



EUROPEAN COMMISSION

Information Society and Media Directorate-General
ICT addressing Societal Challenges
ICT for Sustainable Growth

Energy Directorate-General
Internal Energy Market
Internal Market

**A joint contribution of DG ENER and DG INFSO towards the
Digital Agenda, Action 73:**

Set of common functional requirements of the SMART METER

October 2011

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Introduction

Background

- Annex I of the 2009 Electricity and Gas Directives (Directive 2009/72/EC and 2009/73/EC);
- Recommendation C(2009)7604 and subsequently in the Digital Agenda for Europe, Com(2010)245;
- ERGEG Guidelines of Good Practice (GGP) on regulatory aspects of Smart Meters for electricity and gas (Ref. E10-RMF-29-05), providing a set of 16 high level requirements for meter and gas.
- CEN/CENELEC/ETSI Smart Meter Co-ordination Group (M441) has proposed a set of 6 functionalities relevant for communications and is working on their standardization.

We believe that a commonly agreed definition of the Smart Meter, based on a set of minimum or optional functional requirements, would enable Member States to identify common means of achieving cost-efficiencies (and inefficiencies) in their roll-out plans. This could in turn serve Member States, the metering industry and utilities as a solid basis for their respective investments, facilitate roll-out-associated procurement and provide regulators with European reference definitions.

This is a joint contribution of DG ENER and DG INFSO towards the Digital Agenda, Action 73.



http://ec.europa.eu/information_society/digital-agenda/index_en.htm

Purpose

To date, around one third (11) of Member States have already carried out a an economic assessment of the costs and benefits of Smart Metering Systems as set out in Annex I of Directives 2009/72/EC and 2009/73/EC.

In this context the Commission sees a benefit in reaching a consensus around the functional specifications for Smart Meters. To this end, based on an analysis of these 11 cost benefit assessments (CBAs), we have defined a Smart Metering System in terms of 13 key Functionalities – see below.

We then determined, by means of a questionnaire, whether these Functionalities have been considered within the scope of your national CBAs, and their respective impact on the cost of the metering system.

The Commission then convened a workshop to seek agreement on what Functionalities could be considered as common.

We would like to propose this set of common Functionalities to the remaining Member States, to be used in their CBAs.

Original Functionalities included in the questionnaire

The following Functionalities of a Smart Meter were used in the Questionnaire and were based on the ERGEG Guidelines of Good Practice on Regulatory Aspects of Smart Metering for Electricity and Gas (E10-RMF-29-05):

For the Customer:

- 1** Provides readings from the meter to the customer and to equipment that he may have installed;
- 2** Updates these readings frequently enough to allow the information to be used to achieve energy savings;
- 3** Provides these readings in a form easily understood by the untrained consumer, and with calculations enabling final customers to better control their energy consumption. E.g. In terms of cost, as averages, as comparisons to other periods, etc.

For grid & network support:

- 4** Allows remote reading of meter registers by energy suppliers and by grid operators;
- 5** Provides two-way communication between the meter and external networks (both supply & grid) for maintenance and control of the meter;
- 6** Provides for the monitoring of Power Quality;
- 7** Allows readings to be taken frequently enough to allow the information to be used for grid control.

For commercial aspects of energy supply:

- 8** Supports advanced tariff systems. Includes multiple tariffs, time of use registers, block tariff registers, remote tariff control, etc as applicable;
- 9** Supports energy supply by pre-payment and on credit;
- 10** Allows remote ON/OFF control of the supply and/or flow or power limitation.

For security and privacy:

- 11** Provides Secure Data Communications;
- 12** Fraud prevention and detection.

To allow distributed generation:

- 13** Provides Import / Export & Reactive Metering.

Answers received

Answers to the questionnaire were received from the following countries:

	N° of Functionalities Considered ¹			
	Electricity	Gas	Questionnaire	After Workshop
Austria	✓		10.5	10.5
Belgium	✓	✓	8	8.5
France	✓	✓	10	10.5
Ireland	✓		10.5	11
Netherlands	✓	✓	12	12
Norway	✓		8	8
Poland	✓		11	11.5
Portugal	✓		11.5	12.5
Slovenia	✓		10	10
Sweden	✓		4	10.5
UK	✓	✓	13	13

The differences between the number of Functionalities considered by each country in the questionnaire and after the workshop is the result of a better understanding of the questions asked and a better understanding of the situations in each of the countries.

