWh)/ Minutes per year (#/year) * Average non-supplied minutes/year (#/year) * Value of lost load (€/MWh) * % Decrease in outage time (%/100)***
	Reduced cost of client indemnification	***Value (€) = Average annual client indemnifications (€) * % Reduction of client compensations***

[14] Medium voltage

Reduction of CO_2 emissions	Reduced CO_2 emissions due to reduced line losses	***Value (€) = [Line losses (MWh) * CO2 content (tonnes/MWh) * Value of CO2 (€/tonne)]*** $_{Baseline}$ ***-*** ***[Line losses (MWh) * CO2 content (tonnes/MWh) * Value of CO2 (€/tonne)]*** $_{Roll\text{-}out\ scenario}$
	Reduced CO_2 emissions due to wider spread of low-carbon generation sources (as a consequence of the roll-out of smart metering)	***Value (€) = [CO2 emissions (tonnes) * Value of CO2 (€/tonne)]*** $_{Baseline}$ ***— [CO2 emissions (tonnes) * Value of CO2 (€/tonne)]*** $_{Roll\text{-}out\ scenario}$
	Reduced CO_2 emissions due to truck rolls of field personnel	***Value (€) = Avoided # litres of fuel (#) * Cost per litre of fuel (€)***
	Reduced fuel usage due to truck rolls of field personnel	***Value (€) = Avoided # litres of fuel (#) * Cost per litre of fuel (€)***

Reduction of air pollution (Particulate Matters, NOx, SO_2)	Reduced air pollutants emissions due to reduced line losses	***For each pollutant:*** ***Value (€) = [Line losses (MWh) * air pollutant content (unit/ MWh)* cost of air pollutant (€/unit)]*** $_{Baseline}$ ***-*** ***Line losses (MWh) * air pollutant content (unit/MWh)* cost of air pollutant (€/unit)]*** $_{Roll\text{-}out\ scenario}$
	Reduced air pollutants emissions due to wider diffusion of low carbon generation sources (as a consequence of the roll-out of smart metering)	***For each pollutant:*** ***Value (€) = [air pollutant Emissions (unit) * cost of air pollutant(€/unit)]*** $_{Baseline}$ ***— [air pollutant Emissions (unit) * cost of air pollutant(€/unit)]*** $_{Roll\text{-}out\ scenario}$
	Reduced air pollutants emissions due to truck rolls of field personnel	***Value (€) = Avoided # litre of fuel (#) * Cost per litre of fuel avoided (€)***

Note: For the '*cost of air pollutants'* (particulate matters, NO_x, SO_2), it is recommended to consult the Clean Vehicles Directive - Directive 2009/33/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of clean and energy-efficient road transport vehicles, and the "CAFÉ" (Clean Air For Europe) air quality benefits' quantification process.