¹ When assessing the number of functionalities considered in each country's CBA, a YES scored 1, a PARTLY scored ½ and a NO scored 0

Statistics

Post-workshop	AT	BE	FR	IE	NL	NO	PL	PT	SE	SI	UK	yes	partly	no	consensus level
Functionality 1															
Provides readings from the meter to the customer	partly	partly	yes	yes	yes	yes	partly	yes	yes	yes	yes	8	3	0	9,5
Impact	minimal			low	low	low	low			low	low				
Functionality 2															
Updates these readings frequently enough	yes	yes	yes	yes	yes	yes	yes	yes	yes	partly	yes	10	1	0	10,5
Impact	medium			low	low	minimal	low		high		low				
Functionality 3															
Calculations	yes	partly	no	yes	yes	yes	partly	partly	no	yes	yes	6	3	2	7,5
Impact				medium	medium	high	low			low	minimal				
Functionality 4															
Allows remote reading	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	11	0	0	11
Impact	high			high	minimal	medium	medium		high	minimal	low				
Functionality 5															
Maintenance and control of the meter	yes	partly	yes	partly	yes	no	yes	yes	yes	yes	yes	8	2	1	9
Impact	low			high	medium		medium			minimal	low				
Functionality 6															
Power Quality	no	no	yes	yes	partly	partly	partly	yes	no	yes	yes	5	3	3	6,5
Impact					minimal	high	low			minimal	low				
Functionality 7															
Grid control	yes	yes	yes	no	yes	no	yes	yes	yes	no	yes	8	0	3	8
Impact	minimal				minimal		minimal				low				
Functionality 8															
Advanced tariff and payment	yes	partly	yes	partly	yes	partly	yes	yes	yes	yes	yes	8	3	0	9,5
Impact	medium				low	low	low			low	low				
Functionality 9															
Pre-payment and on credit	partly	no	no	yes	yes	partly	yes	yes	no	no	yes	5	2	4	6
Impact	minimal			minimal	low	low	low				low				
Functionality 10															
Remote ON/OFF / power	yes	partly	partly	yes	yes	yes	yes	yes	yes	yes	yes	9	2	0	10
Impact	medium			minimal	low	low	low			medium	low				
Functionality 11															
Provides Secure Data Communications	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	11	0	0	11
Impact	medium			low	medium		medium			low	low				
Functionality 12															
Fraud prevention and	yes	yes	yes	yes	partly	partly	yes	yes	yes	yes	yes	9	2	0	10
Impact	low			minimal	low		low			low	low				
Functionality 13															
Import / Export & Reactive	partly	yes	yes	yes	yes	yes	yes	yes	no	partly	yes	8	2	1	9
Impact	low			minimal	medium	minimal	low			minimal	low				
country profile level	10,5	8,5	10,5	11	12	9	11,5	12,5	9	10	13				

Summary Analysis of the Answers Received to the original Questionnaire ²

Consensus level threshold set to 8/11

² When assessing the number of functionalities considered in each country's CBA, a YES scored 1, a PARTLY scored ½ and a NO scored 0

Final Functionalities with high consensus

Following analysis of the Questionnaires received and the workshop, the Functionalities of a Smart Meter were amended and three were removed as not having consensus enough. They now read:

For the Customer:

- **Provides readings from the meter to the customer and to equipment that he may have installed;**
- **Updates these readings frequently enough to allow the information to be used to achieve energy savings;**

For the Meter Operator:

- **Allows remote reading of meter registers by the Meter Operator;**
- **Provides two-way communication between the meter and external networks for maintenance and control of the meter;**
- **Allows readings to be taken frequently enough to allow the information to be used for network planning.**

For commercial aspects of energy supply:

- **Supports advanced tariff systems;**
- **Allows remote ON/OFF control of the supply and/or flow or power limitation.**

For security and privacy:

- **Provides Secure Data Communications;**
- **Fraud prevention and detection.**

To allow distributed generation:

- **Provides Import / Export & Reactive Metering.**

Functionalities for the Customer:

Functionality 1: Provides readings from the meter to the customer and to equipment that he may have installed ³

Explanations

This Functionality relates purely to the Demand side, namely the end customer, and in particular to the requirements of DIRECTIVE 2006/32/EC.

Points to be considered within this Functionality include:

- The need for all customers to benefit from Smart Metering;
- Customer ownership & control of Meter Data;
- Provision of a method (such as an SM-HAN or a user accessible communications port) by which this data is transmitted to in-house devices;

Points not to be considered here but within other Functionalities include:

- Provision of messages or other information to the customers from the energy supplier. This is considered under Functionality 10;

Statistics

Was this Functionality considered	Yes — 8	Partly — 3	No — 0 ⁴
Cost Impact	Minimal to Low		
	Minimal: 1	Low: 6	Medium: 0 High: 0
Consensus Level ⁵	9.5		

³ This relates to the provision of readings to a display external to the meter, to a computer, etc. This does not refer to any display built into a meter. **The external display cost is not included here.**

⁴ This negative response related simply to the fact that this functionality had not been considered in the CBA. Information is provided by the DSO.

⁵ When assessing the consensus level for each Functionality, a YES scored 1, a PARTLY scored ½ and a NO scored 0

Comments made

In most countries, the meter is fitted with a user accessible port. This allows the consumer to connect other equipment such as an In-home Display (IHD) to the meter and thus monitor energy use. One country is mandating the supply of such a display to all domestic consumers while seven countries are actively considering a Home Area Network (HAN).

Some concerns were expressed as to the cost of providing such a display; also as to the lack of standardisation of this port.

Following clarifications at the workshop, one Country reports that at the time of the CBA, this functionality was not included, but later used at all metering systems. We count them as a YES to be included in future CBAs.

Conclusions

This Functionality appears to be considered as essential of a Smart Meter,— as consumer feedback is essential if savings are to be achieved. There is universal consensus on the provision of a gateway, but less agreement on how the information provided by this gateway is to be communicated in the house. In some cases, provision of an In-home Display (IHD) appears to be the customer's decision.

Functionality 2: Updates these readings frequently enough to allow the information to be used to achieve energy savings

Explanations

This Functionality relates purely to the Demand side, namely the end customer, and in particular to the requirements of Directive 2006/32/EC.

Points to be considered within this Functionality include:

- Installation of Smart Meters should lead to Energy savings by the customers;
- That the information flow to the customer is fast enough to allow the customer to react to excessive loads;
- That a clear benefit arises to the Customer.

Points not to be considered here but within other Functionalities include:

- Provision of information across the WAN to the energy supplier or to the network operator. These are considered in Functionality 5 and Functionality 7

Statistics

Was this Functionality considered	Yes — 10	Partly — 1	No — 0
Cost Impact	Minimal to Low		
	Minimal: 1	Low: 4	Medium: 1 High: 1 ⁶
Consensus Level ⁷	10.5		

⁶ The one high cost answer relates to more than just the provision of these readings from the meter.

⁷ When assessing the consensus level for each Functionality, a YES scored 1, a PARTLY scored ½ and a NO scored 0

Comments made

A majority of those responding are suggesting that the update interval is in line with the national demand profiling or meter reading intervals, normally 15, 30 or 60 minutes; four countries however are specifying updates every few seconds.

Conclusions

Member States have agreed that the key to achieving energy savings is accurate and timely information for energy saving decisions. If consumers are to rely on the information provided by the system, they need to see the information responding to their actions. The rate has to be adapted to the response time of the energy consuming or producing products. The general consensus is that a **15 minute update** rate is needed at least; further developments are likely to lead to faster communications which will be the subject of a future CBA.

Functionality 3: Provides these readings in a form easily understood by the untrained consumer, and with calculations enabling final customers to better control their energy consumption.

Explanations

This Functionality relates just to the Demand Side.

Points to be considered within this Functionality include:

- That the information on energy consumption is provided in a fashion that does not require any numerical computation or energy literacy to understand.
- Examples include display of cost rather than kWh or cubic metres;
- High consumption warning designed to minimise the risk being ignored;
- Where Time-of-Use tariff is in use, information on impending tariff changes;
- Installation of a Smart Metering System will not lead to increases in measured consumption & cost;
- For Pre-payment systems, customer information on outstanding available credit (and how long it is likely to support present consumption);
- For credit customers, the accrued cost in the current billing period;
- For systems incorporating remote switching or power limitation, customer information on the present status and, if applicable for impending power limitation, the effect of continued consumption at the present level. Similarly if a block tariff is implemented.

Points not to be considered here but within other Functionalities include:

- Status of a switch or valve controlling supply. This is considered under Functionality 10.

Statistics

Was this Functionality considered	Yes — 6	Partly — 3	No — 2
Cost Impact	Minimal to High		
	Minimal: 1	Low: 2	Medium: 2 High: 1
Consensus Level ⁸	7.5		

Comments made

Only 2 countries seem to have considered this functionality in any detail; others are awaiting the results of further projects, consider it out of the scope of the CBA or the remit of the DSO, or are leaving it to the market.

Conclusions

Although this Functionality is considered of substantial importance, there is little consensus on whether this is a Functionality of the Smart Meter device or a Functionality of the overall system. Some countries place this Functionality at other free market Energy Service devices or systems.

⁸ When assessing the consensus level for each Functionality, a YES scored 1, a PARTLY scored ½ and a NO scored 0

Functionalities for grid & network support:

Functionality 4: Allows remote reading of meter registers by meter operators and by third parties

Explanations

This Functionality relates to the Supply Side (Metering Operators).

Points to be considered within this Functionality include:

- Facility for both on-demand and frequent regular readings being available to the meter operator;
- Provision of meter reading information by the supplier to the customer. This would include interval readings or peak demands where the tariff is based on these;
- Ability of linking several meters (electric, gas, water, etc) into a single Smart Meter System in order to facilitate communications;
- Data storage within the meter;
- Correct billing, both on a regular basis or on demand (say on the change of occupier or energy supplier);

Points not to be considered here but within other Functionalities include:

- Provision of meter readings from the meter directly to the customer. This is considered under Functionality 1.
- Security and privacy. This is considered under Functionality 11.

Statistics

Was this Functionality considered	Yes — 11	Partly — 0	No — 0
Cost Impact	Minimal to High		
	Minimal: 1	Low: 1	Medium: 3 High: 3
Consensus Level ⁹	11		

Comments made

Logically, since remote reading is a key part of smart metering, all the responses indicate that this was to be implemented, with the reading rate varying between 15 minutes and daily. The indicated cost of this does however seem to vary quite considerably. In some countries, legal constraints limit access to the meter just to the DSO which then makes the necessary data available to other parties.

Following clarifications received at the workshop, the three ‘partly’ replies were amended to ‘yes’.

Conclusions

This Functionality has unanimous consensus.

⁹ When assessing the consensus level for each Functionality, a YES scored 1, a PARTLY scored ½ and a NO scored 0

Functionality 5: Provides two-way communication between the meter and external networks for maintenance and control of the meter

Explanations

This Functionality relates to both the Demand Side and the Supply Side (both supply & grid).

Points to be considered within this Functionality include:

- Removal of the need for manual intervention under any normal operating conditions;
- Ability to remotely upgrade the firmware in any meter or attached device;
- Monitoring of the status of the meter and of attached devices with the ability to provide warnings of actual or impending problems;
- Time synchronisation;
- Upload of new tariff details, including changes in cost and/or switching times.

Points not to be considered here but within other Functionalities include:

- Fraud prevention which is covered under Functionality 12, although it is dependant on effective 2 way communications;
- Security and privacy. This is considered under Functionality 11.

Statistics

Was this Functionality considered	Yes — 8	Partly — 2	No — 1
Cost Impact	Low to Medium		
	Minimal: 1	Low: 2	Medium: 2 High: 1
Consensus Level ¹⁰	9		

¹⁰ When assessing the consensus level for each Functionality, a YES scored 1, a PARTLY scored ½ and a NO scored 0

Comments made

In the two countries where this has not been considered in the CBA, it is either generally available (over 90% of meters) or has been left to the DSO; in that case, it was felt that the DSO had enough commercial incentive to include this anyway.

Following clarifications received at the workshop, one ‘*no*’ reply was amended to ‘*yes*’.

Conclusions

There is almost universal consensus that this is a key functionality.

Functionality 6: Provides for the monitoring of Power Quality

Explanations

This Functionality relates to both the Demand Side and the Supply Side.

Points to be considered within this Functionality include:

- Provision of a warning to the customer should voltage quality fall to such a level that equipment could be damaged. Factors affecting voltage quality include sags & surges, high harmonic content, etc;
- Provision of warning to the supplier and the grid in the event of any problems, including excessive harmonic currents;
- Logging of power quality issues (such as outages in excess of a defined time).

Points not to be considered here but within other Functionalities include:

- None. Power Quality is an independent Functionality, but depends on Functionality 5 (2 way communications) for operation.

Statistics

Was this Functionality considered	Yes — 5	Partly — 3	No — 3
Cost Impact	Minimal to Low		
	Minimal: 2	Low: 2	Medium: 0 High: 1
Consensus Level ¹¹	6.5		

¹¹ When assessing the consensus level for each Functionality, a YES scored 1, a PARTLY scored ½ and a NO scored 0

Comments made

Seven of the countries are monitoring some aspects of power quality, or have the ability to do so. There does not however seem to be consensus as to what is monitored — it could be outages, voltage sags & swells, voltage distortion, etc. One country considered this too expensive to monitor.

Conclusions

There is no consensus on this Functionality. At present most such measurements can adequately be carried out at the sub-station level although in the future, with the growth of distributed generation, there will be greater need for this to be done at the meter.

It is noted that this was functionality was not part of the final ERGEG GPP E10-RMF-29-05.

Functionality 7: Allows readings to be taken frequently enough to allow the information to be used for network planning

Explanations

This Functionality relates to both the Demand Side and the Supply Side.

Points to be considered within this Functionality include:

- Whether grid control is being considered at a micro (e.g. local) level or a macro (e.g. sub-station) level;
- The information provided to the grid;
- The frequency at which the data is updated. This will depend on whether micro or macro control is used.

Points not to be considered here but within other Functionalities include:

- None. Grid Control is an independent Functionality, but depends on Functionality 5 (2 way communications) for operation.

Statistics

Was this Functionality considered	Yes — 8	Partly — 0	No — 3
Cost Impact	Minimal Minimal: 3	Low: 1	Medium: 0 High: 0
Consensus Level ¹²	8		

¹² When assessing the consensus level for each Functionality, a YES scored 1, a PARTLY scored ½ and a NO scored 0

Comments made

Two countries are implementing this at sub-station level while one country felt that the DSO had enough commercial incentive to include this anyway. One negative reply was due to a lack of exact requirements. Most countries indicate a high enough reading frequency to implement this, or can increase the reading rate.

This information is provided to the Meter Operator, in most countries the DSO. It is thus of use in network planning, not primarily for grid control. In the future, it should prove of value to the DSO for monitoring power quality.

Conclusions

There is a reasonably high consensus about this functionality.

Functionalities for commercial aspects of energy supply:

Functionality 8: Supports advanced tariff systems.

Explanations

Includes advance tariff structures, time of use registers, remote tariff control, etc.; this Functionality relates to both the Demand Side and the Supply Side.

Points to be considered within this Functionality include:

- Data storage capacity within the Smart Meter System to allow effective comparison of consumption profiles.
- Storage of other applicable tariff related data together with any necessary associated information. (e.g. Peak Demands with date/time of occurrence);
- Support for time-of-use, block and demand based tariffs;
- Support for remote control of tariffs; switching times, unit costs, etc;
- Provision of active tariff information to the customer.

Points not to be considered here but within other Functionalities include:

- Depends on Functionality 5 (2 way communications) for operation.

Statistics

Was this Functionality considered	Yes — 8	Partly — 3	No — 0
Cost Impact	Low Minimal: 0 Low: 5 Medium: 1 High: 0		
Consensus Level ¹³	9.5		

¹³ When assessing the consensus level for each Functionality, a YES scored 1, a PARTLY scored ½ and a NO scored 0

Comments made

All the responses show that Smart Meters have the ability to implement advanced tariffs in some form or another (Time-of-Day, Demand and Block), either individually or in combination. In at least one case, it appears that this will be done at the system level rather than at the meter. In many cases, these will include remote control of tariffs and of tariff switching.

Following clarifications received at the workshop, the one '*partly*' and one '*no*' replies were both amended to '*yes*'.

Conclusions

Advanced tariff structures are part of the Demand Response scheme; it should help consumers achieve energy efficiencies. This Functionality, together with Functionalities 1 & 2, is a key driving force for empowering the consumer and for achieving energy efficiency.

Functionality 9: Supports energy supply by pre-payment and on credit

Explanations

This Functionality relates to both the Demand Side and the Supply Side.

Points to be considered within this Functionality include:

- Ability to switch between Credit & Pre-payment; and back;
- Advice to customer of change of payment method;
- Net benefit to the customer of the change in payment method.

Points not to be considered here but within other Functionalities include:

- Customer information on outstanding available credit (and how long it is likely to support present consumption). This is covered in Functionality 3.
- Depends on Functionality 5 (2 way communications) for operation;
- Depends on Functionality 10 (ON/OFF Control) for operation.

Statistics

Was this Functionality considered	Yes — 5	Partly — 2	No — 4	
Cost Impact	Low			
	Minimal: 2	Low: 4	Medium: 0	High: 0
Consensus Level ¹⁴	6			

¹⁴ When assessing the consensus level for each Functionality, a YES scored 1, a PARTLY scored ½ and a NO scored 0

Comments made

One country has not considered this functionality, one (gas) solution does not include a valve while seven countries could implement this at a system level.

Conclusions

Switching is a commercial matter between the supplier and the consumer. There is no consensus on this Functionality to be considered to be a key functionality of a Smart Meter.

Functionality 10: Allows remote ON/OFF control of the supply and/or flow or power limitation

Explanations

This Functionality relates to both the Demand Side and the Supply Side.

Points to be considered within this Functionality include:

- Net benefit to the customer of the application of power limitation or supply disconnection;
- Protection of vulnerable customers;
- For electricity, the projected life of the disconnect switch;
- For gas, the projected battery & operational life of the valve;
- Safety considerations, of disconnection as well as connection.
- Customer information on status. This is NOT covered in Functionality 3.

Points not to be considered here but within other Functionalities include:

- Depends on Functionality 5 (2 way communications) for operation;

Statistics

Was this Functionality considered	Yes — 9	Partly — 2	No — 0
Cost Impact	Low to Medium		
	Minimal: 1	Low: 4	Medium: 2 High: 0
Consensus Level ¹⁵	10		

¹⁵ When assessing the consensus level for each Functionality, a YES scored 1, a PARTLY scored ½ and a NO scored 0

Comments made

Although only three countries have implemented direct remote switching, a further four could implement this as a system function. One (gas) solution does not include a valve while one further country did not consider this in their CBA (though most meters have this function). Seven countries confirmed that they provide customer warnings and, where safety is concerned, require a customer acknowledgement. Legal conditions apply in some countries.

Following clarifications received at the workshop, one ‘no’ reply was amended to ‘yes’.

Conclusions

There was a high consensus on the provision of this Functionality.

It provides additional protection for the consumer at allowing for grades in the limitations

It speeds up processes such as when moving home — the old supply can be disconnected and the new supply enabled quickly and simply.

It is needed for handling technical grid emergencies.

Functionalities for security and privacy:

Functionality 11: Provides Secure Data Communications

Explanations

This Functionality relates to both the Demand Side and the Supply Side.

Points to be considered within this Functionality include:

- Privacy and Security are separate and different;
- Privacy is the restriction of information to the customer and those authorised by the customer to have access to it;
- Security is the prevention of access to information by unauthorised 3rd parties.
- Security of communications between the Smart Meter and energy suppliers / grid operators;
- Privacy of communication within a customer's premises;
- Access to information or equipment that could lead to a breach of security or privacy;
- Is security and privacy integral to the design of the Smart Meter System, or added;
- Provision for improvements in security and privacy in the event that existing processes are shown insufficient.

Points not to be considered here but within other Functionalities include:

- Depends on Functionality 5 (2 way communications) for operation;
- Notification of any breaches, or attempted breaches, of security or privacy is covered in Functionality 12.

Statistics

Was this Functionality considered	Yes — 11	Partly — 0	No — 0
Cost Impact	Low to Medium		
	Minimal: 0	Low: 3	Medium: 3 High: 0
Consensus Level ¹⁶	11		

Comments made

Security and privacy are legal requirements in all member states.
 Six countries have explicitly considered this as part of their CBA, with a low to medium cost.
 In the case of two countries, this was not included as it is part of national law.
 Following clarifications received at the workshop and further discussions, three ‘no’ replies was amended to ‘yes’.

Conclusions

High levels of security are essential for all communications between the meter and the Meter Operator. This is both for direct communications with the meter and for any messages that may be being passed through the meter to or from any appliances or controls within the consumer’s premises.
 For local communications within the consumer’s premises, both privacy and security are required.

¹⁶ When assessing the consensus level for each Functionality, a YES scored 1, a PARTLY scored ½ and a NO scored 0

Functionality 12: Fraud prevention and detection

Explanations

This Functionality relates to the Supply Side.

Points to be considered within this Functionality include:

- Design appraisal that considers potential attempts to breach the security and privacy of the Smart Metering System;
- Detection and storage of any breaches, or attempted breaches, of security; also notification (if possible) to the energy supplier;
- Notification to the energy supplier of the lack of any security breach (AOK signal).

Points not to be considered here but within other Functionalities include:

- None. Fraud Prevention is an independent Functionality, but depends on Functionality 5 (2 way communications) for operation.

Statistics

Was this Functionality considered	Yes — 9	Partly — 2	No — 0	
Cost Impact	Low			
	Minimal: 1	Low: 5	Medium: 0	High: 0
Consensus Level ¹⁷	10			

¹⁷ When assessing the consensus level for each Functionality, a YES scored 1, a PARTLY scored ½ and a NO scored 0

Comments made

In one case, a loss reduction over 20 year with an NPV of 1200 M€ was identified. Only one country did not consider it as part of their CBA; all other countries are implementing methods of Fraud Prevention and Fraud Detection.

Following clarifications received at the workshop, one 'no' reply was amended to 'yes'.

Conclusions

Security, and safety in case of access, is covered by the MID Directive. The high consensus shows the importance attached to this Functionality. This is necessary to protect the consumer, say from hacking access, and not just for fraud prevention.

Functionalities to allow distributed generation:

Functionality 13: Provides Import / Export & Reactive Metering

Explanations

This Functionality relates to both the Demand Side and the Supply Side.

Points to be considered within this Functionality include:

- Provision of 4 quadrant measurement of active energy (kWh) — import & export;
- In a 4 quadrant kWh meter, differentiation between net energy and generated energy;
- Provision of 2 quadrant measurement of reactive energy (kvarh) — import/export or inductive/reactive;
- Provision of 4 quadrant measurement of reactive energy (kvarh) — import/export and inductive/reactive;
- Communication of high reactive energy to relevant actors.

Points not to be considered here but within other Functionalities include:

- Depends on Functionality 5 (2 way communications) for operation;

Statistics

Was this Functionality considered	Yes — 8	Partly — 2	No — 1
Cost Impact	Minimal to Low		
	Minimal: 3	Low: 3	Medium: 1 High: 0
Consensus Level ¹⁸	9		

¹⁸ When assessing the consensus level for each Functionality, a YES scored 1, a PARTLY scored ½ and a NO scored 0

Comments made

Only one country gave a negative reply as this was not considered in their CBA, it is however available in some meters while in other cases a new meter is supplied. All other countries have allowed for this, and a majority appear to be planning full 4-quadrant measurement.

One country expressed concern as to the potentially larger costs for the DSO.

Conclusions

Most countries are allowing for the necessary functionalities to allow renewable and local micro-generation thus future-proofing the meter installation;

Annex: Source Material for the Functionalities

The questionnaire was based on the Smart Meter Functionalities as developed by ERGEG and published in their publication C11-RMC-44-03 and on the work of the CEN/CLC/ETSI Smart Meter Coordination Group (SM-CG).

SM-CG

In their May 2011 Technical Report '*Functional Reference Architecture for Communications in Smart Metering Systems*', the SM-CG defined six key functionalities. These are:

1. Remote reading of metrological register(s) and provision to designated market organisations
2. Two-way communication between the metering system and designated market organisation(s)
3. To support advanced tariffing and payment systems
4. To allow remote disablement and enablement of supply and flow/power limitation
5. To provide secure communication enabling the smart meter to export metrological data for display and potential analysis to the end consumer or a third party designated by the end consumer
6. To provide information via web portal/gateway to an in-home/building display or auxiliary equipment

This Technical Report on communications only considered additional functionalities to the extent necessary to ensure that there are smart metering communications standards to support the functionalities envisaged.

The smart metering system may be used for a further important functionality:

To enable communication of AMI components with devices or gateways within the home / building used in the provision of energy efficiency and demand-side management services.

In this role, this functionality is directly linked to smart grid functionalities using building and home automation systems. Building and home automation are outside the scope of this mandate; however their interfaces with the smart meter will be treated in co-operation with the SM-CG.

The current Functionalities (based on the ERGEG "Status Review on Regulatory Aspects"¹⁹ report issued Sept 09, page 51) are:

	Metering Interval	Communication ways	Communication technology	Communication protocol	Data security	Storage capability	Remote Control	Local communication interface	Different tariffs recorded	Bi-directionality
Cyprus	X	X	X	X	X	X	X			
Estonia	X	X	X		X	X	X	X	X	X
Finland	X	X			X		X	X		
France	X	X	X	X	X	X	X	X	X	X
Germany (under Discussion)	X	X	X	X	X	X	X	X	X	X
Greece	X	X	X	X	X		X	X		X
Hungary	X	X					X			X
Iceland			X						X	X
Italy	X	X		X	X	X	X	X		X
Lithuania	X	X	X	X	X	X	X	X	X	X
Poland	X	X	X	X			X	X		X
Romania	X	X	X			X			X	X
Spain	X	X	X			X	X	X	X	X
Sweden	X					X		X	X	
The Netherlands	X	X	X		X	X	X	X	X	

Table 8: Overview of required functions for smart meters in electricity

There is no equivalent table for Gas

In the ERGEG
 “Final Guidelines
 of Good
 Practice”²⁰ issued
 Feb 2011 (page 8)
 the
 recommendations
 are:

ELECTRICITY AND GAS	
Data security & integrity	E/G 1. Customer control of metering data
ELECTRICITY	
Customer services	E 2. Information on actual consumption and cost, on a monthly basis, free of charge
	E 3. Access to information on consumption and cost data on customer demand
	E 4. Easier to switch supplier, move or change contract
	E 5. Bills based on actual consumption
	E 6. Offers reflecting actual consumption patterns
	E 7. Remote power capacity reduction/increase
	E 8. Remote activation and de-activation of supply
	E 9. All customers should be equipped with a metering device capable of measuring consumption and injection
	E 10. Alert in case of non-notified interruption
	E 11. Alert in case of exceptional energy consumption
	E 12. Interface with the home
	E 13. Software to be upgraded remotely
	Costs and benefits
Roll-out	E 15. All customers should benefit from smart metering
	E 16. No discrimination when rolling out smart meters
GAS	
Customer services	G 2. Information on actual consumption and cost, on a monthly basis, free of charge
	G 3. Access to information on consumption and cost data on customer demand
	G 4. Easier to switch supplier, move or change contract
	G 5. Bills based on actual consumption
	G 6. Offers reflecting actual consumption patterns
	G 8. Remote enabling of activation and remote de-activation of supply
	G 11. Alert in case of exceptional energy consumption
	G 12. Interface with the home
	G 13. Software to be upgraded remotely
Costs and benefits	G 14. When making a cost benefit analysis, an extensive value chain should be used
Roll-out	G 15. All customers should benefit from smart metering
	G 16. No discrimination when rolling out smart meters

Table 1: ERGEG's guidelines of good practice on regulatory aspects of smart metering

²⁰

Comparison between ERGEG & SM-CG Functionalities

The relationship of these ERGEG recommendations and the defined Functionalities in Mandate M/441

See pages 35 & 36 of the ERGEG Public Consultation Paper E10-RMF-29-05 of 10th June 2010

ELECTRICITY	Additional functionalities according to Mandate M/441					
	Remote reading, meter reading of injected and consumed energy, F1	Two-way communication, F2	Interval metering/ registers, F3	Remote management, F4	Interface with the home/ home automation, F5	Information through webportal/ gateway, F6
E 2. Information on actual consumption, on a monthly basis, free of charge						
E 3. Access to information on consumption data on customer demand						
E 4. Easier to switch supplier, move or change contract						
E 5. Bills based on actual consumption						
E 6. Offers reflecting actual consumption patterns						
E 7. Remote power capacity reduction/increase						
E 8. Remote activation and de-activation of supply						
E 9. All customers should be equipped with a metering device capable of measuring consumption and injection						
E 10. Alert in case of non-notified interruption						
E 11. Alert in case of exceptional energy consumption						
E 12. Interface with the home						
E 13. Software to be upgraded remotely						

Table 2: Correlation of Mandate M/441 additional functionalities and ERGEG Electricity recommendations

GAS	Additional functionalities according to Mandate M/441					
	Remote reading, meter reading of injected and consumed energy, F1	Two-way communication, F2	Interval metering/ registers, F3	Remote management, F4	Interface with the home/ home automation, F5	Information through webportal/ gateway, F6
G 2. Information on actual consumption, on a monthly basis, free of charge						
G 3. Access to information on consumption data on customer demand						
G 4. Easier to switch supplier, move or change contract						
G 5. Bills based on actual consumption						
G 6. Offers reflecting actual consumption patterns						
G 8. Remote enabling of activation and remote de-activation of supply						
G 11. Alert in case of exceptional energy consumption						
G 12. Interface with the home						
G 13. Software to be upgraded remotely						

Table 3: Correlation of Mandate M/441 additional functionalities and ERGEG Gas recommendations

List of Links to CBAs provided in the ERGEG report C11-RMC-44-03

Austria

http://www.econtrol.at/portal/pls/portal/portal.kb_folderitems_xml.redirectToItem?pMasterthingId=1605211

Belgium

<http://www.vreg.be/vreg/documenten/rapporten/RAPP-2008-10.pdf>

Denmark

http://www.ens.dk/d_adk/info/nyheder/nyhedsarkiv/2009/sider/intelligenteforbrug.aspx

France

<http://www.cre.fr/en/content/download/10348/173506/file/100129ComptageEvolueGaz-Notedesynthesephase1-en.pdf>

Hungary

(<http://www.eh.gov.hu/home/html/index.asp?msid=1&sid=0&hkl=610&lng=2>)

Italy

<http://www.autorita.energia.it/allegati/docs/08/155-08argengsummary.pdf>

Ireland

www.cer.ie/en/information-centrereports-andpublications.aspx?article=f948d38ea9cf-4b82-aa26-f8f4b4de217e

The Netherlands

<http://www.rijksoverheid.nl/documenten-enpublicaties/rapporten/2010/09/03/intelligente-meters-nederlandherziene-financieleanalyse-enadviezen-voorbeleid.html>

Poland

http://www.piio.pl/bszpre_cele_projektu.php

Portugal

http://www.erse.pt/pt/consultaspublicas/historico/Documents/CP_18/18_3/Func_Plano_Subsc_contadores_F.pdf

Slovenia

http://www.cigre-cired.si/Images/File/Coga/Posvet_2/7_SmartGrids_CIGRE_2_EIMV_Souvent.pdf

Sweden

<http://www.ei.se/upload/Rapporter/EI/M%C3%A5nadsvis%20av1%C3%A4sning%20av%20elm%C3%A4tare.pdf>

<http://www.ei.se/Bibliotek/Rapporter-2010/Okatinflytande-forkunderna-paelmarknaden---Timmatning-orelkunder-medabonnemang-omhogst-63-ampere-EI-R-201022/>

UK

http://www.decc.gov.uk/en/content/cms/consultations/smart_metering/smart_metering.aspx